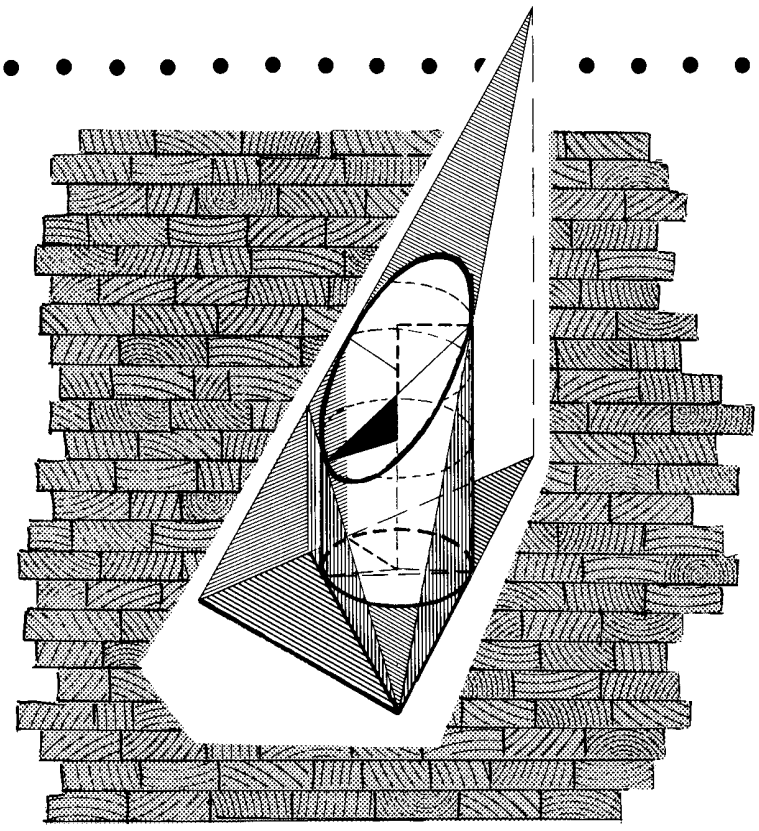
Forest Service - U.S. Department of Agriculture

STX -- FORTRAN - 4 PROGRAM for estimates of tree populations from 3P sample-tree-measurements



U.S. FOREST SERVICE RESEARCH PAPER PSW-13 REVISED 1967

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NOTICE
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THIS COMPUTER-PRODUCED PUBLICATION IS AN EXPERIMENTAL EFFORT TO PUBLISH MORE RAPIDLY AND MORE EFFICIENTLY) INFORMATION ON COMPUTER-ORIENTED THEORIES AND TECHNIQUES.

AT THE SAME TIME, WE ARE TRYING TO IMPROVE SUSCEPTIBILITY OF THE INFORMATION TO AUTOMATED SEARCH AND RETRIEVAL. THE INITIAL SUMMARY AND THE ENTIRE TEXT OF THE PAPER ARE IMMEDIATELY SUITABLE FOR COMPUTER SEARCH BY VIRTUE OF ALREADY BEING ON PUNCHED CARDS. AN IDENTIFIER AT THE TOP OF EACH PAGE SERVES TO MATCH IT WITH ITS PARENT DOCUMENT IN CASE OF SEPARATION OR MIXUPS.

FINALLY, COMPUTER-PROCESSED TEXT IS EASILY REVISED AND REPUBLISHED. THIS IS AN IMPORTANT CONSIDERATION IN FIELDS WHERE CHANGES AND NEW DEVELOPMENTS ARE OCCURRING SO RAPIDLY.

THE COMPUTER PROGRAM 'PRN', WRITTEN BY THE AUTHOR IN FORTRAN-4 LANGUAGE, WAS USED TO PRINT THIS REVISION AS WELL AS THE ORIGINAL VERSIONS OF U.S. FOREST SERVICE RESEARCH PAPERS PSW-13 AND PSW-21.

PROGRAM LISTING AND SOURCE DECKS FOR 'STX' CAN BE MADE AVAILABLE TO INTERESTED ORGANIZATIONS HAVING ACCESS TO A SUITABLE LARGE COMPUTER.

Grosenbaugh, L. R.

1967. *STX--Fortran-4 program for estimates of tree populations from 3P sample-tree-measurements.* Berkeley, Calif., Pacific SW. Forest & Range Exp. Sta. 76 pp., illus. (U.S. Forest Serv. Res. Paper PSW-13, 2nd ed., rev.)

Describes how to use an improved and greatly expanded version of an earlier computer program (1964) that converts dendrometer measurements of 3P-sample trees to population values in terms of whatever units user desires. Many new options are available, including that of obtaining a product-yield and appraisal report based on regression coefficients supplied by user. Improved techniques for extrapolation may be employed to estimate unseen length and upper bark thickness.

OXFORD: 524.34--U. 518.5 [+524.38+536]+652.51--U. 518.5+U.681.3

RETRIEVAL TERMS: 3P-sampling; optical dendrometry; timber realization value; timber appraisal; timber conversion to product-yield; sample-tree-measurement; extrapolation; tree volume; tree length; tree surface.

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STX--FORTRAN 4 PROGRAM FOR ESTIMATES OF TREE POPULATIONS

BY

L. R. GROSENBAUGH

CONTENTS

THE AUTHOR

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U.S. FOREST SERVICE RESEARCH PAPER PSW-13. (ORIGINAL VERSION DATED 1-10-64)
(LATEST REVISION DATED 5-01-67)
PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, BERKELEY, CALIFORNIA
FOREST SERVICE, U.S. DEPARTMENT OF AGRICULTURE

STX -- FORTRAN-4 PROGRAM FOR ESTIMATES OF TREE POPULATIONS FROM 3P SAMPLE-TREE-MEASUREMENTS

L. R. GROSENBAUGH

SUMMARY

PROGRAM 'SIX' (WRITTEN IN FORTRAN 4) PROCESSES SAMPLE-TREE-MEASUREMENTS AS TAKEN IN THE FIELD AND COMPUTES FINAL POPULATION ESTIMATES IN TERMS OF WHATEVER VARIABLES ARE DESIRED. INPUTS ARE TREE-STEM MEASUREMENTS WITH QUALITY ASSESSMENTS, PLUS SUCH WHOLE-TREE AND PRODUCT-OUTTURN DATA AS ARE DEEMED APPROPRIATE. VARIOUS DENDROMETERS, TAPES, OR CALIPERS CAN BE USED TO MEASURE TREES. TREE SELECTION MAY BE WITHOUT UNCERTAINTY (ALL TREES OF INTEREST), WITH PROBABILITY PROPORTIONAL TO PREDICTION ('3P' SAMPLING), OR WITH SOME OTHER FORM OF PROBABILITY SAMPLING IF USERS MODIFY THE PROGRAM SLIGHTLY. PROVISION CAN BE MADE TO INCLUDE OR EXCLUDE BARK AND/OR USABLE MATERIAL ABOVE HIGHEST MEASURED DIAMETER.

THE PRINTED OUTPUT PRODUCED FROM ORIGINAL DATA INPUT HAS FOUR MAJOR SECTIONS PLUS CERTAIN DATA-PROCESSING STATISTICS. OPTIONAL CARD OUTPUT FOR INDIVIDUAL LOGS OR TREES IS ALSO POSSIBLE. IF APPROPRIATE SETS OF CONVERSION COEFFICIENTS ARE SUPPLIED BY THE USER, THE PROGRAM WILL COMPUTE PRODUCT OUTTURN AND REALIZATION VALUE BY VARIOUS TREE AND LOG CATEGORIES. ADDITIONAL DUMMY SUBROUTINES ARE INCLUDED IN THE PROGRAM TO ALLOW USERS WIDE LATITUDE IN CHOICE OF METHODOLOGY.

PROGRAM IMPROVEMENTS HAVE NOT REQUIRED ANY IMPORTANT CHANGES IN FORMAT FOR INPUT, SO THAT MOST DATA PROCESSED BY EARLIER VERSIONS OF THE PROGRAM CAN BE PROCESSED BY THE PRESENT IMPROVED VERSION WITHOUT MODIFICATION. INTERNAL CHANGES PROVIDE GREATER PROGRAM COMPATIBILITY ON A WIDER RANGE OF COMPUTERS, INCLUDING THOSE WITH 32-BIT WORD LENGTH, ASCII OR EBCDIC CHARACTER CODE, SYSTEM SORT-MERGE LACKING OVERLAY, OR SUBROUTINE SORT-MERGE USING OVERLAY. VOLUME AND SURFACE COMPUTATIONS FOR MEASURED PORTIONS OF A TREE NOW ASSUME CONIC SHAPE (INSTEAD OF PARABOLIC SHAPE FORMERLY ASSUMED), WHILE PROJECTION BEYOND LAST MEASURED DIAMETER CAN BE CONVEX, LINEAR, OR CONCAVE AS DETERMINED BY COMPUTER ANALYSIS OF ADJACENT TAPER. ELEVATION ANGLE FOR SHORTBASE-RANGEFINDER DENDROMETERS CAN BE INPUT EITHER AS (SINE) OR AS (UNITY PLUS SINE).

==========GENERAL==========

FORESTERS HAVE LONG NEEDED A BETTER WAY OF CALCULATING THE EXPECTED PRODUCT-YIELD AND REALIZATION-VALUE OF STANDING TIMBER FROM ACCURATE UPPER-STEM MEASUREMENTS OF A RELATIVELY SMALL NUMBER OF STANDING SAMPLE TREES.

A PRACTICAL, EFFICIENT TECHNIQUE IS AT LAST AVAILABLE--A COMPREHENSIVE NEW COMPUTER PROGRAM CALLED 'STX' THAT TAKES ADVANTAGE OF SEVERAL RECENT DEVELOPMENTS, INCLUDING NEW '3P' SAMPLING THEORY (*4, *8), BETTER MAGNIFYING SPLIT-IMAGE DENDROMETERS (*2), TREE QUANTITIES EXPRESSED IN UNITS THAT ARE MORE FUNCTIONAL AND INVARIANT THAN 'BOARD FEET' OR 'CUBIC FEET' (*3, *6), EXPLICIT USE OF CERTAIN IMPLICIT GEOMETRIC RELATIONSHIPS (*5), AND WIDESPREAD AVAILABILITY OF LARGE HIGH-SPEED BINARY COMPUTERS.

THE PROGRAM ASSUMES USE OF 3P-SAMPLING (A FORM OF SAMPLING WITH PROBABILITY PROPORTIONAL TO PREDICTION), IN WHICH EVERY INDIVIDUAL TREE IN THE POPULATION IS VISITED AND ASSIGNED AN ARBITRARY RELATIVE PROBABILITY OF BEING MEASURED, BUT ONLY MINOR MODIFICATION WOULD BE NEEDED TO ADAPT IT TO PLOT-SAMPLING, POINT-SAMPLING, OR ANY OTHER DESIRED FORM OF CLUSTER-SAMPLING WITH OR WITHOUT COMPLETE KNOWLEDGE OF PROBABILITY FOR EVERY INDIVIDUAL IN THE POPULATION.

THE ENTIRE PROGRAM IS STRUCTURED FOR USE WITH 'OVERLAY', AN IMPROVED FORM OF 'CHAIN' EXECUTION. WHERE. 'OVERLAY' IS NOT AVAILABLE, THE PROGRAM CAN BE MODIFIED FOR USE WITH LESS DESIRABLE FORMS OF 'CHAIN' EXECUTION, OR IT CAN BE SPLIT INTO TWO MAIN PROGRAMS (STX, PROD) SEPARATED BY A GENERAL SYSTEM TAPESORT (SEE APPENDIX A FOR DECK ARRANGEMENTS AND MODIFICATIONS).

THE ZERO OR RESIDENT LINK IS COMPOSED OF MASTER EXECUTIVE ROUTINE STX, TOGETHER WITH BLD AND NECESSARY LIBRARY SUBROUTINES.

SUBROUTINE TREE HEADS THE FIRST LINK, WHICH CARRIES OUT THE NECESSARY PROBABILITY AND GEOMETRIC CALCULATIONS, THEN SUMMARIZES BASIC POPULATION STATISTICS.

SUBROUTINE PREP HEADS THE SECOND LINK, WHICH SORTS INDIVIDUAL LOG DATA BY SMALL-END DIAMETER WITHIN SPECIES-QUALITY-DEFECT CATEGORIES. THIS REARRAY IS WRITTEN ON TAPE JX, WITH OPTIONAL PRINTOUT IF DESIRED. MAXIMUM NUMBER OF SAMPLE LOGS THAT CAN BE SORTED BY THE CORE-SORT CURRENTLY EMPLOYED IS 1500. THIS LIMITATION NO LONGER APPLIES IF THE SECOND LINK IS REPLACED BY A GENERAL SYSTEM TAPESORT. HOWEVER THE SORTING IS HANDLED, IT INVOLVES BINARY RECORDS OF LENGTH 19, 20, OR 21 WORDS, DEPENDING ON WHETHER 0, 1, OR 2 CODE WORDS WERE SYSTEM-GENERATED BY EACH BINARY WRITE STATEMENT. THE DATA TO BE SORTED IS INPUT FROM AND OUTPUT ON TAPE JX, AND SHOULD BE SORTED IN LOGICAL ASCENDING ORDER ACCORDING TO DATA WORDS 5, 6, AND 9 (5 BEING THE MOST SIGNIFICANT WORD). THE NUMBER OF DATA RECORDS THUS WRITTEN HAS BEEN RECORDED AS 'IZERO', BUT TWO ADDITIONAL RECORDS ARE SORTED TO THE BEGINNING OF THE FILE TO PROVIDE COMMUNICATION BETWEEN FIRST AND THIRD PART OF THE PROGRAM WHEN A GENERAL SYSTEM TAPESORT HAS WIPED OUT DYNAMIC STORAGE.

SUBROUTINE PROD HEADS THE THIRD LINK, WHICH SUBTOTALS VOLUME, SURFACE, AND LENGTH FOR AS MANY AS 9 SPECIES EACH HAVING AS MANY AS 11 QUALITY-DEFECT CLASSES. IF THE USER HAS INSERTED APPROPRIATE COEFFICIENTS INTO SUBROUTINE ST44, THESE SUBTOTALS CAN THEN BE CONVERTED INTO PRODUCT OUTTURN AND VALUE.

OUTPUT FROM THE PROGRAM OUTLINED ABOVE IS COMPRISED OF FOUR MAJOR PARTS, EACH GENERATED BY A DOUBLY NUMBERED SUBROUTINE (ST11, ST22, ST33, ST44).

SUBROUTINE ST11 EDITS INPUT AND ACCUMULATES POPULATION FREQUENCY AND RELATIVE PROBABILITY FOR EACH TREE-SAMPLING CATEGORY IN EACH VALUE STRATUM. INPUT ERRORS ARE FLAGGED BY SPECIAL PRINTOUTS. THE PROGRAM ALSO COPIES INDIVIDUAL SAMPLE TREE DATA ONTO SCRATCH TAPE JW FOR LATER PROCESSING. FINALLY, IF NO ERRORS ARE DETECTED, IT MAY PRINT OUT A PRELIMINARY REPORT ON AGGREGATE FREQUENCIES AND PROBABILITIES BY VALUE STRATUM.

SUBROUTINE ST22 FURTHER EDITS THE SAMPLE-TREE PORTION OF INPUT AND CONVERTS THE FIGURES TO LOG AND TREE VOLUMES, SURFACES, LENGTHS, FREQUENCIES, BASAL AREAS, PREDICTIONS, AND QUANTITIES NEEDED FOR ESTIMATES OF SAMPLING ERROR. RESULTS MAY BE PRINTED OUT IN A DETAILED INDIVIDUAL LOG AND TREE REPORT, WRITTEN ON SCRATCH TAPE JX FOR FURTHER PROCESSING, PUNCHED OUT ON CARDS, AND (IN THE ABSENCE OF ERROR) AGGREGATED BY VALUE STRATUM. SPECIAL DIAGNOSTIC ERROR MESSAGES ARE PRINTED WHEN INPUT ERRORS ARE DETECTED. AMONG SEVERAL MINOR SUBROUTINES THAT ASSIST IN THE PROCESS IS SBRD, WHICH CONVERTS SHORTBASE-RANGEFINDER DENDROMETER READINGS TO TREE DIAMETERS AND ELEVATIONS. ALTERNATIVELY, SUBROUTINE OLIN SIMILARLY HANDLES LINEAR MEASUREMENTS OF LOG DIAMETER AND LENGTH OBTAINED WITH MECHANICAL CALIPERS AND STEEL TAPE. OR AGAIN ALTERNATIVELY, USERS MAY EXPAND DUMMY SUBROUTINES OPCL, OPFK, OR OTHR TO SIMILARLY HANDLE MEASUREMENTS MADE WITH OPTICAL CALIPERS, OPTICAL FORKS, OR OTHER DENDROMETRIC DEVICES. SUBROUTINE GAPP MAY THEN SUPPLY CERTAIN OMITTED MEASUREMENTS, MAKE REDUCTIONS FOR BARK AS DIRECTED, AND PROJECT THE UNMEASURED UPPER STEM ABOVE THE LAST MEASURED DIAMETER IF THIS UNSEEN STEM WAS DEEMED LIKELY TO CONTAIN USABLE MATERIAL. FINALLY, USERS NOT SATISFIED WITH OPTIONS FOR HANDLING BARK OR UNSEEN LENGTH, SURFACE, AND VOLUME MAY REPLACE BARK FUNCTION FFB3 OR EXPAND DUMMY FUNCTIONS FFH3, FFS3, AND FFV3.

SUBROUTINE ST33 APPROPRIATELY COMBINES THE AGGREGATE POPULATION ESTIMATES FOR SAMPLING CATEGORY AND STRATUM, WHILE COMPLETING COMPUTATIONS OF SAMPLING ERROR. IT MAY PRINT OUT A SUMMARY REPORT. IN ADDITION, IT PROVIDES A PAGE OF DATA-PROCESSING STATISTICS, CHECKS, ERROR COUNTS, AND A LIST OF TREES WITH SUSPICIOUS INPUT DATA.

SUBROUTINE ST44 CONVERTS VOLUMES, SURFACES, AND LENGTHS TO WHATEVER GRADE-YIELDS, PRODUCT OUTTURNS, OR REALIZATION VALUES ARE OF INTEREST, BUT THE USER MUST FIRST PROVIDE APPROPRIATE COEFFICIENTS, OF COURSE.

THE PROGRAM TAKES ADVANTAGE OF THE 'BLOCK DATA' CAPABILITY OF FORTRAN 4. IMPORTANT CONSTANTS HAVE BEEN PLACED IN A LABELLED COMMON STORAGE AREA CALLED /CONS/, WHERE THEIR VALUES MAY BE EASILY CHANGED MERELY BY RECOMPILING THE SMALL BLOCK DATA SUBPROGRAM BED. THIS CAPABILITY IS ESPECIALLY HELPFUL IN THE CASE OF INPUT-OUTPUT TAPE ASSIGNMENTS THAT ARE NOT THE SAME FOR EVERY INSTALLATION. ADDITIONALLY, THERE IS A REAL ADVANTAGE IN BEING ABLE TO

MODIFY CONSTANTS LOCALLY APPROPRIATE FOR BARK PROJECTION OR MANUFACTURED PRODUCT CONVERSION WITHOUT LENGTHY RECOMPILATIONS.

STX WILL NOT RUN EFFICIENTLY ON BUSINESS-TYPE, VARIABLE-WORD-LENGTH COMPUTERS. SCIENTIFIC-TYPE BINARY COMPUTERS WITH CORE-STORAGE FOR 32K WORDS, WORD LENGTH OF AT LEAST 32 BITS OR 4 CHARACTERS, AND A FORTRAN-4 COMPILER ARE NEEDED. HOWEVER, MINOR LOCAL PROGRAM MODIFICATIONS MAY BE REQUIRED EVEN FOR SUCH COMPUTERS. THIS IS ESPECIALLY TRUE WHERE 'OVERLAY' AND MACHINE-LANGUAGE SUBROUTINES SORT AND MERJ CANNOT BE USED AS DESIGNED. APPENDIX A SHOWS SOME OF THE MODIFICATIONS APPROPRIATE TO PARTICULAR SITUATIONS, AND OTHERS CAN BE INFERRED. PL/I VERSIONS OF SORT AND MERJ SHOULD ULTIMATELY ALLOW GREATER UNIFORMITY.

INSTALLATIONS FORBIDDING DIRECT ADDRESSING OF PERIPHERAL PUNCH MUST REPLACE 'WRITE (MPU,22) . .' WITH 'PUNCH 22 . . .' ON CARD 281 OF ST22, AND SIMILARLY REPLACE 'WRITE IMPU,21) . . .' WITH 'PUNCH 21 . . .'ON CARD 291 OF ST22.

ALL STX DATA CARDS PUNCHED FOR PROCESSING IN CONFORMITY WITH ORIGINAL SPECIFICATIONS APPEARING IN PSW-13 (01-10-64) WILL BE PROPERLY PROCESSED BY THE LATEST VERSION. HOWEVER, THE FIFTH CHARACTER OF TREE CODE WILL BE IGNORED AND WILL NOT APPEAR ON PRINTOUT. ALSO, THE IMPLICIT FORMAT OF QUANTITY 'UDORT' IN COLUMNS 39-41 OF THE TREE INPUT CARDS HAS BEEN CHANGED FROM F3.2 TO F3.3 TO ALLOW MORE PRECISE INPUT. AN UNUSED CONSTANT ON THE SECOND CONTROL CARD HAS BEEN DECLARED INTEGER INSTEAD OF REAL. THE SECOND BARK OPTION NOW IMPLIES THAT THE RATIO CF BARK TO WOOD AND BARK DIMINISHES HYPERBOLICALLY UPWARDS, WHILE THE THIRD BARK OPTION IMPLIES THAT THE RATIO OF WOOD TO WOOD AND BARK DIMINISHES HYPERBOLICALLY UPWARDS (THIS WAS FORMERLY THE SECOND OPTION, AND USERS CAN EASILY REPLACE TEE FUNCTION FFB3 WITH ONE OF THEIR OWN). SHAPE BETWEEN MEASURED DIAMETERS IS NOW TREATED AS CONOIDAL INSTEAD OF PARABOLOIDAL. EXTRAPOLATION FOR UNSEEN LENGTH UNDER THE IMPLICIT OR FIRST OPTION NOW FOLLOWS THE ANALYTICAL PROCEDURE DEVELOPED IN REFERENCE (*5) INSTEAD OF THE EARLIER ONE-PARAMETER HYPERBOLIC PROJECTION . FINALLY, TRIGONOMETRIC CALCULATIONS INVOLVING CONVERGENCE IN SUBROUTINES ST22 AND SBRD NOW USE DOUBLE-PRECISION ARITHMETIC TO IMPROVE ACCURACY FOR LARGE TREES AT LONG RANGES. THIS ALSO COMPENSATES FOR THE LOSS OF A SIGNIFICANT DIGIT IN THE SINGLE-PRECISION ARITHMETIC OF COMPUTERS WITH ONLY 32-BIT WORDS.

MANY NEW OPTIONS AND CAPABILITIES ARE AVAILABLE IN THE LATEST REVISION. THOSE USERS WHO HAVE WRITTEN THEIR OWN SUBROUTINES OR MODIFICATIONS OR WHO HAVE EXPANDED SKELETON SUBROUTINES MUST RECOMPILE IN ORDER TO GAIN COMPATIBILITY WITH NEW LABELLED COMMON (UNLABELLED COMMON HAS BEEN ELIMINATED). THEY MUST ALSO TAKE INTO ACCOUNT THE CHANGE IN MODE OF SCRATCH TAPES JW AND JX THAT NOW CONSIST OF BINARY (NOT BCD) RECORDS CONTAINING 19 DATA WORDS EACH.

LOGICAL 'IF' STATEMENTS REPLACE ARITHMETIC 'IF' STATEMENTS IN THE LATEST VERSION, TO MAKE IT MORE EASILY TRANSLATABLE INTO POTENTIAL SUCCESSOR LANGUAGES SUCH AS PL/I. STRING COMPARISONS NOW INVOLVE ONLY 'EQUAL' AND 'NOT EQUAL', SO THAT LOGIC IS FREED FROM DEPENDENCE ON BCD CHARACTER CODE. USE OF THE PROGRAM IN COMPUTERS WITH WORD LENGTH AS SHORT AS 4 CHARACTERS 132 BITS) HAS BEEN MADE POSSIBLE BY KEEPING STRING VARIABLES FROM EXCEEDING THAT LENGTH, SO THAT NO FORMAT LONGER THAN A4 IS REQUIRED TO HANDLE I/O.

==========INPUT==========

BEFORE PROCESSING OF ACTUAL DATA IS POSSIBLE, THE SOURCE PROGRAM OUTLINED IN THE SECTION ABOVE MUST BE COMPILED INTO A BINARY OBJECT PROGRAM ACCEPTABLE TO THE LOCAL MACHINE INSTALLATION. IF APPROPRIATE PROGRAM MODIFICATIONS JUST DISCUSSED HAVE BEEN MACE WHERE NEEDED, THE ONLY PROGRAM FEATURES NEEDING ATTENTION ARE TO ESTABLISH CERTAIN APPROPRIATE LOCAL CONSTANTS IN SUBROUTINE BLD (PARTICULARLY, WHAT I/O UNITS ARE NEEDED), TO ENSURE THAT SCRATCH TAPES CAN HANDLE BINARY I/O, AND TO PREVENT BUFFER SPACE FROM BEING WASTED ON UNNEEDED I/O UNITS. THESE LAST TWO JOBS CAN BE ACCOMPLISHED FOR THE IBM 7090 BY MAP SUBROUTINES BUFK, UN04, UN08. THE IBM 7040 WOULD BE SIMILARLY SERVED BY AN APPROPRIATELY MODIFIED VERSION OF BUFK AND MAP SUBROUTINES FTC02., FTC03.

CARDS 9 THROUGH 14 OF SUBROUTINE BLD CONTAIN ALL CONSTANTS THAT MUST BE INITIALLY ESTABLISHED IN THE PROGRAM ITSELF, AS OPPOSED TO CONSTANTS READ FROM DATA OR ESTABLISHED LATER IN SUBROUTINE ST44 FOR CONVERSION PURPOSES.

THE POSITIVE OR NEGATIVE INTEGER FOLLOWING MRE ON CARD 9 OF BLD SHOULD BE THE LOGICAL NUMBER OF THE SYSTEM INPUT TAPE. SIMILARLY, THE INTEGER FOLLOWING MPR SHOULD BE THE LOGICAL NUMBER OF THE SYSTEM OUTPUT TAPE, AND THE INTEGER FOLLOWING MPU SHOULD BE THE LOGICAL NUMBER OF THE SYSTEM PUNCH TAPE. INTEGERS FOLLOWING JW AND JX SHOULD BE LOGICAL NUMBERS FOR SYSTEM BINARY SCRATCH TAPES. LOGICAL NUMBERS FOR SCRATCH TAPES JY AND JZ NEED NOT BE SPECIFIED UNLESS THESE ARE NEEDED BY USER-SUPPLIED OR USER-EXPANDED PROGRAMS. MEOF SHOULD ALWAYS BE SET EQUAL TO ZERO WHEN MPR IS A MONITOR SYSTEM OUTPUT UNIT, BUT MEOF SHOULD ALWAYS BE NONZERO WHEN MPR IS A USER-CONTROLLED TAPE.

