

**NORTH CENTRAL**  
**RESOURCES EVALUATION**  
**FIELD INSTRUCTIONS**



**NORTH CENTRAL FOREST EXPERIMENT STATION**  
**FOREST SERVICE**  
**U.S. DEPARTMENT OF AGRICULTURE**

NORTH CENTRAL  
FOREST EXPERIMENTAL STATION  
RENEWABLE RESOURCE EVALUATION  
FIELD MANUAL

North Central Forest Experiment Station  
Forest Service  
U.S. Department of Agriculture

Andrew P. Doman  
Robert Ennis  
Dale Weigel  
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## INTRODUCTION

This manual provides Forest Survey field instructions for the North Central Forest Experiment Station, National Forest Systems, and other cooperating organizations in establishing and measuring field sample plots for the Survey in the North Central Region.

Forest Survey is faced with the problem of remeasuring and recovering information from plot systems other than the standard 10-point cluster plot specified in this chapter. No attempt will be made in this handbook to outline remeasurement procedures. Appropriate supplements to this handbook will be prepared covering remeasurement procedures. (See Remeasurement Instructions, item 58).

## FIELD EQUIPMENT LIST

The following equipment will be needed to measure required items at field locations. Each field person should check to make sure he/she has this equipment and it is in good working order.

- Pocket Steroscope
- 37.5 Factor Prism
- Hand Axe
- Compass (Suunto)
- Increment Borer
- Diameter Tape
- Plot Tape (100 ft. woven type) and chaining pin
- Clinometer (Suunto)
- Photo Holder
- Clip Board (With Tatum Guides and Photo Scales)
- Telescopic Height Pole (30 ft.)
- Wheeler Pentaprism
- Cruiser's Vest
- Tree Marking Scribe
- Tree Paint
- Ten Yellow Stakes
- Ten Metal Pins
- Flagging
- Safety Pin
- Mini-Caliper

## FIELD PROCEDURES

Uniform measuring and recording methods are provided to ensure comparability of the resource data compiled by different units and efficiency in the collection of timber resource statistics.

Precise measurements and classifications are essential to keep field-technique errors to a minimum. Errors in area classification of tree measurements will be expanded several hundred times in the processing phase of the Forest Survey, and an accumulation of even small errors may lead to erroneous inventory results.

An emphasis on limiting predictions of the future needs to be made clear. Potential product use of seedlings, saplings, and small pole-timber, based on site index, will not enter into tree class determinations. Poor form on seedlings and small saplings should not be used to classify them as cull trees. Predicting death should only enter into tree class determinations in most severely damaged situations.

An appropriate 5 digit code (Sequential Plot Number) will be recorded by a photo interpreter to identify consecutive plot numbers in each unit. All plots, both forest and questionable forest, permanent and temporary, office and field, will receive a number. Sequential Plot Numbers will be used to identify sample plots on aerial photographs and county road maps. A plot sheet must be completed for all plots, forest and non-forest, that are sent to the field.

Field crews will be supplied with road maps, and aerial photographs with sample locations marked. Field crews should select the field sample locations to be visited each day and plan travel to field sample locations using the maps, photographs, and other information on local travel conditions.

Information obtained on each sample location will be recorded on the corresponding plot sheet (see exhibit A). All measurement categories have an "X" for each digit that must be recorded for that entry. The criteria used to determine these measurements can be found in the appropriate sections of this manual. In addition, commonly used codes can be found on each crew members clip board under the heading "Tatum Guides".

# EXHIBIT - A

SEQUENTIAL PLOT # XXXX OLD PLOT #/DOT # XXXX / XXXX PAGE      OF      CRUISER XX TALLER XX

NC-4800-11																				FOREST INVENTORY SAMPLE RECORD										JANUARY 1981			
STATE	UNIT	COUNTY	SAMPLE KIND	STAND AREA	DISTANCE TO WATER				DISTANCE TO ROAD				NATIONAL FOREST	RANGER DISTRICT	OWNERSHIP CLASS	OWNER TENURE	P. I. LAND USE	GROUND LAND USE	USE TREND	ASPECT	POSITION	SLOPE											
					TYPE	AREA/WIDTH	DISTANCE				TYPE	DISTANCE																					
51	52	53	2	46	47	47	47	48	48	54	55	1	1	50	4	5	6	6	6	6													
XX	X	XX	X	XXX	X	XXX	XXX	X	XXX	XX	XX	XX	XX	XX	XX	XX	XXX	XXX	X	XX													
PHYSIO. CLASS	STAND ORIGIN	STAND HISTORY	SEED SOURCE	CONIFER UNDERSTORY	PHOTO AGE	DATE		B. A. /ACRE		FOREST TYPE STAND SIZE CLASS		STAND AGE		SITE DATA		RECREATIONAL OPPORTUNITIES																	
						ORIGINAL	CURRENT	ORIGINAL	CURRENT	ORIGINAL	CURRENT	ORIGINAL	CURRENT	SITE INDEX	SPECIES	RECREATION SETTING	TRAILS-ROADS	STRUCTURES	SIZE	POSTING													
7	8	9	10	11	12	13	13	43	43	44	44	45	45	42	42	44	44	44	44	44													
X	X	XX	X	XXX	X	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XX	XXX	X	X	X	X	X													
B. A. COUNT	POINT #	TREE #	SPECIES	TREE HISTORY	DISTANCE	D. B. H.			DAMAGE CAUSE OF DEATH	TREE CLASSIFICATION						TREE MEASUREMENT																	
						ORIGINAL	CURRENT	AZIMUTH		TREE OR COVER CLASS	CROWN RATIO	CROWN CLASS	STOCKING PERCENT	POINT OCCUPANCY	TREE CAVITIES	SAM LOG LENGTH	SAM LOG TOP D.O.B.	CULL BOARD FEET	LOG GRADE	BOLE LENGTH	BOLE LENGTH TOP D.O.B.	CULL CUBIC FEET	INTERNAL DEFECT										
20	16	21	22	23	24	25	25	26	27	28	28	29	29	30	30	31	32	33	34	35	36	37	38	39	40	41							
XX	X	XX	XXX	XX	XX	XXX	XXX	XXX	XX	XX	XX	X	X	X	X	XX	X	XX	XXX	XXX	XXXX	X	XXX	XXX	XXX	XXX	X						

# EXHIBIT - A

OWNERS NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
**1** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**3** STARTING POINT DESCRIPTION:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**3** COURSE TO SAMPLE LOCATION:  
 DIRECTION \_\_\_\_\_  
 DISTANCE \_\_\_\_\_  
 TO \_\_\_\_\_

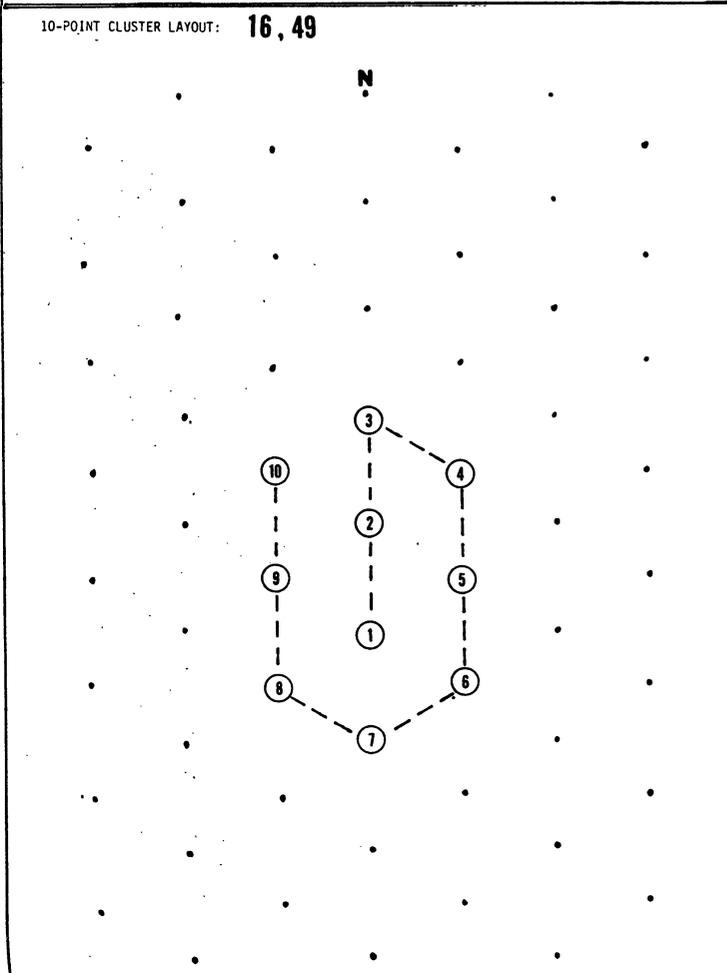
WITNESS TREES:  
**16**

SPECIES	D.B.H. (INCHES)	AZIMUTH (DEGREES)	DISTANCE (FEET)

LOCATION:  
 STATE \_\_\_\_\_ COUNTY \_\_\_\_\_ T. \_\_\_\_\_ R. \_\_\_\_\_  
 SECTION \_\_\_\_\_ SUBDIVISION \_\_\_\_\_  
 FLIGHT# \_\_\_\_\_ PHOTO# \_\_\_\_\_  
 PHOTO LOCATION \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 SCALE OF PHOTO \_\_\_\_\_

FIELD CREW:  
 CRUISER \_\_\_\_\_  
 TALLYER \_\_\_\_\_  
 DATE \_\_\_\_\_

FIELD EDIT: \_\_\_\_\_ DATE: \_\_\_\_\_  
 OFFICE EDIT: \_\_\_\_\_ DATE: \_\_\_\_\_



NOTES: **49**

Ownership, Item 1.

Field personnel will visit county court offices to obtain owner's name, ownership class, owner's address, ownership size (commercial forest land only), and length of tenure from tax and ownership records for all plot center locations on private land. USFS land ownership information may be taken from the land status atlas located at the District or Supervisor's offices. Ownership information on public lands (other than USFS) can usually be obtained from local field offices.

Personal contact with the landowner (while gaining permission to trespass) is often the best way to get ownership information on very small tracts of land.

Ownership Class-Record the ownership class using the following 2-digit codes:

<u>Code</u>	<u>Owner</u>
11	National Forest
12	Bureau of Land Management
13	Indian
14	Miscellaneous Federal
15	State
16	County & Municipal
2*	Forest Industry (Must process own products)
4*	Farmer
6*	Miscellaneous Private Corporate
7*	Miscellaneous Private Individual

\*In ownership class codes 2- through 7- use the second digit to indicate ownership size (commercial forest land only) in the United States by the following codes:

<u>Code</u>	<u>Areas of Commercial Forest Land</u> <u>(round to nearest acre)</u>
1	1-4
2	5-9
3	10-19
4	20-49
5	50-99
6	100-499
7	500-2499
8	2500-4999
9	5000+ (Include ACTUAL Number of acres owned for all tracts 5000+ acres in notes section)

Owner Tenure- Record the two digit code for the length of time that the present owner has owned the property where the plot center is located.

<u>Code</u>	<u>Years Owned</u> (Round to nearest year)
01	1
02	2
03	3
04	4
05	5
.	.
.	.
.	.
.	.
99	99 and over

Owner tenure is needed only for plots established on commercial forest land.

Sample Kind, Item 2.

A one digit code recorded by the photo interpreter.

<u>Code</u>	<u>Description</u>
1	Full Measurement Plot
2	Full Remeasurement Plot
*7	Partial Measurement Plot
*8	Partial Remeasurement Plot

\*On sample kind 7 and 8, items 34-41, sawlog length through internal defect will not be recorded.

### Plot Location, item 3.

Establishment of Base Line. The first step in locating the forest sample location is to draw a straight base line between two features visible on the photograph and easily located on the ground. Whenever possible these two features should be at least 10 chains apart to help minimize error. Select such features as straight road sections, drainage ditches, or two distinct trees. Avoid using railroads or power lines, since they influence the compass reading. A line drawn between two well-spaced buildings or other easily identifiable landmarks may also serve as a base line.

Next draw the base line on the back of the photograph with an arrow at one end of the line to indicate the azimuth direction. Measure the azimuth with a compass to the nearest 1/2 degree and record it on the back of the photograph. Disregard magnetic declination.

Starting Point. Select a landmark readily identifiable on the ground and on the photograph and as close to the sample location as possible. Select landmarks which can be readily identified on resurveys, such as prominent trees, field corners, house corners, etc.

Pinprick the starting point on the aerial photograph on which the sample location is pinpricked. Label and circle the pinprick "SP" on the back of the photograph.

In the field mark the starting point with paint. Paint "SP" facing direction of normal approach in letters about 4" high located at DBH and a 3" high "SP" near ground level. Discretion should be used in painting trees in well travelled areas, or on private lands.

Describe the starting point on the back of the plot sheet under starting point description.

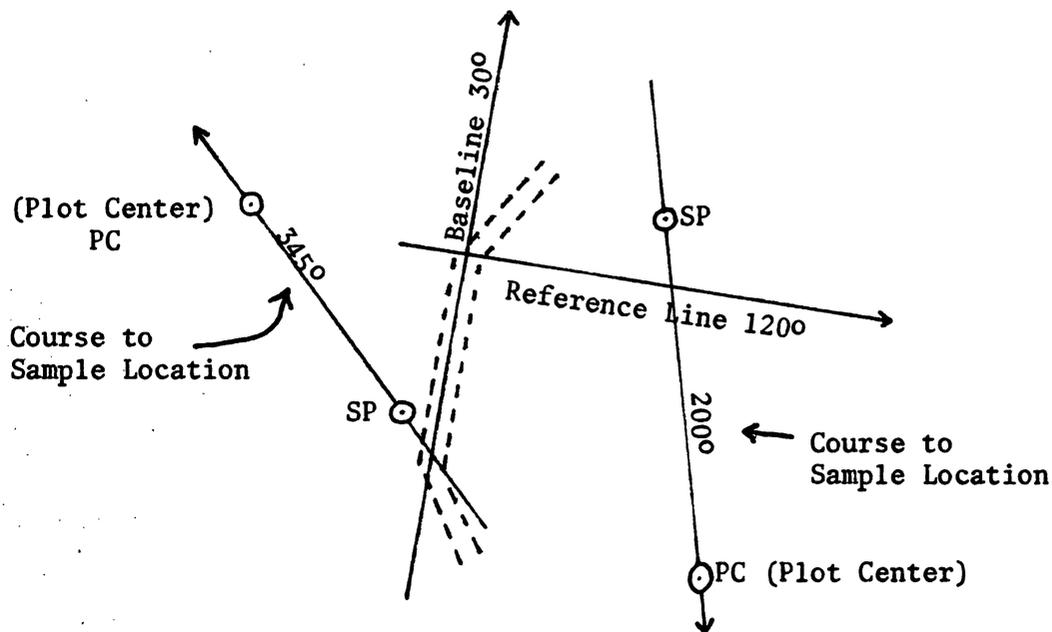
Azimuth and Distance Computation. Draw a straight line on the back of the photograph through the center of the starting point pinprick and the center of the sample location pinprick. Extend this line to intersect the base line. Lines should extend well beyond the intersection to allow reading the backsight off the 360 degree protractor to check the accuracy of the angle being measured.

If the base line and the line to the sample location do not intersect on the photograph, draw a straight line that will intersect the base line and the course to sample location line. Indicate the directions of the sample location line and the base line by putting an arrow at the end of each line.

Measure the angle between these lines, starting from the base line.

Obtain the azimuth of the sample location line by inverting the transparent photo scale and aligning the 360 degree protractor over the azimuth of the base line. Once the azimuth of the base line is correctly aligned on the inverted protractor the azimuth of the sample location line can be directly read off the protractor. This is because east-west azimuths are reversed 180 degrees when working on the back of the photographs. Repeat this procedure if an additional line (reference line) was needed to intersect the course to sample location. To minimize error check the backsights of both base and course to sample location lines. This is a check to see if straight lines have been drawn.

AZIMUTH CALCULATIONS  
Exhibit 3



Measure on the photograph the distance from the starting point to the plot center to the nearest 1/3 of a chain by using a transparent photo scale. Each crew member is supplied with various photo scales which correspond to the scale of the aerial photograph. Record both distance and direction on the back of the photograph and on the back of the plot sheet under Course to Sample Location.

Chaining. Using compass and tape, run a course on the computed azimuth. Distance correction for slope will be necessary when slope exceeds ten percent. Using the Suunto clinometer the slope correction can be quickly determined and added by the tallier after the cruiser has run out the line. Making adjustments for differences in the height of crew partners the tallier can sight on the cruiser and directly read the percent scale on the clinometer, using the percent slope and the following table (table 3). The correct adjustment to whatever length line was run should be added at the same percent slope.

Slope Correction Table  
Table 3

Distance is measured on slope.

<u>Percent</u>	<u>66'</u>	<u>70'</u>	<u>99'</u>
10	.3	.3	.5
15	.7	.8	1.1
20	1.3	1.4	2.0
25	2.0	2.2	3.0
30	2.9	3.1	4.4
35	3.9	4.2	5.9
40	5.1	5.4	7.6
45	6.4	6.8	9.6
50	7.8	8.3	11.7
55	9.3	9.9	14.0
60	11.0	11.6	16.5
65	12.7	13.5	19.1
70	14.6	15.5	21.9
75	16.5	17.5	24.7
80	18.5	19.7	27.8
85	20.6	21.9	30.9
90	22.8	24.2	34.2
95	25.0	26.6	37.6
100	27.3	29.0	41.0

Once the computed course has been run, place a permanent stake at the end of the computed course. Check to make sure that photograph location agrees with ground location.

Location Correction. If the ground location is clearly not the point pinpricked on the photograph, and the correct location can be determined on the site, place a second pin at the correct location. Note the azimuth and distance from the initial pin to the relocated pin and record these items on the back of the Forest Inventory Sample Record under the course to sample location and remove the first pin. The initial pin is referred to as a turning point. The second pin becomes the location of point one of the 10-point cluster.

#### Ground Land Use, item 4.

Once plot center has been established, carefully examine, select and record the present primary land use classification as determined from ground examination. Use one of the following two digit codes.

FOREST LAND: Land not currently developed for nonforest use and having at least 16.7 percent stocking of forest trees of any size or formerly having 16.7 percent stocking. Roadside or streamside strips of trees must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams or other bodies of water or clearings in forest areas will be classed as forest if less than 120 feet wide. The minimum area for classification of forest land is 1 acre and 120 feet in width.

#### Code

- 20 Commercial forest land: Forest land that is capable of producing in excess of 20 cubic feet per acre per year of roundwood products, excluding fuelwood, and is not withdrawn from timber utilization by statute, administrative designation, or exclusive use for Christmas tree production. (If land is used for grazing, see codes 21 and 59).
- 21 Pastured commercial forest land: Forest land for which the primary use is wood production, but is used for grazing. (If land is less than 25 percent stocked in growing stock trees, see code 59).
- 22 Plantations: An artificially reforested area sufficiently productive to qualify as commercial forest land, established by planting or by direct seeding. Planted species is not necessarily predominant. (If land is used for Christmas Tree production, see code 46).
- 40 Unproductive forest land: Forest land incapable of producing 20 cubic feet per acre per year of roundwood products, excluding fuelwood, because of adverse site conditions. Based on site index under 15 for northern white cedar, under 20 for black spruce and tamarack, under 25 for eastern red cedar and under 35 for all other species. All commercial species must be unproductive.
- 41 Reserved forest land-unproductive: Forest land withdrawn from timber utilization by a public agency or by law but that is incapable of producing 20 cubic feet per acre per year of roundwood products.
- 45 Reserved forest land-productive: Forest land withdrawn from timber utilization by a public agency or by law and sufficiently productive to produce 20 cubic feet per acre per year of roundwood products.
- 46 Christmas Tree Plantations: Forest land sufficiently productive to qualify as commercial forest land but with drawn from timber utilization for exclusive use in Christmas tree production. There must be evidence of annual shearing or other management practices that indi-

Commercial Forest Locations (Code 20, 21, 22). If point one of the sample location falls on land that qualifies as commercial forest land, establish the sample location and record information for all required tally items on the Forest Inventory sample record (see TALLY ITEMS).

In dealing with plot location, it should be remembered that plot center (as defined by the pinprick on the photo) determines the land use class, provided the area surrounding the pinprick is at least 1 acre and 120 feet in width. Forest boundaries are measured on the ground at the point where a vertical line is dropped from the outside edge of the forest crown since the accurate location of the bole cannot be seen by the photo interpreter. This is not to be confused with the line of shadows cast from the edge of the crowns. Often when uneven boundaries exist the tallier must use an imaginary line to distinguish forest from nonforest. A one-acre circle is printed on the transparent photo scales issued. These can be helpful in determining forest and nonforest areas. One acre is 43,560 square feet; this requires a strip of land 120 feet wide to be over 350 feet long. A square area needs to be 210 feet on a side, and a circular area needs to be 235 feet in diameter.

Noncommercial Forest Locations (Code 40). If point one falls in a forest of marginal productivity, site index will be measured first. All commercial species found within the plot area must be measured and determined unproductive before classifying the plot as noncommercial unproductive land. These trees receive a tree history of 99. The tallier must use judgment when determining whether the unproductive area is over one acre in size; if it is, the area is classified as unproductive. Refer to Site Index for more information.

Noncommercial forest land also includes productive and unproductive forest land withdrawn from commercial timber use, including land used for Christmas tree production (code 41, 45, 46).

For a plot with land use 40, 41, 45, or 46, record the following information on the plot sheet:

Old Plot No./Dot No.	National Forest	Stand Origin
State	Ranger District	Stand History
Unit	Ownership Class	Photo Age
County	P. I. Land Use	Date
Sample Kind	Ground Land Use	BA/Acre
Stand Area	Use Trend	Forest type-stand
Distance to Water	Aspect-Position-Slope	size class
Distance to Road	Physio-class	Stand Age
		Recreational Opportunities

BA/acre, forest type-stand size class and stand age may be estimated.

Nonforest Locations. A certain number of locations interpreted as questionable on aerial photographs will require a field check in accordance with an improved sampling design. In addition, a certain number of locations interpreted as forest on aerial photographs, upon field examination, will turn out to be nonforest.

NONFOREST LAND. Land currently developed for use other than growing trees; and/or land that has never had 16.7 percent stocking in forest trees 5.0" DBH or larger.

Nonforest with trees (Tree species present in plot area)

Code

- 51 Cropland with trees
- 52 Improved pasture and rangeland with trees: Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush (less than 16.7 percent stocked with all trees).
- 53 Wooded strip: An acre or more of continuous forest land that meets the definition of commercial forest land (code 20, 21, 22) except that it is less than 120 feet wide.
- 54 Idle farmland with trees: Farmland that has not been tended within the last two years and is less than 16.7 percent stocked with all trees.
- 55 Marsh with trees: Land that has less than 16.7 percent stocking with live trees; and which characteristically supports low, generally herbaceous or shrubby vegetation and which is intermittently covered with water.
- 56 Narrow windbreaks: A group of trees less than 120 wide feet used for the protection of buildings in use.
- \*57 Wide windbreaks: A group of trees greater than 120 feet wide and one acre in size used for the protection of buildings in use. Area would qualify as commercial forest land except that the primary land use is protection of buildings.
- 58 Shelterbelt: A group of trees less than 120 feet wide and used for the protection of soil and cropfields.
- \*59 Wooded pasture: Pasture land with more than 16.7 percent stocking in all trees, but less than 25 percent stocking in growing stock (20 class) trees and would qualify as pastured commercial forest land except that the primary land use is grazing. Area is currently improved for grazing by cultivation, seeding, irrigation, ponds, or clearing of trees or brush. Other evidence may be severe compaction of the soil, formation of a hardpan, or presence of the herbaceous and woody

understory. The above should indicate that the primary use of the land is some thing other than wood production or the protection of buildings. The 25 percent stocking rule should be used only as guide to help the field person determine primary land use.

- 71 Urban forest land - locationally reserved: Land that would otherwise meet the criteria for commercial forest land, but is in an urban-suburban area surrounded by commercial, industrial, or residential development.
- 72 Urban and other with trees: Areas with trees that are developed for residential, industrial, recreational, or other urban uses. For example city parks, cemeteries, or golf courses.

For a plot with land use 51-56, 58, 71 and 72 record the following on the

Old Plot No./Dot No.	National Forest	Stand Origin
State	Ranger District	Stand History
Unit	Ownership Class	Photo Age
County	P. I. Land Use	Date
Sample Kind	Ground Land Use	BA/Acre
Stand Area	Use Trend	Forest type-stand
Distance to Water	Aspect-Position-Slope	size class
Distance to Road	Physio-class	Stand Age
		Recreational Opportunities

BA/acre, forest type-stand size class and stand age may be estimated.

\*A plot will be established for plots with land use 57 and 59, and a plot sheet completed according to the sample kind.

Nonforest without Trees. (no tree species present in plot area)

Code

- 61 Cropland without trees
- 62 Improved pasture and rangeland without trees
- 64 Idle farmland without trees: Farmland that has not been tended within the last two years and has no trees.
- 65 Marsh without trees
- 66 Other farmland: Including farmsteads and farm buildings.
- 67 Urban and other areas without trees: Areas without trees that are developed for residential, industrial, recreational, or other use than those covered in other land use codes.

- 68 Rights-of-way: Transportation, utility, and communication right-of-ways. These include railroads, powerlines, pipelines, and maintained roads.
- 69 Nonforest without trees (reserved)
- 80 Noncensus Water: A body of water more than 120 feet wide, and one acre in size, but less than 10 chains wide and 40 acres in size (normal water level).
- 90 Census Water: A body of water greater than 10 chains wide and greater than 40 acres (normal water level).

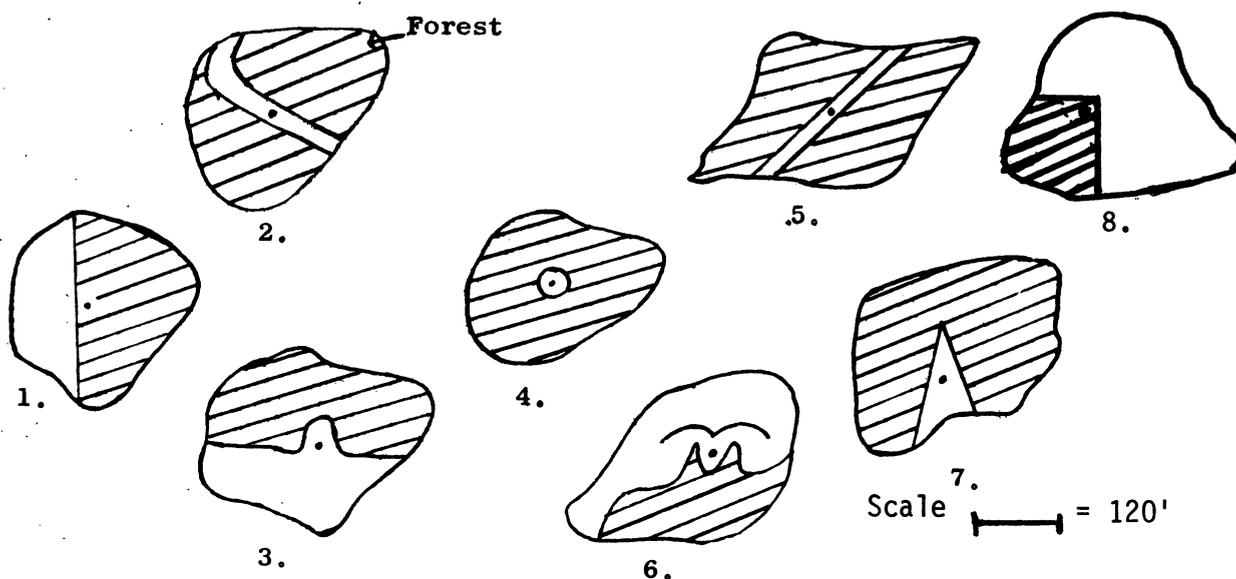
For a plot with land use 61-69, 80 and 90 record the following on the plot sheet:

Old Plot No./Dot No.	Distance to Water	Ground Land Use
State	Distance to Road	Use Trend
Unit	National Forest	Photo Age
County	Ranger District	Date
Sample Kind	P. I. Land Use	Recreational Opportunities

The following examples have been included to aid in assigning land use:

Hatched areas represent forest lands.

Example 4



1. FOREST-dot falls on forest land larger than 1 acre in size.
2. & 3. FOREST-dot falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least 2 sides.
4. FOREST-dot falls on nonforest land (less than 1 acre in size) that is surrounded by forest land.
5. NONFOREST-dot falls in improved road less than 120 feet wide. Improved roads and powerline clearings of any width are nonforest.
6. FOREST-dot falls in area of more than two adjacent strips of clearly defined forest and nonforest land (each strip less than 120 feet in width). As the band of strips in the acre is comprised of more forest than nonforest, the classification is forest.
7. FOREST-dot falls on nonforest land (less than 120 feet in width). If point had fallen in area 120+ wide, the classification would be nonforest.
8. FOREST-dot falls in a forest land area less than 120 feet in width, but it is classified as forest. This is a special case to handle corners (in the vicinity of 90 degrees) of forest land that have man-created boundaries adjoining them to nonforest lands. An example would be a farm woodlot over 120 feet in width and one acre in size that was bordered by a field.

The above rules apply equally, but in the reverse manner, if the location of forest and nonforest land is reversed.

Land Use Trend, Item 5 (3 digits).

The first two digits describe the land class change that took place between surveys or the change since the date of photography. Codes to be used for the first two digits are divided into the following two categories:

When land class is not commercial forest on both occasions:

First two digits-The first digit is the code for the present land class. The second digit is the code of the land class at the time of the last survey or the date of photography.

<u>Code</u>	<u>Land Use Class</u>
1	Commercial forest
2	Productive reserved forest
3	Unproductive forest
4	Cropland
5	Pasture, rangeland
6	Idle farmland
7	Wooded pasture
8	Urban, recreation, wooded strips, rights of way, other
9	Water and marsh

For commercial forest land on both occasions:

First two digits - Use the codes as they appear to indicate any major changes in the stand since the last survey or the date of photography.

If there has been a disturbance in the sampling area since the date of photography but it has not been to the extent of changing the forest type or stand-size class it will be recorded as no change. This disturbance could be recorded under stand history.

<u>Code</u>	<u>Stand changes</u>
10	No change
01	Forest type change
02	Stand-size change
03	Forest type and size change

Third Digit-Indicate the process that caused the change with one of the following codes:

<u>Code</u>	<u>Cause of Land Use Change</u>
0	No change
1	Definition
2	Legislation
3	Natural
4	Herbicide
5	Clearing (land cleared by mechanical or hand means but timber not utilized)
6	Clearcut (includes land clearing where timber is utilized)
7	Partial cut
8	Planting
9	Other man (includes fencing to exclude livestock)

- Examples:
1. Commercial forest land (Red Pine Plantation) now, on the photo was idle farmland, use trend code 168.
  2. Marsh without trees now, on photo was marsh with trees, use trend code 990.
  3. Cleared powerline right of way now, on photo was commercial

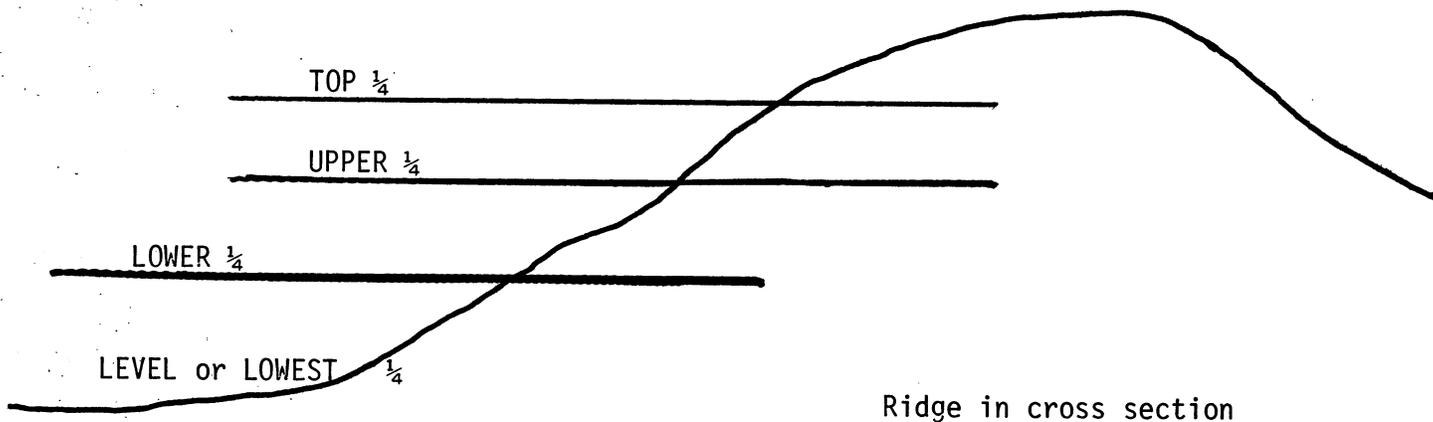
Aspect, Position and Slope, Item 6.

Record the appropriate codes in the heading information.

Aspect (3 digits)-represents the direction of drainage for the majority of the sample points, and is recorded as the azimuth of this direction. For instance, if the direction of drainage is  $36^{\circ}$ , the code is 036. Direction due North will be recorded as 001.

Position (1 digit)-represents the location of the majority of the points in reference to topography of the immediate area.

EXHIBIT 6



<u>Code</u>	<u>Position</u>
1	Top 1/4
2	Upper 1/4
3	Lower 1/4
4	Level or lowest 1/4

Slope (2 digits)-represents the average percentage of the deviation from horizontal over the entire 10 sample points. Recorded code will be a measure of this percentage. For instance, 35% slope is recorded as 35. All slope percentages 100+% will receive a code 99.

Physiographic Class, Item 7.

Physiographic class is a measure of soil and water conditions that affect tree growth on the majority of the points. Record the appropriate code.

Code   Physiographic Class

- 3   Xeric sites. Very dry soils where excessive drainage seriously limits both growth and species occurrence. Example: sandy jack pine plains.
- 4   Xeromesic sites. Moderately dry soils where excessive drainage limits growth and species occurrence to some extent. Examples: dry oak ridges and the red pine-jack pine associations on sandy and gravelly soils.
- 5   Mesic sites. Deep well drained soils. Soil and water relationship most favorable to management opportunities. Growth and species occurrence limited only by climate.
- 6   Hydromesic sites. Moderately wet soils where insufficient drainage or frequent flooding limit growth and species occurrence to some extent. Examples: better drained bottom land hardwood sites.
- 7   Hydric sites. Very wet sites where excess water seriously limits both growth and species occurrence. Examples: wet, frequently flooded river bottoms and spruce bogs.

Stand Origin, Item 8.

Record the stand origin of the sample area using the following 1 digit codes. Consider only trees in the predominant stand-size class of the area.

- | <u>Code</u> | <u>Stand Origin</u>   |
|-------------|---|
| 1           | Natural stand with no evidence of artificial regeneration.                  |
| 2           | 40 percent or more of the trees originating from artificial regeneration.   |
| 3           | Less than 40 percent of the trees originating from artificial regeneration. |

### Stand History, Item 9.

Stand history reflects the kind of disturbance on 5 or more of the sample points within the last 20 years.

Explain the kind and extent of any disturbance in the "Notes" on the back of the plot sheet. Use the following 2-digit code to record stand history:

#### First digit (what happened)

- 1 No disturbance
- 2 Timber stand improvement
- 3 Clearcut
- 4 Partial harvest cut
- 5 Natural--fire, insects, disease
- 6 Man caused--drainage, spraying
- 7 Planting of forest land
- 8 Planting of nonforest land
- 9 Natural regeneration of non-forest land

#### Second digit (how long ago)

- 0 No disturbance
- 1 1-4 years
- 2 5-10 years
- 3 11-15 years
- 4 15-20 years

### Seed Source, Item 10.

Select and record a 1-digit code that represents the prospects for natural regeneration of commercial species. Seed source is adequate for a plot when one or more of the following conditions exist on 5 or more points:

- A. There is a tree of commercial species that is capable of producing seed within the distance of a point not exceeding the total height of that tree.
- B. Seedlings are present within the fixed-radius plot.
- C. Hardwoods are expected to have sprouts within the fixed-radius plot.

#### Code Seed Source

- 1 Adequate softwood
- 2 Adequate hardwood
- 3 Adequate softwood and hardwood
- 4 Inadequate, all species

Conifer Understory, Item 11 (4 digits).

First digit-identifies the condition of the coniferous understory within the plot area.

<u>Code</u>	<u>Condition</u>
1	No conifers or inadequate conifer stocking for future stands.
2	Planted conifers should succeed when present stand is harvested.
3	Planted conifers need treatment other than regeneration cut.
4	Natural conifers should succeed when present stand is harvested.
5	Natural conifers need treatment other than regeneration cut.

Second, Third, and Fourth Digits-identify the predominant softwood species present in the understory using regular species codes. For example, 4012 would indicate an understory of Balsam Fir that should succeed when the present stand is harvested. Code 1000 indicates no conifer understory.

In order for a stand to be adequately stocked, conifers must be present on at least five sample points.

Photo Age, Item 12.

Photo age represents the number of growing seasons between the photo date and the date the fieldwork is completed. July 1st will be considered the last day of a growing season. Minimum photo age is one growing season. Record a 1-digit code.

<u>Code</u>	<u>Photo Age</u>
1	1 growing season or less
2	2 growing seasons
3	3 growing seasons
4	4 growing seasons
5	5 growing seasons
6	6 growing seasons
7	7 growing seasons
8	8 growing seasons
9	9 or more growing seasons

Date of Survey, Item 13.