THE STRING VARIABLES ESTABLISHED BY CARDS 10 AND 11 OF BLD MERELY LABEL THE MANUFACTURED UNITS OR VALUES INTO WHICH VOLUME, SURFACE, LENGTH ARE TO BE CONVERTED FOR ERROR COMPUTATIONS. THE CONVERSION COEFFICIENTS CORRESPONDING TO BORD, SLAB, AND CLFT ON CARD 12 OF BLD CONVERT CUBIC FEET OF VOLUME, SQUARE FEET OF SURFACE, AND LINEAL FEET OF LENGTH TO ARBITRARY UNITS (*1) OF THE SAME SORT AS THOSE USED IN PREDICTION. ANY LOCALLY APPROPRIATE COEFFICIENTS MAY BE SUBSTITUTED FOR THOSE INITIALLY SUPPLIED WITH THE PROGRAM.

NUMBERS AND CHARACTERS ON CARD 13 OF BLD ENSURE THAT CHARACTER CODE ASSUMED BY PROGRAM LOGIC IS IDENTICAL WITH THAT OF THE USER.

ON CARD 14 OF BLD, THE DECIMAL FRACTION FOLLOWING RDE IS THE RATIO OF D.I.B./D.O.B. AT BREAST-HEIGHT THAT WILL BE ASSUMED IF NO BARK-MEASUREMENTS ARE RECORDED FOR A PARTICULAR INDIVIDUAL TREE.

THE DECIMAL FRACTION FOLLOWING UDTRO IS THE ASSUMED RATIO OF D.O.B. OF UNSEEN TOP TO D.B.H., OR THE ASSUMED TAPER TO THE UNSEEN TOP IN INCHES PER FOOT. THIS FRACTION IS IGNORED IF THE OBSERVER HAS RECORDED A BETTER ESTIMATE. THE USE OF THIS CONSTANT IS DISCUSSED IN MORE DETAIL LATER.

THE DECIMAL NUMBERS FOLLOWING QUAN AND DENO ARE FOR HYPERBOLIC EXTRAPOLATION OF D.I.B./D.O.B. RATIOS ABOVE BREAST HEIGHT. THE PROCESS IS

DISCUSSED IN MORE DETAIL LATER.

IF THE PROGRAM HAS BEEN PROPERLY COMPILED WITH APPROPRIATE CONSTANTS AS DISCUSSED ABOVE, EXECUTION REQUIRES ONLY THAT THE BINARY DECKS BE PRECEDED AND FOLLOWED BY APPROPRIATE MONITOR CARDS AND 8Y ONE OR MORE SETS OF DATA.

APPENDIX A SHOWS SYSTEM CONTROL CARDS, DECK ARRANGEMENT, AND PROGRAM CHANGES REQUIRED TO RUN PROGRAM STX ON SEVERAL DIFFERENT DIFFERENT COMPUTERS WITH QUITE DIFFERENT OPERATING SYSTEMS (IBM 360, 7040, 7090, CDC 6400, 6600).

APPENDIX A ALSO LISTS 2 SETS OF TEST INPUT DATA USED IN DEBUGGING AND FOR GENERATING THE ILLUSTRATORY OUTPUT SHOWN IN APPENDIX B.

FIVE CONTROL CARDS MUST ALWAYS PRECEDE EACH SET OF DATA CARDS THAT IS TO BE SEPARATELY PROCESSED. THE FIELDS OF THESE CARDS ALONG WITH THE FORMAT AND LIST OF VARIABLES OCCUPYING THESE FIELDS ARE DESCRIBED IN FIGURES 1 THROUGH 3.

THE FIRST CARD IDENTIFIES THE PARTICULAR AREA OR BODY OF TREES BEING MEASURED, AND FURNISHES A SHORT 4-CHARACTER IDENTIFIER USED TO IDENTIFY PUNCHED OUTPUT AND CERTAIN ERROR DIAGNOSTICS (IF ANY).

THE SECOND CARD GIVES THE INITIALS OF THE PERSON RESPONSIBLE FOR HANDLING THE PARTICULAR SET OF DATA, AND THE DATE OF INPUT. IN ADDITION, IT FURNISHES INSTRUMENT AND SAMPLE-DESIGN PARAMETERS AND SPECIFIES A PARTICULAR JOB-PROCESSING OPTION IN EACH OF 6 DIFFERENT CATEGORIES.

THE THIRD AND FOURTH CARDS CAN BE LEFT BLANK IF THE FIRST OF THESE STX JOB OPTIONS IS LEFT BLANK, PUNCHED 0, OR PUNCHED 1. IF THE FIRST JOB-OPTION IS PUNCHED 2 OR GREATER, THE THIRD CARD MUST CONTAIN THE TOTAL NUMBER OF TREES IN EACH STRATUM, AND THE FOURTH CARD MUST CONTAIN THE AGGREGATE PREDICTED VOLUME OR VALUE OF ALL TREES IN EACH STRATUM. THESE TOTALS MUST INCLUDE NOT ONLY SURE-TO-BE-MEASURED TREES AND 3P-MEASURED TREES, BUT ALSO ALL TREES THAT ARE 3P-PREDICTED-ONLY.

THE FIFTH CARD CONTAINS AN ARBITRARY RELATIVE VALUE PER UNIT VOLUME FOR TREES IN EACH STRATUM. ANY OR ALL STRATA LEFT BLANK WILL BE UNDERSTOOD TO HAVE A RELATIVE VALUE OF UNITY.

THE LABELS ON FIGURES 1 THROUGH 3 ARE SELF-EXPLANATORY FOR THE MOST PART WHEN COUPLED WITH THE FORMAT AND LIST SHOWN BENEATH EACH. HOWEVER, PARAMETERS B, O, U, G, K + Z, K, Q2 ARE MORE FULLY EXPLAINED BELOW.

B IS THE SHORT-BASE-RANGEFINDER DENDROMETER OPTICAL BASE IN INCHES.

Q IS THE SINE OF 1/2 THE MAXIMUM DEFLECTION CAUSED BY COUNTER-ROTATION OF SHORT-BASE-RANGEFINDER DENDROMETER PRISMS AWAY FROM NEUTRAL POSITION.

U IS THE CONSTANT AMOUNT CF DEFLECTION (IN DEGREES) BUILT INTO A GIVEN SHORT-BASE-RANGEFINDER DENDROMETER AND ALGEBRAICALLY ADDED TO THE VARIABLE DEFLECTION CAUSED BY PRISMS' COUNTER-ROTATION.

G IS THE REFRACTIVE INDEX OF THE GLASS USED IN THE COUNTER-ROTATING PRISMS.

K + Z (OR KZ OR PRBS) IS THE TOTAL NUMBER OF OPPORTUNITIES FOR SELECTION OR REJECTION SPECIFIED BY THE 3P-SAMPLING DESIGN.

K IS THE LARGEST ASSIGNABLE RELATIVE SAMPLING PROBABILITY IN A 3P-SAMPLING DESIGN (EQUIVALENT TO THE INTEGER NUMBER OF NON-NULL OPPORTUNITIES SPECIFIED BY THE 3P-SAMPLING DESIGN).

Q2 IS AN INTEGER RESERVED EITHER FOR SPECIFYING FUTURE OPTIONS OR FOR AN INSTRUMENT PARAMETER POSSIBLY NEEDED WHEN EXPANDING SUBROUTINES OPCL, OPFK, OR OTHR TO CONVERT INSTRUMENT READINGS OF A DIFFERENT SORT TO DIAMETER, HEIGHT, AND RANGE.

VALUES FOR B, Q, U, AND G USED IN EXAMPLES IN THE APPENDICES HAVE BEEN DERIVED BY THE AUTHOR FROM RATHER CRYPTIC DESIGN PARAMETERS RECENTLY PROVIDED BY THE MANUFACTURER OF THE ONLY COMMERCIALLY AVAILABLE SHORTBASE-RANGEFINDER DENDROMETER (INSTEAD OF FROM EMPIRICAL CALIBRATION PROCEDURES). VALUES ARE -- B=8.000 INCHES, Q=.01964673, U=-1.1905 DEGREES, AND G=1.5658.

REFERENCES (*2), (*4), (*5), AND (*8) EXPLAIN DENDROMETER TRIGONOMETRY, EXTRAPOLATION PROCEDURE, AND 3P-SAMPLING THEORY MORE FULLY.

THE SIX JOB-OPTIONS OF THE SECOND CONTROL CARD ARE SPECIFIED BY PUNCHING OF COLUMNS 66- 71, THUS--

FIRST (66)	(0 OR 1	INPUT CARDS MUST BE PUNCHED FOR ALL TREES (INCLUDING NON-MEASURED TREES ASSIGNED PREDICTIONS ONLY), BUT THIRD AND FOURTH CONTROL CARDS ARE LEFT BLANK.
	(2 OR 2+	INPUT CARDS MUST BE PUNCHED ONLY FOR MEASURED TREES. BUT AGGREGATE NUMBER OF TREES AND AGGREGATE PREDICTIONS OR EACH STRATUM (INCLUDING SURE-TO-BE-MEASURED TREES, 3P-MEASURED TREES. AND 3P-PREDICTED-ONLY TREES) MUST BE PUNCHED ON THE THIRD AND FOURTH CONTROL CARDS.
SECOND(67)	(0 OR 1	PROCESSING WILL CEASE AFTER ST11 HAS CALCULATED AND PRINTED PRELIMINARY REPORT.
	(2 OR 2+	PROCESSING WILL CONTINUE BEYOND ST11 IF NO FATAL ERRORS OCCUR.
THIRD (68)	(0 OR 1	NO INDIVIDUAL TREE DETAIL WILL BE PRINTED.
	(2	INDIVIDUAL TREE DETAIL WILL BE PRINTED.
	(3 OR 3+	INDIVIDUAL LOG AND TREE DETAIL WILL BE PRINTED.
FOURTH(69)	(0 OR 1	NO DETAIL CARDS WILL BE PUNCHED AS PART OF OUTPUT.
	(2	TREE DETAIL CARDS WILL BE PUNCHED AS PART OF OUTPUT.
	(3 OR 3+	LOG DETAIL CARDS WILL BE PUNCHED AS PART OF OUTPUT.
FIFTH (70)	(0 OR 1	NO LOG AND TREE DETAIL WILL BE WRITTEN ON TAPE JX FOR LATER GRADE-YIELD AND REALIZATION PROCESSING BY PROD.
	(2	LOG AND TREE DETAIL WILL BE WRITTEN ON TAPE JX AND WILL BE PROCESSED BY PROD IF NO FATAL ERRORS HAVE OCCURRED. BUT SUBTOTALS ONLY WILL BE TABULATED IN PRINTOUT.
	(3 OR 3+	SAME AS 2 ABOVE, BUT IN ADDITION SORTED INDIVIDUAL LOG DETAIL WILL BE PRINTED.
SIXTH (71)	(0	NO FURTHER PROCESSING BY PROD OR ST44.
	(1 THRO 9	CONVERSION COEFFICIENT MATRICES IN ST44 WILL BE USED TO CONVERT SUBTOTALS TO PRODUCT OUTTURN AND REALIZATION VALUES. BUT SEARCH FOR APPROPRIATE SPECIES MATRIX NEVER EXTENDS BEYOND NUMBER OF MATRICES SPECIFIED IN COLUMN 71.

IF A FATAL FLAW IS DETECTED DURING EXECUTION OF ST11, IT WILL CAUSE A DIAGNOSTIC ERROR MESSAGE TO BE PRINTED--THEN ADDITIONAL DATA WILL BE

SCANNED FOR ERRORS, BUT NO SUMMARY WILL BE PRINTED, AND PROCESSING BY ST22, ST33, PREP, AND PROD WILL BE BLOCKED. IF A FATAL FLAW IS DETECTED IN ST22, A DIFFERENT DIAGNOSTIC WILL BE PRINTED, AND ADDITIONAL INDIVIDUAL TREES WILL BE PROCESSED AND PRINTED. THEN NO MORE SUMMARIZATION OR CARD PUNCHING WILL BE ALLOWED, EXCEPT FOR THE DATA PROCESSING STATISTICS PRINTED ON PAGE 'ZERO'.

ACTUAL DATA INPUT INVOLVES ONLY 2 CARD FORMS--TREE CARDS AND DENDROMETER CARDS. A SPECIAL FORM OF TREE CARD THAT IS BLANK EXCEPT FOR TREE NUMBER PUNCHED 9999 IS USED AS A JOB-END CARD FOR EACH OF A GROUP OF SIMILAR JOBS AND ALSO AS A FINAL SIGNAL FOR TERMINATION EXIT OF THE PROGRAM (NO MORE JOBS OR SETS OF DATA TO PROCESS). OBVIOUSLY, NO TREE NUMBER HIGHER THAN 9998 CAN BE ASSIGNED TO REAL TREES.

TREE INPUT CARD SHOWN IN FIGURE 4 IS LARGELY SELF-EXPLANATORY. COLUMN 11 DENOTES TREE SAMPLING CLASS THUS -- A BLANK COLUMN IMPLIES A 3P-PREDICTED-ONLY TREE, (*) INDICATES A 3P-SAMPLE TREE, AND (=) FLAGS A SURE-TO-BE-MEASURED TREE.

THE THREE TREE-OPTIONS ON EACH TREE-CARD ARE SPECIFIED BY PUNCHING OF COLUMNS 23-25, THUS--

	(0 OR 1	TREE MEASURED BY SHORT-BASE-RANGEFINDER AND SBRD
	(	(1 IMPLIES THAT SINELV MUST BE REDUCED BY UNITY).
	(2	TREE MEASURED BY LINEAR DEVICES AND DLIN.
FIRST (23)	(3	TREE MEASURED BY OPTICAL CALIPERS (OPCL NOW A DUMMY).
	(4	TREE MEASURED BY OPTICAL FORK (OPFK NOW A DUMMY).
	(5	TREE MEASURED BY OTHER DEVICE (OTHR NOW A DUMMY).
	(0 OR 1	CONSTANT RATIO (D.I.B.)/(D.O.B.) ASSUMED
	(	= (D.B.H.I.B.)/(D.B.H.O.B.).
	(2	HYPERBOLIC RATIO (0.0.8. - D.I.B.)I(D.O.B.) ASSUMED
SECOND(24)	(	= QUAN/(RENO-D.O.B./D.B.H.O.B.) ALL MULTIPLIED BY
	(	(D.B.H.O.B. - D.B.H.O.B.)/(D.B.H.O.B.).
	(3 OR 3+	HYPERBOLIC RATIO (D.I.B.)/(0.0.8.) ASSUMED
	(	= (FIRST BARK OPTION)*9./(10.-D.O.B./D.B.H.O.B.).
	(0 OR 1	UNSEEN BUT USABLE MATERIAL ABOVE LAST MEASURED SECTION
	(	OF TREE ESTIMATED BY CONVEX-CONIC-CONCAVE PROJECTIONS
	(	DEPENDING ON COMPUTER ANALYSIS OF TAPER BEHAVIOR.
	(2	UNSEEN BUT USABLE MATERIAL ABOVE LAST MEASURED SECTION
THIRD (25)	(	OF TREE COMPUTED FROM GUESSED CONIC TAPER RATE, LENGTH.
	(3 OR 3+	UNSEEN BUT USABLE MATERIAL ABOVE LAST MEASURED SECTION
	(	OF TREE ESTIMATED FROM USER-SUPPLIED FUNCTIONS FFH3,
	(	FFS3, FFV3.

THIS THIRD SET OF OPTIONS IS IGNORED UNLESS A FICTITIOUS NEGATIVE VALUE FOR FGRADS IS RECORDED AFTER THE LAST ACTUALLY MEASURED SET OF VALUES. THIS METHOD IS UNIVERSALLY APPLICABLE. BUT AN ALTERNATIVE TECHNIQUE IS ALSO AVAILABLE WHEN A SHORT-BASE-RANGEFINDER HAS BEEN USED TO MEASURE THE TREE. IN THIS CASE, A FINAL FICTITIOUS SET OF READINGS WITH SINELV AND TGRADS MERELY REPEATING THE PREVIOUS ACTUAL SINELV AND TGRADS, AND WITH FICTITIOUS FGRADS EQUAL TO FICTITIOUS TGRADS WILL PRODUCE THE SAME RESULT AS NEGATIVE FGRADS. A FINAL FICTITIOUS NEGATIVE FGRADS ACHIEVES THE SAME RESULT MUCH MORE SIMPLY. THE PRESENCE OF UNSEEN MATERIAL IN A TREE WILL BE FLAGGED LATER BY AN ASTERISK IN PRINTED OR PUNCHED TREE-TOTAL OUTPUT.

SOME OF THE DETAILS INVOLVED IN THE CONVEX-CONIC-CONCAVE PROJECTION ARE DISCUSSED IN REFERENCE (*5). EXACT VOLUME AND SURFACE INTEGRALS ARE USED FOR ALL PROJECTIONS. THE CONVEX PROJECTION USES A DATA-DERIVED, TWO-PARAMETER HYPERBOLA, AND THE CONCAVE PROJECTION USES A DATA-DERIVED, TWO-PARAMETER PARABOLA.

THE FIELDS LABELLED UMAXL AND UDORT ON THE TREE INPUT CARD ARE LEFT BLANK UNLESS A FICTITIOUS SET OF DENDROMETER READINGS IMPLYING UNSEEN USABLE MATERIAL HAS BEEN RECORDED. THEN IF THE THIRD TREE OPTION IS PUNCHED (1) OR (3), THE PROGRAM WILL COMPUTE UPPERMOST UNSEEN D.O.B. IN INCHES AS (UDORT)*(DBH). IF THE THIRD TREE OPTION IS PUNCHED (2), THE UPPERMOST UNSEEN D.O.B. IS COMPUTED BY SUBTRACTING (UDORT)*(UMAXL) FROM THE UPPERMOST MEASURED D.O.B. SUCH A CONIC PROJECTION TREATS UMAXL AS UNSEEN LENGTH IN FEET, AND UDORT AS THE RATE OF TAPER IN INCHES PER FOOT OF LENGTH. IF UMAXL IS LEFT BLANK OR ZERO WHEN THE THIRD OPTION IS PUNCHED (1) OR (3), THE PROJECTION TERMINATES ONLY WHEN CALCULATED UPPERMOST D.0.8. IS REACHED. A POSITIVE, NONZERO VALUE FOR UMAXL, HOWEVER, WOULD BE TREATED AS AN ADDITIONAL LENGTH LIMITATION, AND THE PROJECTION WOULD TERMINATE WHEN EITHER THE LIMITING LENGTH OR THE CALCULATED UPPERMOST D.O.B. WAS REACHED (WHICHEVER OCCURRED FIRST). IF UDORT HAS BEEN LEFT BLANK DESPITE THE FACT THAT DENDROMETER READINGS IMPLY UNSEEN MATERIAL ABOVE LAST MEASURED SECTION, UDORT WILL BE SET EQUAL TO UDTRO, A PARAMETER CURRENTLY SET AT .45 BUT EASILY CHANGED BY REASSEMBLY OF BLD. NOTE THAT UMAXL SHOULD NOT BE LEFT BLANK IF THE CONIC PROJECTION HAS BEEN SPECIFIED-IT WOULD IMPLY ZERO ADDITIONAL LENGTH.

TREES NUMBERED 1 THROUGH 3 IN EXAMPLE 'DBST' ILLUSTRATE THE FIRST OR STANDARD OPTION FOR HANDLING UNSEEN LENGTH. TREE NUMBER 4 ILLUSTRATES THE SAME OPTION BUT WITH A LIMITING UMAXL TRUNCATING THE PROJECTION BEFORE THE LIMITING DIAMETER COULD BE REACHED. TREE NUMBER 5 ILLUSTRATES THE SECOND OPTION FOR HANDLING UNSEEN LENGTH, WHERE THE USER SPECIFIES LENGTH AND RATE OF TAPER FOR A SIMPLE CONIC PROJECTION.

THE FIELDS LABELLED XTRA AND XTRB ON THE TREE INPUT CARD ARE RESERVED FOR INPUT TO SUBROUTINES OR FUNCTIONS SUPPLIED BY THE USER (SUCH AS OPCL, OPFK, OR OT HR) .

CERTAIN OTHER CONVENIENT PROGRAM FEATURES SHOULD BE DISCUSSED AT THIS POINT. IF THE COLUMN FOR TOTAL NUMBER OF STRATA ON THE SECOND CONTROL CARD IS LEFT BLANK OR PUNCHED ZERO, IT WILL BE CONSIDERED TO BE THE SAME AS HAVING A (1) PUNCHED. SIMILARLY, IF THE INDIVIDUAL TREE VALUE STRATUM IS

LEFT BLANK OR PUNCHED ZERO, IT WILL BE CONSIDERED TO BE IN STRATUM (1). THUS, WHERE SAMPLING IS TO BE PROPORTIONAL TO VOLUME (RATHER THAN VALUE). NO STRATIFICATION IS NEEDED ANC ALL VALUE STRATA FIELDS CAN BE IGNORED OR LEFT BLANK. A MAXIMUM OF 9 VALUE STRATA MAY BE USED IN COLUMN 10 TO FACILITATE VARYING SAMPLING INTENSITY, BUT STRATIFICATION FOR OTHER PURPOSES IN COLUMNS 12 - 15 OF THE TREE INPUT CARD IS PRACTICALLY UNRESTRICTED.

A BLANK DBH FIELD WILL CAUSE AN ESTIMATE OF D.B.H. TO BE SUPPLIED FROM THE SECOND SET OF DENDROMETER READINGS (THE SET NEXT ABOVE THE STUMP SET). AND THE NUMBER OF THE TREE WILL BE RECORDED IN THE LIST OF SUSPICIOUS TREES-- ALSO, THE TREE CARD PUNCHED FOR THIS TREE WILL SHOW ZERO BASAL AREA.

THERE IS NO NEED TO DISTINGUISH AMONG BLANK, ZERO, OR ONE IN THE FIRST TREE OPTION ('METH') UNLESS BOTH EARLY AND LATER MODELS OF SHORT-BASE-RANGEFINDER DENDROMETER ARE BEING USED TOGETHER. CARD 78 OF ST22 CAN BE ALTERED TO RESET METH TO ZERO WHERE NO MODEL FP15 INSTRUMENTS ARE USED, OR TO RESET METH TO ONE WHERE ALL INSTRUMENTS ARE MODEL FP15.

A BLANK OR ZERO FIELD IN THE SECOND OR THIRD TREE OPTIONS IS RESET TO ONE AND TREATED ACCORDINGLY.

IF ONLY ONE OF THE TWO FIELDS FOR RECORDING SINGLE-BARK THICKNESS IS PUNCHED, THE PROGRAM WILL. DOUBLE THAT VALUE TO ESTIMATE TOTAL BARK THICKNESS. IF BOTH FIELDS ARE PUNCHED, IT WILL ADD THEM. IF THE SECOND TREE-OPTION (DEALING WITH PROJECTION OF BARK THICKNESS) IS LEFT BLANK AND IF THE SOLE BARK PUNCHED IS NEGATIVE (OR IF BOTH PUNCHED BARKS ARE NEGATIVE), THE PROGRAM WILL CALCULATE VOLUMES AND SURFACES WITHOUT ANY REDUCTION FOR BARK THICKNESS. HENCE BARK WILL BE EITHER INCLUDED OR EXCLUDED DEPENDING ON WHETHER MEASUREMENTS OF DIAMETER HAVE BEEN INSIDE OR OUTSIDE BARK. THE ONLY INDICATION OF POSSIBLE BARK INCLUSION WILL BE A NEGATIVE DOUBLE-BARK THICKNESS ON PRINTED OR PUNCHED OUTPUT OF TREE TOTALS. IF BOTH BARKS ARE LEFT BLANK OR ARE PUNCHED ZERO, THE RATIO D.I.B./D.O.B. AT BREAST HEIGHT WILL BE SET EQUAL TO ROE, A PARAMETER CURRENTLY VALUED AT .90 BUT EASILY CHANGED BY REASSEMBLING BLD. OMISSION OF BOTH BARKS ON THE INPUT (CAUSING USE OF RUE IN ESTIMATING D.I.B.) IS FLAGGED BY THE APPEARANCE OF A ZERO OR A MINUS ZERO IN THE BARK FIELD OF PRINTED OR PUNCHED OUTPUT OF TREE TOTALS (BLANKS ARE FLAGGED BY MINUS ZERO AT MANY BUT NOT ALL INSTALLATIONS).

VARIOUS BARK OPTIONS ARE ILLUSTRATED BY TREES NUMBERED 1 THROUGH 8 IN EXAMPLE 'DBST'. THE FIRST FIVE TREES SHOW HOW INSIDE-BARK MEASUREMENTS ARE CONVERTED TO INSIDE- BARK VOLUMES, ETC., BY SPECIFYING NEGATIVE BARK. TREE NUMBER 6 SHOWS HOW OUTSIDE-BARK MEASUREMENTS ARE CONVERTED TO OUTSIDE-BARK VOLUMES, ETC., SIMILARLY BY SPECIFYING NEGATIVE BARK. THE BARK THICKNESS MADE NEGATIVE MAY BE ACTUALLY MEASURED OR FICTITIOUS, SINCE ITS MAGNITUDE IS NOT USED COMPUTATIONALLY. TREE NUMBER 7 ILLUSTRATES CONVERSION OF OUTSIDE-BARK MEASUREMENTS TO INSIDE-BARK VOLUMES, ETC., EMPLOYING THE FIRST OR STANDARD BARK OPTION, WHILE TREE NUMBER 8 ILLUSTRATES THE SECOND OPTION APPLIED TO A TREE WITH THE SAME DIMENSIONS AS TREE NUMBER 7.

FINALLY, THE LINEAR COMPOUND USED IN THE CALCULATION OF RELATIVE ERROR OF A 3P SAMPLE SHOULD BE MENTIONED. THE PROGRAM ASSUMES THAT THE RELATIVE PROBABILITIES ASSIGNED EACH TREE ARE INTENDED TO BE PROPORTIONAL TO

A VALUE-WEIGHTED LINEAR COMPOUND OF VOLUME, SURFACE, AND LENGTH. EACH VALUE STRATUM IS ASSUMED TO HAVE UNIT VALUE OF UNITY UNLESS OTHERWISE STATED ON FIFTH CONTROL CARD. THUS, BOARD FEET WEIGHTED BY RELATIVE VALUE CAN BE PREDICTED AND THE PROGRAM WILL RELATE SUCH PREDICTIONS TO A SPECIFIED FUNCTION OF THE TYPE DISCUSSED IN REFERENCES (*1, *6) --

(BORD*VOLUME+SLAB*SURFACE+CLFT*LENGTH)*(WV), WHERE WV IS A RELATIVE VALUE PER UNIT MANUFACTURED PRODUCT IN EACH VALUE STRATUM. BORD, SLAB, CLFT ARE SET CURRENTLY AT 8.956, -.6954, .04145 APPROPRIATE TO THE INTERNATIONAL LOG RULE WITH 1/4-INCH KERF AND CUSTOMARY TRIM ALLOWANCE, BUT THEY ARE EASILY CHANGED BY RECOMPILING BLD.