Record a 4-digit code to show the month and year in which the plot is measured, using the following codes:

First two digits

Second two digits

<u>Code</u>	<u>Month</u>	<u>Code</u>	<u>Year</u>
01	January	80	1980
02	February	81	1981
03	March	82	1982
04	April	83	1983
05	May	84	1984
06	June	85	1985
07	July	86	1986
08	August	87	1987
09	September	88	1988
10	October	89	1989
11	November	90	1990
12	December		

Example: A plot completed in June, 1981 would be coded 0681.

## Recreational Opportunities, item 14

A 3 digit code will be used to describe the physical aspects of recreational opportunities on forest and nonforest plots.

Setting (one digit)-Field crews should determine the setting of the immediate plot area in relation to the surrounding natural environment.

### Code

- 1 Primitive. An area 3 or more miles from all maintained roads or railroads and which has an unmodified natural environment. There can be evidence of foot trails, or recreational use. Structures in use are rare. Contact with humans is rare and chances of seeing wildlife are good. Example: Boundary Waters Canoe Area, Minnesota.
- 2 Semi-Primitive Nonmotorized. An area 1/2 to 3 miles from all maintained roads or railroads, but which can be close to primitive roads or trails occasionally used. Modifications to the environment are evident, such as old stumps from logging, but are not apparent to the casual observer. Structures in use are rare. Human contact is low and chances of seeing wildlife are good. Example: Recently undisturbed State lands.
- 3 Semi-Primitive Motorized. An area 1/2 to 3 miles from all maintained roads or railroads, but 1/2 mile or less from primitive roads or trails used by motorized vehicles. Modifications to the environment, human contact and chances of seeing wildlife are the same as code 2. Example: State lands with snowmobile trails.
- 4 Roaded Natural. An area less than 1/2 mile from maintained roads or railroads. Modifications to the environment may be obvious, and buildings are occasionally seen. Chances of seeing wildlife are diminished by evidence of increased human contact. Example: Private hunting lands.
- 5 Rural. An area close to maintained roads, but not limited by distance, and in a setting which has been substantially altered by man. Structures and houses are obvious and/or visible, and human contact is frequent. Wildlife can be present, but sightings are rare. Example: Farm woodlot.
- 6 Urban. An area close to maintained roads, but not limited by distance and surrounded by an urban-suburban setting. Substantial modifications to the environment may be apparent and buildings or structures can usually be seen. Human contact is quite frequent and wildlife sightings are rare. Example: Home Development areas.

Size of area (one digit) Photo interpreters will record and field crews should check the size of area used for determining the setting class of recreational opportunities, by recording one of the following codes:

<u>AREA Code</u>	<u>Acres</u>	<u>Code</u>	<u>Acres</u>
1	1-4	5	50-99
2	5-9	6	100-499
3	10-19	7	500-2499
4	20-49	8	2500-4999
		9	5000+

Posting (one digit) For each property containing a forest sample plot record a 1-digit code to indicate whether the property is posted or restricted from public use. Record the most significant evidence.

<u>Code</u>	<u>Evidence</u>
0	None
1	Locked gate
2	Keep out
3	No trespassing
4	No hunting
5	No fishing
6	No dumping
7	Other posted signs
8	Owner contact
9	Other evidence

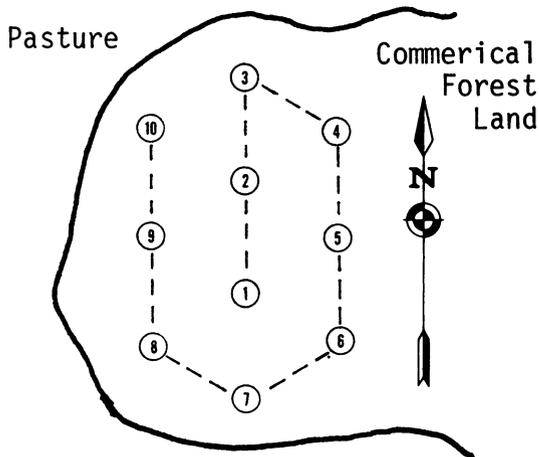
All denied access plots should have a posting code other than 0. Personal contact with the Landowner and his refusal to grant permission to go on his land is the only way a plot can be called a denied access plot.

Plot Design, Item 16.

The pattern of sample points is designed to obtain a uniform distribution of points over approximately 1 acre. Measured distances between sequential points is 70 horizontal feet.

Exhibit 16

From	Point to Point	Azimuth
1	2	0°
2	3	0
3	4	120
4	5	180
5	6	180
6	7	240
7	8	300
8	9	0
9	10	0



After point one has been established the other nine points should be located and marked with metal pins and yellow stakes. The entire 10 points should be restricted to the same land use as shown in the preceding tabulation.

Point Number. Record point number 1 through 10, recording 0 for point 10. For each point there will be at least one line of entries.

Shifted Points. If point one or any other of the 9 points at a sample location falls within a tree trunk, shift the point location back along the approach line a distance of 2 feet from the edge of the tree trunk and mark with a pin or stake. Measure distance to the next point from the pin or stake. Such changes should be recorded in the "Notes" section.

Substitute Points. If any of the points 2 through 10 falls on land with a different land use than the land use recorded for the plot, a regular point will not be established, provided the different land use is 120 feet wide and an acre in size. Instead, a substitute point must be established so that all ten points are in the same land use.

After establishing all possible regular points, use the following procedures to search for a suitable location where a point has not already been established and that has the same land use as the land use recorded for the plot.

Procedure 1: Consider locations 70 feet horizontal distance from the highest numbered established regular point. First consider the location  $0^\circ$  azimuth from the point. If this location is unsuitable, consider in turn locations at azimuth  $60^\circ$ ,  $120^\circ$ ,  $180^\circ$ ,  $240^\circ$ , and  $300^\circ$ . When a suitable location has been found, establish the lowest numbered substitute point.

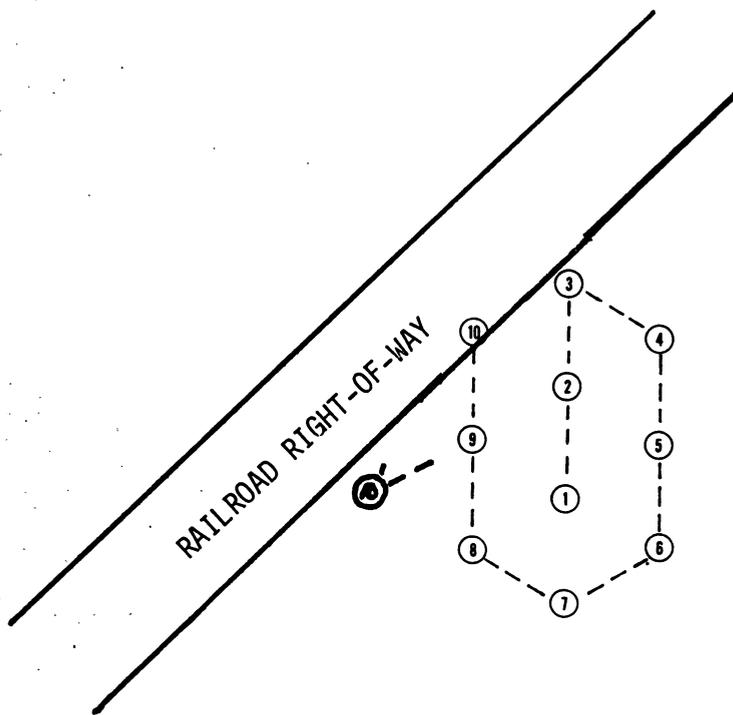
Procedure 2: If procedure 1 fails to yield a suitable point, repeat procedure 1 at each of the next highest numbered regular points in turn. If a suitable point still has not been found, repeat procedure 1 at each substitute point in turn, beginning with the lowest numbered.

If more than one point is to be substituted, repeat procedures 1 and 2 to establish the second lowest numbered substitute point next, and continue in order until all points to be substituted are established.

When a substitute point is used, show its location in the "Notes" section on the back of the plot sheet, and on the sketch.

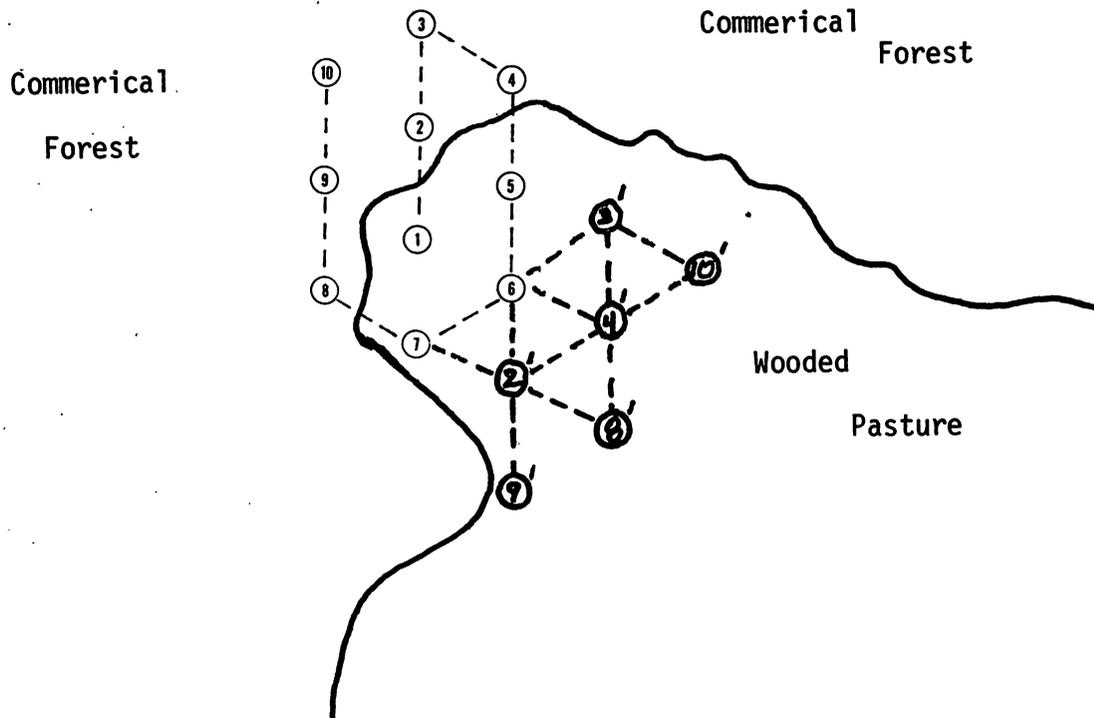
Following are examples of substitute points:

Example 16A



In the first example, point 1 fell in commercial forest, land use 20. Since all ten points must be in the same land use, point 10 could not be established because it fell in a railroad right-of-way, land use 68. Substitute point 10' was established at the first suitable location 70 feet horizontal distance from point 9, the highest regular

## Example 16B



In the second example, points 2, 3, 4, 8, 9, and 10 fell in a different land use than the land use recorded for the plot. Point 7 was the highest numbered established regular point. The lowest substitute point, substitute point 2, was established from point 7. No other location 70 feet horizontal distance from point 7 was suitable, so the search for suitable locations moved to point 6, the next highest numbered established regular point. Substitute points 3 and 4 were established in order from point 6 since they were the next lowest numbered points to be substituted. No other suitable locations were found 70 feet from established regular points, so the search moves to the lowest numbered substitute point, point 2. Substitute points 8 and 9 were established in order at the two suitable points found 70 feet from substitute point 2. The remaining substitute point, point 10, was established at the first suitable location 70 feet from the next lowest numbered established substitute point, point 3.

Witness Point. Reference point one (or any other point within 70 feet) with three or more witness trees if possible. Witness trees should have the following characteristics:

1. Located within 100 feet of the witness point.
2. Not likely to die or be cut before the next survey.
3. Species easily located in the stand.
4. At least 5.0" DBH (at least 2.0" DBH if no 5.0"+ DBH available)

Points 3, 4, or 10 can be used as witness points when none of the other points have acceptable witness trees.

Record the point number of the witness point in the "Notes" section and the following witness tree data on the back of the tally sheet under witness trees:

1) species; 2) DBH; 3) Azimuth; 4) slope distance (to nearest 1/10th foot) from witness point center to the center of the tree at the base, with a 3-digit code.

Mark each witness tree above DBH and at the base with a scribed and painted "X" on the side of the tree facing the witness point.

All established plots will be witnessed.

Rocks or other permanent features may be witnessed when acceptable witness trees are absent (write the description, distances, etc. in the "Notes" section on the back of the tally sheet).

Point Reference. On many plots, certain points within the ten point cluster design have no information that would enable remeasurement crews to determine their location on future surveys. Examples of this are: cover classed points, points where only seedlings are tallied, points 4-10 where no tree 5.0"+ DBH are tallied.

If there is no data that could be used to re-establish a point location (i.e. no azimuths or distances to any tree), the location of the point must be witnessed with at least one identifiable reference.

Criteria for choosing a reference is the same as in the preceding discussion on "Witness Point". However, if those conditions cannot be met, a dominant seedling (or any group of seedlings) can be used.

Record the Point Number and Azimuth and distance to the reference in the "Notes" section on the back of the plot sheet.

TALLY ITEMS

Biomass Study (Shrubs), Item 17.

The following information is recorded for points 1, 2, and 3 in the NE quadrant, 0° to 90°, of the 6.8 foot fixed radius plot:

Point Number 1, 2, or 3

Tree number starting at 50 and increasing for each point. Each species diameter class will have a tree number.

Species. (See list).

Tree history 80-tall, woody perennials or 81-other perennials. Tree history codes of 80 and 81 are used only for the biomass study.

Diameter (use the following codes in the DBH column)

<u>Tree History 80</u>		<u>Tree History 81</u>	
<u>Code</u>	<u>Diameter measured along stem 6" from ground</u>	<u>Code</u>	<u>% ground cover</u>
001*	0.0- .19"	001	solitary plant
002	.2- .29"	002	few plants less than 5%
003	.3- .39"	003	numerous plants less than 5%
004	.4- .49"	004	5 - 25%
005	.5- .99"	005	25 - 50%
010	1.0- 1.49"	006	50 - 90%
015	1.5- 1.99"	007	90 - 100%
020	2.0- 2.49"		
025,030,etc.	1/2" diameter classes continue		

\* also used on any woody stemmed shrub or tree less than 6" tall.

Azimuth column- enter the number of stems present in each size class for tree history 80. This column is left blank for tree history 81.

Note: Only seedlings may be recorded twice, once on the Biomass Study (with a number of 50+) and also on the 6.8 foot fixed radius plot if there are no trees 5.0" DBH on the point. Any tree 1.0" DBH or larger on the point will not be recorded in the Biomass Study.

Wisconsin Biomass List (Includes all commercial and noncommercial tree species and appropriate codes. See Item 22.)

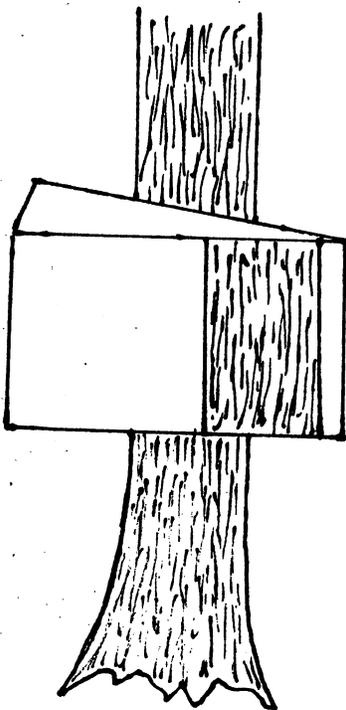
<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
230 81	YEW	TAXUS CANADENSIS
352 80	GREEN ALDER	ALNUS CRISPA
353 80	SPECKLED ALDER	ALNUS RUGOSA
490 80	DOGWOOD	CORNUS SPP.
500 80	HAWTHORN	CRATAEGUS SPP.
592 80	BLACK ALDER	ILEX VERTICILLATA
712 81	VIRGINIA CREEPER	PARTHENOCISSUS
749 81	LABRADOR TEA	LEDUM GROENLANDICUM
750 81	LEATHERLEAF	CHAMAEDAPHNE CALYCVLATA
751 81	BOG LAUREL	KALMIA POLIFOLIA
849 81	SWEETFERN	COMPTONIA PEREGRINA
853 80	WITCH HAZEL	HAMAMELIS VIRGINIANA
854 80	COMMON NINEBARK	PHYSOCARPUS OPULIFOLIUS
855 80	JUNEBERRY	AMELANCHIER SPP.
856 80	HAZEL	CORYLUS SPP.
857 80	PRICKLY ASH	ZANTHOXYLUM AMERICANUM
859 80	ALDER BUCKTHORN	RHAMNUS ALNIFOLIA
861 80	LEATHERWOOD	DIRCA PALUSTRIS
862 80	VIBURNUM	VIBURNUM SPP.
863 80	ELDER	SAMBUCUS SPP.
864 80	SUMAC	RHUS SPP.
865 81	GOOSEBERRY-CURRANT	RIBES SPP.
867 81	RASPBERRY-BLACKBERRY	RUBUS
868 81	ROSE	ROSA
870 81	AMERICAN BLADDERNUT	STAPHYLEA TRIFOLIA
874 81	BLUEBERRY	VACCINIUM SPP.
875 81	BUSH HONEYSUCKLE	DIERVILLA LONICERA
876 81	HONEYSUCKLE	LONICERA SPP.
880 80	BUFFALOBERRY	SHEPHERDIA SPP.
902 81	POISON IVY	RHUS RADICANS
907 80	NEW JERSEY TEA	CEANOTHUS AMERICANUS
913 80	RUSSIAN OR AUTUMN OLIVE	ELAEAGNUS SPP.
920 80	WILLOW	SALIX SPP.
932 81	GREENBRIAR	SMILAX SPP.
978 81	BOG ROSEMARY	ANDROMEDA GLAUCOPHYLLA
982 81	GRAPE	VITIS SPP.
984 81	STRAWBERRY	FRAGARIA SPP.
997 80	OTHER SPECIES (tall, woody perennials)	
998 81	OTHER SPECIES (other perennials)	

### Variable Radius Plot, Item 18.

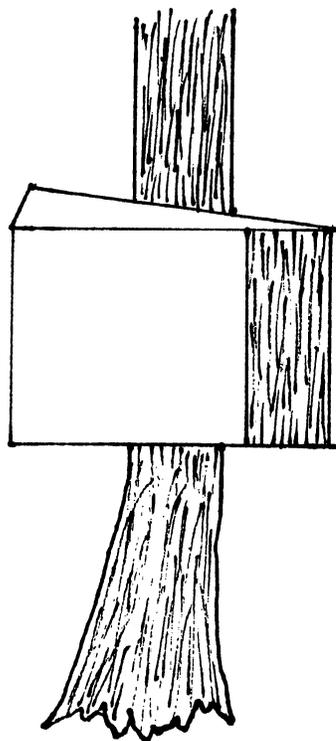
All trees 5.0" DBH and larger (except dead trees not qualifying as mortality or salvable-mortality) will be tallied if the tree is within the limiting distance of the 37.5 basal area factor prism. Example 18 illustrates trees that are within the variable plot, outside the variable plot, and those that are questionable. Questionable trees will be checked for their limiting distance. The limiting distance is the horizontal distance from the pin to the center of the tree at DBH. For example, a tree with a DBH of 14.6", is 20.7 feet, using a basal area factor of 37.5. Table 18 shows the limiting distances for the 37.5 basal area factor prism.