AS WAS NOTED EARLIER, ONLY MINOR MODIFICATIONS IN THE PROGRAM ARE NEEDED TO ALLOW ASSIGNING RELATIVE PROBABILITIES PROPORTIONAL TO BASAL AREA, D.B.H., OR PLOT SIZE, BUT SUCH ASSIGNMENTS WOULD USUALLY BE MUCH LESS EFFICIENT WHERE VOLUME OR VALUE ARE THE VARIABLES OF INTEREST.

AFTER A TREE CARD HAS BEEN PUNCHED, WITH THE COLUMN FOLLOWING THE TREE NUMBER EITHER PUNCHED ZERO OR LEFT BLANK, UP TO 9 DENDROMETER CARDS (NUMBERED SEQUENTIALLY IN THE COLUMN FOLLOWING TREE NUMBER) MAY FOLLOW. THE ILLUSTRATION IN FIGURE 5 IS FOR OBSERVATIONS MADE WITH A SHORT-BASE-RANGEFINDER DENDROMETER. TAPES, MECHANICAL CALIPERS, OPTICAL CALIPERS, AND OPTICAL FORKS WOULD USE THE SAME FIELDS (SOME FIELDS MIGHT BE LEFT BLANK), BUT VARIABLES WOULD BE INTERPRETED DIFFERENTLY. DENDROMETER READINGS FOR EACH TREE ARE PROCESSED BY WHICHEVER ONE OF THE FIVE SUBROUTINES IS APPROPRIATE TO THE METHOD USED TO MEASURE THE TREE (SBRD, DLIN, OPCL, OPFK, OTHR).

THE DENDROMETER CARD REPEATS THE TREE NUMBER AND FOLLOWS IT WITH A WITHIN-TREE CARD SEQUENCE NUMBER STARTING WITH 1 BUT NEVER PROGRESSING HIGHER THAN 9. TRIOS OF DENDROMETER READINGS (TGRADS, FGRADS, SINELV) ARE THEN RECORDED, STARTING AT THE STUMP (OR BASE) OF THE TREE. THE SECOND TRIO OF READINGS SHOULD MEASURE D.B.H. REFERENCE (*2) EXPLAINS THE MEANING OF THESE TERMS FOR SHORT-BASE-RANGEFINDER DENDROMETERS. READINGS PROGRESS UPWARDS--NOTE THAT THIS IS OPPOSITE TO THE DIRECTION SPECIFIED IN THE SMALL EXPLORATORY COMPUTER PROGRAM OUTLINED IN REFERENCE (*2). ASSOCIATED WITH EACH TRIO OF READINGS IS A 2-CHARACTER FIELD (DENOTED AS GAMATH IN FIGURE 5 AND AS GR IN FIGURE 7) USEFUL FOR DESCRIBING EXTERNAL QUALITY AND DEFECT BETWEEN A PARTICULAR DIAMETER AND THE DIAMETER NEXT BELOW IT.

SUBROUTINE SBRD PROCESSES ANGULAR READINGS MADE WITH A SHORT-BASE-RANGEFINDER DENDROMETER (THIS METHOD IS INDICATED BY LEAVING BLANK COLUMN 23 OF A TREE-CARD, OR BY PUNCHING 0 OR 1 IN THIS COLUMN -- AS NOTED EARLIER, UNITY IS SUBTRACTED FROM SINELV IF 1 IS SENSED BY SBRD). TREES NUMBERED 6 THROUGH 13 IN EXAMPLE ‘DBST’ IN APPENDICES ILLUSTRATE DATA FROM SHORT-BASE-RANGEFINDER.

DENDROMETER MEASUREMENT OF THE TWO LOWEST DIAMETERS OF A TREE (USUALLY STUMP AND D.B.H.) IS OFTEN MADE DIFFICULT BY INTERVENING BRUSH. WHEN INITIAL TGRADS IS RECORDED AS A FICTITIOUS -999, THE LATEST VERSION OF SBRD INTERPRETS INITIAL FGRADS TO BE TAPE-MEASURED STUMP DIAMETER IN INCHES AND TENTHS, AND INITIAL SINELV TO BE DISTANCE (IN FEET AND TENTHS WITH EXPLICIT DECIMAL POINT) UPWARDS TO NEXT TAPE-MEASUREMENT. SECOND TGRADS IS IGNORED WHILE SECOND FGRADS IS INTERPRETED TO BE NEXT TAPE-MEASURED DIAMETER (USUALLY D.B.H.) IN INCHES AND TENTHS, AND SECOND SINELV IS INTERPRETED TO BE DISTANCE UPWARDS (IN FEET

AND TENTHS WITH EXPLICIT DECIMAL POINT) TO PLACE WHERE DENDROMETER MEASUREMENTS CAN START. FOR ILLUSTRATION, SEE TREE NUMBER 11 IN EXAMPLE 'DBST' IN APPENDICES.

OCCASIONALLY, SINELV FOR THE VERY TOP OF A TREE CAN BE MEASURED, BUT IT IS IMPOSSIBLE TO OBTAIN A MEASUREMENT FOR TGRADS. VOLUME, SURFACE, AND LENGTH OF THE PORTION OF THE TREE BETWEEN THIS TIP (GIVEN A NOMINAL D.O.B. OF .1 INCH) AND THE HIGHEST ACTUALLY MEASURED DIAMETER WILL BE COMPUTED IF THE TERMINAL TRIO OF DENDROMETER READINGS IS RECORDED AS -999, -999, SINELV OF TOP. THIS IS ILLUSTRATED BY TREE NUMBER 9 OF EXAMPLE 'DBST' IN APPENDICES.

SUBROUTINE OLIN PROCESSES LINEAR READINGS MADE WITH MECHANICAL CALIPERS OR TAPE (THIS METHOD IS INDICATED BY PUNCHING 2 IN COLUMN 23 OF A TREE-CARD). TREES THUS MEASURED MAY BE STANDING OR FELLED, AND TGRADS IS ALWAYS IGNORED. FGRADS IS INTERPRETED TO BE DIAMETER IN INCHES AND TENTHS, AND SINELV IS INTERPRETED TO BE DISTANCE (IN FEET AND TENTHS WITH EXPLICIT DECIMAL POINT) DOWNWARDS TO NEXT DIAMETER BELOW. SINELV MUST BE 0.0 FOR STUMP AND BOTTOM OF EACH FORK. THE USUAL BARK AND UNSEEN LENGTH PROJECTIONS ARE AVAILABLE. HOWEVER, IF IT IS DESIRED TO USE MEASURED D.I.B.'S WITHOUT ANY HYPOTHESIS AS TO BARK BEHAVIOR, THIS CAN BE DONE BY THE USUAL DEVICE OF PUNCHING A FICTITIOUS NEGATIVE BARK THICKNESS. TREES NUMBERED 1 THROUGH 5 IN EXAMPLE 'DBST' EMPLOY OLIN WITH D.I.B.'S AND NEGATIVE BARK FOR INSIDE-BARK VOLUMES.

SUBROUTINES OPCL, OPFK, OR OTHR (INDICATED BY PUNCHING 3,4, OR 5 IN COLUMN 23 OF A TREE-CARD) ARE CURRENTLY DUMMIES THAT CAN BE EXPANDED BY USERS.

SOME USERS HAVE FOUND IT DESIRABLE TO BE ABLE TO PROCESS NONCONVERTIBLE, NONDENDROMETERED TREES (SUCH AS CULLS) ALONG WITH MERCHANTABLE, MEASURED TREES, THOUGH OF COURSE CULLS MUST BE ASSIGNED TO A SEPARATE STRATUM. THIS PROGRAM CAN NOW DO THIS. WHERE A CULL STRATUM (OR STRATA) HAS BEEN SPECIFIED, EACH CULL MUST HAVE A NONZERO KPI, WHICH CAN BE FICTITIOUS OR CONSTANT, BUT IT CANNOT BE OMITTED UNLESS THE CULL IS CLASSED AS SURE-TO-BE-MEASURED. ANY CULL QUALIFYING ACCORDING TO 3P PROCEDURE MUST HAVE A TREE CARD CONTAINING AT LEAST STRATUM, SAMPLING CATEGORY, KPI, SPECIES, AND D.B.H. IF INDIVIDUAL CULL DETAIL IS DESIRED ON PRINTOUT, THIS MUST BE FOLLOWED BY A DENDROMETER CARD WITH 'ONE' PUNCHED IN COLUMNS 5, 19, 34 AND 'ASTERISK' IN COLUMN 72.

IF NO INDIVIDUAL CULL DETAIL IS DESIRED ON PRINTOUT, THE DENDROMETER CARD CAN BE OMITTED. INSTEAD, AN 'ASTERISK' MUST BE PUNCHED IN COLUMN 72 OF THE TREE CARD FOR THE SAMPLE OR SURE-TO-BE MEASURED CULL TREE.

TREE NUMBER 14 IN EXAMPLE 'DBST' (CLASSED AS COLD) IS PRINTED OUT WITH FULL INDIVIDUAL TREE DETAIL BECAUSE A DUMMY DENDROMETER CARD HAS BEEN USED.

TREE NUMBER 15, ON THE OTHER HAND, HAS AN ASTERISK IN COLUMN 72 OF ITS TREE CARD AND LACKS A DUMMY DENDROMETER CARD. HENCE, NO INDIVIDUAL TREE DETAIL APPEARS ON THE PRINTOUT, BUT ITS FREQUENCY, BASAL AREA, AND KPI ARE ACCUMULATED AND INCLUDED IN STRATUM AND GRAND TOTALS.

IF COLUMN 72 IS LEFT BLANK ON A DENDROMETER CARD, IT IMPLIES THAT THE CARD IS COMPLETELY FILLED WITH 4 TRIOS OF DENDROMETER READINGS, AND THAT THE PARTICULAR TREE IS BEING CONTINUED ON A FOLLOWING CARD.

IF COLUMN 72 IS PUNCHED WITH AN ASTERISK (*), IT MEANS THAT THE LAST SET OF DENDROMETER READINGS OCCURS SOMEWHERE ON THAT PARTICULAR CARD, AND THAT THE NEXT CARD SHOULD BE A TREE CARD FOR A NEW TREE, OR A TERMINATING 9999.

IF COLUMN 72 IS PUNCHED WITH A PLUS SIGN (+), IT MEANS THAT A TRUNCATING SET OF DENDROMETER READINGS OCCURS SOMEWHERE ON THAT PARTICULAR CARD, BUT THAT MORE MATERIAL FOR THE SAME TREE STARTING FROM A NEW 'BOTTOM' (WHICH MIGHT, HOWEVER, BE THE SAME POINT ON THE TREE AS THE PREVIOUS TRUNCATION POINT) WILL OCCUR ON THE VERY NEXT CARD. THIS DEVICE ALLOWS CHANGING POSITION ONCE UPHILL OR DOWNHILL FOR BETTER VISIBILITY DURING THE MEASUREMENT OF A SINGLE-STEMMED TREE--HERE THE FIRST MEASUREMENTS FROM THE NEW VIEWPOINT RECORDED ON THE CARD FOLLOWING THE CARD WITH THE TRUNCATING PLUS SIGN SHOULD BE OF THE SAME DIAMETER ON THE TREE AS THAT WHICH TRUNCATED THE PREVIOUS CARD WHEN MEASURED FROM THE OLD VIEWPOINT. THE HEIGHTS OF DIAMETERS AFTER TRUNCATION WILL ALL BE MEASURED ABOVE THE NEW 'BOTTOM' TO WHICH WILL BE ADDED THE TRUNCATING HEIGHT ON THE CARD WITH THE INITIAL PLUS SIGN. TREE NUMBER 12 IN EXAMPLE 'DBST' ILLUSTRATES SUCH A CHANGE OF VIEWING POINT. WHEN VIEWPOINT IS CHANGED ALONG THE CONTOUR (WITH NO CHANGE IN BASE ELEVATION), THE TRUNCATION AND PLUS PROCEDURE IS UNNECESSARY--THE USER GOES RIGHT ON UP THE TREE AS THOUGH HE HAD NOT MOVED.

TREES WITH ANY NUMBER OF FORKS ABOVE BREAST HEIGHT CAN BE HANDLED BY THE TRUNCATION PROCEDURE. THE SINGLE PORTION OF THE STEM IS TRUNCATED WITH THE PLUS SIGN, THEN EACH FORK EXCEPT THE LAST IS MEASURED AND TRUNCATED WITH A PLUS SIGN. THE TALLEST FORK SHOULD ORDINARILY BE LEFT TILL LAST AND SHOULD BE TERMINATED WITH AN ASTERISK RATHER THAN A PLUS SIGN TO SHOW THAT NO MORE MATERIAL IN THAT TREE WILL BE MEASURED. FORKED TREES ARE FLAGGED BY AN ASTERISK ON PRINTED OR PUNCHED TREE-TOTAL RECORDS. TREE NUMBER 13 IN EXAMPLE 'DBST' IS FORKED.

AFTER THE LAST CARD OF THE LAST TREE ON A GIVEN AREA OR JOB, A JOB-END CARD SHOULD FOLLOW (PUNCHED ONLY 9999 IN THE FIRST FOUR COLUMNS). ANOTHER SIMILAR CARD (SERVING AS A PROGRAM-END CARD) IS PLACED AFTER THE JOB-END CARD OF THE LAST SET OF DATA TO TERMINATE ALL USE OF PROGRAM STX. HOWEVER, THE SECOND CARD CONTAINING 9999 (I.E., THE PROGRAM-END CARD) SHOULD BE OMITTED WHEN A GENERAL SYSTEM TAPESORT (E.G., IBM 7040 $IBSRT) IS USED IN PLACE OF THE CORESORT PROVIDED BY SUBROUTINES PREP, SORT, AND MERJ.

WHEN A GENERALIZED SYSTEM TAPESORT IS USED INSTEAD OF SUBROUTINES PREP, SORT, AND MERJ, NO ADDITIONAL JOBS WILL BE PROCESSED AFTER ANY JOB ACTUALLY EMPLOYS THE GENERALIZED SYSTEM TAPESORT. HENCE, USERS WILL FIND IT ADVISABLE, UNDER SUCH CIRCUMSTANCES, TO ENSURE THAT ONLY THE LAST JOB OF A STACK REQUIRES USE OF GENERALIZED SYSTEM TAPESORT.

FIGURE 6 ILLUSTRATES A TALLY FORM SUITABLE FOR RECORDING 3P-PREDICTED-ONLY TREE DATA, SAMPLE-MEASURED OR SURE-TO-BE-MEASURED TREE DATA, AND DENDROMETER DATA IN THE FIELD.

FIGURE 7 ILLUSTRATES A PUNCHED-CARD FORM CONVENIENT FOR INSERTING ALL SUCH DATA INTO A COMPUTER FOR PROCESSING BY PROGRAM STX.

========== CONVERSION TO OUTTURN AND VALUE ==========

SOME USERS OF THE EARLIER SKELETON VERSION OF ST44 HAVE ALREADY EXPANDED IT TO BREAK THE TREE DOWN INTO 16-FOOT LOGS GRADED BY CONVENTIONAL LOG GRADING SYSTEMS. THIS MAY BE EXPEDIENT AS A TEMPORARY MEASURE, BUT ITS USUAL RESULT IS TO INCLUDE UNLIKE MATERIAL IN A SINGLE LOG WHILE IGNORING THE MUCH MORE MEANINGFUL SEGREGATION BASED ON ACTUALLY OBSERVED CHANGE IN TAPER, DEFECT, AND/OR QUALITY THAT IMPELLED THE OBSERVER TO TAKE A NEW SET OF DENDROMETER READINGS. ONCE TREES HAVE BEEN PARTITIONED INTO INEFFICIENT 16-FOOT SECTIONS, THESE ARE USUALLY STRATIFIED INTO SEPARATE SIZE-CLASSES -- A MUCH LESS EFFICIENT WAY OF ACCOUNTING FOR THE DIFFERENTIAL EFFECTS OF SIZE THAN METHODS AGGREGATING VOLUME, SURFACE, AND LENGTH (*6).

THE REVISED AND EXPANDED VERSION OF ST44 DESCRIBED BELOW ASSUMES THAT THE POINTS AT WHICH DENDROMETER READINGS HAVE BEEN TAKEN EFFECTIVELY PARTITION THAT TREE INTO SECTIONS REASONABLY SIMILAR IN TAPER, DEFECT, AND QUALITY.

SUBROUTINES PREP AND PROD WILL NOT BE CALLED AT ALL IF COLUMN 70 OF THE SECOND CONTROL CARD HAS BEEN LEFT BLANK OR PUNCHED 0 OR 1. PUNCHING 2 OR SOME LARGER DIGIT IN THIS FIELD WILL INITIATE SORTING OF INDIVIDUAL LOG DATA, UNLESS SOME FATAL ERROR IS ENCOUNTERED THAT BLOCKS COMPLETE PROCESSING. THE REARRAYED INDIVIDUAL LOG AND PARENT TREE DATA WILL BE PRINTED OUT WITH CLASS SUBTOTALS WHEN 3 OR MORE IS PUNCHED IN COLUMN 70. ONLY SUBTOTALS WILL BE PRINTED WHEN 2 IS PUNCHED IN COLUMN 70. WHEN COLUMN 71 HAS BEEN LEFT BLANK OR PUNCHED 0, NO FURTHER PROCESSING BY PROD WILL OCCUR. NO MORE THAN 99 LOG-AND-TREE CLASSES CAN BE SUBTOTALED BY CURRENT VERSIONS OF SUBROUTINES PROD, SUBT, AND ST44.

IF, HOWEVER, COLUMN 71 OF THE SECOND CONTROL CARD CONTAINS AN INTEGER FROM 1 THROUGH 9, AND IF SUBROUTINE ST44 HAS BEEN RECOMPILED TO INCORPORATE THE NECESSARY SETS OF APPROPRIATE CONVERSION COEFFICIENTS, THEN AN ATTEMPT WILL BE MADE TO CONVERT LOG CLASS SUBTOTALS OF VOLUME, SURFACE, AND LENGTH TO PRODUCT YIELDS AND REALIZATION VALUES. IN GENERAL, ONE MATRIX OR SET OF CONVERSION COEFFICIENTS MUST BE PROVIDED FOR EACH SPECIES INCLUDED IN THE INPUT. SEARCH FOR MATRIX LABEL MATCHING SUBTOTAL LABEL WILL BE LIMITED TO THE NUMBER OF MATRICES INDICATED BY THE DIGIT PUNCHED IN COLUMN 71 OF THE SECOND CONTROL CARD. A MAXIMUM OF 9 CONVERSION COEFFICIENT MATRICES (OR SPECIES GROUPS) CAN BE INCORPORATED INTO SUBROUTINE ST44 AT ANY ONE TIME. PRESENT VERSIONS OF SUBROUTINES PROD, SUBT, AND ST44 CAN CONVERT 9 SPECIES WITH 11 LOG CLASSES INTO 6 END-PRODUCTS.

THE CONVERSION COEFFICIENT MATRICES IN SUBROUTINE ST44 MUST BE INPUT BY DATA STATEMENT. FOR A GIVEN TREE CLASS (OR SPECIES), A GIVEN QUALITY AND DEFECT CLASS (GRADE), AND A GIVEN END-PRODUCT, A MINIMUM OF 3 COEFFICIENTS ARE NEEDED TO CONVERT VOLUME, SURFACE, AND LENGTH TO THE DESIRED ENTITIES. MORE COMPLICATED FUNCTIONS OF VOLUME, SURFACE, LENGTH, OR OTHER AGGREGATED VARIABLES MAY, OF COURSE, REQUIRE ADDITIONAL COEFFICIENTS, BUT SUBROUTINE MODIFICATION TO ACHIEVE THIS IS QUITE SIMPLE.

SAWDUST, TRIM, SLABS-EDGINGS. UNUSABLE LUMBER --ALL IN CUBIC FEET-- HAVE BEEN CHOSEN TO ILLUSTRATE OUTTURN ITEMS. ALONG WITH BOARD FEET OF USABLE LUMBER AND LUMBER VALUE. QUANTITY IN EACH GRADE MIGHT HAVE BEEN COMPUTED JUST AS EASILY. HOWEVER, EXCESSIVE TABULAR DETAIL FORMERLY ESSENTIAL TO THE APPRAISAL PROCESS IS NO LONGER NECESSARY AND WOULD MERELY TEND TO COMPLICATE A RELATIVELY SIMPLE AND CLEAR OUTTURN PICTURE. REALIZATION VALUE IS OBTAINABLE DIRECTLY IN DOLLARS FROM VOLUME. SURFACE. AND LENGTH. SEPARATE COMPUTATIONS BY LOG SIZE CLASS HAVE BEEN MACE UNNECESSARY, SINCE VOLUME, SURFACE, AND LENGTH CONTAIN MUCH MORE INFORMATION ABOUT SIZES OF THE COMPONENT LOGS THAN DO INDIVIDUAL SCALING DIAMETERS AND LENGTHS. AGGREGATE VOLUME CONVERTED TO PRODUCTS OR DOLLARS CAN BE CHECKED AGAINST PREVIOUS AGGREGATE VOLUME PROCESSED.

CONVERSION COEFFICIENT MATRICES FOR OUTTURN AND VALUE OF A GIVEN SPECIES SHOULD PREFERABLY BE DERIVED FROM WHOLE-TREE DATA BY FITTING MULTIVARIATE REGRESSIONS, BUT INDIVIDUAL LOG DATA AND ORDINARY MULTIPLE REGRESSIONS CAN BE USED SOMEWHAT LESS SATISFACTORILY. FROM LOG OR TREE DIAGRAMS FOR WHICH MILLED OUTTURN IS AVAILABLE, THE EXTERIOR SHOULD BE CLASSIFIED INTO NO MORE THAN 3 QUALITY CLASSES AND NO MORE THAN 3 DEFECT CLASSES (EXCLUSIVE OF UNSEEN AND CULL SECTIONS). THIS ALLOWS SPECIFICATION OF 9 JOINT QUALITY-DEFECT CLASSES, WHICH MAY BE CONVENIENTLY BE CODED AA, AB .....CC. ADDITIONALLY, UNSEEN PORTIONS OF THE PROBABLY MERCHANTABLE STEM SHOULD BE CODED UU, WHILE TOTALLY CULL SECTIONS (I.E., WOODS CULL) SHOULD BE CODED XX.

THUS, EACH TREE FOR WHICH OUTTURN AND REALIZATION DATA ARE AVAILABLE MAY HAVE ITS EXTERIOR CLASSIFIED INTO ONE OF 11 CATEGORIES, INDEPENDENT OF SIZE. EACH CATEGORY WILL HAVE VOLUME. SURFACE. LENGTH, WHICH WILL ALL BE ZERO IF NO PORTION OF THE STEM WAS PLACED IN THAT PARTICULAR CLASS. IF AT LEAST 34 TREES ARE AVAILABLE. A 33-VARIABLE REGRESSION CAN BE FITTED FOR EVERY DEPENDENT VARIABLE DESIRED (SAWDUST, TRIM, SLABS, MILL CULL, USABLE LUMBER, DOLLAR SALES VALUE OF LUMBER IN THE ILLUSTRATORY EXAMPLE). THE EXTENSION TO MORE ITEMS OR MORE COMPLICATED YIELD FUNCTIONS IS OBVIOUS. THE AUTHOR'S EXECUTIVE PROGRAM FOR FITTING AND ANALYZING MULTIVARIATE REGRESSIONS--'REX'-- DESCRIBED IN (*7), OBTAINS THE NECESSARY CONVERSION COEFFICIENTS QUITE EASILY.

LABELS USED FOR SPECIES AND GRADE IN ST44 MATRICES MUST CORRESPOND WITH CODES USED ON INPUT DATA. ALSO, MATRICES AND GRADE VECTORS SHOULD BE ARRAYED AND SUBSCRIPTED WITH LABELS IN LOGICAL ASCENDING ORDER THAT WILL COLLATE WITH SORTED LOGS. FAILURE TO DO THIS WILL RESULT IN NONCONVERSION OF OFFENDING CLASS. IN GENERAL, WHENEVER NO COEFFICIENT LABELS CAN BE FOUND TO MATCH LOG LABELS, PROD WILL PRINT OUT (-0.) FOR ALL AFFECTED CONVERSIONS.

USERS CONCOCTING THEIR OWN SPECIES AND GRADE LABELS (CODES) MIGHT KEEP IN MIND THAT ONLY 4 LEFT-JUSTIFIED CHARACTERS ARE AVAILABLE FOR TREE CLASS OR SPECIES NOW, A REDUCTION CAUSED BY POPULARITY OF 8-BIT BYTES AND 4-BYTE WORDS. USERS SHOULD ALSO REMEMBER THAT COLLATING SEQUENCES FOR 'EBCDIC'. 'ASCII'. 'ISO', OR 'CCITT' ARE NOT THE SAME AS FOR 'BCD'.

APPRAISAL CAPABILITIES ARE ILLUSTRATED BY EXAMPLE 'APPR' IN APPENDICES A AND B.

FIGURE 8 ILLUSTRATES THE APPEARANCE OF DATA STATEMENTS ESTABLISHING THE SEVERAL SETS OF CONVERSION COEFFICIENTS IN SUBROUTINE ST44 -- DFIR COLLATES

AHEAD OF PPIN, SO PROPERLY ARRAYED DFIR COEFFICIENTS PRECEDE THOSE FOR PPIN. NOTE THAT IN ADDITION TO SPECIES LABEL AND 11 QUALITY-DEFECT LABELS, THERE ARE 3 COEFFICIENTS (FOR VOLUME, SURFACE, AND LENGTH) FOR EACH OF 6 END-PRODUCTS WITHIN EACH OF 11 QUALITY-DEFECT CLASSES, OR A TOTAL OF 198 COEFFICIENTS AND 12 LABELS FOR A GIVEN SPECIES.

THE VERSION OF SUBROUTINE ST44 USED TO PROCESS EXAMPLE 'APPR' (APPENDIX B) CONTAINS ONLY 2 SPECIES MATRICES, THE FIRST OF WHICH IS LISTED FULLY IN FIGURE 8. THEIR INPUT FORMATS ARE SIMILAR (DIFFERING ONLY IN COLUMNAR SUBSCRIPTS AND LABELS). THE COEFFICIENTS THEMSELVES ARE FICTITIOUS, SO THE SAME SINGLE SET WAS APPLIED TO EACH SPECIES FOR CONVENIENCE IN CHECKING.