#### EXAMPLE 18

Within the variable plot



Outside the variable plot



Questionable tree

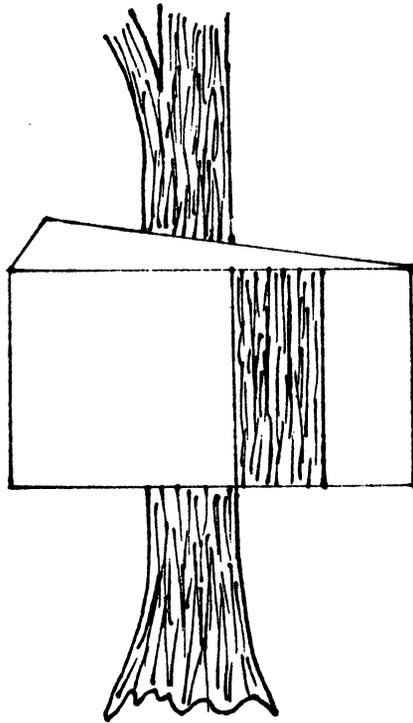


TABLE 18

Limiting distances for B.A.F. 37.5 prism

(1.421 feet per inch DBH)

DBH (inches)	Tenths of inches										DBH (inches)
	0	1	2	3	4	5	6	7	8	9	
1	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.7	1
2	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	2
3	4.3	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.5	3
4	5.7	5.8	6.0	6.1	6.2	6.4	6.5	6.7	6.8	7.0	4
5	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.2	8.4	5
6	8.5	8.7	8.8	9.0	9.1	9.2	9.4	9.5	9.7	9.8	6
7	9.9	10.1	10.2	10.4	10.5	10.7	10.8	10.9	11.1	11.2	7
8	11.4	11.5	11.7	11.8	11.9	12.1	12.2	12.4	12.5	12.6	8
9	12.8	12.9	13.1	13.2	13.4	13.5	13.6	13.8	13.9	14.1	9
10	14.2	14.4	14.5	14.6	14.8	14.9	15.1	15.2	15.3	15.5	10
11	15.6	15.8	15.9	16.1	16.2	16.3	16.5	16.6	16.8	16.9	11
12	17.1	17.2	17.3	17.5	17.6	17.8	17.9	18.0	18.2	18.3	12
13	18.5	18.6	18.8	18.9	19.0	19.2	19.3	19.5	19.6	19.8	13
14	19.9	20.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	14
15	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	15
16	22.7	22.9	23.0	23.2	23.3	23.4	23.6	23.7	23.9	24.0	16
17	24.2	24.3	24.5	24.6	24.7	24.9	25.0	25.2	25.3	25.4	17
18	25.6	25.7	25.9	26.0	26.1	26.3	26.4	26.6	26.7	26.9	18
19	27.0	27.1	27.3	27.4	27.6	27.7	27.9	28.0	28.1	18.3	19
20	28.4	28.6	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	20
21	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.8	31.0	31.1	21
22	31.3	31.4	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.5	22
23	32.7	32.8	33.0	33.1	33.3	33.4	33.5	33.7	33.8	34.0	23
24	34.1	34.2	34.4	34.5	34.7	34.8	35.0	35.1	35.2	35.4	24
25	35.5	35.7	35.8	36.0	36.1	36.2	36.4	36.5	36.7	36.8	25
26	36.9	37.1	37.2	37.4	37.5	37.7	37.8	37.9	38.1	38.2	26
27	38.4	38.5	38.7	38.8	38.9	39.1	39.2	39.4	39.5	39.6	27
28	39.8	39.9	40.1	40.2	40.4	40.5	40.6	40.8	40.9	41.1	28
29	41.2	41.4	41.5	41.6	41.8	41.9	42.1	42.2	42.3	42.5	29
30	42.6	42.8	42.9	43.1	43.2	43.3	43.5	43.6	43.8	43.9	30

Fixed Radius Plot (1/300 Acre), Item 19.

Trees tallied on the fixed radius plot must be live and have the center of their stem at the base within a 6.8' horizontal distance of the point center.

Saplings - Points 1-3. Tally all live saplings (trees  $\geq$  1.0" DBH, but  $<$  5.0" DBH) within the fixed radius plot.

Points 4-10. If 16.0% stocking is not reached using 5.0" DBH and larger trees record the most dominant saplings to reach 16% stocking on each point.

Seedlings - Points 1-10. If no live trees 5.0" DBH or larger are recorded at a point and if not enough saplings are present to reach 16% stocking, record seedling (trees  $<$  1.0" DBH) data until 16% stocking is reached on that point.

Minimum height requirement to be considered a seedling is .5' for softwood and 1.0' for hardwood species. DBH for seedlings is recorded as 000.

Using the following order of preference, record the most dominant (tallest) seedling sized trees:

- 1) 20 class commercial tree species
- 2) non-commercial tree species
- 3) 30 and 40 class commercial tree species.

Fixed radius plot 1/50 acre.

Stumps - Points 1-10. Tally stumps only if they meet all of the following criteria:

- 1) The center of the stump is within 16.6' horizontal distance of the point center.
- 2) The stump is from a tree that was cut within 3 years of the date of the fieldwork.
- 3) The stump is from a tree that has about a 3.0" stump diameter at about 1' off the ground.

Stump height and diameters will be taken at the same point on the stump. Make sure the point selected has minimal natural or mechanical distortion. Record stump diameter in the diameter breast high (DBH) column. Record stump diameter in the bole length column. Beaver cut trees

Basal Area Count, Item 20.

Count the number of live trees 1.0" DBH and larger that occur within the limiting distances of the 37.5 basal area factor prism for each point. Record the count (two digits if required) for each point on the first tree or cover class entry line for that point.

Tree Number, Item 21.

Record a 2-digit code for all line entries except for site trees and cover classed points. Trees and stumps will be numbered consecutively (beginning with 01 on each point) in a clockwise direction starting at 0° from each point.

Tree Species, Item 22.

Record a 3-digit species code for all shrubs, and tree species live or dead. Codes from 010 to 299 are for softwoods, and from 300 to 998 are for hardwoods. Within those groups, numbers are listed in sequence alphabetically by scientific names of genera, species, and varieties. Vacant codes may be assigned for important exotics as needed. Codes are primarily for use in recording trees tallied on field plots taken on Forest Survey and timber management inventories and for subsequent automatic data processing.

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
012	BALSAM FIR	ABIES BALSAMEA VAR.
068	EASTERN REDCEDAR	JUNIPERUS VIRGINIANA
070	EUROPEAN LARCH	LARIX DECIDUA
071	TAMARACK	LARIX LARICINA
091	NORWAY SPRUCE	PICEA ABIES
093	ENGELMANN SPRUCE	PICEA ENGELMANNII
094	WHITE SPRUCE	PICEA GLAUCA
095	BLACK SPRUCE	PICEA MARIANA
096	BLUE SPRUCE	PICEA PUNGENS
105	JACK PINE	PINUS BANKSIANA
125	RED PINE	PINUS RESINOSA
129	WHITE PINE	PINUS STROBUS
130	SCOTCH PINE	PINUS SYLVESTRIS
133	AUSTRIAN PINE	PINUS NIGRA
202	DOUGLAS FIR	PSEUDOTSUGA MENZIESII
241	N. WHITE-CEDAR	THUJA OCCIDENTALIS
261	HEMLOCK	TSUGA CANADENSIS
313	BOXELDER	ACER NEGUNDO
314	BLACK MAPLE	ACER NIGRUM
315	* STRIPED MAPLE	ACER PENNSYLVANICUM

\*Noncommercial tree species

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
316	RED MAPLE	ACER RUBRUM
317	SILVER MAPLE	ACER SACCHARINUM
318	SUGAR MAPLE	ACER SACCHARUM
319 *	MOUNTAIN MAPLE	ACER SPICATUM
331	OHIO BUCKEYE	AESCULUS GLABRA
341 *	AILANTHUS	AILANTHUS ALTISSIMA
371	YELLOW BIRCH	BETULA ALLEGHANIENSIS
372	SWEET BIRCH	BETULA LENTA
373	RIVER BIRCH	BETULA NIGRA
375	PAPER BIRCH	BETULA POPYRIFERA
391 *	AMERICAN HORNBEAM	CARPINUS CAROLINIANA
402	BITTERNUT HICKORY	CARYA CORDIFORMIS
403	PIGNUT HICKORY	CARYA GLABRA
405	SHELLBARK HICKORY	CARYA LACINIOSA
407	SHAGBARK HICKORY	CARYA OVATA
409	MOCKERNUT HICKORY	CARYA TOMENTOSA
421	AMERICAN CHESTNUT	CASTANEA DENTATA
452	NOR.CATALPA	CATALPA SPECIOSA
462	HACKBERRY	CELTIS OCCIDENTALIS
471 *	EASTERN REDBUD	CERCIS CANADENSIS
491	FLOWERING DOGWOOD	CORNUS FLORIDA
500 *	HAWTHORN	CRATEGUS SPECIES
531	BEECH	FAGUS GRANDIFOLIA
541	WHITE ASH	FRAXINUS AMERICANA
543	BLACK ASH	FRAXINUS NIGRA
544	GREEN ASH	FRAXINUS PENNSYLVANICA
546	BLUE ASH	FRAXINUS QUADRANGULATA
552	HONEYLOCUST	GLEDITSIA TRIACANTHOS
601	BUTTERNUT	JUGLANS CINEREA
602	BLACK WALNUT	JUGLANS NIGRA
621	YELLOW POPLAR	LIRIODENDRON TULIPIFERA
641 *	OSAGE ORANGE	MACLUIRA POMIFERO
660 *	APPLE	MALUS
682	RED MULBERRY	MORUS RUBRA
693	BLACK TUPELO	NYSSA SYLVATICA
701 *	EASTERN HOPHORNBEAM	OSTRYA VIRGINIANA
731	SYCAMORE	PLATANUS OCCIDENTALIS
741	BALSAM POPLAR	POPULUS BALSAMIFERA
742	EASTERN COTTONWOOD	POPULUS DELTOIDES
743	BIGTOOTH ASPEN	POPULUS GRANDIDENTATA
746	QUAKING ASPEN	POPULUS TREMULOIDES
752	WHITE POPLAR	POPULUS ALBA
761 *	PINCHERRY	PRUNUS PENNSYLVANICA
762	BLACK CHERRY	PRUNUS SEROTINA
763 *	CHOKECHERRY	PRUNUS VIRGINIANA
765 *	CANADA PLUM	PRUNUS NIGRA
766 *	WILD YELLOW PLUM	PRUNUS AMERICANA

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
802	WHITE OAK	QUERCUS ALBA
804	SWAMP WHITE OAK	QUERCUS BICOLOR
806	SCARLET OAK	QUERCUS COCCINEA
809	NORTHERN PIN OAK	QUERCUS ELLIPSOIDALIS
823	BUR OAK	QUERCUS MACROCARPA
826	CHINKAPIN OAK	QUERCUS MUEHLENBERGII
830	PIN OAK	QUERCUS PALUSTRIS
832	CHESTNUT OAK	QUERCUS PRINUS
833	NORTHERN RED OAK	QUERCUS RUBRA
834	SHUMARD OAK	QUERCUS SHUMARDII
837	BLACK OAK	QUERCUS VELUTINA
851 *	MOUNTAIN ASH	SORBUS
901	BLACK LOCUST	ROBINIA PSEUDOACACIA
921 *	PEACHLEAF WILLOW	SALIX AMYGDALOIDES
922	BLACK WILLOW	SALIX NIGRA
923 *	DIAMOND WILLOW	SALIX ERIOCEPHALA
931	SASSAFRAS	SASSAFRAS ALBIDUM
951	AMERICAN BASSWOOD	TILIA AMERICANA
972	AMERICAN ELM	ULMUS AMERICANA
974	SIBERIAN ELM	ULMUS PUMILA
975	SLIPPERY ELM	ULMUS RUBRA
977	ROCK ELM	ULMUS THOMASSII

Tree History, Item 23.

Record a 2-digit code for tree history.

Full Remeasurement Plots-First digit describes previous tree history, second digit describes current tree history.

Partial Remeasurement and Non-Remeasurement Plots-First digit is always "0", second digit is current tree history.

<u>Code</u>	<u>Tree History</u>
0	No status
1	growing stock live
2	cull live
3	ingrowth
4	dead (salvable-mortality)
5	dead (mortality)
6	ongrowth
7	stump (salvaged dead)
8	stump (utilized)
9	stump (not utilized)

Note: 3 - is only valid as the first digit of the 2-digit code on full remeasurement plots (i.e. ingrowth to cull is coded "32").

6 - is only valid as the first digit of the 2-digit code on full remeasurement plots (i.e. ongrowth to growing stock is coded "61").

0 - is only valid as the first digit of tree history on partial remeasurement or nonremeasurement plots and the second digit on full remeasurement plots that have currently been denied access or are no longer commercial forest land, (i.e. "01" is a live growing stock tree on a non-remeasurement plot, "20" is a cull tree at the time of the previous remeasurement survey which is currently on denied access or non-commercial forest land).

#### Distance, Item 24.

Record distances on all live trees tallied (except seedlings) on points 1 through 3 and all live trees 5.0" DBH or larger on points 4 through 10. The distance recorded will be slope distance to the nearest foot from point center to the face of each tree at its base. Record a 2-digit code.

#### Diameter Breast High (DBH), Item 25.

Record a 3-digit code for each tree tallied. DBH is recorded to the last 0.1". The 6.1" diameter class coded as 061, for example, should include trees 6.10" in diameter up to, but not including trees 6.20" in diameter. Record code 000 for trees with a DBH less than 1.0".

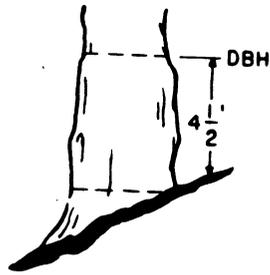
In cases of irregularities at DBH such as swelling, bumps, depressions, or branches measure the diameter immediately above the irregularity at the place where it ceases to affect the normal stem form. If a measurement cannot be taken above the irregularity, record the diameter at the least abnormal spot. Butt swelled trees should be measured at a point 1.5' above the end of the swell if the swell is more than 3' high.

If the stem forks at or above DBH measure diameter below the swell at the place where the fork ceases to affect the stem form. When the stem forks below DBH, consider the tree as two trees and measure the diameter 3 1/2' above the fork (use rule only once per tree).

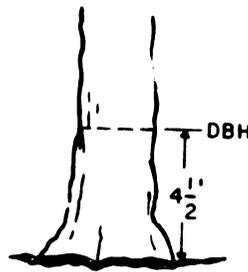
On the side of the tree facing point center paint a 2" horizontal scribed mark just above the upper tape at the point where DBH is measured. Within the 1' stump facing point center, paint a 2" vertical scribed mark to

EXHIBIT 25A

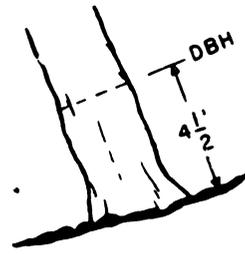
DIAMETER BREAST HIGH MEASUREMENT  
IN A VARIETY OF SITUATIONS



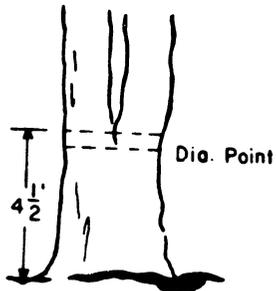
1. Tree on slope



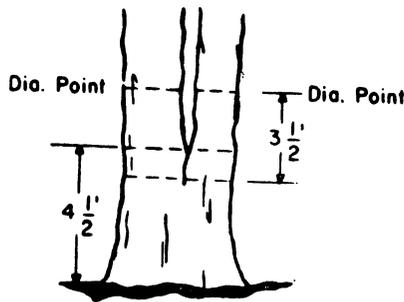
2. Tree on level ground



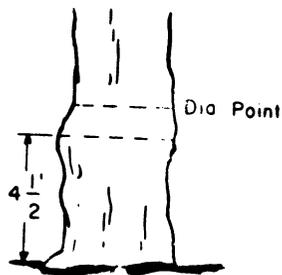
3. Leaning tree



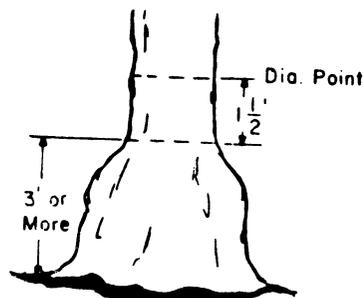
4. Tree forking at or  
above 4 1/2 feet



5. Tree forking below 4 1/2 feet



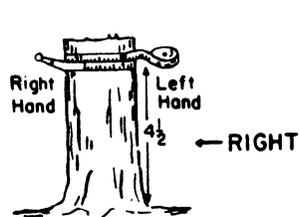
6. Tree deformed at 4 1/2



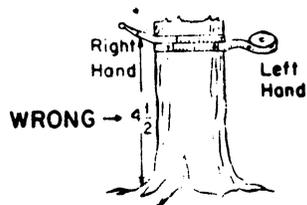
7. Bottleneck tree

EXHIBIT 25B

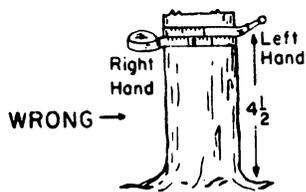
USING THE DIAMETER TAPE



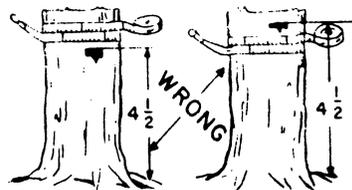
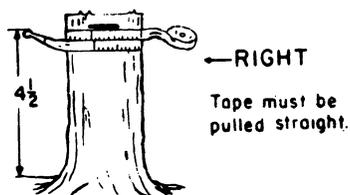
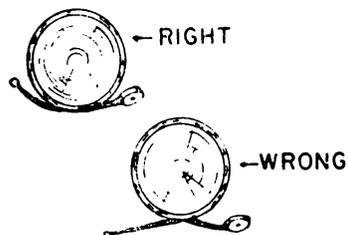
LEFT HANDED - Right hand crossed under.



LEFT HANDED - Right hand crossed over.