========== DIAGNOSTICS AND ERRORS ==========

AN ERROR SIGNAL WILL BE PRINTED IF SUBROUTINE ST11 ENCOUNTERS ERRORS SUCH AS A WITHIN-TREE CARD SEQUENCE NUMBER THAT IS NEGATIVE, A NEGATIVE STRATUM NUMBER OR ONE EXCEEDING THE NUMBER OF STRATA SPECIFIED ON THE JOB CONTROL CARD, OR A SAMPLE-TREE PREDICTION (KPI) THAT IS BLANK, ZERO, NEGATIVE, OR LARGER THAN THE MAXIMUM (K) SPECIFIED ON THE JOB CONTROL CARD.

THE ERROR SIGNAL CONSISTS OF A PRINTOUT OF THE CURRENT CONTENT OF CERTAIN LOCATIONS IN COMMON (ILLUSTRATEC IN FIGURE 9). THE FIRST LOCATION WILL ORDINARILY CONTAIN ZERO UNLESS SPECIAL ERROR RECOVERY FACILITIES ARE AVAILABLE. THE SECOND LOCATION GIVES THE SHORT 4-CHARACTER JOB IDENTITY. SUBSEQUENT LOCATIONS CONTAIN CURRENT TREE NUMBER, WITHIN-TREE CARD SEQUENCE NUMBER, SAMPLING CLASS (=, *, BLANK IMPLYING SURE-TO-BE-MEASURED TREES, 3P-MEASURED TREES, 3P-PREDICTED-ONLY TREES), TERMINAL SYMBOL (*, 4, BLANK IMPLYING LAST CARD OF A GIVEN TREE, LAST CARD PRIOR TO FORKING OR ESTABLISHMENT OF NEW REFERENCE ELEVATION, AND A NON-TERMINAL CARD CONTINUED NORMALLY ON A FOLLOWING CARD). FINALLY, TREE NUMBER READ PREVIOUS TO THAT CURRENTLY STORED IS GIVEN. IF CURRENT TREE NUMBER AND PREVIOUS TREE NUMBER ARE THE SAME, IT IS LIKELY THAT BOTH REPRESENT PREVIOUS NUMBER AND THAT THE TREE CARD FOR THE CURRENT TREE CONTAINS AN ILLEGAL CHARACTER OR INVOLVES TAPE REDUNDANCY.

IF ONE OF THESE ERRORS HAS CAUSED A ONE-LINE INFORMATIONAL PRINTOUT OF THE SORT DESCRIBED, ADDITIONAL TREES ARE SCREENED FOR MORE POSSIBLE ERRORS, BUT ALL FURTHER PROCESSING IS SUPPRESSED.

IF ST11 IS COMPLETED WITHOUT ENCOUNTERING ERRORS, AND IF THE SECOND JOB OPTION ON THE SECOND CONTROL CARD HAS BEEN PUNCHED 2 OR MORE, PROCESSING OF INDIVIDUAL TREES BY ST22 IS STARTED.

A DIFFERENT ERROR MESSAGE WILL BE PRINTED IF CERTAIN ERRORS ARE ENCOUNTERED BY ST22. THE MESSAGE IS OF THE FORM 'ERROR XXX TREE NUMBER XXXX X XXXX', AS ILLUSTRATED IN FIGURE 10. THE FIRST VARIABLE IS A NUMERICAL CODE FOR THE PARTICULAR ERROR, THE NEXT IS THE TREE NUMBER, THE THIRD IS THE WITHIN-TREE DENDROMETER CARD SEQUENCE NUMBER, AND THE LAST IS THE NUMBER OF THE TREE PREVIOUSLY PROCESSED.

DIAGNOSTIC PROCEDURE IN ST22 HAS BEEN SLIGHTLY REVISED. ONE ITEM CHANGED IS THAT NEGATIVE TREE NUMBERS ARE NO LONGER ILLEGAL. HENCE, A NEGATIVE NUMBER CAN BE USED AS A SIGNAL BY USERS WHO WISH TO ADAPT THE PROGRAM TO PLOT-SAMPLES OR POINT-SAMPLES.

ERROR CODE IN ST22 IS NOW AS FOLLOWS --

(1) IMPLIES NEGATIVE DIAMETER ARISING FROM FAULTY UNSEEN LENGTH PROJECTION.

(2) IMPLIES MACHINE ERROR IN FAILING TO BRANCH PROPERLY ON +, *, BLANK, OR FAILURE TO COPY THESE CORRECTLY FROM INPUT TAPE ONTO TAPE JW.

(3) IMPLIES NEGATIVE LENGTH DUE TO FAULTY DENDROMETRY (PROGRESSING FROM TOP TO STUMP, ETC.), TO FAULTY PUNCHING, OR TO FAULTY UNSEEN LENGTH PROJECTION. DOWNWARD PROGRESSION MUST BE REPUNCHED IN UPWARD PROGRESSION.

(4) IMPLIES DISARRANGED DATA DECK OR FAULTY PUNCHING. FAILURE TO PUNCH TERMINAL * CAN CAUSE THIS, AS CAN VARIATION IN TREE NUMBER (CAUSED BY FAULTY PUNCHING) DURING A SINGLE WITHIN-TREE CARD SEQUENCE. THE MOST COMMON CAUSE IS FAILURE OF WITHIN-TREE CARD SEQUENCE TO BE IN ARITHMETIC PROGRESSION WITH UNIT INTERVAL STARTING WITH ZERO.

(5) IMPLIES EARLIER MACHINE FAILURE (IN ST11) TO DETECT FAULTY DATA WITH STRATUM NUMBER LARGER THAN MAXIMUM SPECIFIED ON SECOND CONTROL CARD.

(6) IMPLIES MACHINE ERROR IN FAILING TO BRANCH PROPERLY ON SURE-TO-BE-MEASURED TREE, OR IN EARLIER FAILING TO DETECT FAULTY DATA WITH SAMPLE TREE HAVING BLANK, ZERO,. NEGATIVE, OR TOO LARGE KPI (EXCEEDING K).

(7) IMPLIES INADEQUATE NUMBER OF MEASURED DIAMETERS FOR COMPUTATIONS (MUST BE AT LEAST 4 FOR CONVEX-CONIC-CONCAVE PROJECTION, AT LEAST 1 FOR SIMPLE CONIC PROJECTION, AND AT LEAST 2 WITHOUT ANY PROJECTION AT ALL).

AFTER PRINTING ANY ONE OF THESE 7 ERROR MESSAGES. ST22 WILL CONTINUE TO PROCESS AND PRINT INDIVIDUAL TREE DATA, BUT ADDITIONAL SUMMARIZATION AND PROCESSING WILL BE SUPPRESSED (EXCEPT FOR DATA-PROCESSING STATISTICS ON PAGE ZERO). AT PRESENT, ERROR SCAN TERMINATES AFTER 25 ERROR MESSAGES OR MISARRAYED CARDS, BUT THIS LIMIT CAN BE EASILY INCREASED BY MODIFICATION OF ST22.

========== OUTPUT ==========

THE EXAMPLES OF OUTPUT SHOWN IN APPENDIX B ARE WELL ENOUGH LABELLED SO THAT LITTLE EXPLANATION IS REQUIRED.

THE PRELIMINARY REPORT (PAGES 59, 68) IS PRINTED WHEN ST11 HAS BEEN ABLE TO COMPLETE ITS PROCESSING OF TREE CARDS WITHOUT ENCOUNTERING A FATAL ERROR. NOTE THAT THE PAGE-HEADING FAITHFULLY REPRODUCES THE MOST ESSENTIAL INFORMATION CONTAINED ON THE FIRST TWO CONTROL CARDS (SHOWN IN FIGURE 1). THE SPECIFIED 3P-SAMPLING DESIGN INDICATES THAT (K + Z) IS EQUAL TO 4 IN EXAMPLE 'DBST' AND 50 IN EXAMPLE 'APPR', WITH MAXIMUM (K) BEING 3 FOR 'DBST' AND 25 FOR 'APPR'. IN EACH EXAMPLE, THE SAME NUMBER (3) OF STRATA IS SPECIFIED, AND THE OBSERVED NUMBERS OF TREES AND AGGREGATE PREDICTED VALUES FOR EACH ARE GIVEN. IN ADDITION, THE PRELIMINARY REPORT SHOWS (FOR EACH STRATUM AND TOTAL) EXPECTED VALUES OF SAMPLE-TREE FREQUENCY AND OF TOTAL SAMPLE-TREE PREDICTIONS. THESE ARE FOLLOWED BY PARAMETRIC STANDARD ERRORS WHERE EVERY PREDICTION HAS BEEN INPUT INDIVIDUALLY. WHERE, INSTEAD, AGGREGATE PREDICTIONS HAVE BEEN INPUT (ON FOURTH CONTROL CARD), FIGURES WILL BE SAMPLE-BASED APPROXIMATIONS, UNLESS NO SAMPLES HAVE OCCURRED, IN WHICH CASE SIMPLE BINOMIAL APPROXIMATIONS HAVE BEEN SUPPLIED.

THE DETAILED LOG AND/OR TREE PRINTOUT (PAGES 60-62, 69) IS PRODUCED WHEN THIRD JOB OPTION IS PUNCHED '3' AND NO FATAL FLAWS HAVE BEEN DETECTED BY ST11. VOLUME, SURFACE, LENGTH, UPPER DIAMETER, AND CODED QUALITY OF EACH INDIVIDUAL LOG BETWEEN CONSECUTIVELY ARRAYED DIAMETERS ARE SHOWN, ALONG WITH THE COMPUTED SLANT RANGE TO EACH DIAMETER AND THE RAW DENDROMETER READINGS.

FINALLY, THE TREE IDENTIFYING NUMBER AND TOTALS FOR VOLUME, SURFACE, AND LENGTH ARE GIVEN, ALONG WITH TREE D.B.H. IN INCHES, POPULATION FREQUENCY REPRESENTED BY THE MEASURED TREE, PREDICTION FOR THE TREE (KPI), DOUBLE-BARK THICKNESS IN INCHES (0. OR -0. SIGNALS THAT NO BARK MEASUREMENT WAS RECORDED), ASTERISK DENOTING A FORKED TREE, TYPE OF DENDROMETER USED, BARK OPTION, OPTION GOVERNING UNSEEN LENGTH PROJECTION, ASTERISK DENOTING ACTUAL OCCURRENCE OF UNSEEN LENGTH, TREE CLASSIFICATION, AND VALUE STRATUM (APPROPRIATE LABELS WOULD BE THE SAME AS IN FIGURE 11). THUS, TREES NUMBERED 1 THROUGH 5, 10, AND 13 IN EXAMPLE 'DBST' HAVE UNSEEN USABLE UPPER STEM, WHILE TREE NUMBER 13 IS FORKED.

THE SUMMARY PRINTOUT FOR THE TREE POPULATION (PAGES 63-66, 70-73) IS PRINTED BY ST33 WHEN SECOND JOB OPTION IS PUNCHED '2' AND NO FATAL FLAWS HAVE BEEN DETECTED BY EITHER ST11 OR ST22. SEPARATE SUMMARIES WILL BE PRODUCED FOR EACH STRATUM AS WELL AS FOR THE WHOLE, BUT THE PERCENTAGE SAMPLING ERROR FOR RELATIVE VALUE WILL BE OMITTED, SINCE IT IS IDENTICAL WITH THAT FOR VOLUME IN THE CASE OF AN INDIVIDUAL STRATUM.

THE SUMMARY PRINTOUT FOR DATA-PROCESSING STATISTICS (PAGES 67, 74) WILL BE PRODUCED BY ST33 WHENEVER THE SECOND JOB OPTION IS PUNCHED '2' AND NO FATAL FLAWS HAVE BEEN DETECTED BY ST11. THE PAGE NUMBER OF THIS SUMMARY WILL ALWAYS BE ZERO. THE NUMBER OF INPUT FLAWS REPORTED HERE IS A COUNT OF CARDS THAT HAD TO BE IGNORED BECAUSE OF ERROR, MISARRAY, OR FOLLOWING ERRONEOUS OR

MISARRAYED CARDS. SOMETIMES AFTER SUCH ERRORS, CORRECT CARDS IN CORRECT ORDER MUST BE SCANNED AND IGNORED TO SECURE PROPER ORIENTATION OF SUBSEQUENT SCANS. DATA AND OUTPUT ASSOCIATED WITH TREE NUMBERS LISTED AS SUSPICIOUS SHOULD BE CLOSELY EXAMINED. REASONS FOR SUSPICION ARE LACK OF RECORDED D.B.H. (THE PROGRAM USES THE SECOND SET OF DENDROMETER MEASUREMENTS TO PROVIDE A SUBSTITUTE), A POPULATION FREQUENCY OF ONE OR LESS FOR ANY SAMPLE-TREE, DR AN UPPER D.O.B. MORE THAN ONE-HALF INCH LARGER THAN ITS NEXT LOWER D.O.B.

TREE NUMBER 10 IN EXAMPLE 'DBST' IS LISTED AS SUSPICIOUS ON ALL 3 GROUNDS. THIS TREE ALSO DEMONSTRATES THAT THE PROGRAM CORRECTLY PROCESSES UNINTENTIONAL FRONT COINCIDENCE OF THE SHORT-BASE-RANGEFINDER DENDROMETER (SEE REFERENCE *2). THIS TREE ADDITIONALLY ILLUSTRATES THE LESS DESIRABLE METHOD FOR SIGNALING UNSEEN LENGTH USING SHORT-BASE-RANGEFINDER (FGRAD SAME AS TGRADS). FINALLY, THIS TREE SHOWS WHAT HAPPENS IN THE STANDARD OPTION FOR UNSEEN LENGTH WHEN ANOMALOUS TAPER IS DETECTED (UDTRO IS USED AS ASSUMED CONICAL TAPER RATE UNTIL D.O.B. BECOMES LESS THAN UDORT*DBH OR UNTIL LENGTH EXCEEDS UMAXL).

THE AMOUNTS OF INPUT AND PROCESSING DONE BEFORE ENCOUNTERING FATAL FLAWS ARE HELPFUL IN VERIFYING THAT THE SAME NUMBER OF TREE CARDS WERE READ BY ST11 AND BY ST22, AND THAT LATER PROCESSING WAS COMPLETED FOR ALL MEASURED TREES. ALSO, THE NUMBER OF TREE CR LOG CARDS PUNCHED AS OPTIONAL OUTPUT MAY BE CHECKED AGAINST THE TOTAL NUMBER OF TREES OR LOGS.

FURTHER REASSURANCE MAY BE OBTAINED FROM A CHECK OF THE ACTUAL NUMBER OF TREES IN THE POPULATION AGAINST THE NUMBER ESTIMATED FROM THE SAMPLE. THE DIFFERENCE MAY BE COMPARED WITH THE APPROXIMATE STANDARD ERROR ATTRIBUTABLE TO CHANCE. WITH 3P SAMPLING, THE SAMPLING ERROR FOR FREQUENCY IS APT TO BE LARGER THAN THAT FOR ANY OTHER SAMPLE ESTIMATE.

FINALLY, THE AGGREGATE PREDICTIONS SHOULD BE CHECKED AGAINST THE SAMPLE ESTIMATE. UNLESS THEY AGREE EXACTLY, ALL SAMPLE-BASED ESTIMATES MUST BE REJECTED. MACHINE ERROR, FAILURE TO DRAW AT LEAST ONE SAMPLE FROM A NON-EMPTY STRATUM, OR THE OCCURRENCE OF SOME FATAL FLAW FLAGGED BY A DIAGNOSTIC MESSAGE IS USUALLY RESPONSIBLE WHEN THIS CHECK INDICATES A FAULTY ESTIMATE.

FIGURE 11 ILLUSTRATES A DETAILED TREE PRINTOUT (WITHOUT LOGS) THAT IS AN ALTERNATIVE TO THE LOG PRINTOUT. THE THIRD JOB-OPTION SHOULD BE PUNCHED '2' INSTEAD OF '3' WHEN NO LOG DATA IS DESIRED. IF THE THIRD JOB-OPTION IS LEFT BLANK, OR PUNCHED 0 OR 1, NO DETAILED INFORMATION ON EITHER LOGS OR TREES WILL PRINTOUT.

FIGURES 12 AND 13 ILLUSTRATE ALTERNATIVE PUNCHED CARD OUTPUTS THAT MAY BE OBTAINED IN ADDITION TO WHATEVER PRINTOUTS ARE SECURED. THE FOURTH JOB-OPTION SHOULD BE PUNCHED '2' TO OBTAIN THE TREE CARDS, AND '3' TO OBTAIN THE LOG CARDS.

FIGURE 14 ILLUSTRATES THE CONSTITUENTS AND THE FORMAT OF INDIVIDUAL LOG AND TREE INFORMATION STORED ON TAPE JX AND PROCESSABLE BY PROD IF THE FIFTH JOB-OPTION IS PUNCHED '2' OR GREATER. IT MUST BE PUNCHED '3' TO OBTAIN THE PARTIAL PRINTOUT OF SORTED INDIVIDUAL LOG DATA ILLUSTRATED BY FIGURE 14.

PAGE 75 ILLUSTRATES THE SUBTOTALS BY TREE-CLASS (SPECIES, ETC.) AND LOG

QUALITY-AND-DEFECT CLASS (GRADE) PRINTED WHEN THE FIFTH JOB-OPTION HAS BEEN PUNCHED EITHER 2 OR 3. TOTAL VOLUME SHOULD CHECK EXACTLY WITH THAT GIVEN EARLIER IN THE SUMMARY REPORT.

PAGE 76 ILLUSTRATES THE CONVERSION OF VOLUME, SURFACE, LENGTH IN VARIOUS SUBCLASSES TO VARIOUS END-PRODUCTS AND REALIZATION VALUE. THIS DEPENDS ON OBTAINING APPROPRIATE COEFFICIENTS FROM LOCAL GRADE-YIELD STUDIES WITH INDIVIDUAL TREES ANALYZED BY MULTIVARIATE METHODS. OF COURSE, MANY ADDITIONAL END-PRODUCTS MAY BE RECOGNIZED IF DESIRED. FAILURE OF ANY VOLUME TO BE MATCHED WITH CONVERSION COEFFICIENTS CAN BE DETECTED BY DISAGREEMENT BETWEEN TOTAL CONVERTED VOLUME AND TOTAL VOLUME TABLED EARLIER.

EXAMPLE 'DBST' ILLUSTRATES THE FIRST METHOD OF DATA INPUT WHERE AT LEAST ONE CARD HAS BEEN PUNCHED FOR EACH TREE IN THE POPULATION, INCLUDING TREES THAT ARE 3P-PREDICTED-ONLY. IT ALSO ILLUSTRATES AND WARNS OF TWO UNUSUAL AND POSSIBLY MISLEADING SAMPLING SITUATIONS' DISCUSSED BELOW.

STRATUM 2 IS REPRESENTED BY ONLY 1 SAMPLE TREE, SO NO ERROR CALCULATIONS ARE POSSIBLE AND ERRORS ARE SET EQUAL TO ZERO.

STRATUM 3 IS REPRESENTED BY NO SAMPLE TREES, BUT SINCE IT WAS A COMPLETELY EMPTY STRATUM WITH REGARD TO PREDICTED-ONLY TREES ALSO, THE ARBITRARILY ESTABLISHED ZERO TOTALS AND ZERO ERRORS HAPPEN TO BE CORRECT.

EXAMPLE 'APPR' ILLUSTRATES THE SECOND METHOD OF DATA INPUT WHERE TOTAL NUMBER OF TREES AND TOTAL PREDICTIONS FOR EACH STRATUM HAVE BEEN INPUT ON CONTROL CARDS 3 AND 4, OBVIATING THE NEED TO MAKE INDIVIDUAL CARDS FOR TREES THAT ARE 3P-PREDICTED-ONLY. THIS SECOND METHOD MINIMIZES CARD HANDLING AND INPUT TIME FOR SUBSEQUENT EDITING RUNS AFTER A SATISFACTORY PRELIMINARY REPORT HAS BEEN OBTAINED. EXAMPLE 'APPR' ALSO ILLUSTRATES THE CONVERSION AND APPRAISAL FEATURES OF THE LATEST VERSION OF STX -- NEWLY ADDED CAPABILITIES.

ORDINARILY, THE LAST PRINTOUT FOR THE LAST SET OF DATA WILL BE FOLLOWED BY THE MESSAGE 'NORMAL TERMINATION EXIT', INDICATING THAT PERIPHERAL PRINTING OF WHATEVER TAPE OUTPUT WAS SECURED IS COMPLETE AT THIS POINT.

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FIGURE 1. FIRST AND SECOND CONTROL CARDS.

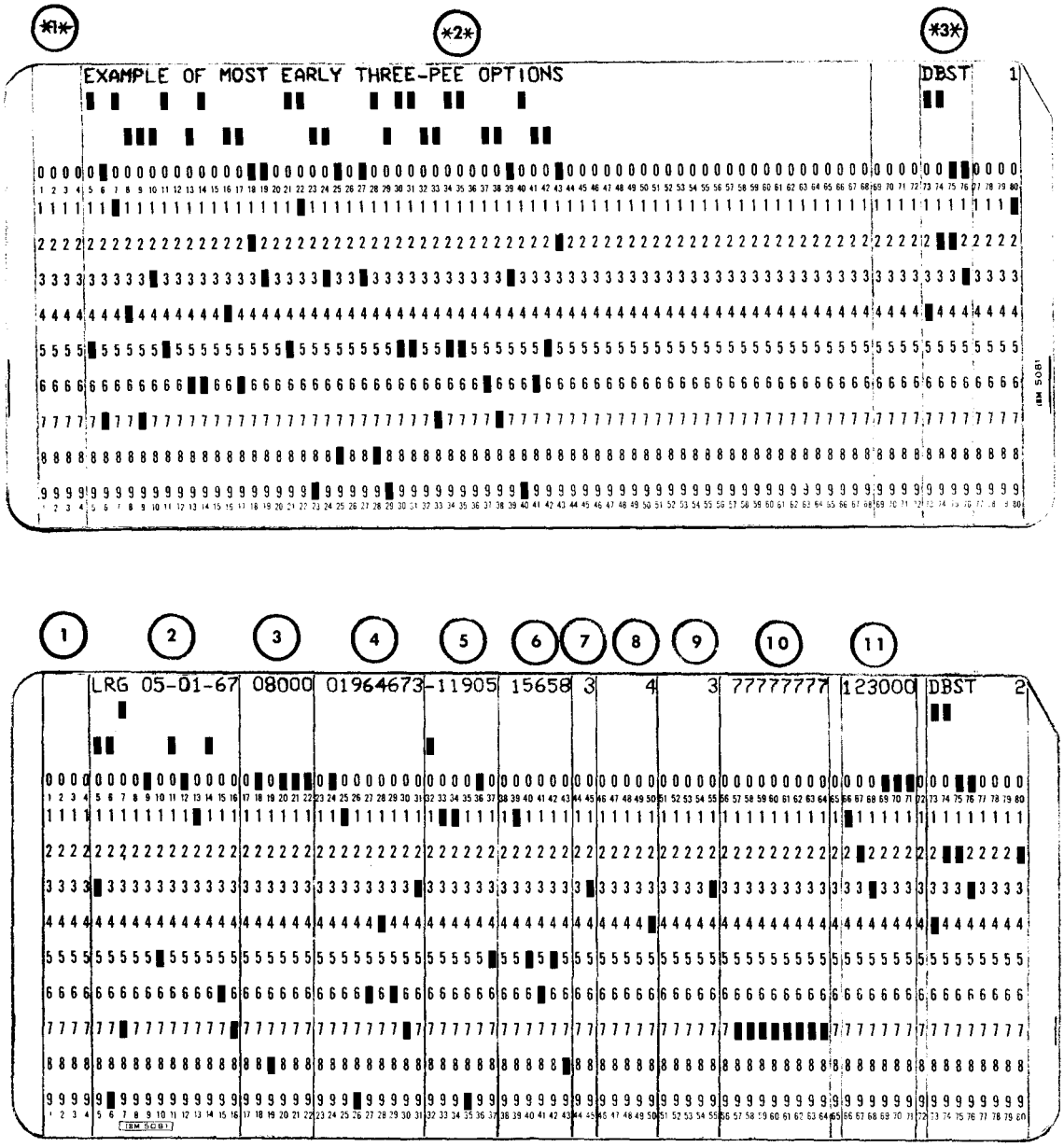


FIGURE 1 (CONTINUED).

FIRST CONTROL CARD

1=KREENO= ALWAYS BLANK.

2=ALFATH= NAME OF SALE, AREA, OR JOB.

3= CDID = BRIEF JOB IDENTIFIER.

SECOND CONTROL CARD

1 =KREENO = ALWAYS BLANK.

2 =ADALFA = INITIALS OF USER AND INPUT DATE.

3 = B = SEE PAGE 7.

4 = Q = SEE PAGE 7.

5 = U = SEE PAGE 7.

6 = G = SEE PAGE 7.

7 = NSTR = TOTAL NUMBER OF VALUE STRATA USED.

8 = PRBS = K + Z (OR KZ). SEE PAGE 7.

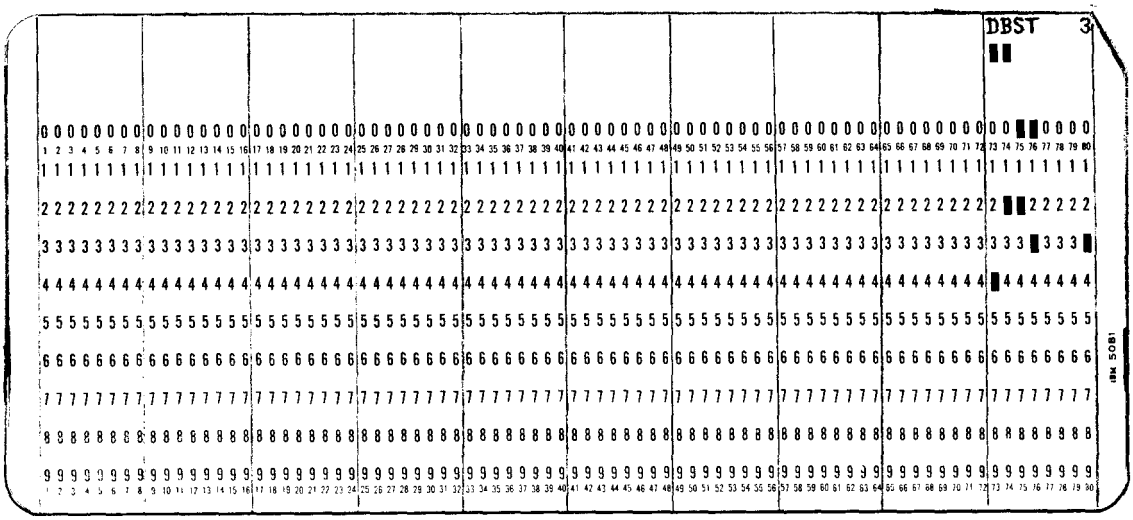
9 = K = MAXIMUM POSSIBLE SAMPLE PREDICTION.

10 = Q2 = RESERVED FOR POSSIBLE FUTURE USE.