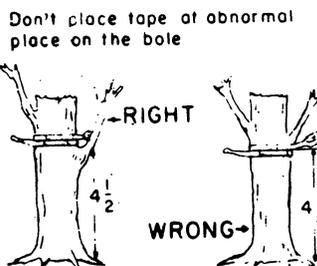
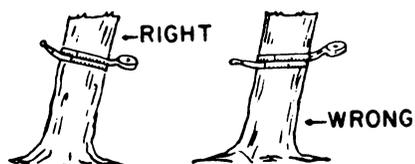


RIGHT HANDED - Left hand crossed over.



Always assume that the 4 1/2 ft D.B.H. point is at the top of lower tape at this point.

The tape must be at right angles to the lean of the tree.



Azimuth, Item 26.

Record azimuth on all live trees tallied (except seedlings) on points 1 through 3 and all live trees 5.0" DBH or larger on points 4 through 10. The azimuth recorded will be a 3-digit code representing the magnetic azimuth from the point center to the center of the tree at its base. Examples: 9° is recorded as 009, 89° is recorded as 089, 347° is recorded as 347.

Zero degree azimuth will not be used. Any tree at 0° will be tallied as 001 azimuth.

Two trees on the same point can not be recorded with the same azimuth. Record one before the other, for example, record one as 059 and the other as 060.

Damage or Cause of Death, Item 27.

Damage. For live trees record presence of damage or pathogen activity if serious enough to reduce the quality or vigor of the tree.

The second digit of damage codes 20 (disease) will be used to identify specific diseases of living trees. Identifying the presence of any of these diseases will be sufficient reason to record them as a damage.

Tent caterpillar, spruce budworm, jack pine budworm, or other extensive damage by insects should be noted in the "Notes" section of the plot sheet. Also record extensive disease occurrence in the notes section.

Cull trees (except noncommercial species) must have a damage code other than 00.

When a tree is damaged by more than one agent, code the most severe damage.

For seedlings and saplings, unless a specific damage is observed, should be considered growing-stock trees. Excessive sweep and crook will not be considered a specific damage code on seedling and small saplings.

Record presence of pathogens or damage using the following 2-digit code:

<u>Code</u>	<u>Disease or Damage</u>	<u>Susceptible Species</u>	<u>Code</u>	<u>Disease</u>	<u>Susceptible Species</u>
10	Insect damage		25	Dwarf mistletoe	Black spruce
11	Poplar Borer	Aspen	26	Shoot blights	Red & jack pine
20	Disease damage		27	Butternut canker	Butternut
21	Phellinus tremulae	Aspen	28	Nectria canker	All hardwoods
22	Hypoxylon canker	Aspen	29	Eutypella canker	Maple
23	Other cankers	All hdwds.			
24	White pine blister rust	White pine			

Code   Disease or Damage

30	Fire damage
40	Animal damage
41	Beaver
42	Cattle
43	Deer
44	Porcupine
45	Sapsuckers
50	Weather damage
60	Suppression
70	Unknown and other damage-Used to indicate old age; spike, or flat top crowns, crown defects such as foliage color and length; any presence of barb wire or nails from signs or deer stands.
71	Missing or dead top
72	Poor form (leaning or forked trees, excessive sweep or crook)
80	Logging and related damage
82	Timber stand improvement
85	Conversion to nonforest or noncommercial forest land use. (Note: Includes all growing trees that were attempted to be removed in the process of changing the land use.)
00	No serious damage.

Cause of Death.   Record cause of death for dead trees tallied, using the following 2-digit codes:

Code   Cause of Death

10	Insects
20	Disease
30	Fire
40	Animals
41	Beaver
42	Cattle
43	Deer
44	Porcupine
45	Sapsuckers
50	Weather
60	Suppression
70	Unknown
81	Logging
82	Timber stand improvement
84	Land clearing
85	Conversion to nonforest or noncommercial forest land use. (Note: Includes all growing trees removed from area by

When there are multiple causes of mortality, code for the predominant cause of death. Thus, a tree killed by windthrow, but showing evidence of root rot, would be coded 50, since windthrow actually caused the death of the tree. A tree killed by disease only would be coded 20.

Tree or Cover Class, Item 28, (2 digits)

Tree Class. Tree class of all trees will be based on tree classification codes. Tree class is not permanently assigned. On future remeasurements it is possible for a tree to move from a cull category back to an acceptable tree. The following tree class codes will be used:

<u>Code</u>	<u>Tree Class</u>
20	Acceptable tree
30	Rough tree
31	Short sawtimber tree
40	Rotten tree

On partial plots where log grade and internal defect are not recorded the requirements for these items must be met when assigning tree classes.

Cover Class. If no live trees are recorded at a point, examine the fixed radius plot for cover class and record, using the codes given below:

Code    Cover Class

- 51-54 Inhibiting vegetation. Cover sufficiently dense to prevent establishment of tree seedlings. Use the following codes: 51-grass, 52-shrubs, 53-vines, 54-other.
- 60 Nonstocked not overtopped. Area sufficiently clear to permit establishment and development of one or more tree seedlings by natural or artificial methods.
- 70 Nonstocked overtopped. Area clear enough to permit establishment of seedlings, but sufficiently overtopped by tree crowns to prevent survival of tree seedlings.
- 81-83 Nonstockable. Not capable of supporting trees of commercial species, because of the presence of rocks, water, etc. Use the following codes: 81-rocks, 82-water, 83-other.

Tree Classification. Entries log grade, internal defect, crown ratio, crown class, and damage are tree classification codes. These codes provide the basis for systematically classifying trees into classes that reflect their vigor and suitability for timber products now or prospectively. Tree classes used permit relating inventories and growth to area condition, which in turn provides a basis for rating harvesting and management opportunities.

A systematic procedure to determine tree class will be carefully explained to promote better understanding. In deriving tree class first, some information will no longer need to be figured on cull trees, and therefore cut down the time spent recording data.

Upon the first observation, the sawlog portion on a sawtimber tree, the potential sawlog portion on a poletimber tree, or any sapling or seedling, should be screened using criteria which would place it into one of two categories; growing stock or cull. Following are the criteria for these categories:

Acceptable tree (Code 20)

Live trees of commercial species that are:

1) Sawtimber size and have at least one merchantable 12-foot sawlog or two merchantable 8-foot sawlogs, meet minimum log grade requirements, and contain 33 percent or more of their gross board foot volume in sound material.

2) Poletimber size trees that have the potential to meet the above specifications (see 1 above). The assumption shall be made that pole size trees will eventually attain sawlog size at DBH. In evaluating the potential sawlog portion of pole size trees, only rot, large limbs, forks, and excessive sweep and crook may be used to disqualify the tree as a growing stock tree. When estimating the potential sawlog height for poletimber trees, the two-inch rule can be applied as a guide. The two-inch rule assumes that a tree's diameter will increase uniformly along its bole. For example, a hardwood poletimber tree with a DBH of 8.0 inches needs three inches of diameter growth to become sawtimber size. If diameter growth is uniform then the DBH minus 2 inches, 8-2 or 6 inches, identifies the potential sawlog top. This system works for both hardwoods and softwoods.

3) Seedlings and saplings will be considered growing stock trees unless a specific damage is observed. Seedlings and small saplings may not be culled on the basis of excessive sweep or crook. It will be assumed that seedlings and saplings will eventually attain sawlog size at DBH.

Tree vigor, predicted death, or plot site index are not considerations in determining tree class.

Rough Tree (Code 30)

- a) Sawtimber size and do not have any merchantable sawlog, where over one-half of the volume in the sawlog portion does not meet minimum log grade specifications because of roughness, excessive sweep or crook, splits, cracks, limb stoppers, or forks. The sawlog portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.
- b) Pole size trees which do not have the potential to meet the specifications for growing stock trees because of forks, limb stoppers, or excessive sweep or crook. The assumption shall be made that all live trees not presently sawlog size will eventually attain sawlog size at DBH. Predicted death, tree vigor, or plot site index are not considerations in determining tree class.

#### Short sawtimber-sized tree (code 31)

- 1) Any live sawtimber-sized tree of commercial species which has at least one eight-foot log, but less than a twelve-foot log, that meets minimum log grade specifications. Measured log must be at least 33 percent sound.
- 2) Any live sawtimber-sized tree of commercial species which has less than one-third of the volume of the sawlog portion in merchantable logs, but has at least one eight-foot or longer sawlog that meets minimum log grade specifications. Measured log must be at least 33 percent sound. The sawlog portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.

NOTE: POLE SIZE TREES CANNOT RECEIVE A TREE CLASS 31.

#### Rotten tree (Code 40)

All live trees of commercial species that are:

- 1) Sawtimber size and do not have any merchantable sawlog, where over one-half of the volume in the saw log portion does not meet minimum log grade specifications primarily because of rot or missing sections. The saw log portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.
- 2) Pole size trees which do not have the potential to meet the log grade specifications for growing stock trees because of rot. The assumption shall be made that all live trees not presently sawlog will eventually attain sawlog size at D.B.H. Predicted death, tree vigor, or plot site index are not considerations in determining tree class.

#### SUMMARY:

If any of the sawlog section requirements for a growing stock tree (20) is not met, the tree is considered cull. If a short sawlog is present, the tree class is 31 and an accurate estimation of internal defect shall be determined and sawlog information recorded. If no sawlog is present tree class is 30 or 40. If a poletimber tree does not have the potential to meet sawlog standards, its tree class is 30 or 40.

Following, are the required tally items for each tree class.

For growing stock trees (tree class 20) on full permanent plots bole length will be recorded to the highest possible 4.0" top D.O.B., or to that point where the stem or branch is terminated by a stopper and there is no merchantable four-foot section above it. On forked sawtimber trees, bole length will be recorded using the fork that contained the highest sawlog. Cubic foot cull will be recorded for the rotten volume within merchantable sections and the total volume in unmerchantable sections. Sawlog length should be recorded to the top of the highest sawlog section meeting minimum sawlog requirements. Board foot cull will include the unusable board foot volume in merchantable sawlog sections, and the total volume of sections that do not meet sawlog requirements below the sawlog top. All remaining required information will be accurately recorded.

For tree class 30, record bole length to a 4.0" top D.O.B. ignoring all stoppers. On cubic foot cull, cull out for actual rot or missing wood only. For sawtimber trees dash out sawlog length, sawlog top D.O.B., board foot cull and log grade. Internal defect will be estimated. Crown ratio and crown class should be accurately recorded. Except for noncommercial species, the damage code must not be "00" and must reflect the primary reason that the tree was culled. Note evidence of tree cavities.

For short sawlog trees (tree class 31) record bole length to a 4.0" top D.O.B. ignoring all stoppers. On forked trees, bole length will be recorded using the fork that contains the highest sawlog. Cull out for rot or missing wood only on cubic foot cull. Record sawlog length and sawlog top D.O.B. to the height where the highest merchantable log terminates. Cull out total board foot volume in all unmerchantable sections in the sawlog portion, and the unusable board foot volume within the merchantable sawlog. Record log grade for the log that is present. Internal defect will be a true indication of the volume loss due to rot. Crown ratio and crown class will be accurately determined. Damage code cannot be "00" and must reflect the primary reason that the tree was culled. Note evidence of tree cavities.

For tree class 40 record bole length to a 4.0" top D.O.B. ignoring all stoppers. On cubic foot cull, cull out for rot or missing wood only. Dash out saw log length, saw log top D.O.B., board foot cull, and log grade. Internal defect will be estimated. Crown ratio and crown class will be accurately recorded. Damage code must not be "00" and must reflect rot or disease. (codes "20-29").

Dead Trees-Dead trees, 5.0" DBH or larger, will be tallied if they meet either of the following criteria:

1. Mortality tree-dead tree that has died within three years and has no merchantable volume. All recorded information will reflect the trees condition at the time of death (not as the tree appears now).

2. Salvable-mortality tree-dead tree that has died within the last three years, and contains at least one four foot section that meets pulpwood specifications. Recorded information will reflect the trees present condition.

Tree classes recorded for all dead trees will reflect the tree class of the tree as if it were alive. Tree class for mortality trees should be projected to the time of death. Tree class for salvable-mortality trees should reflect the trees present condition.

When measuring DBH on dead trees take into consideration any distortion (lost bark, cracks, splits, shrinkage, etc.) to get the most accurate DBH possible.

The following tally items are required for dead trees:

Mortality tree- tree number, species, tree history (05), DBH, damage/cause of death, tree class (present), tree cavities, sawlog length, sawlog top D.O.B., board foot cull, bole length, bole length top D.O.B., cubic foot cull.

Salvable-mortality tree-tree number, species, tree history (04), DBH, damage/cause of death, tree class (present), tree cavities, sawlog length, sawlog top D.O.B., board foot cull, bole length, bole length top D.O.B., cubic foot cull.

Following is an explanation of tree class for selected examples. Hardwood trees are pictured in the examples, but softwoods can also be applied using a minimum 7.0" sawlog top D.O.B.

1. A growing-stock hardwood sawtimber tree. Sawlog length terminates at 9" top D.O.B. The sawlog meets both minimum log grade specifications and the minimum 12-foot qualification for a growing-stock tree. The upper stem portion contains no cull and terminates at 4 inches D.O.B. Sawlog length is recorded as 12 feet; bole length as 21 feet.

2. A hardwood grades 1, 2, and 3 or softwood sawtimber tree. Sawlog portion is terminated by limbs creating a full diameter stopper. Each limb is over 2 inches in diameter and their sum exceeds the diameter of the stem at that point (10 inches D.O.B.). The sawlog contains no cull and meets minimum grade specifications. Both bole length and sawlog length are 14 feet. Again, two limbs each over 2 inches in diameter whose sum exceeds the diameter of the stem at that point (5 inches D.O.B.) create a full diameter bole length stopper. The portion between the whorls of limbs is large enough in diameter, but not in length to meet pulpwood specifications (i.e., is less than 4 feet long). Also, the section above the stopper is not 4 feet to the 4-inch D.O.B. Cull board feet and cull cubic feet are zero.

3. A growing-stock hardwood grade 4 sawtimber tree. There are no sawlogs in the 21-foot sawlog portion that have minimum clear panel length to meet hardwood factory log grade 3 specifications, but the bottom 14 feet contains no rot or sweep and will meet hardwood construction grade 4 specifications. The sawlog terminates at 14 feet, because the 5-inch diameter limb creates a one-third diameter stopper for hardwood construction grade 4 and only a 6-foot section is left above the 1-foot sawlog stopper. Log grade specifications require a minimum sawlog length of 8 feet. Since bole length stoppers must be full diameter the entire portion between the sawlog top at 14 feet and the 5-inch top meet pulpwood specifications. Bole length is terminated at 26 feet with a 5-inch top D.O.B. because of a fork with 2 3-inch diameter limbs. Cull board feet and cull cubic feet are zero.

4. A hardwood sawtimber tree. The sawlog length is 16 feet to the 9-inch D.O.B. The bottom 2 feet are over 50 percent rotten and do not meet log grade specifications. The next 14-foot section meets minimum factory log grade specifications, but contains some cull due to a frost crack and a narrow cone of rot extending up from the bottom. A 6-1/2-foot section above a 1/2-foot fork at 19-1/2 feet terminates the bole length at 26 feet. Board foot cull will include the entire board foot volume in the bottom 2 feet, and the unusable board foot volume in the next 14 feet. Cubic foot cull will include the total cubic foot volume in the bottom 2 feet, only the cubic foot volume loss due to rot in the next 14 feet, and the total cubic foot volume in the 1/2-foot fork.

5. Two hardwood sawtimber trees. Since the lowest fork is below DBH, each fork is appraised and recorded as a separate tree. The lower 14 feet of the left-hand fork (or left-hand tree) meets log grade specifications. A 7-foot section meets pulpwood specifications above a full diameter stopper created by two large limbs. The bole length is 22 feet and the sawlog length 14 feet. Cull board feet is zero and the total cubic foot volume of the one-foot stopper section is recorded for cubic foot cull.

In the right-hand tree, a 13-foot merchantable sawlog plus a 9-foot merchantable sawlog in the right-hand fork (with an intervening one-foot section of sound cull) is recorded as 23 feet of sawlog length, a 4-foot section of the right-hand fork meets pulpwood specifications making the bole length 27 feet. Cull board feet and cull cubic feet will both reflect the total volume of the one-foot fork. When a tree forks above DBH, measurements are recorded on one fork only. Merchantable bole length should be recorded continuing up the same fork that has the highest merchantable sawlog length. In this illustration the left-hand fork on the right-hand tree had a higher merchantable bole length at 33 feet, but the right-hand fork on the same tree had a higher merchantable sawlog length, so the bole length is recorded as 27 feet using the right-hand fork.

6. A rough hardwood sawtimber tree. Sawlog portion is 15 feet long. There is no sawlog present that will meet minimum hardwood log grades 1-4. Minimum clear panel length is not present for grade 3 and sweep plus a 1/3 diameter limb stopper prevents grade 4. Since more than 1/2 the board foot volume is lost as sound cull, it is a rough tree (tree class 30). Dash out sawlog information. Bole length is taken 25 feet to the 4-inch D.O.B. ignoring all bole length stoppers (pulpwood specifications). Cull cubic feet is zero.

7. A rotten hardwood sawtimber tree. The sawlog portion is 20 feet long. The entire volume of a 13-foot section is cull, because it will not meet log grade specifications due to excessive rot. This creates a 7-foot sound cull section beneath, because there is not a minimum sawlog length of 8 feet. Since there is no sawlog that will meet minimum log grade specifications, the tree is cull. Because more than 1/2 the board foot volume loss is due to rot, the tree is a rotten cull (tree class of 40). Dash out sawlog information and log grade. Bole length is 27 feet and cubic foot cull would represent only the rotten cubic foot volume within the 13-foot rotten section.

8. A tree class 31. The sawlog portion is 28 feet and stops at a point just below where the tree forks for a second time at a 9.5-inch D.O.B. The first 16 feet do not meet minimum log grade specifications, but there is a 12-foot merchantable sawlog above the first fork. Since over 2/3 of the total board foot volume between the one-foot stump and the top of the merchantable sawlog is cull, this is a cull tree, but since the tree contains a merchantable sawlog it is a tree class 31. Use Tatum Guides to compute the board foot volumes of the sections listed. For this example the sawlog information is recorded as sawlog length 028, sawlog top D.O.B. 095, and board foot cull is the total board foot volume in the 16-foot cull section. Bole length and cubic foot cull are handled the same as in other cull trees (tree class 30) ignoring all stoppers and culling only for rot.

9. A tree class 31. The sawlog portion is 16 feet to the 9.0" DBH. Because of a fork at 11 feet the tree does not contain a 12-foot merchantable sawlog or two 8-foot merchantable sawlogs. This classifies the tree as a cull and since it contains a merchantable sawlog at least 8 feet or longer it is a tree class 31. Sawlog length is recorded as 011, sawlog top D.O.B. 100, and board foot cull 0000. Bole length and cubic foot cull are handled the same as on other cull trees ignoring all stoppers and culling for rot.

10. Mortality and Salvable-Mortality Dead Tree. Assume that this tree died within three years. It is therefore considered a mortality tree. If it meets the specifications for pulpwood and or sawlog it would be considered a salvable-mortality tree. It is possible to have a tree which is mortality, but not salvable-mortality.

When determining what information to record for a mortality tree, all tree measurements should be projected back to the time of death.

Bole length would be 26 feet. The cubic foot cull will include the cubic foot volume loss due to rot or missing wood in the entire 26 feet.

Sawlog length would be 16 feet and the board foot cull includes the salvable board foot volume in the 16 foot log. If the tree has decayed considerably, it may be difficult to judge the volume loss at the time of death.

The tallier must estimate the amount of cull present at the time of death.

In determining what to record for Salvable-mortality trees, the tree should be looked at in its present condition.

Bole length may still be 26 feet and the cubic foot cull may be the same as recorded for mortality or there may have been some further decay since death. This would increase the cubic foot cull.

Sawlog length may also be the same as that recorded for mortality (16 feet), and the amount of board foot volume loss may be the same. Again, if the tree has been dead for a long period the decay may increase.

The longer a tree has been dead the more decay and deterioration takes place. A salvable-mortality tree takes into consideration the tree in its present condition. It is possible that the sawlog portion which was sound at the time of death is now checked and split. The sawlog length, sawlog top D.O.B., and board foot cull would then be dashed out because there is no merchantable sawlog present in the salvable-mortality tree. Bole length information would still be recorded as the wood is probably sound. Only rot and missing wood would be taken out in the cubic foot section.

Cause of death and tree class are reflected back to the time of death for both mortality and salvable-mortality trees.

The tree in the example was a 20 class tree at the time of death according to survey standards. Even if the tree is now considered a 30 class tree.

EXHIBIT 28

HOW TO HANDLE TREE MEASUREMENTS  
FOR ALL TREE CLASSES

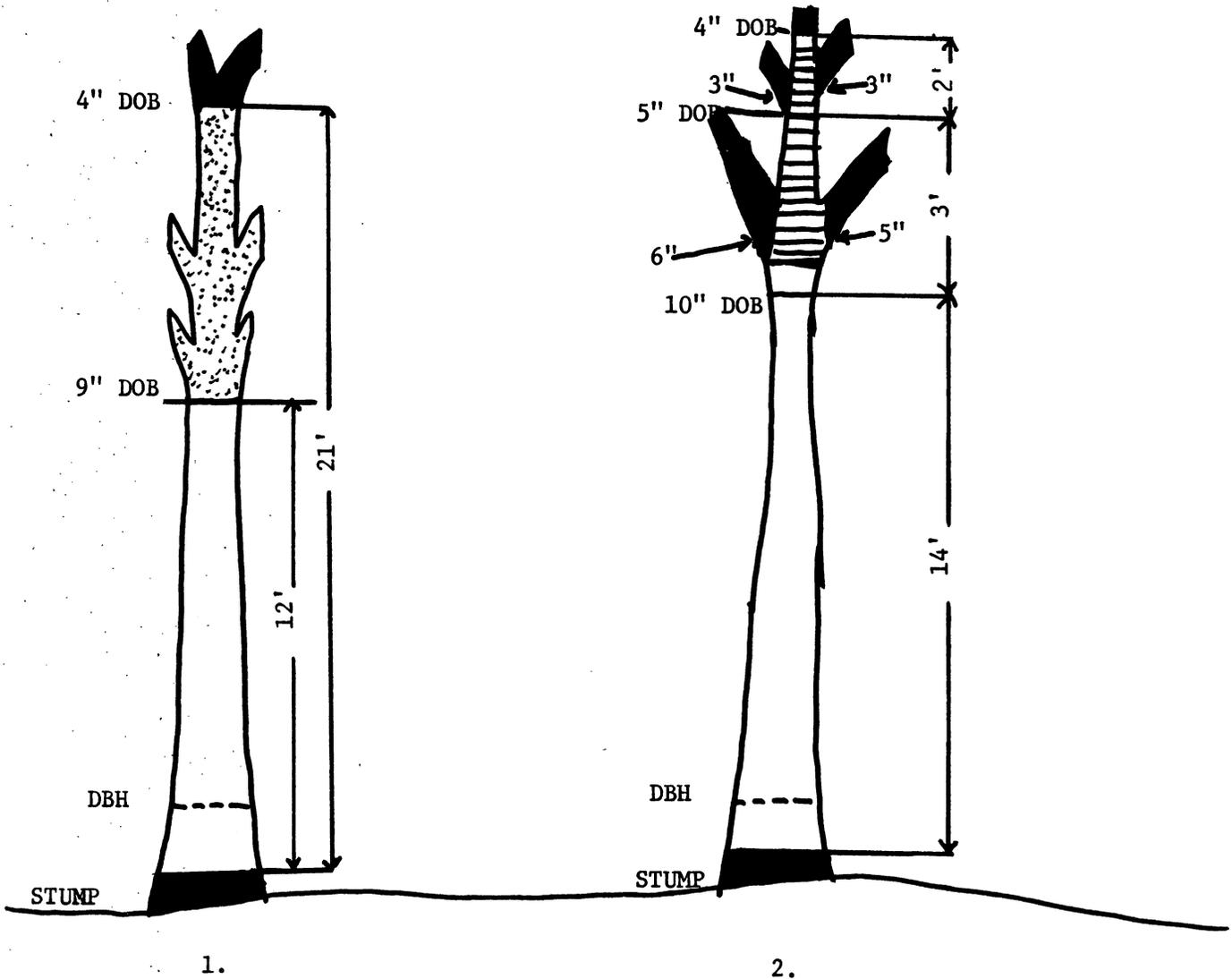
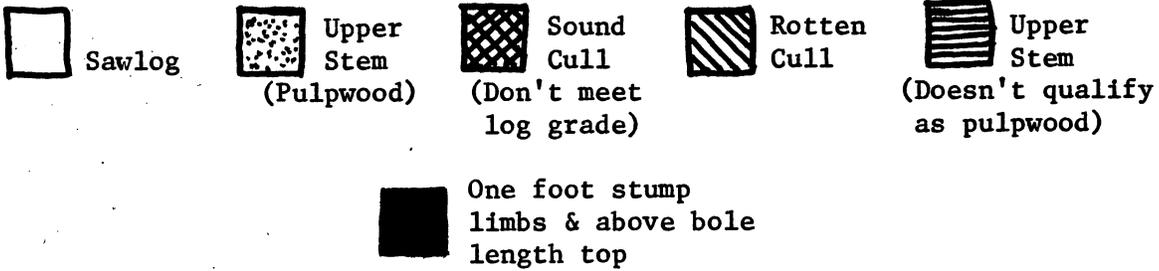


EXHIBIT 28 continued

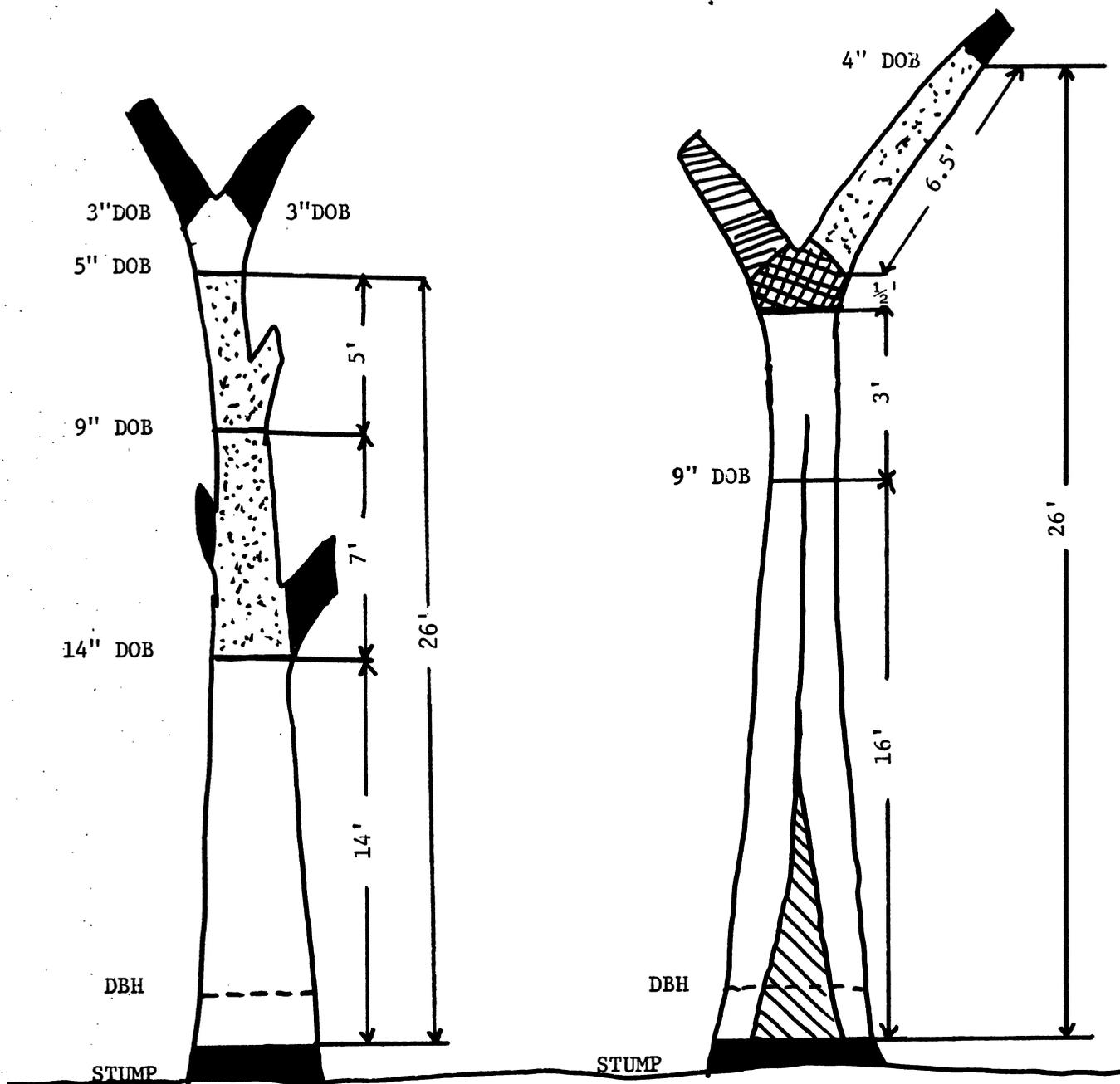
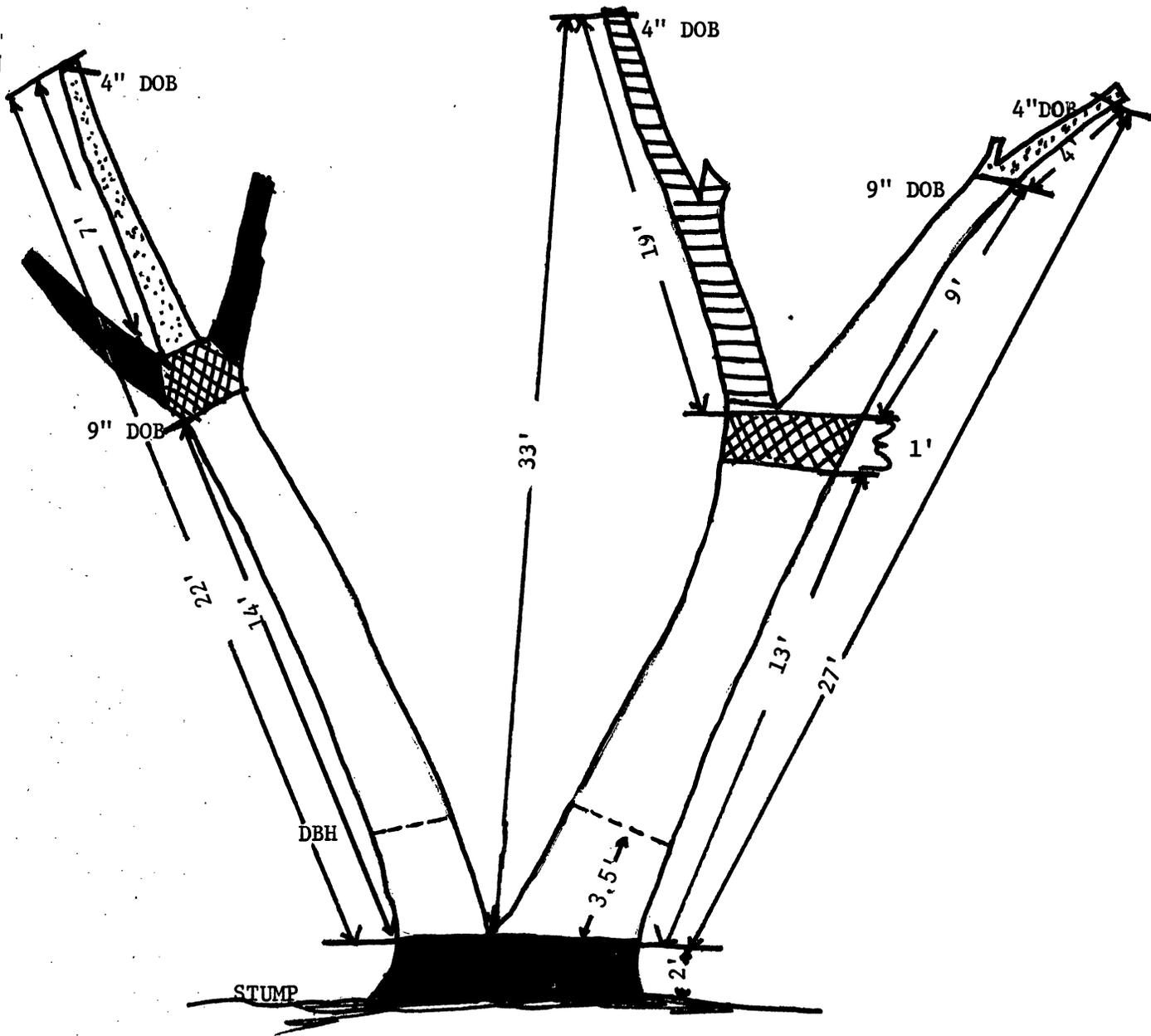


EXHIBIT 28 continued



4.