(LS1)
( )
(LS2)
( )
11 = (LS3)= JOB OPTIONS (SEE PAGE 8).
( )
(LS4)
( )
(LS5)
( )
(LS6)

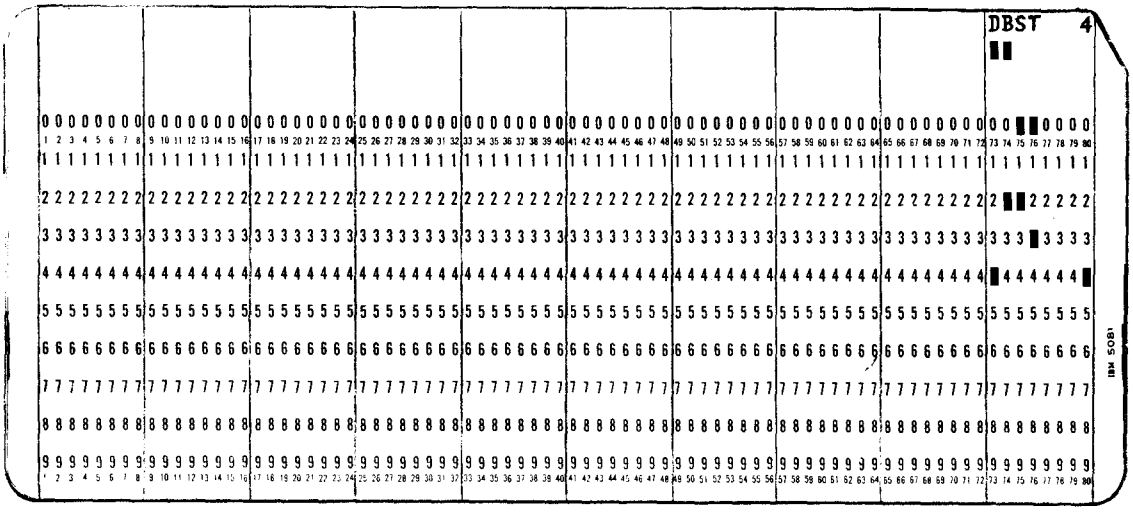
FIGURE 2. THIRD AND FOURTH CONTROL CARDS.

TOTAL POPULATION OF TREES WITHIN EACH VALUE STRATUM.



THIRD CONTROL CARD WILL BE BLANK UNLESS FIRST JOB-OPTION IS '2'.

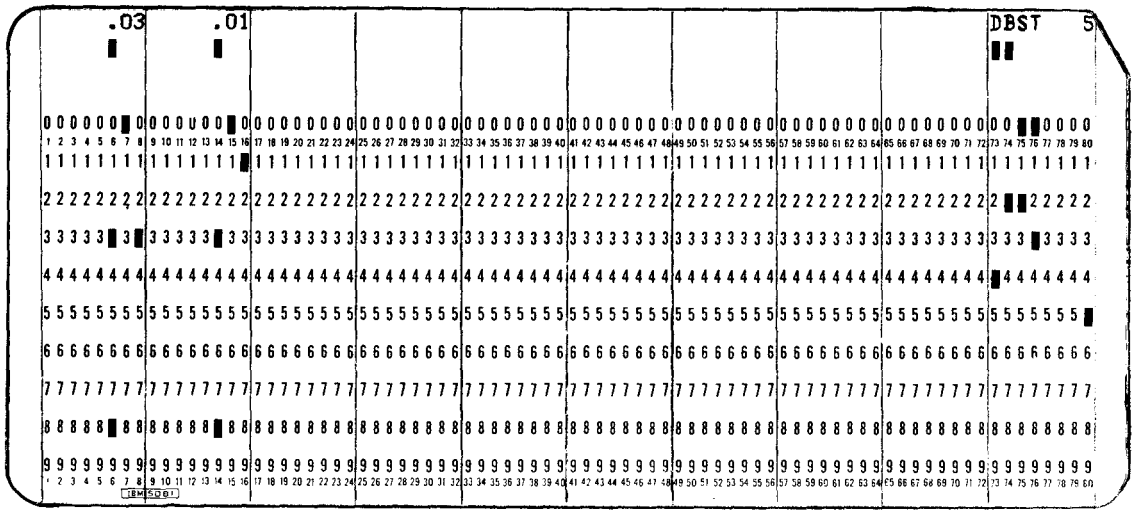
TOTAL PREDICTION FOR TREES WITHIN EACH VALUE STRATUM.



FOURTH CONTROL CARD WILL BE BLANK UNLESS FIRST JOB-OPTION IS '2'.

FIGURE 3. FIFTH CONTROL CARD, WITH FORMATS AND LISTS FOR ALL 5 CONTROL CARDS.

RELATIVE VALUE PER UNIT VOLUME FOR TREES WITHIN EACH VALUE STRATUM.

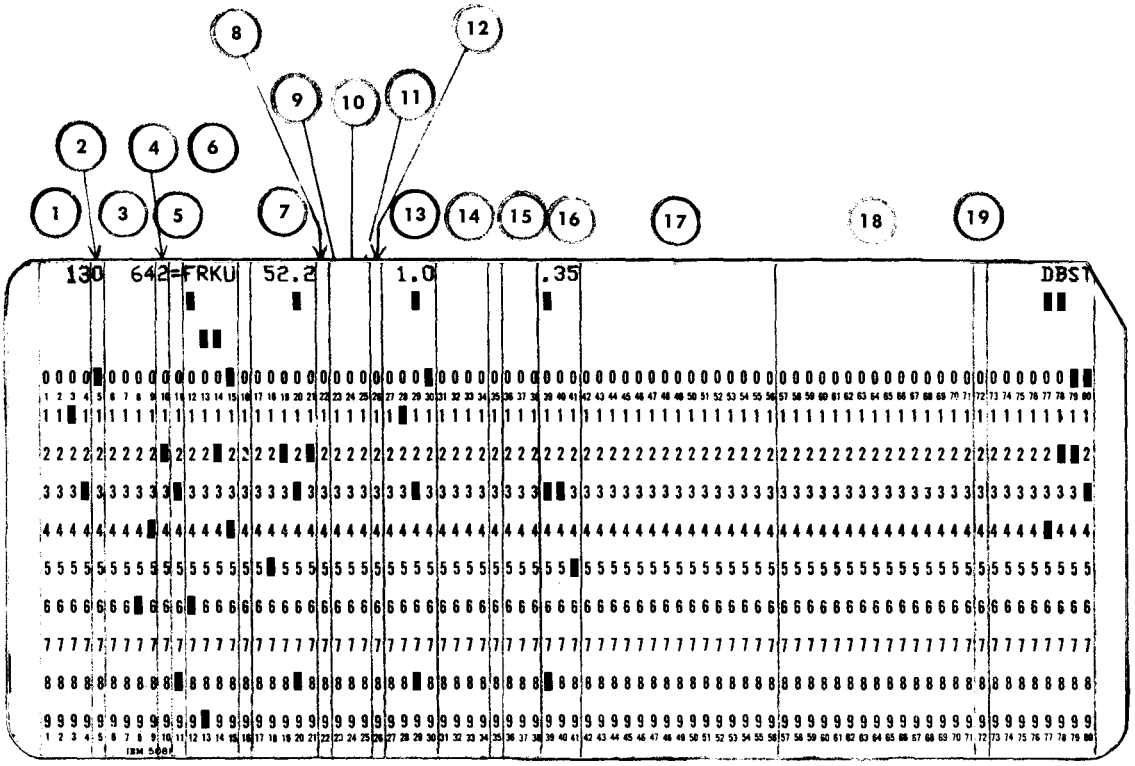


FIFTH CONTROL CARD WILL BE BLANK UNLESS DIFFERENT VALUES PER UNIT—VOLUME ARE USED IN PREDICTING TREE—VALUE IN DIFFERENT STRATA.

FORMATS AND LISTS

1		FORMAT (I4,16A4,4X,A4)	STX 22
91		READ (MRE,1) KREENO,ALFATH,COID	STX 33
2		FORMAT (4X,3A4,F6.3,F9.8,2F6.4,I2,F5.0,I5,I9,1X,6I1/9I8/9I8/9F8.0)	STX 23
92	0	READ (MRE,2) ADALFA,B,QsU,G,NSTR,PRBS,K,IQs	STX 35
92	1	L51,LS2,LS3,LS4,LS5,LS6,(JN(I),I=1,9),(KP(I),I=1,9),(WV(I),I=1,9)	STX 36

FIGURE 4. TREE INPUT CARD.



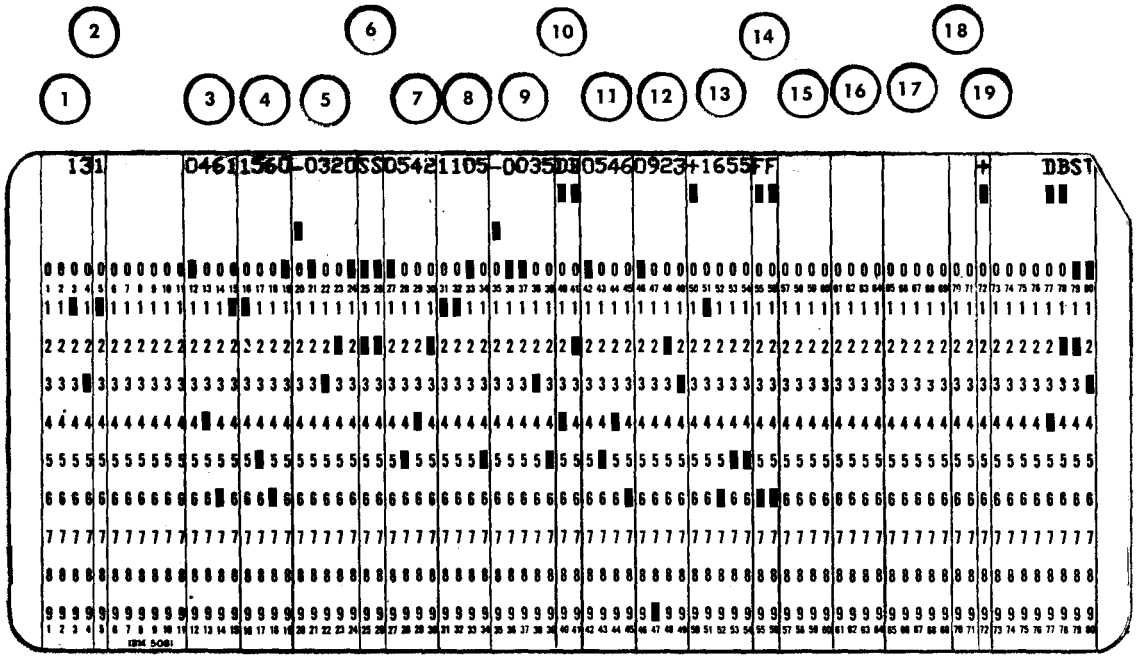
FORMAT AND LIST

```
9| 0| FORMAT (I4,I1,I4,I1,A1,A4,1X,F5.1,I1,3I1,I1,2F4.1,1X,F3.0,F3.3,    | ST11  22
9| 1| 2F15.0,A1)                                                          | ST11  23
 |  |                                                                     |
 |  0| READ (MRE, 9)           KREENO,J,KPI,LST,CERT,BETATH,DBH,JIM,METH, | ST11  94
 |  1| MBK,MUL,JAM,BKA,BKB,UMAXL,UDORT,XTRA,XTRB,TERM                      | ST11  95
```

FIGURE 4 (CONTINUED).

```
 1 =KREENO= TREE NUMBER.

 2 =   J  = CARD NUMBER WITHIN TREE.

 3 = KPI  = PREDICTION FOR TREE.

 4 = LST  = VALUE STRATUM.

 5 = CERT = SAMPLING CLASS (=,*, ).

 6 =BETATH= OTHER TREE CLASSIFICATIONS.

 7 = DBH  = BREAST-HIGH DIAMETER IN INCHES.

 8 = JIM = DUMMY VARIABLE USED ONLY TO PAD RECORD.

 9 = METH)
       )
10 = MBK )= TREE OPTIONS (SEE PAGE 9).
       )
11 = MUL )
12 = JAM = DUMMY VARIABLE USED ONLY TO PAD RECORD.

13 = BKA = SINGLE-BARK THICKNESS (FIRST).
14 = BKB = SINGLE-BARK THICKNESS (SECOND).

15 =UMAXL= SEE PAGE 10.

16 =UD0RT= SEE PAGE 10.
17 =XTRA = RESERVED FOR POSSIBLE FUTURE USE.

18 =XTRB = RESERVED FOR POSSIBLE FUTURE USE.
19 =TERM = ALWAYS BLANK EXCEPT * FOR SOME CULLS (SEE PAGE 13).
```

FIGURE 5. DENDROMETER INPUT CARD.



FORMAT AND LIST

```
 10|  | FORMAT (I4,I1,6X, 4(2F4.1,F5.4,A2),A1)                                  | ST11 24

115| 0| READ (MRE,10)       KREENO,J,(TGRADS(I),FGRADS(I),SINELV(I),            | ST11 128
115| 1| GAMATH(I),I=1,4), TERM                                                  | ST11 129
```

FIGURE 5 (CONTINUED).

```
 1 =KREENO =TREE NUMBER.

 2 =   J    = CARD NUMBER WITHIN TREE.

 3 =TGRADS)
          )
 4 =FGRADS)= LOWEST PAIR OR TRIO OF DENDROMETER READINGS.
          )
 5 =SINELV)

 6 =GAMATH =GRADE AND DEFECT.

 7 =TGRADS)
 8 =FGRADS)=NEXT DENDROMETER READINGS.
          )
 9 =SINELV)

10 =GAMATH =GRADE AND DEFECT.

11 =TGRADS)
          )
12 =FGRADS)=NEXT DENDROMETER READINGS.
          )
13 =SINELV)

14 =GAMATH =GRADE AND DEFECT.

15 =TGRADS)
          )
16 =FGRADS)=NEXT DENDROMETER READINGS.
          )
17 =SINELV)

18 =GAMATH =GRADE AND DEFECT.

19 = TERM =* IF NEXT CARD STARTS NEW TREE.
          =+ IF NEXT CARD STARTS NEW REFERENCE PLANE FOR SAME TREE.
          =BLANK IF TREE AND REFERENCE PLANE CONTINUE ON NEXT CARD.
```

FIGURE 6. CONVENIENT TALLY FORM FOR RECORDING FIELD DATA.

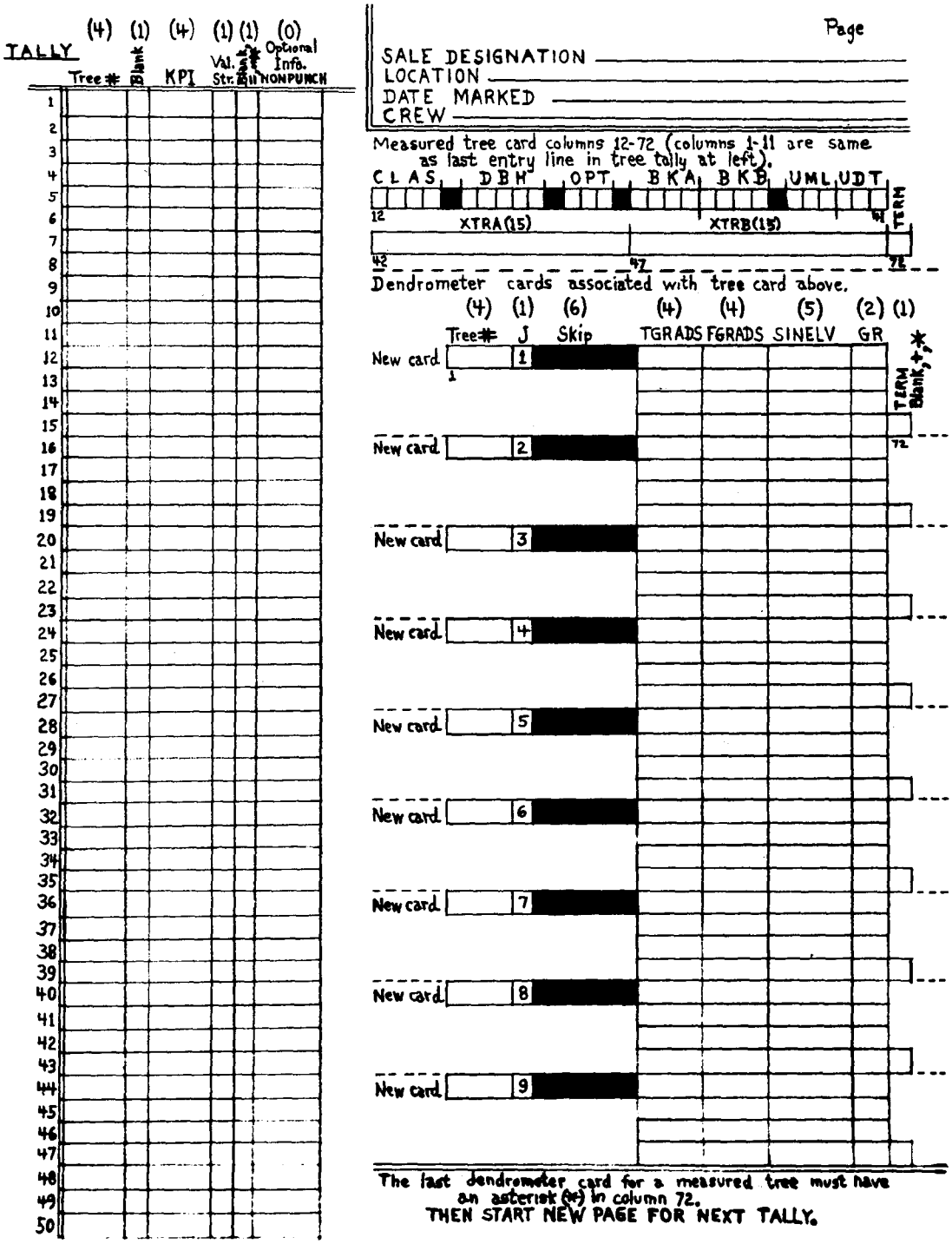


FIGURE 7. SUGGESTED PRINTED CARD-FORMAT TO FACILITATE PUNCHING EITHER TREE OR DENDROMETER INPUT DATA.

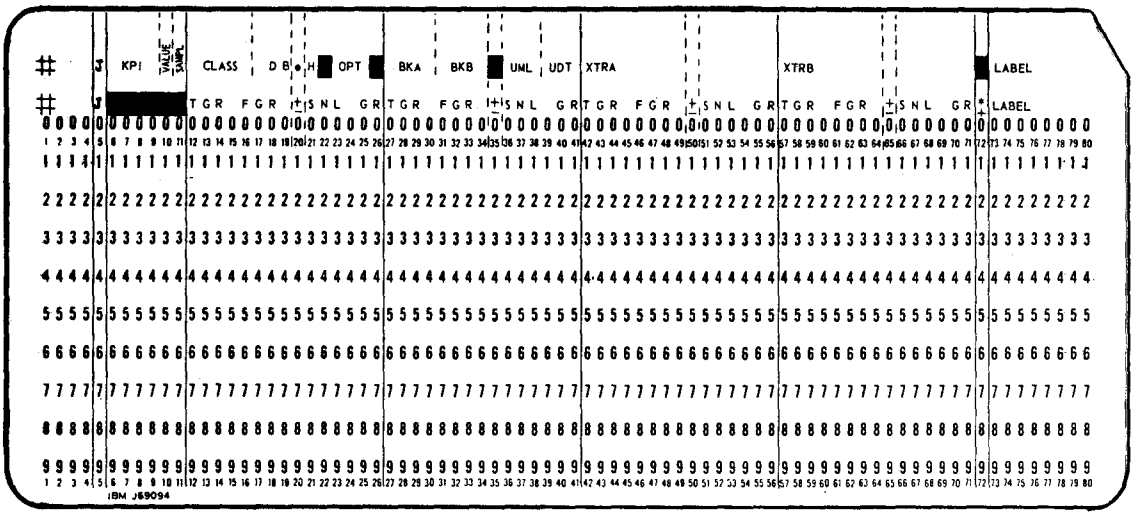


FIGURE 8. ILLUSTRATION OF DIMENSION STATEMENTS, EQUIVALENCE STATEMENTS, AND DATA STATEMENTS USED TO INCORPORATE CONVERSION COEFFICIENT MATRIX INTO SUBROUTINE ST44 PRIOR TO COMPILATION.

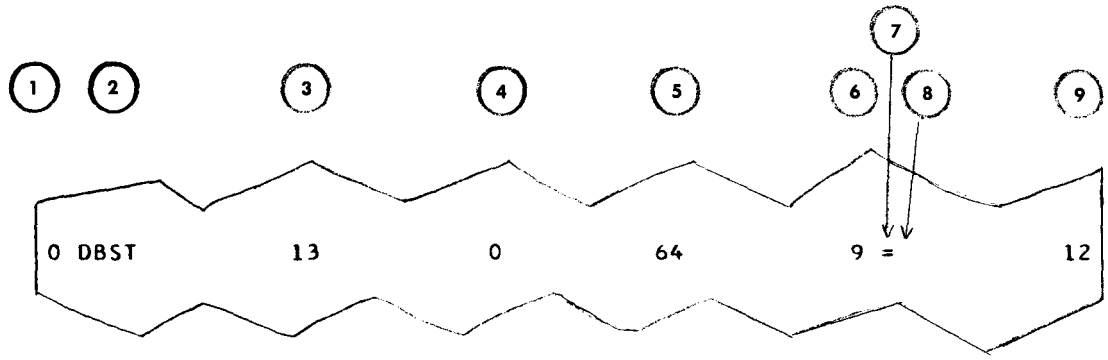
```
     SUBROUTINE ST44                                                        ST44   5
0    COMMON                                                                 ST44   6
1    /ORBAK/    MM(19),IT(8,100),JT(8),CHECK                                ST44   7
     DIMENSION YY(19),ST(8,100),GT(8)                                       ST44   8
     EQUIVALENCE (MM(1),YY(1)),(IT(1,1),ST(1,11),(JT(1),GT(11)              ST44   9
     DIMENSION LC(210,91,PC(210,9)                                          ST44  10
     EQUIVALENCE (LC(1,1),PC(1,1))                                          ST44  11
0    DIMENSION P1AA(18),P1AB(18),P1AC(18),P1BA(18),P1BB(18),P18C(18),       ST44  12
1              PICA(18),PICK(18),PICC(18),PIUU(18),P1XX(18)                 ST44  13
0    DIMENSION P2AA(18),P2A8(18),P2AC(18),P2BA(18),P288(18),P28C(18),       ST44  14
1              P2CA(18),P2CB(18),P2CC(181,P2UU(18),P2XX(18)                 ST44  15
0    EQUIVALENCE                                                            ST44  16
1     (PIAA(1),PC(  3, 1)),(P1AB(1),PC( 22, 1)),(P1AC(1),PC( 41, 1)),       ST44  17
2     (P1BA(1),PC( 60, 1)),(P1BB(1),PC( 79, 1)),(P1BC(1),PC( 98, 1)),       ST44  18
3     (P1CA(1),PC(117, 1)),(PICB(1),PC(136, 1)),(P1CC(1),PC(155, 1)),       ST44  19
4     (P1UU(1),PC(174, 1)),(PIXX(1),PC(193, 1))                             ST44  20
0    EQUIVALENCE                                                            ST44  21
1     (P2AA(1),PC(  3, 2)),(P2AB(1),PC( 22, 2)),(P2AC(1),PC( 41, 2)),       ST44  22
2     (P2BA(1),PC( 60, 2)),(P2BB(1),PC( 79, 2)),(P2BC(1),PC( 98, 2)),       ST44  23
3     (P2CA(1),PC(117, 2)),(P2CB(1),PC(136, 2)),(P2CC(1),PC(155, 2)),       ST44  24
4     (P2UU(1),PC(174, 2)),(P2XX(1),PC(193, 2))                             ST44  25
```

FIGURE 8 (CONTINUED).

```
     |  |DATA LC( 1, 1)/4HDFIR/                                                 |ST44  26
     |0 |DATA LC( 2, 1)/2HAA/,P1AA/                                             |ST44  27
     |1 |     .19176,.0,.0,.01488,-.00115,.00007,                               |
     |2 |     .0,.06273,-.00374,.0,.0,.0,                                       |
     |3 |     8.960,-.695,.041,1.500,-.120,.004/                                |
     |O |DATA LC( 21, 1)/2HAB/,P1AB/                                            |ST44  31
     |1 |     .19176,.0,.0,.01339,-.00103,.00006,                               |
     |2 |     .0,.06273,-.00374,.07616,-.00591,.00035,                          |
     |3 |     8.064,-.625,.037,1.300,-.120,.004/                                |
     |O |DATA LC( 40, 1)/2HAC/,P1AC/                                            |ST44  35
     |1 |     .19176,.0,.0,.01205,-.00093,.00005,                               |
     |2 |     .0,.06273,-.00374,.14470,-.01123,.00067,                          |
     |3 |     7.158,-.563,.033,1.100,-.120,.004/                                |
     |O |DATA LC( 59, 1)/2HBA/,P1BA/                                            |ST44  39
     |1 |     .19176,.0,.01.01488,-.00115,.000.07,                              |
     |2 |     .0,.06273,-.00374,.0,.0,.0,                                       |
     |3 |     8.960,-.695,.041,1.350,-.120,.004/                                |
     |O |DATA LC( 78, 1)/2HBB/,P1BB/                                            |ST44  43
     |1 |     .19176,.0,.0,.01339,-.00103,.00006,                               |
     |2 |     .0,.06273,-.00374,.07616,-.00591,.00035,                          |
     |3 |     8.064,-.625,.037,1.170,-.120,.004/                                |
     |O |DATA LC( 97, 1)/2HBC/1P1BC/                                            |ST44  47
     |1 |     .19176,.0,.0,.01205,-.00093,.00005,                               |
     |2 |     .0,.06273,-.00374,.14470,-.01123,.00067,                          |
     |3 |     7.158,-.563,.033, .990,-.120,.004/                                |
     |O |DATA LC(116, 1)/2HCA/,P1CA/                                            |ST44  51
     |1 |     .19176,.0,.0,.01488,-.00115,.00007,                               |
     |2 |     .0,.06273,-.00374,.0,.0,.0,                                       |
     |3 |     8.960,-.695,.041,1.053,-.120,.0041                                |
     |O |DATA LC(135, 1)/2HCB/,P1CB/                                            |ST44  55
     |1 |     .19176,.0,.0,.01339,-.00103,.00006,                               |
     |2 |     .0,.06273,-.00374,.07616,-.00591,.00035,                          |
     |3 |     8.064,-.625,.037, .948,-.120,.004/                                |
     |O |DATA LC(154. 1)/2HCC/9P1CC/                                            |ST44  59
     |1 |     .19176,.0,.0,.01205,-.00093,.00005,                               |
     |2 |     0,.06273,-.00374,.14470,-.01123,.00067,                           |
     |3 |     7.158,-.563,.033, .8919-.120,.004/                                |
     |O |DATA LC(173, 1)/2HUU/,P1UU/                                            |ST44  63
     |1 |     .19176,.0,.0,.01203,.00044,-.00332,                               |
     |2 |     .0,.06273,-.00374,.15438,-.08649,.18417,                          |
     |3 |     7.249,.263,-2.000,1.000,-.100,.001/                               |
     |  |DATA LC(192, 1)/2HXX/,P1XX/9*0.0,1.0,8*0.0/                            |ST44  67
     |  |                                                                       |
     |  |DATA LC(  1, 2)/4HPPIN/                                                |ST44  68
     |0 |DATA LC(  2, 2)/2HAA/,P2AA/                                            |ST44  69
```

ET CETERA, ET CETERA. '2' MERELY REPLACES '1' AS SECONDARY ELEMENT OF MATRIX NAME OR OF MATRIX SUBSCRIPT.