EXHIBIT 28 continued

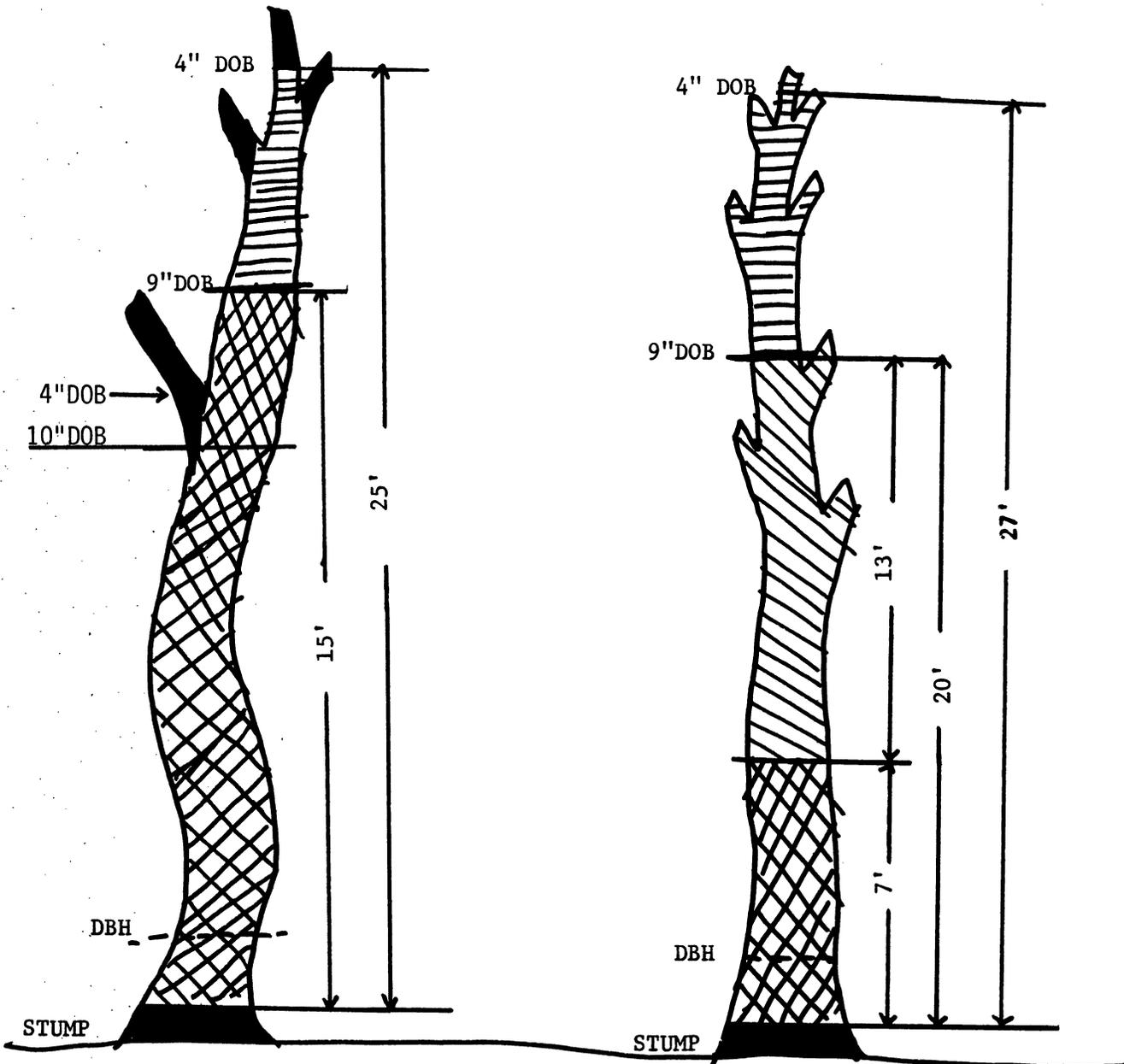


EXHIBIT 28 continued

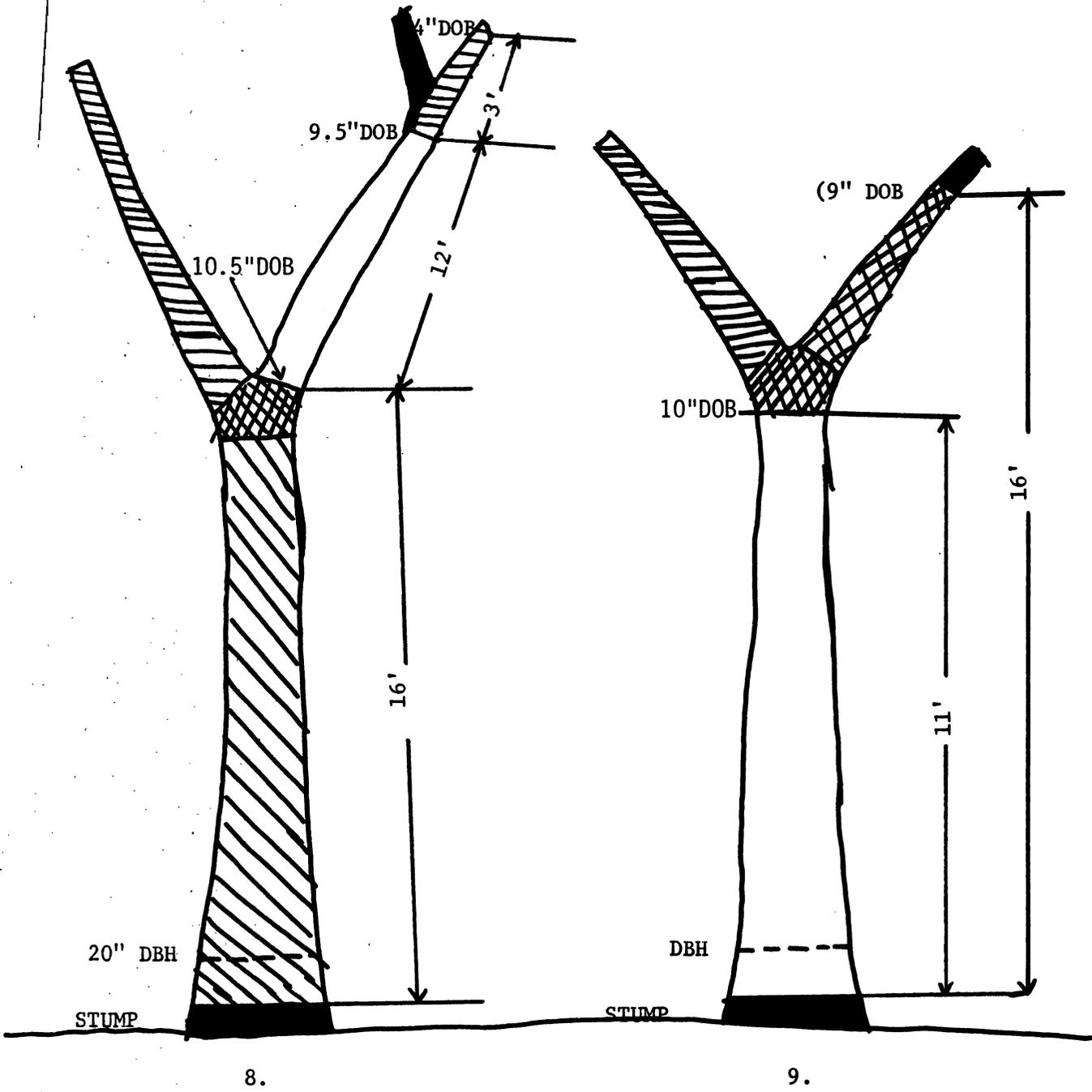
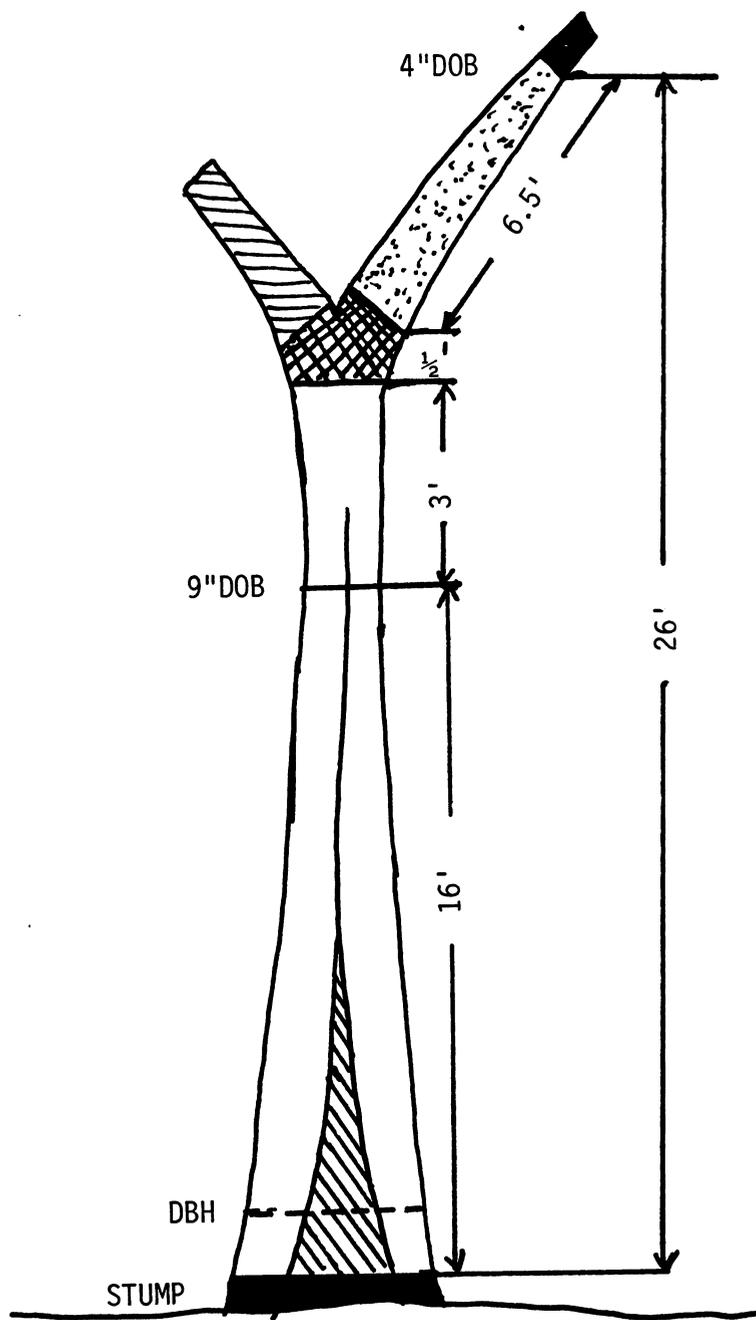


EXHIBIT 28 continued



Crown Ratio, Item 29.

Crown ratio is the percentage of total tree height that supports a full, live, green, healthy, foliage that is effectively contributing to tree growth. Crown ratio is expressed as a percent of total tree height and recorded as a 1-digit code for all live trees 1 inch DBH or larger. For trees that have uneven length crowns, ocularly transfer branches to fill holes in the upper portion of the crown, until an even crown is visualized. For example, a tree might have scattered green branches extending over 60 percent of its total height, but by ocularly transferring branches to produce a full crown, the crown ratio might be 40 percent.

Record crown ratio using the following one-digit codes:

<u>Code</u>	<u>Crown Ratio</u>
1	1 through 10 percent
2	11 through 20 percent
3	21 through 30 percent
4	31 through 40 percent
5	41 through 50 percent
6	51 through 60 percent
7	61 through 70 percent
8	71 through 80 percent
9	81 through 90 percent
0	91 through 100 percent

Crown Class, Item 30.

Crown classification primarily reflects the amount of sunlight received rather than the conventional "crown position" classification found in forestry textbooks. Record a one-digit code to show crown class of all live trees 1.0" DBH and larger, as follows:

Code    Crown Class

- 1    Open grown. Trees with crowns which have received full light from above and from all sides throughout all or most of the life of the tree, particularly during its early developmental period.
- 2    Dominant. Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides; larger than the average trees in the stand, and with crowns well developed, but possibly somewhat crowded on the sides.
- 3    Codominant. Trees with crowns forming part of the general level of the crown cover and receiving full light from above, but comparatively little from the sides--usually with medium-sized crowns more or less crowded on the sides. (In stagnated stands, includes trees with small-sized crowns crowded on the sides).
- 4    Intermediate. Trees shorter than those in the two preceding classes, but with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.
- 5    Overtopped. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

In multiple-age stands with understory trees of younger age classes, crown classification is often difficult. As a general rule, the crown class for each tree should be judged in the context of its immediate environment; that is, those trees affecting it or being affected by it in terms of crown competition. For example, the intermediate and overtopped crown classes are intended to include only trees seriously affected by direct competition from adjacent trees.

Stocking Percent, Item 31.

There are two tables for assigning stocking percent. The table to be used is determined separately on each point by the point description given at the top of each table listed below. Following the order of point occupancy assigned to trees on a particular point, stocking percent are assigned to live trees according to the tree's DBH class.

A maximum of 16.0 percent stocking will be assigned to each point. The last tree to contribute to 16.0 percent total will not usually be assigned its full stocking percent value possible for that DBH class, but will receive just that amount needed to reach 16.0 percent. For example, on a point with four 5.0" or larger trees, the tree given a point occupancy of 4 will receive only 1.9 percent which would bring the total to the 16.0 percent stocking necessary for that point.

<u>One or more 5.0" or larger DBH live trees on the point</u>		<u>No live trees 5.0" DBH or larger on the point</u>	
<u>DBH</u>	<u>Stocking Percent</u>	<u>DBH</u>	<u>Stocking Percent</u>
5.0"+	4.7	4.0-4.9	4.0
4.0 - 4.9	4.0	3.0-3.9	3.5
3.0 - 3.9	2.4	2.0-2.9	3.0
2.0 - 2.9	1.2	1.0-1.9	2.5
1.0 - 1.9	.4	Seedling	2.0

Stocking percent is used to determine forest type and the number of trees to be tallied on points 4-10. It is not necessary to record stocking percent on the tally sheet. If the tallier chooses to record stocking percent it should be recorded on all ten points using a two digit code. Example: .4% recorded as 04, 2.4% recorded as 24.

Point Occupancy, Item 32.

Show the order of occupancy by ranking those trees tallied on a point that are making the most use of the site. Crown class, crown ratio, and DBH can be used as as guidelines in determining point occupancy. Trees fully crowned and of large diameter that are obviously dominating the point yet are shorter than the surrounding trees can receive a higher point occupancy code than a taller tree that has a small weakened crown. Record point occupancy using the following one-digit codes:

Code    Point Occupancy

- 1    Most controlling tree
- 2    Second most controlling tree
- 3    Third most controlling tree
- 4    Fourth most controlling tree
- 5    Fifth most controlling tree
- 6    Sixth most controlling tree
- 7    Seventh most controlling tree
- 8    Eighth most controlling tree and all remaining trees on the point.  
No code greater than 8 is recorded.

Tree Cavities, Item 33.

At each sample point, examine each live tree 5.0" DBH and larger for cavities used as nesting, resting or storage by birds or mammals. For the largest cavity record a 2-digit code to indicate the size of the cavity entrance hole and location of the cavity in the tree. The first digit will indicate the cavity hole size, the second digit indicates the location of the cavity.

To qualify as a cavity, the entrance hole must be 1.0" or larger in the main stem, fork, or larger limb. (A large limb must be greater than 8.0" in diameter o.b.) If no cavity is present, dash " - " out this item.

<u>First digit</u>		<u>Second digit</u>	
<u>Code</u>	<u>Size of opening</u> (inches)	<u>Code</u>	<u>Location of cavity</u> (feet)
1	1	1	0-1
2	2	2	2-5
3	3	3	6-9
4	4	4	10-19
5	5	5	20-29
6	6	6	30-39
7	7	7	40-49
8	8	8	50-59

### Sawlog Length, Item 34.

Sawlog length on live or dead sawtimber size trees is the distance from the top of the one foot stump to a minimum top of 7.0" D.O.B. (diameter outside bark) for softwoods sawtimber and 9.0" D.O.B. for hardwood sawtimber or to the point on the bole above which no merchantable sawlog exists.

Record sawlog length on live or dead 20 and 31 class sawtimber size trees. In the case of 30 or 40 class trees, record a dash "-" for sawlog length for sawtimber size trees and poletimber size trees.

Record sawlog length to the last whole foot. Example: Sawlog length of 14.8' would be recorded as 14.

Saw log length should not extend above a large fork, excessive limbs or other defects or a section of the tree bole that does not meet minimum log grade specifications unless the tree has at least 8 feet of saw log length above the limitaiton (12 feet if this is the only log in the tree). Limitations or "stoppers" for hardwoods grades 1, 2, and 3 and for all softwoods are any limb or group of 2.0" or larger limbs within a one-foot span whose sum exceeds DOB at that point. Limitations for grade 4 hardwoods only include any limb or group of limbs within a one-foot span with a diameter or sum of diameters greater than 1/3 the stem DOB of that section.

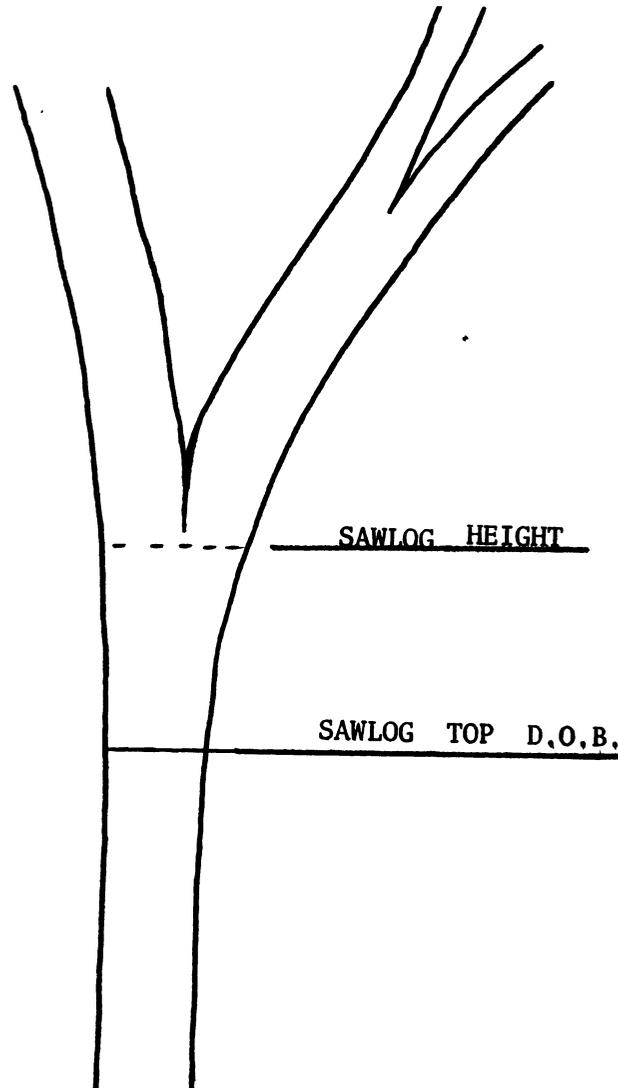
Minimize limb limitations by logical log making, aimed at obtaining the longest sawlog length. For example, bucking between staggered limbs within a one-foot span whose combined diameters exceed the D.O.B. at point of occurence may give a longer sawlog length.

In situations where limbs are a limiting factor in determining merchantable length, length will be taken to the point where the limbs divide the diameter of the merchantable section. (See Exhibit 34).

No sawlog length reduction will be made because of an unmerchantable section as long as a merchantable 8' or longer log is present above the unmerchantable piece.

In the case of trees forking above DBH, sawlog length will be taken on the trunk yielding the greatest length.

EXHIBIT 34



Sawlog Top Diameter Outside Bark, Item 35.

For each sawtimber-sized tree record sawlog top DOB to the last 0.1", using a three-digit code. For example, record 7.0" as 070. The minimum top D.O.B. recorded for softwoods will be 7.0" and 9.0" for hardwoods. For trees with sawlog length terminating before reaching minimum top D.O.B., or if the sawlog length is affected by a fork or the flare from a limb, the smallest diameter immediately below the swell is recorded. When no sawlog is present in sawtimber sized trees, record a dash "-" in this item.

### Board Foot Cull, Item 36.

Board-foot cull is the volume within the sawlog portion of trees which cannot be recovered for use as lumber because of rot, sweep, crook, forks, or other defects.

#### Cull Volumes Include:

1. The entire volumes of tree sections which do not meet minimum log grade requirements.
2. The entire volume in any one foot or longer section of a tree which is less than 50% sound.
3. The cull volume only, in any one foot or longer section of a tree which is greater than 50% sound.
4. Computed volumes for sweep and crook.
5. Forks or stoppers.

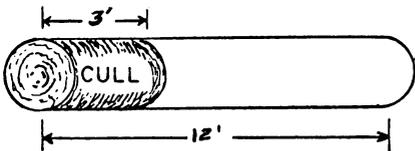
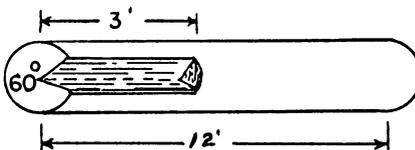
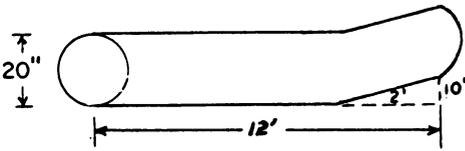
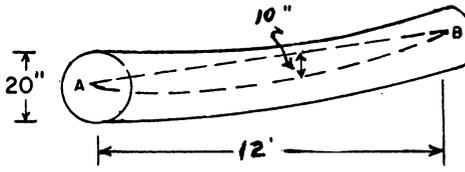
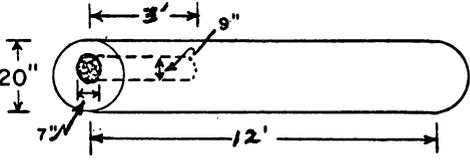
Board foot measure is computed from a squared off section within the circular form of a log. This is the only portion which contains lumber. Therefore, shallow defects that are expected to be cut in slabbing for lumber and rounding for veneer are ignored.

Determine the board foot cull volume in logs and/or cull sections by estimating the length and D.O.B. at midpoint and looking up the board foot volume in the "Board-foot Volume of Short Logs" table on the "Tatum Guides". In determining cull due to sweep and crook, minimize the defect by logical log-making aimed at obtaining maximum high grade material. Sweep and crook tables along with guides for determining the proportion of cull are also found on the "Tatum Guides".

Use a four-digit code to record cull volume, to the last board foot. When no sawlog is present, record a dash " - " in Board-Foot Cull on sawtimber-sized trees.

Exhibit 36

The following are suggestions for estimating cull in logs.

<p>If section of log is affected, deduct length of log length affected.</p> <p>Example: <math>\frac{3}{12} \times 100 = 25</math> percent board foot cull.</p>	
<p>If sector is affected, multiply percent of circle times percent of length.</p> <p>Example: <math>\frac{60}{360} \times \frac{3}{12} \times 100 = 4</math> percent board foot cull.</p>	
<p>For a crook, multiply proportion of diameter displaced times proportion of log length affected by crook.</p> <p>Example: <math>\frac{10}{20} \times \frac{2}{12} \times 100 = 8</math> percent board foot cull.</p>	
<p>For sweep, determine sweep departure and subtract 2 inches. Divide this by minimum log diameter.</p> <p>Example: <math>\frac{10-2}{20} \times 100 = 40</math> percent board foot cull.</p>	
<p>For interior defect, determine the defective material as percent of total volume of the log. Add 1 inch to width and thickness of defect, and divide by one less than average scaling diameter of the log.</p> <p>Example: <math>\frac{8 \times 10}{20-1} \times \frac{3}{12} \times 100 = 11</math> percent board foot cull.</p>	

Log Grade, Item 37.