FIGURE 9. INFORMATION PRINTOUT FOR ERROR ENCOUNTERED BY SUBROUTINE ST11.



1 = NERR = 0 UNLESS SPECIAL ERROR RECOVERY PROCEDURE IS AVAILABLE.

2 = CDID = BRIEF JOB IDENTIFIER.

3 =KREENO= TREE NUMBER STORED MOST RECENTLY.

4 = J = CARD NUMBER WITHIN TREE.

5 = KPI = PREDICTION FOR TREE.

6 = LST = VALUE STRATUM.

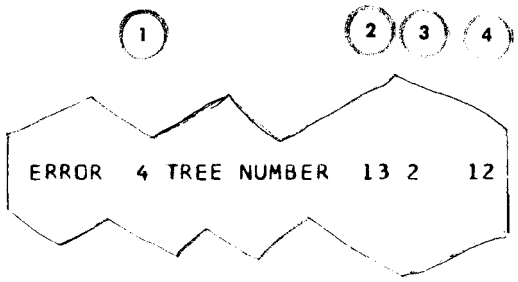
7 =JCERT = SAMPLING CLASS (=,*,).

8 = TERM = TERMINAL SYMBOL (,+,*).

9 = LKR = PREVIOUS TREE NUMBER.

```
                          FORMAT AND LIST
15 FORMAT (1H ,I3,1X,A4,4I12,1X,2A1,I12)                          ST11   39
   WRITE IMPR,15)       NERR,CDID,KREENO,J,KPI,LST,JCERT,TERM,LKR  ST11  217
```

FIGURE 10. ERROR MESSAGE PRINTED FOR ERRORS ENCOUNTERED BY SUBROUTINE ST22.



1 = NERR = ERROR CODE (SEE PAGE 19).

2 =KREENO= TREE NUMBER.

3 = J = CARD NUMBER WITHIN TREE.

4 = LKR = PREVIOUS TREE NUMBER.

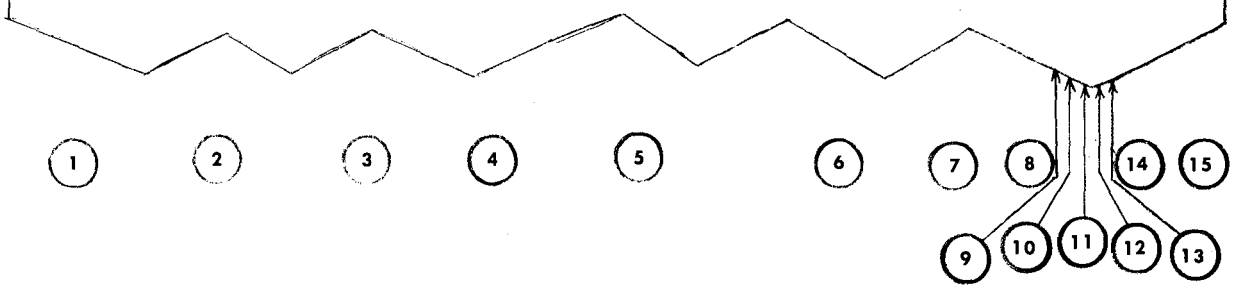
FORMAT AND LIST

```
   23 |  FORMAT (11H  ERROR ,I3,1X,12HTREE NUMBER ,I4,1X,I1,1X,I4)     | ST22 40
 1011 |  WRITE (MPR,23)        NERR,KREENO,J,LKR                       | ST22 338
```

FIGURE 11. TREE PRINTOUT WITHOUT LOGS (OBTAINED BY PUNCHING '2' IN 3RD. J0B-OPTION).

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 2
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 122000
DETAILED LOG AND/OR TREE REPORT

TREE/ NO./	VOLUME / CU.FT. /	SURFACE / SQ.FT. /	LENGTH / FEET /	D.B.H. / INCHES /							
1	7.0	50.3	32.7	10.0=D,F=	2.333,	1, -2.0	2	1	1	*CNVX	1
2	6.7	50.0	34.3	10.0=D,F=	2.333,	1, -2.0	2	1	1	*LINR	1
3	6.4	49.9	37.3	10.0=D,F=	2.333,	1, -2.0	2	1	1	*CNCV	1
4	6.3	47.6	33.3	10.0=D,F=	2.333,	1, -2.0	2	1	1	*STPT	1
5	7.6	57.8	40.3	10.0=D,F=	2.333,	1, -2.0	2	1	2	*CONE	1
6	21.9	93.2	32.0	12.0=D,F=	1.000,	4, -1.2	0	1	1	OUBK	1
7	17.7	83.9	32.0	12.0=D,F=	1.000,	4, 1.2	0	1	1	INB1	1
8	17.6	83.5	32.0	12.0=D,F=	1.000,	4, 1.2	0	2	1	INB2	1
9	18.7	92.4	40.0	12.0=D,F=	1.000,	4, -0.0	0	1	1	TOTH	1
10	14.3	69.3	28.8	10.6=D,F=	0.778,	3, -0.0	0	1	1	*SDTF	1
11	16.4	81.1	32.1	11.4=D,F=	1.000,	1, 1.1	0	1	1	TPBT	2
12	16.5	81.3	32.2	11.4=D,F=	3.000,	1, 1.1	0	1	1	MOVE	2
13	835.7	1393.4	197.4	52.2=D,F=	1.000,	64, 2.0	*	0	1	1	*FRKU	2
14	0.0	0.0	0.0	12.0=D,F=	1.000,	-0, -0.0	0	1	1	CULD	3



FORMAT AND LIST

```
 19| 0| FORMAT         (1X,14,F11.1,F10.1,F8.1,F9.1,5H=D,F=,F9.3,1H,,  | ST22  35
 19| 1| 15,1H,,F5.1,A1,3I1,A1,A4,1X,I1)                                 | ST22  36

365| 0| WRITE (MPR,19)         KREENO,SUMV,SUMS,SUMH,DBH,FREQ,KPI,BK,   | ST22 271
365| 1| MX(5),METH,MBK,MUL,MX(6),BETATH,LST                             | ST22 272
```

FIGURE 11 (CONTINUED).

1 =KREENO= TREE NUMBER.

2 = SUMV = VOLUME OF TREE IN CU. FT. AFTER BARK ALLOWANCE.

3 = SUMS = SURFACE OF TREE IN SQ. FT. AFTER BARK ALLOWANCE.

4 = SUMH = LINEAL FT. IN TREE (INCLUDING FORKS).

5 = DBH = BREAST-HIGH DIAMETER IN INCHES.

6 = FREQ = POPULATION FREQUENCY REPRESENTED BY SAMPLE TREE.

7 = KPI = PREDICTION FOR TREE.

8 = BK = DOUBLE-BARK THICKNESS IN INCHES.

9 = MX(5)= ASTERISK IMPLIES FORKED TREE.

10 = METH = TYPE OF DENDROMETER (SEE PAGE 9).

11 = MBK = METHOD OF HANDLING BARK DEDUCTION (SEE PAGE 9).

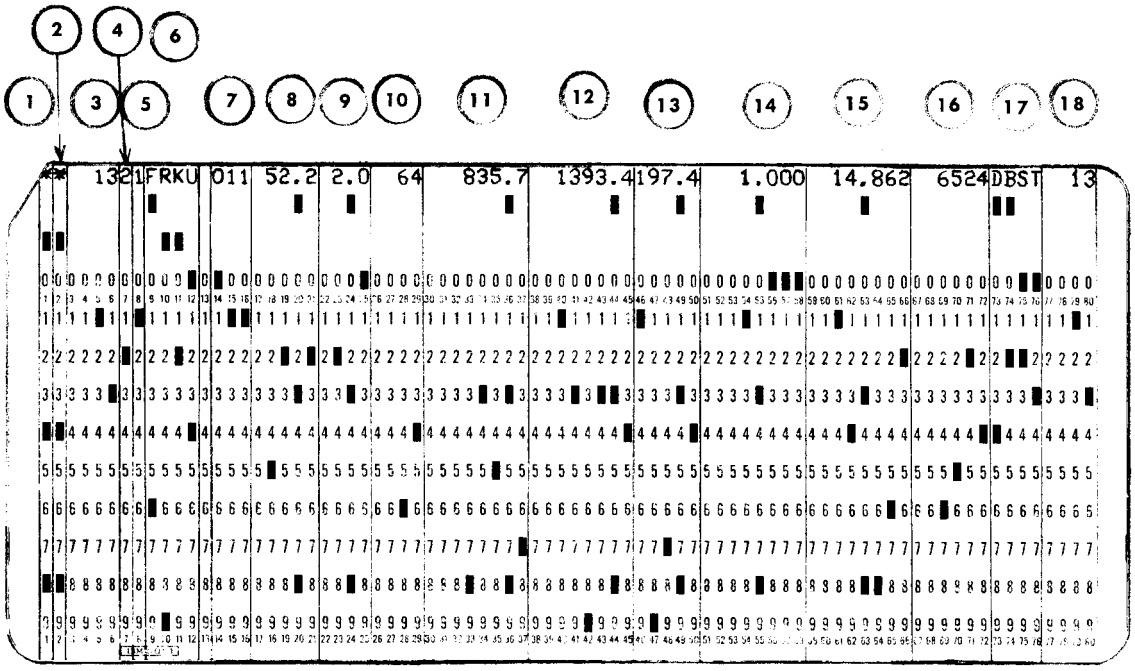
12 = MUL = METHOD OF PROJECTION FOR UNSEEN LENGTH (SEE PAGE 9).

13 = MX(6)= ASTERISK IMPLIES UNSEEN USABLE MATERIAL.

14 =BETATH= TREE CLASSIFICATIONS.

15 = LST = VALUE STRATUM.

FIGURE 12. TREE OUTPUT CARD (OBTAINED BY PUNCHING '2' IN 4TH. JOB-OPTION).



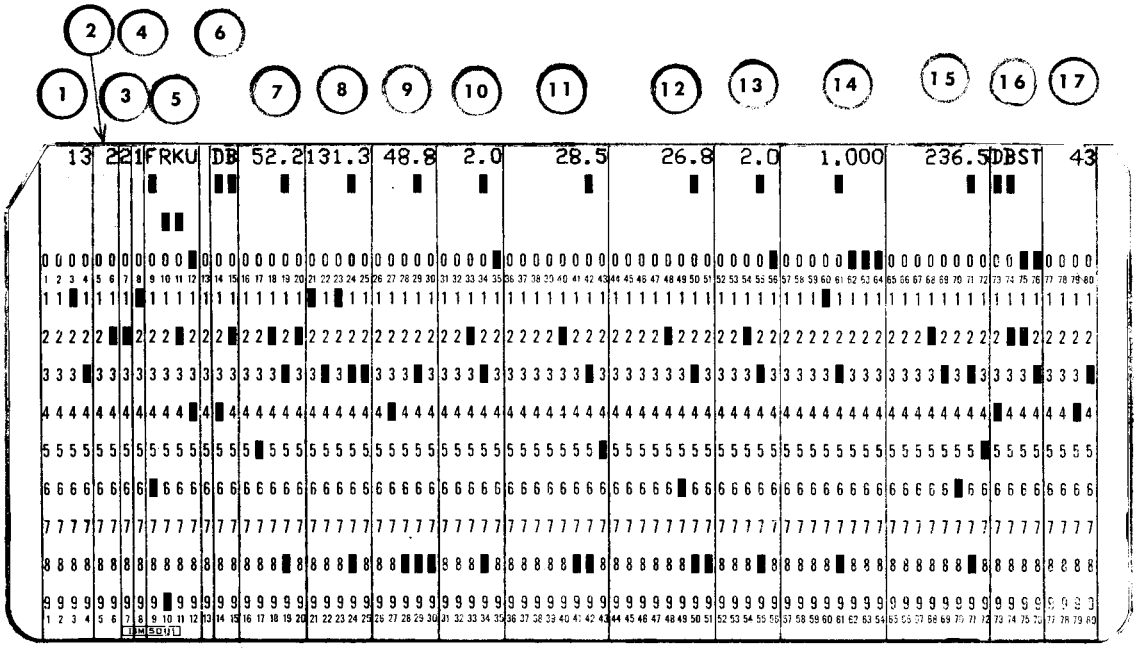
FORMAT AND LIST

```
21| 0| FORMAT (2AI,14,2I1,A4,1X.3I1,F5.1,F4.1,I4,2F8.1,F5.1,2F8.3,I6,A4,  | ST22  37
21| 1| I4)                                                                 | ST22  38
  |  |                                                                     |
  | 0| WRITE (MPU,21)      MX(5),MX(6),KREENO,LST, CERT.BETATH.METH,       | ST22 291
  | 1| MBK,MUL,DBH,BK,KPI,SUMV,SUMS,SUMH,FREQ,BA,LOUT,CDID,KRDS2           | ST22 292
```

FIGURE 12 (CONTINUED).

```
 1 = MX(5)= ASTERISK IMPLIES FORKED TREE.

 2 = MX(6)= ASTERISK IMPLIES UNSEEN USABLE MATERIAL.

 3 =KREENO= TREE NUMBER.

 4 = LST  = VALUE STRATUM.

 5 = CERT = SAMPLING CLASS (1=CERTAIN, 2=SAMPLE).

 6 =BETATH= OTHER TREE CLASSIFICATIONS.

    (METH)
    (    )
 7 =( MBK)= TREE OPTIONS (SEE PAGE 91.
    (    )
    ( MUL)

 8 = DBH  = BREAST-HIGH DIAMETER IN INCHES.

 9 =  BK  = DOUBLE-BARK THICKNESS IN INCHES.

10 = KPI  = PREDICTION FOR TREE.

11 = SUMV = VOLUME OF TREE IN CU. FT. AFTER BARK ALLOWANCE.

12 = SUMS = SURFACE OF TREE IN SQ. FT. AFTER BARK ALLOWANCE.

13 = SUMH = LINEAL FT. IN TREE (INCLUDING FORKS).

14 = FREQ = POPULATION FREQUENCY REPRESENTED BY SAMPLE TREE.

15 =  BA  = BASAL AREA OF TREE IN SQ. FT.

16 = LOUT = VOLUME OF TREE IN BD. FT.

17 = CDID = BRIEF JOB IDENTIFIER.

18 = KRDS2= CARD OUTPUT SEQUENCE WITHIN JOB.
```

FIGURE 13. LOG OUTPUT CARD (OBTAINED BY PUNCHING '3' IN 4TH. JOB-OPTION).



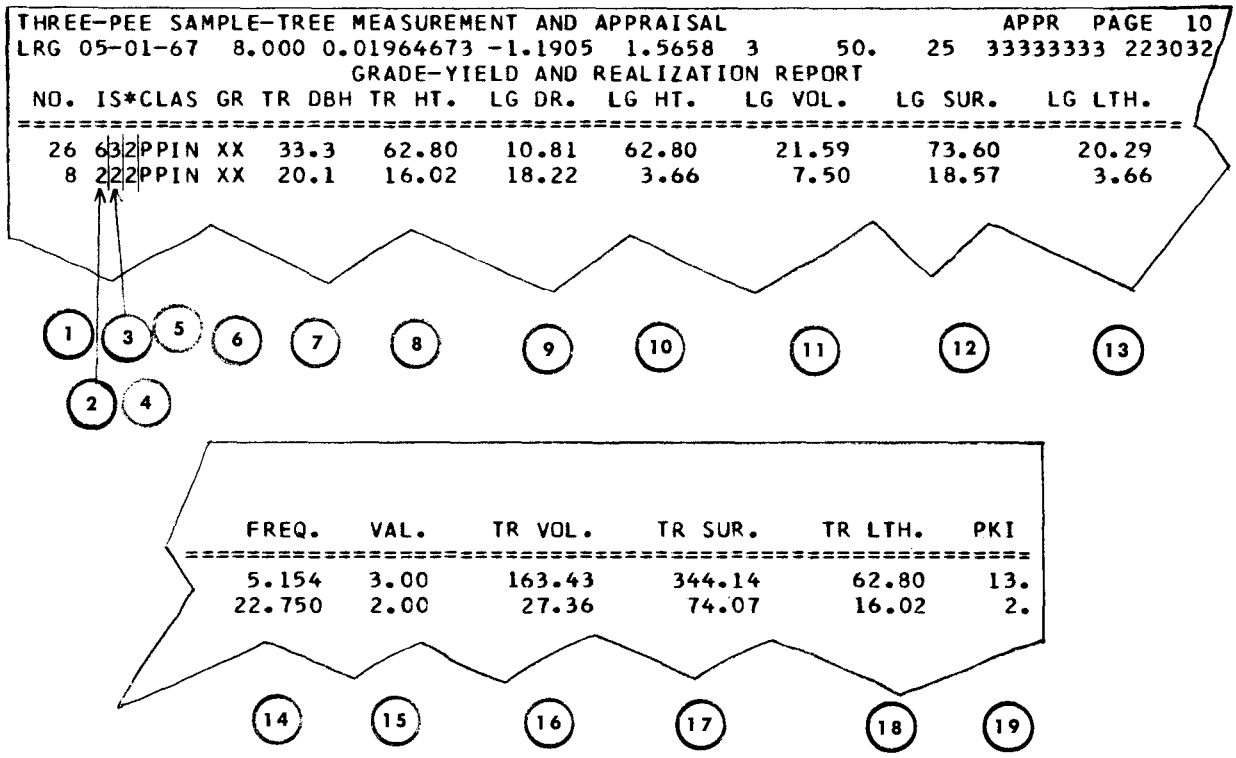
FORMAT AND LIST

```
22|  |FORMAT (I4,I2,2I1,A4,1X,A2,4F5.1,2F8.1,F5.1,F8.3,F8.1,A4,I4)    |ST22  39
  |  |                                                                 |
  |0 |WRITE (MPU,22)          KREENO,I,LST, CERT,BETATH,GAMATH(I),DBH, |ST22 281
  |1 |E(N),DR(I),E(I),CC(I),C(I),H(I),FREQ,POUT,CDID,KRDS2             |ST22 282
```

FIGURE 13 (CONTINUED).

```
 1 =KREENO= TREE NUMBER.
 2 =  I   = DIAMETER SEQUENCE WITHIN TREE.
 3 = LST  = VALUE STRATUM.
 4 = CERT = SAMPLING CLASS (1=CERTAIN, 2=SAMPLE).
 5 =BETATH= OTHER TREE CLASSIFICATIONS.
 6 =GAMATH= GRADE AND DEFECT.
 7 = DBH  = BREAST-HIGH DIAMETER IN INCHES.
 8 = E(N) = HEIGHT IN FT. ABOVE STUMP OF LAST USABLE MATERIAL IN TREE.
 9 =  DR  = UPPER DIAMETER OF LOG IN INCHES AFTER BARK ALLOWANCE.
10 =  E   = HEIGHT OF UPPER END OF LOG IN FT. ABOVE STUMP.
11 =  CC  = VOLUME OF LOG IN CU. FT. AFTER BARK ALLOWANCE.
12 =  C   = SURFACE OF LOG IN SQ. FT. AFTER BARK ALLOWANCE.
13 =  H   = LENGTH OF LOG IN FT.
14 = FREQ = POPULATION FREQUENCY REPRESENTED BY-SAMPLE LOG.
15 = POUT = VOLUME OF LOG IN BD. FT.
16 = CDID = BRIEF JOB IDENTIFIER.
17 = KRDS2= CARD OUTPUT SEQUENCE WITHIN JOB.
```

FIGURE 14. LOG AND TREE INFORMATION WRITTEN ON TAPE JX FOR USE BY GRADE-YIELD AND REALIZATION SUBROUTINE PROD WHEN '2' OR '3' IS PUNCHED IN 5TH. JOB-OPTION ('3' MUST BE PUNCHED TO OBTAIN PRINTOUT SHOWN BELOW).



```
THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL                    APPR  PAGE  10
LRG 05-01-67  8.000 0.01964673 -1.1905  1.5658  3     50.   25  33333333 223032
                    GRADE-YIELD AND REALIZATION REPORT
 NO. IS*CLAS GR TR DBH TR HT.  LG DR.  LG HT.   LG VOL.   LG SUR.   LG LTH.
==========================================================================
  26 632PPIN XX  33.3   62.80   10.81   62.80     21.59     73.60     20.29
   8 222PPIN XX  20.1   16.02   18.22    3.66      7.50     18.57      3.66
```



```
   FREQ.    VAL.    TR VOL.    TR SUR.    TR LTH.   PKI
=========================================================
   5.154    3.00     163.43     344.14      62.80    13.
  22.750    2.00      27.36      74.07      16.02     2.
```


BINARY RECORDS AVAILABLE CN TAPE JX (AFTER SORT, JOB PARAMETERS WILL PRECEDE)

```
| 0| READ   (JX)            IZERO,CDID,JPAGE,ADALFA(l),JAMM,JAMM,     | PROD 41
| 1| ADALFA(2),ADALFA(3),JAMM,(ALFATH(I),I=1,10)                      | PROD 42
| 0| READ (JX)              B,Q,U,G,JAMM,JAMM,PRBS,K,NSTR,IQ,LSSS,   | PROD 43
| 1| LS5,LS6,(ALFATH(I),I=11,16)                                      | PROD 44
|       FOLLOWED BY 'IZERO' RECORDS OF THE KIND SHOWN BELOW,/--
| 0| READ (JX)              KREENO,I,LST, CERT,BETATH,GAMATH(I),DBH,  | PROD
| 1| E(N),DR(I),EII),CC(I),C(I),H(I),FREQ,WV(LST),SUMV,SUMS,SUMH,PKI   | PROD
```

FIGURE 14 (CONTINUED).

```
 1 =KREENO= TREE NUMBER.
 2 =  I   = DIAMETER SEQUENCE WITHIN TREE.
 3 = LST  = VALUE STRATUM.
 4 = CERT = SAMPLING CLASS (1=CERTAIN, 2=SAMPLE).
 5 =BETATH= OTHER TREE CLASSIFICATIONS.
 6 =GAMATH= GRADE AND DEFECT.
 7 = DBH  = BREAST-HIGH DIAMETER IN INCHES.
 8 = E(N) = HEIGHT IN FT. ABOVE STUMP OF LAST USABLE MATERIAL IN TREE.
 9 =  DR  = UPPER DIAMETER OF LOG IN INCHES AFTER BARK ALLOWANCE.
10 =  E   = HEIGHT OF UPPER END OF LOG IN FT. ABOVE STUMP.
11 =  CC  = VOLUME OF LOG IN CU. FT. AFTER BARK ALLOWANCE.
12 =   C  = SURFACE OF LOG IN SQ. FT. AFTER BARK ALLOWANCE.
13 =   H  = LENGTH OF LOG IN FT.
14 = FREQ = POPULATION FREQUENCY REPRESENTED BY SAMPLE LOG.
15 =  WV  = STRATUM VALUE PER UNIT VOLUME.
16 = SUMV = VOLUME OF TREE IN CU. FT. AFTER BARK ALLOWANCE.
17 = SUMS = SURFACE OF TREE IN SQ. FT. AFTER BARK ALLOWANCE.
18 = SUMH = LINEAL FT. IN TREE (INCLUDING FORKS).
19 = PKI  = PREDICTED VOLUME OR VALUE FOR TREE (FLOATING POINT).
```

========== APPENDIX A ==========

'STX' SOURCE DECK ARRANGEMENTS AND CHANGES NEEDED FOR VARIOUS OPERATING SYSTEMS

WITH LISTING OF 2 SETS OF TEST DATA THAT GENERATE OUTPUT SHOWN IN APPENDIX B

ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITH APPROPRIATE OVERLAY CONTROL CARDS
FOR USE WITH IBM 7090—7094 UNDER IBSYS

```
$JOB    XX      5,100,800           GROSENBAUGH—00.STX(05—01—67)
$IBJOB STX      MAP
$IBMAP BUFK     DECK                                                    BUFK   0
$IBMAP UN04     DECK                                                    UN04   0
$IBMAP UN08     DECK                                                    UN08   0
$IBFTC STX      DECK                                                    STX    0
$IBFTC BLD      DECK                                                    BLD    0
     ODATA MRE/+5/,MPR/+6/,MPU/+7/,JW/ 4/,JX/ 8/,MEOF/0/,               BID    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION)
$ORIGIN         ABLE
$IBFTC TREEHH   DECK                                                    TREE   0
$IBFTC ST11HH   DECK                                                    ST11   0
$IBFTC ST22HH   DECK                                                    ST22   0
$IBFTC GAPPHH   DECK                                                    GAPP   0
$IBFTC SBRDHH   DECK                                                    SBRD   0
$IBFTC OLINHH   DECK                                                    DIIN   0
$IBFTC OPCLHH   DECK                                                    OPCL   0
$IBFTC OPFKHH   DECK                                                    OPFK   0
$IBFTC OTHRHH   DECK                                                    OTHR   0
$IBFTC FF83HH   DECK                                                    FF83   0
$I8FTC FFH3HH   DECK                                                    FFH3   0
$IBFTC FFS3HH   DECK                                                    FFS3   0
$IBFTC FFV3HH   DECK                                                    FFV3   0
$IBFTC ST33HH   DECK                                                    ST33   0
$ORIGIN         ABLE
$IBFTC PREPHH   DECK                                                    PREP   0
$IBMAP SORT     DECK   PREST SORT,GRO—26,33.5—15—64,6—4—64.MAXA EQU 253.  SORT   0
$IBMAP MERJ     DECK   TWO—WAY ASCENDING LOGICAL MERGE ON WORDS 5,6,9   MERJ   0
$ORIGIN         ABLE,REW
$IBFTC PRODHH   DECK                                                    PROD   0
$IBFTC SUBTHH   DECK                                                    SUBT   0
$IBFTC ST44HH   DECK                                                    ST44   0
$ENTRY          STX
$DATA
    (FOLLOWED BY APPROPRIATE DATA DECK)
$EOF
```

ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITHOUT OVERLAY BUT WITH A GENERAL SYSTEM TAPESORT (SUCH AS IBM 7040 $IBSURT) BREAKING UP THE PROGRAM INTO THREE SEQUENTIAL TASKS FOR PROCESSING BY IBM 7040-7044 UNDER IBSYS.

```
$JOB 592048      18 T 20 99999 GROSENBAUGH-2          STX,SRT,PROD    48
 OPEN            S.SUO3=I01
$*SCRATCH        L2 AND L3
$IBJOB STX40     MAP
$IBMAP BUFK      DECK                                                  BUFK   0
$IBMAP F02       DECK                                                  F02    0
$IBMAP F03       DECK                                                  F03    0
$IBFTC STX       DECK                                                  STX    0
C 102 CALL PREP                                                        STX   45
C       IF (IZERO .GT. 1500) RETURN                                    STX   46
C 103 CALL PROD                                                        STX   47
C 104 GO TO 90                                                         STX   48
$IBFTC BLD       DECK                                                  BID    0
     ODATA MRE/+5/,MPR/+6/,MPU/+7/,JW/ 2/,JX/ 3/,MEOF/0/,              BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION)
$IBFTC TREEHH    DECK                                                  TREE   0
$IBFTC ST11HH    DECK                                                  ST11   0
$IBFTC ST22HH    DECK                                                  ST22   0
$IBFTC GAPPHH    DECK                                                  GAPP   0
$IBFTC SBRDHH    DECK                                                  SBRD   0
$IBFTC DLINHH    DECK                                                  OLIN   0
$IBFTC OPCLHH    DECK                                                  OPCL   0
$IBFTC OPFKHH    DECK                                                  OPFK   0
$IBFTC OTHRHH    DECK                                                  OTHR   0
$IBFTC FFB3HH    DECK                                                  FF83   0
$IBFTC FFH3HH    DECK                                                  FFH3   0
$IBFTC FFS3HH    DECK                                                  FFS3   0
$IBFTC FFV3HH    DECK                                                  FFV3   0
$IBFTC ST33HH    DECK                                                  ST33   0
$ENTRY           STX
   (FOLLOWED BY APPROPRIATE DATA DECK)
```

(PROGRAM DECKS CONTINUE ON NEXT PAGE)

CONTINUATION OF
ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITHOUT OVERLAY BUT WITH A GENERAL SYSTEM TAPESORT (SUCH AS IBM 7040 SIBSORT) BREAKING UP THE PROGRAM INTO THREE SEQUENTIAL TASKS FOR PROCESSING BY IBM 7040-7044 UNDER IBSYS.

```
$IBSYS
$IBSRT FILE,INPUT/1,MODE/B,BLOCKSIZE/20,REWIND
 FILE,OUTPUT,MODE/B,BLOCKSIZE/20,REWIND
 RECORD,TYPE/F,LENGTH/20,FIELD/(30,6,6,12,6)
 SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(2,3,5)
 SYSTEM,INPUT/S.SUO3,MERGE/B,CUTPUT/S.SUO3
 END
$IBSYS
$IBJOB PROD40   MAP
$IBMAP BUFK     DECK                                                  BUFK   0
$IBMAP F02      DECK                                                  F02    0
$IBMAP F03      DECK                                                  F03    0
$IBFTC BLD      DECK                                                  BLD    0
     ODATA MRE/+5/,MPR/+6/,MPU/+7/,JW/ 2/,JX/ 3/,MEOF/0/,             BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION)
$IBFTC PRODHH DECK                                                    PROD   0
C      SUBROUTINE PROD                                                PROD   4
$IBFTC SUBTHH   DECK                                                  SUBT   0
$IBFTC ST44HH   DECK                                                  ST44   0
$ENTRY          PRODHH
$IBSYS
```

ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITH APPROPRIATE CHAIN CONTROL CARDS FOR USE ON 16K IBM 7040 WITH $IBSORT UNDER IBSYS.

```
$JOB   067182  999999 80082 GROSENBAUGH
$TIME          999
$OPEN          S.SUO3=I01
$IBJOB STXARK  MAP,DECK
$CHAIN STX     U05
$NAME          SJXIT=S.JXIT
$IBMAP BUFK    DECK                                                    BUFK   0
$IBMAP F02     DECK                                                    F02    0
$IBMAP F03     DECK                                                    F03    0
$IBFTC BLD     DECK                                                    BLD    0
     ODATA MRE/+5/,MPR/+6/,MPU/+7/,JW/ 2/,JX/ 3/,MEOF/0/,              BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION)
$IBFTC STX     DECK                                                    STX    0
C 102 CALL PREP                                                        STX   45
C     IF (IZERO .GT. 1500) RETURN                                      STX   46
C 103 CALL PROD                                                        STX   47
C 104 GO TO 90                                                         STX   48
      CALL SJXIT                                                       STX   50
$IBFTC TREEHH DECK                                                     TREE   0
   11 CALL CHAIN(1)                                                    TREE  19
   22 CALL CHAIN(2)                                                    TREE  22
   33 CALL CHAIN(3)                                                    TREE  31
$ENTRY         STX
$LINK LINK1
$IBFTC ST11HH DECK                                                     ST11   0
C      SUBROUTINE ST11                                                 ST11   3
 2000 CALL CHNXIT                                                      ST11 224
$ENTRY
$LINK LINK2
$IBFTC ST22HH DECK                                                     ST22   0
C     SUBROUTINE ST22                                                  ST22   3
 3000 CALL CHNXIT                                                      ST22 350
$IBFTC GAPPHH DECK                                                     GAPP   0
$IBFTC SBRDHH DECK                                                     SBRD   0
$IBFTC DLINHH DECK                                                     OLIN   0
$IBFTC OPCLHH DECK                                                     OPCL   0
$IBFTC OPFKHH DECK                                                     OPFK   0
$IBFTC OTHRHH DECK                                                     OTHR   0
$IBFTC FFB3HH DECK                                                     FF83   0
$IBFTC FFH3HH DECK                                                     FFH3   0
$IBFTC FFS3HH DECK                                                     FFS3   0
$IBFTC FFV3HH DECK                                                     FFV3   0
$ENTRY
$LINK LINK3
$IBFTC ST33HH DECK                                                     ST33   0
C      SUBROUTINE ST33                                                 ST33   3
   85 CALL CHNXIT                                                      ST33 209
$ENTRY
$ENDCH
   (FOLLOWED BY APPROPRIATE DATA DECK)
```

(PROGRAM DECKS CONTINUE ON NEXT PAGE)

CONTINUATION OF
ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITH APPROPRIATE CHAIN CONTROL CARDS
FOR USE ON 16K IBM 7040 WITH SIBSORT UNDER IBSYS.

```
$IBSYS
$IBSRT FILE,INPUT/1,MODE/B,BLOCKSIZE/20,REWIND
 FILE,OUTPUT,MODE/B,BIOCKSIZE/20,REWIND
 RECORD,TYPE/F,LENGTH/20,FIELD/(30,6,6,12,6)
 SORT,FILE/1,SEQUENCE/S,ORDER/2,FIELD/(2,3,5)
 SYSTEM,INPUT/S.SUO3,MERGE/A,OUTPUT/S.SUO3
 END
$IBSYS
$IBJOB PRdARK MAP,DECK
$IBMAP BUFK     DECK                                                    BUFK   0
$IBMAP F02      DECK                                                    F02    0
$IBMAP F03      DECK                                                    F03    0
$IBFTC BLD      DECK                                                    BLD    0
     ODATA MRE/+5/,MPR/+6/,MPU/+7/,JW/ 2/,JX/ 3/,MEOF/0/,               BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION)
$IBFTC PRODHH   DECK                                                    PROD   0
C      SUBROUTINE PROD                                                  PROD   4
$IBFTC SUBTHH   DECK                                                    SUBT   0
$IBFTC ST44HH   DECK                                                    ST44   0
$ENTRY          PRODHH
$IBSYS
```

ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITH APPROPRIATE CONTROL CARDS AND CHANGES FOR USE WITH IBM 360 UNDER OPERATING SYSTEM 360

```
//JXXXXST JOB (XXXX,60,100,1000),GROSENBAUGH,MSGLEVEL=1
//CLG1 EXEC FORTGCLG,PARM.FORT='DECK,LOAD,SOURCE,BCD,NAME=STX'
//FORT.SYSIN DD *
 (USE DECKS DENOTED BY FOLLOWING LABELS, BUT DELETE ALL SIBMAP AND $IBFTC CARDS)
C  STX, EXECUTIVE PROGRAM FOR 3P SAMPLE-TREE-MEASUREMENT COMPUTATIONS, STX     1
C 102 CALL PREP                                                        STX   45
C     IF (IZERO .GT. 1500) RETURN                                      STX   46
C 103 CALL PROD                                                        STX   47
C 104 GO TO 90                                                         STX   48
C BLOCK DATA DECK LABELLED 'BLD' FOR SETTING CONSTANTS NEEDED BY 'STX'. BLD    1
        (PUNCH THIS DECK IN EBCCIC TO ENSURE CORRECT HOLLERITH CONSTANTS)
     ODATA MRE/ 5/,MPR/ 6/,MPC/ 7/,JW/ 4/,JX/ 8/,MEOF/O/,               BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION AND DO CARDS)
C           SUBROUTINE PROVIDING INTERNAL LINKAGE FOR STX OVERLAY LINKS  TREE   1
C           SUBROUTINE FOR PRELIMINARY REPORT ON STX THREE-PEE SAMPLING  ST11   1
C           SUBROUTINE FOR DETAILED REPORT ON STX THREE-PEE SAMPLING     ST22   1
C           SUBROUTINE FOR SUPPLYING MISSING TREE-VARIABLES IN ST22      GAPP   1
C           SUBROUTINE FOR CONVERTING SHORT-BASE-RANGEFINDER READINGS TO  SBRD   1
C           SUBROUTINE FOR CONVERTING LINEAR TREE MEASUREMENTS TO        OLIN   1
C           SUBROUTINE FOR OPTICAL-CALIPER DENDROMETER CONVERSION        OPCL   1
C           SUBROUTINE FOR OPTICAL-FORK DENDROMETER CONVERSION           OPFK   1
C           SUBROUTINE FOR ANY OTHER-TYPE DENDROMETER CONVERSION         OTHR   1
C           FUNCTION CONVERTING DOB TO DIB                               FF83   1
C           FUNCTION ESTIMATING UNSEEN LENGTH FROM SEEN PART OF TREE     FFH3   1
C           FUNCTION ESTIMATING UPPERMOST SURFACE OF TREE                FFS3   1
C           FUNCTION ESTIMATING UPPERMOST VOLUME OF TREE                 FFV3   1
C           SUBROUTINE FOR SUMMARY REPORT ON STX THREE-PEE SAMPLING      ST33   1
/*
//LKEO.SYSIN DO *
 ENTRY STX
/*
//GO.FT04FOO1 DD DSNAME=&TAPE4,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),     X1
//            DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,DELETE)       2
//GO.FT08FO01 DD DSNAME=&TAPE8,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),     X1
//            DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,PASS)         2
//GO.SYSIN DD *
         (FOLLOWED BY INPUT DATA DECK PUNCHED ACCORDING TO EBCDIC CODE)
/*
```

(PROGRAM DECK ARRANGEMENT CONTINUED ON NEXT PAGE)

CONTINUATION OF
ARRANGEMENT CF PROGRAM DECKS FOR INPUT WITH APPROPRIATE CONTROL CARDS
AND CHANGES FOR USE WITH IBM 360 UNDER OPERATING SYSTEM 360

```
//SRT2 EXEC SORT
//SORT.SORTIN   DD DSNAME=&TAPE8,DISP=(OLD,DELETE)
//SORT.SORTOUT  DD DSNAME=&TAPE88,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),   X1
//              DCB=(,RECFM=V,LRECL=80,8LKSIZE=84),DISP=(NEW,PASS) 2
//SORT.SORTWK01  DD   DSNAME=WK01,UNIT=SYSSQ,SPACE=(CYL,(20) ,,CONTIG), XI
//              DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,DELETE)     2
//SORT.SORTWK02  DD   DSNAME=WK02,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),   X1
//              DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,DELETE)     2
//SORT.SORTWK03  DD   DSNAME=WK03,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),   X1
//              DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,DELETE)     2
//SORT.SORTWK04  DD   DSNAME=WK04,UNIT=SYSSQ,SPACE=(CYL,(20),,CONTIG),   X1
//             DCB=(,RECFM=V,LRECL=80,BLKSIZE=84),DISP=(NEW,DELETE)      2
//SORT.SYSIN DD *
 SORT FIELDS=(21.0,4.0,CH,A,25.0,2.0,CH,A,37.0,4.0,FL,A),SIZE=E1500
 RECORD TYPE=V,LENGTH=(80)
 END
/*
//CLG3 EXEC FORTGCLG,PARM.FORT='DECK,LOAO,SOURCErBCD,NAME=PROD'
//FORT.SYSIN 00 *
 (USE DECKS DENOTED BY FOLLOWING LABELS, BUT DELETE ALL $IBMAP AND $IBFTC CARDS)
C           MAJOR SUBROUTINE FOR GRADE-YIELD, PRODUCT OUTTURN, AND      PROD   1
C      SUBROUTINE PR00                                                  PROD   4
C BLOCK DATA DECK LABELLED 'BLD' FOR SETTING CONSTANTS NEEDED BY  'STX'.BLD    1
     ODATA MRE/ 5/,MPR/ 6/,MPU/ 7/,JW/ 4/,JX/ 8/,MEOF/O/,               BLD    9
   (ASSIGNMENTS APPROPRIATE TO INSTALLATION I/O CONFIGURATION AND DD CARDS)
C           SUBROUTINE FOR SUBTOTALLING VOLUME, SURFACE, LENGTH IN PROD  SUBT   1
C           SUBROUTINE FOR CONVERSION OF VOLUME, SURFACE, LENGTH TO      ST44   1
//LKED.SYSIN DD *
  ENTRY PROD
/*
//GO.FT08F001 DD DSNAME=&TAPE88,DISP=(OLD,DELETE)
/*
//
PARENS AND PLUS SIGN MAY NOT PRINT PROPERLY UNLESS EBCDIC SOURCE DECKS ARE USED.
```

ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITHOUT OVERLAY BUT WITH A GENERAL SYSTEM TAPESORT (SUCH AS CDC SORTMRG) DIVIDING THE PROGRAM INTO THREE SEQUENTIAL TASKS FOR PROCESSING BY CDC 6400-6600 UNDER SCOPE 3.0.

```
JXXXXST,7,400,55000.XXXX,GROSENBAUGH-75.STX
RUN(P, 55000,,,,, 12000,1,1)
LGO.
SORTMRG.
REWIND,LGO.
RUN (P, 55000,,,,, 12000,1,1)
LGO.
CDC RECORD SEPARATOR CARD, WITH 7,8,9 PUNCHED IN COLUMN ONE.
     OPROGRAM STX(INPUT,OUTPUT,PUNCH,TAPE5=INPUT,TAPE6=OUTPUT,
     1TAPE7=PUNCH,TAPE2,TAPE3)
$IBFTC STX     DECK                                                  STX    0
C 102 CALL PREP                                                      STX   45
C       IF (IZERO .GT. 1500) RETURN                                  STX   46
C 103 CALL PROD                                                      STX   47
C 104 GO TO 90                                                       STX   48
$IBFTC BLD     DECK                                                  BLD    0
     ODATA MRE/ 5/,MPR/ 6/,MPU/ 7/,JW/ 2/,JX/ 3/,MEOF/01,            BLD    9
   (ASSIGNMENTS APPROPRIATE TO PROGRAM CARD I/O EQUIVALENCES)
$IBFTC TREEHH DECK                                                   TREE   0
$IBFTC ST11HH DECK                                                   ST11   0
$IBFTC ST22HH DECK                                                   ST22   0
$IBFTC GAPPHH DECK                                                   LAPP   0
$IBFTC SBRDHH DECK                                                   SBRD   0
$IBFTC DLINHH DECK                                                   OLIN   0
$IBFTC OPCLHH DECK                                                   OPCL   0
$IBFTC OPFKHH DECK                                                   OPFK   0
$IBFTC OTHRHH DECK                                                   OTHR   0
$IBFTC FFB3HH DECK                                                   FFB3   0
$IBFTC FFH3HH DECK                                                   FFH3   0
$IBFTC FFS3HH DECK                                                   FFS3   0
$IBFTC FFV3HH DECK                                                   FFV3   0
$IBFTC ST33HH DECK                                                   ST33   0
CDC RECORD SEPARATOR CARD, WITH 7,8,9 PUNCHED IN COLUMN ONE.
    (FOLLOWED BY APPROPRIATE DATA DECK)
```

(PROGRAM DECKS CONTINUE ON NEXT PAGE)

CONTINUATION OF
ARRANGEMENT OF PROGRAM DECKS FOR INPUT WITHOUT OVERLAY BUT WITH A GENERAL SYSTEM TAPESORT (SUCH AS CDC SORTMRG) DIVIDING THE PROGRAM INTO THREE SEQUENTIAL TASKS FOR PROCESSING BY CDC 6400-6600 UNDER SCOPE 3.0.

```
COC RECORD SEPARATOR CARD, WITH 7,8,9 PUNCHED IN COLUMN ONE.
SORT(1,3,190,,2,,19)
KEY(A,C,41,4)
KEY(A,C,51,2)
KEY(A,F,9)
FILE(TAPE3,S,B,,R,N)
FILE(TAPE3,0,8,,R,N)
RECORO(I,F,190)
RECORD(O,F,190)
END
CDC RECORD SEPARATOR CARD, WITH 7,8,9 PUNCHED IN COLUMN ONE.
     OPROGRAM PROD(INPUT,OUTPUT,PUNCH,TAPE5=INPUT,TAPE6=OUTPUT,
     1TAPE7=PUNCH,TAPE3)
$IBFTC PRODHH DECK                                                    PROD    0
C      SUBROUTINE PROD                (REPLACES CARD 'SUBROUTINE PROD') PROD    4
$IBFTC BLD     DECK                                                   BLD     0
     ODATA MRE/ 5/,MPR/ 6/,MPU/ 7/,JW/ 2/,JX/ 3/,MEOF/0/,             BLD     9
   (ASSIGNMENTS APPROPRIATE TO PROGRAM CARD I/O EQUIVALENCES)
$IBFTC SUBTHH DECK                                                    SUBT    0
$IBFTC ST44HH DECK                                                    ST44    0
```

CDC END-OF-FILE CARD, WITH 6,7,8,9 PUNCHED IN COLUMN ONE.
(EFFICIENCY CAN BE IMPROVED BY CHANGING 'DOUBLE PRECISION' TO 'REAL' ON CARDS ST22 18 AND SBRD 5, ALONG WITH CONSTANTS OR FUNCTIONS ON CARDS ST22 42, 50-51 AND SBRD 40-47, 51-52, 55, AND 65)

TEST INPUT (TWO SETS OF DATA)

```
      EXAMPLE OF MOST EARLY THREE-PEE OPTIONS                                              DBST  1
      LRG 05-01-67 08000 01964673-11905 15658 3    4    3 77777777 123000                  DBST  2
                                                                                           DBST  3
                                                                                           DBST  4
        .03      .01                                                                       DBST  5
           11                                                                                  DBST
           11                                                                                  DBST
           11                                                                                  DBST
           31                                                                                  DBST
           22                                                                                  DBST
   1       11*CNVX  10.0 211 -1.0          .20        88888888         .99999999               DBST
  11              11.0  0.0ST      8.0  4.3DB      6.0 12.0FL       3.0 13.0LS                 DBST
  12              -999       UU                                                      *         DBST
   2       11*LINR  10.0 211 -1.0          .20                                                 DBST
  21              11.0  0.0ST      8.0  4.3DB      5.6 12.0FL       3.0 13.0LS                 DBST
  22              -999       UU                                                      *         DBST
   3       11*CNCV  10.0 211 -1.0          200                                                 DBST
  31              11.0  0.0ST      8.0  4.3DB      5.0 12.0FL       3.0 13.0LS                 DBST
  32              -999       UU                                                      *         DBST
   4       11*STPT  10.0 211 -1.0        4.200                                                 DBST
  41               110   .0ST       80  4.3DB       50 12.0FL        30 13.0LS                 DBST
  42              -999       UU                                                      *         DBST
   5       11*CONE  10.0 212 -1.0       36.167                                                 DBST
  51              11.0  0.0ST      8.0  4.3DB    -999       UU                       *         DBST
  60       41=OUBK  12.0 011  -.7 -.5                                                          DBST
  61          01960841+0000ST03410673+6247MH                                         *         DBST
  70       41=INB1  12.0 011      7   5                                                        DBST
  71          01960841+0000ST03410673+6247MH                                         *         DBST
  80       41=INB2  12.0 021      6                                                            DBST
  81          01960841+0000ST03410673+6247MH                                         *         DBST
  90       41=TOTH  12.0 011                                                                   DBST
  91          01960841+0000ST03410673+6247MH-999-999+7071TH                          *         DBST
 100       31*SDTF          011                                                                DBST
 101          04910690-0250BK04910169+0250FR05000768+1000LG05030697+1250AN                     DBST
 102          05030503+1250UU                                                        *         DBST
 110       12=TPBT  11.4          6   5                                                        DBST
 111          -99914.5  3.7SS     11.4 12.5BB01850736+3031CC03120698+5810CC          *         DBST
 120       12*MOVE  11.4          6   5                                                        DBST
 121          01500894-1108SS01480780-0140BB01850736+3031CC                          +         DBST
 122          03120719+0000MV03240697+3244CC                                         *         DBST
 130      642=FRKU  52.2       1.0         .35                                                 DBST
 131          04611560-0320SS05421105-0035DB05460923+1655FF                          +         DBST
 132          05460913+1659FS05510859+3410FA05580814+4528FB05640773+5407FC           +         DBST
 133          05460913+1659FT05510859+3410FW05580814+4528FX05640773+5407FY                     DBST
 134          05680753+6080FZ     -999      UU                                       *         DBST
  14        3=CULD  12.0                                                                       DBST
 141                  1              1                                               *         DBST
  15        3=CULL  48.0                                                             *         DBST
9999
```

CONTINUATION OF TEST INPUT

```
    THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL                                  APPR   1
    LRG 05-01-67 08000 01964673-11905 15658 3   50   25          222022 APPR   2
      53      124       60                                                         APPR   3
     215      245      239                                                         APPR   4
    1.00     2.00     3.00                                                         APPR   5
   40   51*PPIN  20.3         9  10  16                                               APPR
   41       03251048-0750SS03200977+0084BC03360934+2450BB03830848+4980CA            APPR
   42       04270785+6675CB     -999      UU                                    *    APPR
   50   12*PPIN  11.3         6   5                                                  APPR
   51       01500894-1108SS01480780-0140AA01850736+3031AC03120698+5810CC*           APPR
   60   23*PPIN  15.9         7   7                                                  APPR
   61       02451047-0720SS02400922-0022BA02700875+2863BA03350801+5718BB*           APPR
   70   61*DFIR  31.7        12  15                                                  APPR
   71       02951552-0821SS03001403-0080BB03091247+2585BB                    *      APPR
   80   22*PPIN  20.1        11  10                                                  APPR
   81       03181077-0686SS03141009+0068XX03260935+2563CB                    *      APPR
   90   33*PPIN  24.5        12   9                                                  APPR
   91       01921457-0977SS01831210-0105BA02281101+2892BA                    *      APPR
  100   21*PPIN  17.6         8   9                                                  APPR
  101       03660960-0747SS03630900-0116AB03720859+2108AB                    *      APPR
  110   12*PPIN  11.0         4   4                                                  APPR
  111       02520862-0730SS02550745+0056CC02730687+2620CC                    *      APPR
  210  252=DFIR  37.2 012    20  19  49.08                                           APPR
  211       04031560-0656SS04051339-0305AA04141143+0783AA04141057+2335BA            APPR
  212       04270967+3275BC04640890+5937CB04800863+6758CC     -999      UU*          APPR
  220  382=DFIR  38.8 012    14  17  16.38                                           APPR
  221       05321021+0240SS05271038+0504AC05280968+1154AB05480908+3330BB            APPR
  222       05480825+6296CB05640746+6758CC     -999      UU                    *    APPR
  230  383=DFIR  40.0 012    12  13  10.25                                           APPR
  231       05810897-0212SS05780851+0351BB05820795+3093BC05860729+4646CA            APPR
  232            -999      UU                                                  *    APPR
  240  201*DFIR  39.4        19  19                                                  APPR
  241       05021146-0697SS04971122-0377XX04941054+1079AC05060994+2640BC            APPR
  242       05060904+4275CC                                                  *      APPR
  250   72*DFIR  28.8        15  14                                                  APPR
  251       04441080-0820SS04431040-0460XX04151010+0186XX04510855+3333CC            APPR
  252       04720743+5119CC05030640+6715CC                                   *      APPR
  260  133*PPIN  33.3        16  17                                                  APPR
  261       03881403-0505SS03901300-0096CA03911192+1220CA03951063+3522CB            APPR
  262       04390870+5654CC04790718+7089XX                                   *      APPR
9999
9999
```

APPENDIX B

PRINTED OUTPUT PRODUCED

WHEN 2 SETS OF DATA

(SHOWN IN APPENDIX A)

ARE PROCESSED BY PROGRAM STX

ON AN IBM 7094 OR ANY

OTHER COMPARABLY LARGE BINARY COMPUTER

HAVING A FORTRAN-4 COMPILER

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 1
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 123000
PRELIMINARY REPORT-COUNTS AND AGGREGATE PREDICTIONS

STRATUM 1	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	4	16
THREE-PEE MEASURED TREES(*2)	6	8
THREE-PEE PREDICTED TREES(3)	4	6
ALL TREES(1,2,3)	14	30
ALL MEASURED TREES(1,2)	10	24
ALL THREE-PEE TREES(2,3)	10	14
EXPECTED VALUES FOR (*2)	3.500	6.500
EXP. VAL. ST. ERRORS 1*2)	1.369	2.208
STRATUM 2	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	2	65
THREE-PEE MEASURED TREES(*2)	1	1
THREE-PEE PREDICTED TREES(3)	1	2
ALL TREES(1,2,3)	4	68
ALL MEASURED TREES(1,2)	3	66
ALL THREE-PEE TREES(2,3)	2	3
EXPECTED VALUES FOR (*2)	0.750	1.250
EXP. VAL. ST. ERRORS (*2)	0.661	1.090
STRATUM 3	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	2	0
THREE-PEE MEASURED TREES(*2)	0	0
THREE-PEE PREDICTED TREES(3)	0	0
ALL TREES(1,2,3)	2	0
ALL MEASURED TREES(1,2)	2	0
ALL THREE-PEE TREES(2,3)	0	0
EXPECTED VALUES FOR (*2)	0.000	0.000
EXP. VAL. ST. ERRORS (*2)	-0.000	0.000
TOTALS FOR ALL 3 STRATA	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	8	81
THREE-PEE MEASURED TREES(*2)	7	9
THREE-PEE PREDICTED TREES(3)	5	8
ALL TREES(1,2,3)	20	98
ALL MEASURED TREES(1,2)	15	90
ALL THREE-PEE TREES(2,3)	12	17
EXPECTED VALUES FOR 1*2)	4.250	7.750
EXP. VAL. ST. ERRORS (*2)	1.521	2.462

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 2
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 12300
DETAILED LOG AND/OR TREE REPORT

TREE/ NO./	VOLUME CU.FT.	/ SURFACE / SQ.FT.	/ LENGTH / FEET	/ D.I.B. / INCHES	/ LOG /CODE	/ RANGE/ FEET/	TGRADS	FGRADS	SINELV
	0.1	2.3	3.4	2.0	UU	-0.0	-0.0	-99.9	-0.0000
	1.5	15.3	13.0	3.0	LS	0.0	-0.0	3.0	13.0000
	3.2	22.0	12.0	6.0	FL	0.0	-0.0	6.0	12.0000
	2.1	10.7	4.3	8.0	DB	0.0	-0.0	8.0	4.3000
	0.0	0.0	0.0	11.0	ST	0.0	-0.0	11.0	0.0000
1	7.0	50.3	32.7	10.0=D,F=		2.333,	1,	-2.0	211*CNVX 1
	0.2	3.3	5.0	2.0	UU	-0.0	-0.0	-99.9	-0.0000
	1.4	14.6	13.0	3.0	LS	0.0	-0.0	3.0	13.0000
	3.1	21.4	12.0	5.6	FL	0.0	-0.0	5.6	12.0000
	2.1	10.7	4.3	8.0	DB	0.0	-0.0	8.0	4.3000
	0.0	0.0	0.0	11.0	ST	0.0	-0.0	11.0	0.0000
2	6.7	50.0	34.3	10.0=D,F=		2.333,	1,	-2.0	211*LINR 1
	0.3	5.2	8.0	2.0	UU	-0.0	-0.0	-99.9	-0.0000
	1.2	13.6	13.0	3.0	LS	0.0	-0.0	3.0	13.0000
	2.8	20.4	12.0	5.0	FL	0.0	-0.0	5.0	12.0000
	2.1	10.7	4.3	8.0	UB	0.0	-0.0	8.0	4.3000
	0.0	0.0	0.0	11.0	ST	0.0	-0.0	11.0	0.0000
3	6.4	49.9	37.3	10.0=D,F=		2.333,	1,	-2.0	211*CNCV 1
	0.2	2.9	4.0	2.5	UU	-0.0	-0.0	-99.9	-0.0000
	1.2	13.6	13.0	3.0	IS	0.0	-0.0	3.0	13.0000
	2.8	20.4	12.0	5.0	FL	0.0	-0.0	5.0	12.0000
	2.1	10.7	4.3	8.0	DB	0.0	-0.0	8.0	4.3000
	0.0	0.0	0.0	11.0	ST	0.0	-0.0	11.0	0.0000
4	6.3	47.6	33.3	10.0=D,F=		2.333,	1,	-2.0	211*STPT 1
	5.5	47.1	36.0	2.0	UU	-0.0	-0.0	-99.9	-0.0000
	2.1	10.7	4.3	8.0	DB	0.0	-0.0	8.0	4.3000
	0.0	0.0	0.0	11.0	ST	0.0	-0.0	11.0	0.0000
5	7.6	57.8	40.3	10.0=D,F=		2.333,	1,	-2.0	212*CONE 1

EXAMPLE CF MOSTEARLY THREE-PEE OPTIONS DBST PAGE 3
LRG 05-01-67 8.000 0.019*4673 -1.1e05 1.5658 3 4. 3 77777777 123000
DETAILED LOG AND/OR TREE REPORT

TREE/ NO./	VOLUME / CU.FT.	SURFACE / SQ.FT.	LENGTH / FEET	D.I.B./ INCHES	LOG /CODE	RANGE/ FEET	TGRADS	FGRADS	SINELV
	21.9	93.2	32.0	8.9	MH	51.3	34.1	67.3	0.6247
	0.0	0.0	0.0	13.3	ST	40.0	19.6	84.1	0.0000
6	21.9	93.2	32.0	12.0=D,F=		1.000,	4,	-1.2 011	DUBK 1
	17.7	83.9	32.0	8.0	MH	51.3	34.1	*7.3	0.6747
	0.0	0.0	0.0	12.0	ST	40.0	19.6	84.1	0.0000
7	17.7	83.9	32.0	12.0=D,F=		1.000,	4,	1.2 011	INB1 1
	17.7,	83.9	32.0	8.2	MH	51.3	34.1	67.3	0.6247
	0.0	0.0	0.0	11.8	ST	40.0	19.6	84.1	0.0000
8	17.7	83.9	32.0	12.0=D,F=		1.000,	4,	1.2 021	INB2 1
	0.9	8.5	8.0	0.1	TH	0.0	-99.9	-99.9	0.7071
	17.7	83.9	32.0	8.0	MH	51.3	34.1	67.3	0.6247
	0.0	0.0	0.0	12.0	ST	40.0	19.6	84.1	0.0000
9	18.7	92.4	40.0	12.0=D,F=		1.000,	4,	-0.0 011	TOTH 1
	4.s	27.2	14.4	4.3	UU	-0.0	50.3	50.3	0.1250
	2.1	8.3	2.6	10.1	AN	97.1	50.3	69.7	0.1250
	5.6	22.6	7.3	14.2	LG	95.3	50.0	76.8	0.1000
	2.2	11.3	4.5	9.5	FR	90.3	49.1	16.9	0.0250
	0.0	0.0	0.0	9.5	BK	90.3	49.1	69.0	-0.0250
10	1*.3	69.3	28.8	10.6=D,F=		0.778,	3,	-0.0	011*SDTF 1

LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 12300

DETAILED LOG AND/OR TREE REPORT

TREE/ NO./	VOLUME / CU.FT. /	SURFACE / SQ.FT. /	LENGTH/ FEET /	D.I.B. / INCHES /	LOG /CODE/	RANGE/ FEET/	TGRADS	FGRADS	SINELV
	7.1	37.6	15.9	8.7	CC	48.0	31.2	69.8	0.5810
	6.6	32.2	12.5	9.4	CC	39.5	18.5	73.6	0.3031
	2.8	11.3	3.7	10.3	BB	0.0	-0.0	11.4	12.5000
	0.0	0.0	0.0	13.1	SS	0.0	-99.9	14.5	3.7000
11	16.4	81.1	32.1	11.4=D,F=		1.000,	1,	1.1 011	TPBT 2
	7.1	37.7	16.0	8.7	CC	49.3	32.4	69.7	0.3244
	0.0	0.0	0.0	9.3	MV	48.0	31.2	71.9	0.0000
	6.6	32.2	12.5	9.4	CC	39.5	18.5	73.6	0.3031
	2.8	11.4	3.7	10.3	BB	38.2	14.8	78.0	-0.0140
	0.0	0.0	0.0	13.1	SS	38.2	15.0	89.4	-0.1108
12	16.5	81.3	32.2	11.4=D,F=		3.000,	1,	1.1 011	MOVE 2
	45.0	116.9	24.2	17.6	UU	-0.0	-0.0	-99.9	-0.0000
	35.8	84.8	16.0	19.5	FZ	172.2	56.8	75.3	0.6080
	54.6	115.0	19.3	21.1	FY	164.0	56.4	77.3	0.5407
	77.2	142.1	20.8	24.4	FX	153.3	55.8	81.4	0.4528
	126.1	203.1	26.1	27.7	FW	142.4	55.1	85.9	0.3410
	0.0	0.0	0.0	31.8	FT	135.6	54.6	91.3	0.1659
	54.6	115.0	19.3	21.1	FC	164.0	56.4	77.3	0.5407
	77.2	142.1	20.8	24.4	FB	153.3	55.8	81.4	0.4528
	126.1	203.1	26.1	27.7	FA	142.4	55.1	85.9	0.3410
	0.0	0.0	0.0	31.8	FS	135.6	54.6	91.3	0.165e
	210.4	244.5	22.9	32.8	FF	135.6	54.6	92.3	0.1655
	28.5	26.8	2.0	48.8	DB	130.7	54.2	110.5	-0.0035
	0.0	0.0	0.0	53.1	SS	77.1	46.1	156.0	-0.0320
13	835.7	1393.4	197.4	52.2=D,F=		1.000,	64,	2.0*011*FRKU	2
	-0.0	-0.0	-0.0	0.0		36.0	-0.0	0.1	-0.0000
	0.0	0.0	0.0	0.0		36.0	-0.0	0.1	-0.0000
l4	0.0	0.0	0.0	12.0=D,F=		1.000,	-0,	-0.0 011	CULD 3

STRATUM 2 HAS LESS THAN TWO SAMPLES.

STRATUM 3 HAS LESS THAN TWO SAMPLES.

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 5
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 123000
SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 1.

SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	4.000	12.444	16.444
PREDICTIONS(KPI)	16.	14.	30.
B.A.(SQ.FT.O.B.)	3.1	6.8	10.0
LENGTH(FT.)	136.1	437.6	573.7
SURFACE(SQ.FT.IB.)	353.3	650.2	1003.5
VOLUME(CU.FT.I.B.)	75.9	90.4	166.3
REL.VAL.PER MF.UNIT	0.03	0.03	0.03
GROSS MF.UNITS	439.8	375.3	815.2
ST.ERROR(PCT.)	-----	3.5	1.6

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	4	6	10
MEASURED LOGS	5	22	27

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 6
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 123000
SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 2

SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	2.000	3.000	5.000
PREDICTIONS(KPI)	65.	3.	68.
B.A.(SQ.FT.O.B.)	15.6	2.1	17.7
LENGTH(FT.)	229.6	96.6	326.2
SURFACE(SQ.FT.IB.)	1474.5	244.0	1718.5
VOLUME(CU.FT.I.B.)	852.1	49.5	901.6
REL.VAL.PER MF.UNIT	0.01	0.01	0.01
GROSS MF.UNITS	6615.8	277.5	6893.3
ST.ERROR(PCT.)	----	0.0	0.0

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	2	1	3
MEASURED LOGS	13	3	16

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 7
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 123000
SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 3	3	3	3
SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	2.000	0.000	2.000
PREDICTIONS(KPI)	0.	0.	0.
B.A.(SQ.FT.0.8.)	13.4	0.0	13.4
LENGTH(FT.)	0.0	0.0	0.0
SURFACE(SQ.FT.IB.)	0.0	0.0	0.0
VOLUME(CU.FT.I.B.)	0.0	0.0	0.0
REL.VAL.PER MF.UNIT	1.00	1.00	1.00
GROSS MF.UNITS	0.0	0.0	0.0
ST.ERROR(PCT.)	-----	0.0	0.0

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1.2) NUMBER
MEASURED TREES	2	0	2
MEASURED LOGS	1	0	1

EXAMPLE OF MOST EARLY THREE-PEE OPTIONS DBST PAGE 8
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3 4. 3 77777777 123000
SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

TOTALS ALL 3 STRATA

SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	8.000	15.444	23.444
PREDICTIONS(KPI)	81.	17.	98.
B.A.(SQ.FT.O.B.)	32.1	9.0	41.0
LENGTH(FT.)	365.7	534.2	899.8
SURFACE(SQ.FT.IB.)	1827.8	894.2	2722.0
VOLUME(CU.FT.I.B.)	928.0	139.9	1067.9
REL.VAL.PER MF.UNIT	0.01	0.02	0.01
GROSS MF.UNITS	7055.6	652.9	7708.5
ST.ERROR(PCT.)	-----	2.0	0.2
GROSS WTD.MF.UNITS	79.35	14.04	93.39
ST.ERROR(PCT.)	-----	2.8	0.4

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	8	7	15
MEASURED LOGS	19	25	44

MF.UNITS= BD. FT. (INT. 1/4-IN.) .AFTER ALLOWANCE FOR TRIM OF .3 FT. PER 16 FT
=(0.89560000E 01)*(CU.FT.)+(-0.69540000E 001*(SQ.FT.)+(0.41450000E-01)*(FT.)

```
EXAMPLE OF MOST EARLY THREE-PEE OPTIONS                          DBST PAGE    0
LRG 05-01-67 8.000 0.01964673 -1.1905 1.5658 3      4.     3    77777777 123000
       SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES
================================================================================

DATA PROCESSING BLOCKED BY    O INPUT FLAWS.
SAMPLE ESTIMATES INVOLVE   3 SUSPICIOUS ITEMS NUMBERED
             10     10    10
INPUT READ BEFORE FLAW, IF ANY---
    CARDS WITH TREE PREDICTIONS ONLY        (FIRST)                          5
    CARDS WITH MEASURED TREE INFO           (FIRST)                         15
    ----------------------------------------------------------------------------
    CARDS WITH MEASURED TREE INFO           (SECOND)                        15
    CARDS WITH ADDITIONAL DENDROMETER INFO  (SECOND)                        23

PROCESSING DONE BEFORE FLAW, IF ANY---
    NUMBER OF MEASURED TREES PROCESSED                                      15
    NUMBER OF MEASURED LOGS PROCESSED                                       44
    TREE CARDS PUNCHED OR WRITTEN                                            0
    LOG CARDS PUNCHED OR WRITTEN                                             0
    LABEL ON CARD OUTPUT                                                  DBST

CHECK OF INPUT AGGREGATES WITH EXPANDED 3P SAMPLE
    AGGREGATE NUMBER OF TREES INPUT(1+2+3)                          20
    SAMPLE ESTIMATE(EXPANDED 2)+NO.SURE(1)                          23.444
    STANDARD ERROR OF ESTIMATED NUMBER                               1.556
    ----------------------------------------------------------------------------
    AGGREGATE PREDICTIONS(KPI) INPUT(1+2+3)                         98
    SAMPLE ESTIMATE(EXPANDED 2)+KPI SURE(1)                         98.
```

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 1
LRG 05—01—67 8.000 0.01964673 -1.1905 1.*658 3 50. 25 -0 222022
PRELIMINARY REPORT-COUNTS AND AGGREGATE PREDICTIONS

STRATUM 1	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	0	0
THREE-PEE MEASURED TREES(*2)	4	33
THREE-PEE PREDICTED TREES(3)	49	182
ALL TREES(1,2,3)	53	215
ALL MEASURED TREES(1,2)	4	33
ALL THREE-PEE TREES(2,3)	53	215
EXPECTED VALUES FOR (*2)	4.300	32.979
EXP. VAL. ST. ERRORS (*2)	1.908	14.633

STRATUM 2	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	2	63
THREE-PEE MEASURED TREES(*2)	4	11
THREE-PEE PREDICTED TREES(3)	118	171
ALL TREES(1,2,3)	12+	245
ALL MEASURED TREES(1,2)	6	74
ALL THREE-PEE TREES(2,3)	122	182
EXPECTED VALUES FOR (*2)	3.640	9.866
EXP. VAL. ST. ERRORS (*2)	1.855	5.029

STRATUM 3	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	1	38
THREE-PEE MEASURED TREES(*2)	3	18
THREE-PEE PREDICTED TREES(3)	56	183
ALL TREES(1,2,3)	60	239
ALL MEASURED TREES(1,2)	4	56
ALL THREE-PEE TREES(2,3)	59	201
EXPECTED VALUES FOR (*2)	4.020	24.932
EXP. VAL. ST. ERRORS (*2)	1.877	11.638

TOTALS FOR ALL 3 STRATA	TREE COUNTS	PREDICTIONS
SURE-TO-BE MEASURED TREES(=1)	3	101
THREE-PEE MEASURED TREES(*2)	11	62
THREE-PEE PREDICTED TREES(3)	223	536
ALL TREES(1,20)	237	699
ALL MEASURED TREES(1.2)	14	163
ALL THREE-PEE TREES(2,3)	234	598
EXPECTED VALUES FOR (*2)	11.960	67.778
EXP. VAL. ST. ERRORS (*2)	3.256	19.362

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 2
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DETAILED LOG AND/OR TREE REPORT

TREE/ NO./	VOLUME / CU.FT./	SURFACE / SQ.FT. /	LENGTH / FEET /	D.B.H. / INCHES /				
4	77.2	247.2	64.2	20.3=D,F=	10.750,	5,	1.9	011*PPIN 1
5	16.5	81.2	32.1	11.3=D,F=	45.500,	1,	1.1	011 PPIN 2
6	33.2	115.0	32.0	15.9=D,F=	33.500,	2,	1.4	011 PPIN 3
7	73.0	121.5	16.1	31.7=D,F=	8.958,	6,	2.7	011 DFIR 1
8	27.4	74.1	16.0	20.1=D,F=	22.750,	2,	2.1	011 PPIN 2
9	40.9	90.1	15.9	24.5=D,F=	22.333,	3,	2.1	011 PPIN 3
10	21.0	64.5	15.8	17.6=D,F=	26.875,	2,	1.7	011 PPIN 1
11	7.9	38.2	14.8	11.0=D,F=	45.500,	1,	0.8	011 PPIN 2
21	254.0	577.9	110.4	37.2=D,F=	1.000,	25,	3.9	012*DFIR 2
22	471.5	832.6	124.0	38.8=D,F=	1.000,	38,	3.1	012*DFIR 2
23	503.7	845.8	117.7	40.0=D,F=	1.000,	38,	2.5	012*DFIR 3
24	248.3	388.5	49.1	39.4=D,F=	2.688,	20,	3.8	011 DFIR 1
25	101.6	285.1	71.1	28.8=D,F=	6.500,	7,	2.9	011 DFIR 2
26	163.4	344.1	62.8	33.3=D,F=	5.154,	13,	3.3	011 PPIN 3

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 3
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SUMMARY REPORT--SURE-TO-8E MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 1

SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	0.000	49.271	49.271
PREDICTIONS(KPI)	0.	215.	215.
B.A.(SQ.FT.O.B.)	0.0	141.4	141.4
LENGTH(FT.)	0.0	1391.9	1391.9
SURFACE(SQ.FT.IB.)	0.0	6523.2	6523.2
VOLUME(CU.FT.I.B.)	0.0	2715.7	2715.7
REL.VAL.PER MF.UNIT	1.00	1.00	1.00
GROSS MF.UNITS	0.0	19843.1	19843.1
ST.ERROR(PCT.)	----	7.7	7.7

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	0	4	4
MEASURED LOGS	0	13	13

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 4
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SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 2 SAMPLE VARIABLES	2 SURE-TO-BE MEASURED AGGREGATIONS	2 3P-EXPANDED SAMPLE ESTIMATES	2 TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	2.000	120.250	122.250
PREDICTIONS(KPI)	63.	182.	245.
B.A.(SQ.FT.O.B.)	15.8	141.3	157.0
LENGTH(FT.)	234.4	2963.3	3197.7
SURFACE(SQ.FT.IB.)	1410.5	8969.2	10379.6
VOLUME(CU.FT.I.B.)	725.5	2393.0	3118.5
REL.VAL.PER MF.UNIT	2.00	2.00	2.00
GROSS MF.UNITS	5526.6	15317.0	20843.6
ST.ERROR(PCT.)	----	15.6	11.5

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	2	4	6
MEASURED LOGS	13	12	25

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 5
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SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

STRATUM 3 SAMPLE VARIABLES	3 SURE-TO-BE MEASURED AGGREGATIONS	3 3P-EXPANDED SAMPLE ESTIMATES	3 TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	1.000	60.987	61.987
PREDICTIONS(KPI)	38.	201.	239.
B.A.(SQ.FT.O.B.)	8.7	150.5	159.2
LENGTH(FT.)	117.7	1750.2	1867.9
SURFACE(SQ.FT.IB.)	845.8	7637.7	8483.5
VOLUME(CU.FT,I.B.)	503.7	2865.8	3369.5
REL.VAL.PER MF.UNIT	3.00	3.00	3.00
GROSS MF.UNITS	3927.9	20427.8	24355.6
ST.ERROR(PCT.)		4.2	3.5

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	1	3	4
MEASURED LOGS	4	10	14

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 6
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SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

TOTALS ALL 3 STRATA**********

SAMPLE VARIABLES	SURE-TO-BE MEASURED AGGREGATIONS	3P-EXPANDED SAMPLE ESTIMATES	TOTAL SAMPLE ESTIMATES PLUS SURE
TREES(FREQUENCY)	3.000	230.508	233.508
PREDICTIONS(KPI)	101.	598.	699.
B.A.(SQ.FT.O.B.)	24.5	433.2	457.6
LENGTH(FT.)	352.0	6105.5	6457.5
SURFACE(SQ.FT.IB.)	2256.2	23130.1	25386.4
VOLUME(CU.FT.I.B.)	1229.2	7974.5	9203.7
REL.VAL.PER MF.UNIT	2.42	2.01	2.07
GROSS MF.UNITS	9454.5	55587.9	65042.4
ST.ERROR(PCT.)	-----	5.3	4.6
GROSS WTD.MF.UNITS	22836.81	111760.44	134597.25
ST.ERROR(PCT.)	-----	5.1	4.2

COMPONENT ITEMS	(1=) NUMBER	(2*) NUMBER	(1,2) NUMBER
MEASURED TREES	3	11	14
MEASURED LOGS	17	35	52

MF.UNITS= BD. FT. (INT. 1/4-IN.) ,AFTER ALLOWANCE FOR TRIM OF .3 FT. PER 16 FT
=(0.89560000E 011*(CU.FT.)+(-0.69540000E 00)*(SQ.FT.)+(0.41450000E-01)*(FT.)

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 0
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SUMMARY REPORT--SURE-TO-BE MEASURED TREES PLUS EXPANDED 3P SAMPLES

DATA PROCESSING BLOCKED BY 0 INPUT FLAWS.
SAMPLE ESTIMATES INVOLVE 0 SUSPICIOUS ITEMS NUMBERED
0

INPUT READ BEFORE FLAW, IF ANY---

CARDS WITH TREE PREDICTIONS ONLY	(FIRST)	223
CARDS WITH MEASURED TREE INFO	(FIRST)	14
CARDS WITH MEASURED TREE INFO	(SECOND)	14
CARDS WITH ADDITIONAL DENDROMETER INFO	(SECOND)	21

PROCESSING DONE BEFORE FLAW, IF ANY---

NUMBER OF MEASURED TREES PROCESSED	14
NUMBER OF MEASURED LOGS PROCESSED	52
TREE CARDS PUNCHED OR WRITTEN	0
LOG CARDS PUNCHED OR WRITTEN	0
LABEL ON CARD OUTPUT	APPR

CHECK OF INPUT AGGREGATES WITH EXPANDED 3P SAMPLE

AGGREGATE NUMBER OF TREES INPUT(1+2+3)	237
SAMPLE ESTIMATE(EXPANDED 2)+NO.SURE(1)	233.508
STANDARD ERROR OF ESTIMATED NUMBER	49.832
AGGREGATE PREDICTIONS(KPI) INPUT(1+2+3)	699
SAMPLE ESTIMATE(EXPANDED 2)+KPI SURER)	699.

THREE-PEE SAMPLE-TREE MEASUREMENT AND APPRAISAL APPR PAGE 7
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GRADE-YIELD AND REALIZATION REPORT

CLAS	GR	CU.FT.IB.VOL.	SQ.FT.IB.SURF.	LIN.FT.LENGTH	FREQUENCY	COUNT
DFIR	AA	51.80	76.08	8.99	2.00	2
DFIR	AB	48.23	67.75	7.59	1.00	1
DFIR	AC	243.87	345.60	39.05	3.69	2
DFIR	84	35.16	65.97	9.87	1.00	1
DFIR	BB	909.80	1462.30	188.56	19.92	4
DFIR	BC	524.14	841.76	108.29	4.69	3
DFIR	CA	113.19	233.57	38.76	1.00	1
DFIR	CB	212.23	413.30	65.61	2.00	2
DFIR	CC	747.84	2037.35	494.51	24.19	6
DFIR	UU	110.84	321.85	75.00	3.00	3
DFIR	XX	214.10	376.36	54.40	15.69	3
PPIN	AA	126.94	517.22	168.51	45.50	1
PPIN	AB	564.18	1732.94	424.86	53.75	2
PPIN	AC	300.31	1465.29	569.41	45.50	1
PPIN	BA	1531.55	4033.64	883.98	111.67	4
PPIN	BB	695.38	2404.53	671.57	44.25	2
PPIN	BC	85.10	217.34	44.23	10.75	1
PPIN	CA	494.55	1122.16	226.26	21.06	3
PPIN	CB	879.05	2349.95	523.62	38.65	3
PPIN	CC	893.39	3949.41	1494.51	141.65	4
PPIN	UU	140.18	550.19	172.00	10.75	1
PPIN	XX	281.86	801.80	187.92	27.90	2
TOTALS		9203.70	25386.36	6457.50	629.60	52

THREE–PEE SAMPLE–TREE MEASUREMENT AND APPRAISAL APPR PAGE 8
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GRADE–YIELD AND REALIZATION REPORT

CLAS GR	SAWKERF CU.FT.IB.	SHORTS(TRIM) CU.FT.IB.	SLABS–EDGES CU.FT.IB.	UNUSABLE LBR. CU.FT.IB.	USABLE LBR. BD.FT.	LBR.VALUE DOLLARS
DFIR AA	9.93	0.68	4.74	0.00	411.58	68.60
DFIR AB	9.25	0.58	4.22	3.28	346.90	54.60
DFIR AC	46.76	2.62	21.53	31.43	1552.34	226.94
DFIR BA	6.74	0.45	4.10	0.00	269.56	39.58
DFIR BB	174.46	10.69	91.03	60.71	6429.66	889.74
DFIR BC	100.51	5.54	52.40	66.46	3281.47	418.32
DFIR CA	21.70	1.42	14.51	0.00	853.42	91.31
DFIR CB	40.70	2.42	25.68	13.74	1455.56	151.86
DFIR CC	143.41	7.14	125.95	85.66	4222.32	423.82
DFIR UU	21.26	1.23	19.91	3.09	738.16	78.73
DFIR XX	0.00	0.00	0.00	214.10	0.00	0.00
SUBTOT	574.72	32.76	364.07	478.49	19560.96	2443.53
PPIN AA	24.34	1.31	31.82	0.00	784.85	129.02
PPIN AB	108.19	5.79	107.12	32.88	3482.19	527.18
PPIN AC	57.59	2.28	89.79	27.38	1343.42	156.78
PPIN BA	293.69	18.21	249.72	0.00	10955.58	1587.10
PPIN BB	133.35	6.87	148.32	38.98	4129.57	527.74
PPIN BC	16.32	0.83	13.47	9.90	488.28	58.35
PPIN CA	94.84	6.08	69.55	0.00	3660.56	387.01
PPIN CB	168.57	9.38	145.45	53.24	5639.29	553.44
PPIN CC	171.32	7.17	242.16	85.92	42.20.68	328.06
PPIN UU	26.88	1.36	33.87	5.73	816.90	85.34
PPIN XX	0.00	0.00	0.00	281.86	0.00	0.00
SUBTOT	1095.07	59.29	1131.27	535.90	35521.31	4340.01
TOTALS	1669.80	92.05	1495.34	1014.39	55082.27	6783.54

VOLUME (CU.FT.IB.) PAIRED WITH YIELD COEFFICIENTS= 9203.70