Grade the first sawlog in each live sawtimber tree and record a one-digit code corresponding to the log grade number. If a tree does not have one 12' or two 8' sawlogs that meet minimum log grade requirements, it is a cull tree.

For hardwood sawtimber (20 class) trees grade the best 12' of the lowest 16' section or the best 12' of an upper section if the butt log does not meet minimum log grade standards. "A Guide to Hardwood Log Grading (Revised)" and the "Tatum Guides" will be used in determining log grade.

For softwood sawtimber (20 class) trees grade first merchantable 16' log or shorter lengths down to 12' if a 16' log is not present. Use the grading rules in the "Tatum Guides" to assist in determining log grade.

Sawlog length should not extend above a large fork, excessive limbs or other defects or a section of the tree bole that does not meet minimum log grade specifications unless the tree has at least 8 feet of sawlog length above the limitation. Limitations or "stoppers" for hardwoods grades 1, 2, and 3 and for all softwoods are any limb or group of 2.0 inch or larger limbs within a one-foot span whose sum exceeds D.O.B. at that point. Limitations for grade 4 hardwoods include any limb or group of limbs within a one-foot span with a diameter or sum of diameters greater than 1/3 the stem D.O.B. of that section.

For 31 class trees grade the log that is present.

For 30 & 40 class trees record a dash " - " in the log grade column.

### Bole Length, Item 38.

Merchantable bole length of all growing-stock trees 5.0" DBH and larger should be determined between the top of a one-foot stump and 4.0" diameter outside bark, or the point on the bole above which no merchantable pulpwood section exists. Merchantable section refers to a section that meets pulpwood specifications.

Bole length stoppers are: 1. a limb with a diameter outside the knot collar greater than the stem diameter at that point, or 2. several limbs over 2 inches D.O.B. within a one-foot span with an aggregate diameter outside the knot collar greater than the stem D.O.B. of the section, or 3. any four-foot section of bole so crooked that a line drawn between the center of the ends falls outside the bark at any point.

In the case of 20 class sawlog size trees forking above DBH, bole length is taken on the same trunk as sawlog length.

In situations where limbs are a factor in determining merchantable length, measurement will be taken to the point where the limbs divide the diameter of the merchantable section.

Minimize limb limitations by logical log making aimed at obtaining maximum bole and sawlog lengths. For example, bucking between staggered limbs within a one-foot span that exceeds the bole D.O.B. at point of occurrence.

Record length to the last whole foot using a three-digit code. For example, a bole length of 23 feet would include lengths of 23.0 feet up to, but not including, 24.0 feet and would be coded 023.

Bole length of all cull trees 5.0" DBH and larger should be measured between the one-foot stump and the 4.0-inch diameter outside bark, ignoring all stoppers.

Note: NEVER ZERO OUT BOLE LENGTH EVEN IF NO MERCHANTABLE VOLUME IS PRESENT.

### Bole Length Top D.O.B., Item 39.

Using a 3-digit code record bole top D.O.B. to the last 0.1" for all trees with an entry under bole length except stumps. Bole length top D.O.B. is measured at the smallest point before the bole length terminates. If the bole length is taken to the bottom of a fork or the flare from a limb, the smallest diameter immediately below the swell is recorded.

#### Cubic-Foot Cull, Item 40.

For 20-class live and dead trees, cubic-foot cull is the cubic-foot volume of decayed or missing wood in merchantable sections and the total cubic-foot volume in sections that do not meet pulpwood specifications up to the growing stock top. A section meets pulpwood specifications unless:

1. It is less than 4 feet long.
2. It has a diameter less than 4 inches D.O.B.
3. It is a fork.
4. A limb has a knot collar greater than the stem diameter at that point, or several limbs over 2 inches D.O.B. within a one-foot span have an aggregate knot collar diameter greater than the stem D.O.B. of the section.
5. A four-foot section of bole is so crooked that a line drawn between the center of the ends falls outside the bark at any point.
6. A rotten section is unusable for industrial products. Regional standards are a four-foot section less than 50 percent sound.

For 31, 30 and 40 class live trees, or dead trees that were cull trees at time of death, record only the volume of decayed or missing wood up to the bole length top. Ignore all stoppers.

Cubic foot cull may be computed by determining the length of the section affected, and the midpoint D.O.B. The volume of the section can then be looked up in the "Tatum Guide", "Cubic Foot Volumes of Short Logs", item 57. Using a four-digit code, estimate and record cull to the last 1/10 cubic foot (0.1 cubic feet would be recorded as 0001).

#### Internal Defect, Item 41.

Internal defect includes the volume of decayed or missing wood in the bole length section of live trees 5.0" D.B.H. and larger. Based on a cubic foot measure, this is the percentage of unusable wood in relation to the total volume of the bole length section. When determining internal defect, cull out for rotten or missing wood only: do not cull out wood for form damage or more than the percentage of rotten wood in a given section.

Internal defect will be recorded as a code corresponding to the percentage of defect on all full measurement plots (sample kind 1 or 2). The following percentage classes will be used to record internal defect:

<u>CODE</u>	<u>PERCENTAGE DEFECT</u>
0	0
1	1 through 10
2	11 through 20
3	21 through 30
4	31 through 40
5	41 through 50
6	51 through 60
7	61 through 70
8	71 through 80
9	81+

### Site Index, Item 42:

Site index is the height attainable by the average dominant and codominant trees of one species in a stand at an index age (usually 50 years in the eastern states). It reflects the combined effects of different environmental factors, and is used as an indicator of stand productivity.

For Forest Survey, site index will be determined in the field using available site index curves appropriate for the area.

Site Tree Selection. On each site plot that site index entries are required, a minimum of three site index trees of one species will be measured. Site tree species selection will be based on availability of suitable site trees. It is not necessary that the tree species used for site index be of the plot forest type.

Generally site trees should be vigorous in growth and still putting on height. Avoid trees declining in vigor or stagnated. All site trees should have been dominant or codominant throughout their lives. Do not use trees that have been suppressed during early years and then released. These can be identified by increment cores which show growth rings close together in early years followed by a sudden and marked widening of growth rings. Avoid trees with major injuries. Finding vigorous, free growing trees is more important than finding the biggest trees in the stand. Site trees should be at least three inches in diameter and 15 feet tall for use with most site index curves. Site trees should be near the index age of the site index curves for that species. Look for trees that are 20 to 80 years old for curves based on an index age of 50 years.

Reliable site index curves are available for most tree species that are major components of forest types in the survey area. Crew members should be aware of what species have site index curves available. Do not collect site index data on a species unless curves are available.

Site trees should be well distributed over the plot area. If there are no suitable site trees on the plot, select nearby trees from the same general aspect, elevation, and soil type. Feel free to collect and record data on more than one species if it is needed to get a good site index estimate. Do not select permanent tally trees, "SP" trees or witness trees if possible. If these trees must be used, record point number and tree number on the line with site index data.

Growth Intercept Method. In the event suitable trees are not available for use with site index curves the growth intercept method of measuring site index may be an alternative. This method has been proposed and tables developed for some tree species that have limbs showing distinct annual whorls (ex. red pine and southern pines). This method is applied in situations where only young trees (less than 25 years old) of these species are available for site index indicators. Crew members should be familiar with what species have these tables available and how to use them.

For red pine:

<u>Height growth during last 5 years</u>	<u>Site Index (Estimated)</u>
4 feet	46
5 feet	50
6 feet	53
7 feet	57
8 feet	60
9 feet	63
10 feet	67
11 feet	70
12 feet	74

Site Tree Data. For all trees measured for site index information record a tree history code of 99, species, DBH, total height under bole length, total age under bole length top DOB, and the years added to age at D.B.H. under cull cubic feet. All site index information collected should be coded on the front of the plot sheet, not in the notes.

Minimum Stand Productivity. In order for a stand to be classified as productive commercial land, there must be at least one tree in the plot area that has a site index that meets the minimum site indices below.

<u>SPECIES</u>	<u>MINIMUM SITE INDEX</u>
N. white cedar	15
Black spruce	20
Tamarack	20
E. red cedar	25
All other species	35

Remember, the productive tree need not be the same species as the forest type.

Techniques of Site Index Data Collection. Careful measurement of tree diameter, height, and age are essential to get a good estimate of site index.

Tree DBH. See DBH section of the survey manual.

Tree Height should be taken to the nearest whole foot. Use the 30' height pole on trees that are 30' tall or less. On trees greater than 30' tall use your clinometer and tape. The distance you stand from the base of the tree should be approximately equal to the total tree height. Make a visual estimate of tree height before choosing the scale on the clinometer that you want to use. Choose a place to stand that gives you a clear view of both the top and base of the tree. Try to keep the sun at your back.

Tree Age is taken at DBH using an increment borer. Keep your increment borer clean and sharp to get clean, smooth cores. WD-40, sharpening stones and instructions are available in the office. Ring porous hardwood are generally easy to count. Growth rings of many softwood and diffuse porous hardwood can be difficult to see. To get an accurate count on these species it can help to moisten the core and hold it up to the light. If growth rings are very difficult to see, put the core in a plastic straw, label it, and bring it into the office or motel with you. Try soaking the core, shaving one side of it clean and holding it up to or under a strong light. Winter is a good time to use this method. Count growth rings more than once and have your partner count them to reach agreement on the tree age.

It is probably wise, especially in winter, to collect site index information as soon as you have located the plot. Site index trees can also be measured as you come across suitable individuals while doing the plot rather than waiting until the end.

Site Index-Record the highest value obtained for site index on the front of the plot sheet. (Record the site index value for the species actually bored).

Site Tree Species - Record a three digit code for the species of tree bored in determining site index.

## FIELD AND OFFICE PROCEDURES

### Basal Area Per Acre, Item 43.

Using a three-digit code record the basal area per acre for the plot. BA/Acre is determined by totaling all trees counted for basal area on all ten sample points, then multiplying the total number of trees counted by 3.75. Total BA/Acre may be determined directly from the "Basal Area Table" in the "Tatum Guides".

### Forest Type-Stand/Size Class, Item 44.

Forest type (first and second digit): Record the appropriate two digit code for forest type. Forest type is calculated based on plurality of stocking of all live commercial trees. Forest type is determined by following the flowchart on the state supplement sheet. If there is insufficient stocking, use your best judgment.

Following are the species included in corresponding cover types:

#### LAKE STATES TYPE SPECIES Michigan, Minnesota, Wisconsin

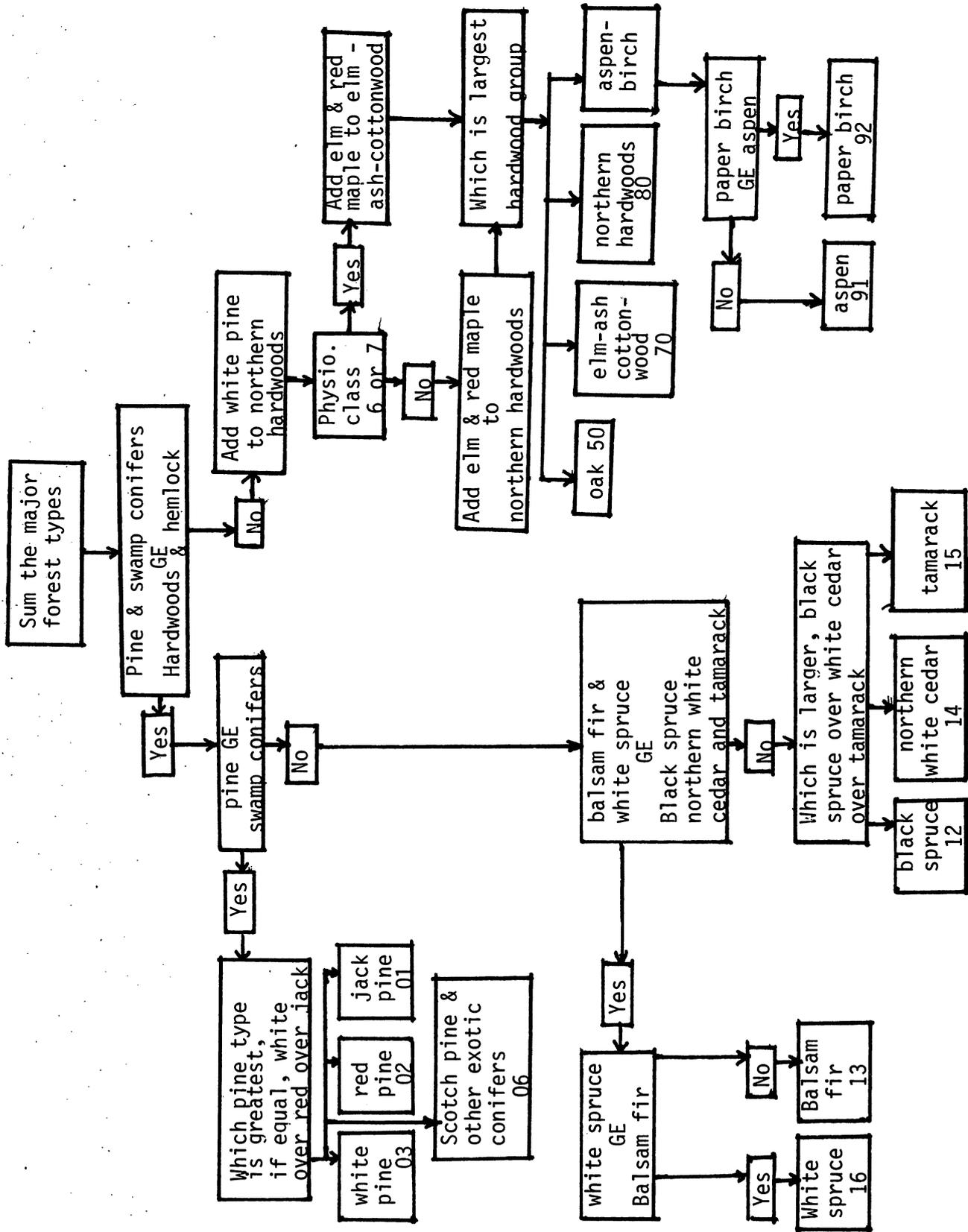
<u>Code</u>	<u>Forest Type</u>	<u>Code</u>	<u>Species</u>
01	JACK PINE	105	JACK PINE
02	RED PINE	125	RED PINE
03	WHITE PINE	129	WHITE PINE
06	SCOTCH PINE & OTHER EXOTIC CONIFERS		
13	BALSAM FIR	012	BALSAM FIR
16	WHITE SPRUCE	094	WHITE SPRUCE
12	BLACK SPRUCE	095	BLACK SPRUCE
14	NORTHERN WHITE-CEDAR	241	NORTHERN WHITE-CEDAR
15	TAMARACK	071	TAMARACK
50	OAK-HICKORY	068	EASTERN RED-CEDAR
		402	BITTERNUT HICKORY
		403	PIGNUT HICKORY
		405	SHELLBARK HICKORY
		407	SHAGBARK HICKORY
		409	MOCKERNUT HICKORY
		802	WHITE OAK
		804	SWAMP WHITE OAK
		806	SCARLET OAK
		809	NORTHERN PIN OAK
		823	BURR OAK

<u>Type</u>	<u>Code</u>	<u>Species</u>
	826	CHINKAPIN OAK
	830	PIN OAK
	832	CHESTNUT OAK
	833	NORTHERN RED OAK
	834	SHUMARD OAK
	837	BLACK OAK
	601	BUTTERNUT
	602	BLACK WALNUT
70 ELM-ASH COTTONWOOD	313	BOXELDER
	317	SILVER MAPLE
	373	RIVER BIRCH
	543	BLACK ASH
	462	HACKBERRY
	731	SYCAMORE
	742	COTTONWOOD
	922	BLACK WILLOW
80 MAPLE-BEECH-BIRCH (SUGAR MAPLE-BASSWOOD)	261	HEMLOCK
	314	BLACK MAPLE
	318	SUGAR MAPLE
	371	YELLOW BIRCH
	531	BEECH
	762	BLACK CHERRY
	951	BASSWOOD
91 ASPEN	541	WHITE ASH
	741	BALSAM POPLAR
	743	BIGTOOTH ASPEN
	746	QUAKING ASPEN
92 PAPER BIRCH	375	PAPER BIRCH
*RED MAPLE-ELM	316	RED MAPLE
	972	AMERICAN ELM
	975	SLIPPERY ELM
	977	ROCK ELM
	544	GREEN ASH

Note: Not all species are expected in every state.

\*In determining forest type the stocking in the Red maple-elm group is added to 80 Maple-Beech-Birch, if physio class is 5 or less, and to 70 Elm-ash-cottonwood if physio class is 6 or greater.

EXHIBIT 44



### Stand-Size Class (Third Digit):

Normally this item will be computed in the office. If ten or less trees are recorded, enter the estimated size class. Use stocking percents of growing-stock trees only to calculate stand-size class. Separate and total the stocking percents of all growing-stock trees into one of three categories: seedling-sapling, poletimber, and sawtimber. Combine the poletimber and sawtimber and compare it to the seedling-sapling total. If the seedling-sapling total is higher record code "3", if poletimber-sawtimber is higher, whichever one is greater will receive the stand size class. When ties occur poletimber-sawtimber is favored over seedling-sapling and sawtimber is favored over poletimber. A plot that has less than 16.7 percent in growing-stock trees will be recorded as nonstocked. Record stand size class using the following codes:

<u>Code</u>	<u>Stand-size Class</u>
1	Sawtimber stands
2	Poletimber stands
3	Sapling and seedling stands
4	Nonstocked stands

### Stand Age, Item 45.

Determine the age of the predominant stand size class from three or more borings of trees on or near the plot. If there is an insufficient number of acceptable trees to determine stand age record an estimate. Stand age will be recorded as a 3 digit code to the nearest year. For example, if the stand age is 49 years, stand age is 049.

### Stand Area, Item 46.

The size of the forest type stand-size density condition that the plot falls in will be determined by the photo interpreter in St. Paul and recorded on the plot sheet in acres.

Distance to Water, Item 47.

Photo interpreters will record from PC, and field crews should check, the straight line distance to the nearest type of water, the actual size, and the actual distance from the plot.

Code Type of Water (one Digit):

- 1 Streams and Flowages
- 2 Lakes
- 3 Swamps
- 4 Farm ponds

AREA (Three Digits):

Area is measured in width for streams and flowages in feet. (000 to 999 feet)  $\pm$  33 feet

Area is measured in acres for lakes, swamps and farm ponds. (000 to 999 acres)  $\pm$  5 acres

DISTANCE (Four Digits):

The distance to the body of water measured to the nearest  $\frac{1}{2}$  chain. (0000 to 999.5 chains)

Distance to Road, Item 48.

Photo interpreters will record and field crews should check the straight line distance from PC to the nearest road, using the following codes for type and distance:

Code Type of Road (One Digit):

TYPE (One Digit):

- 1 Paved - 4 lane
- 2 Paved - 2 lane
- 3 Improved - gravel

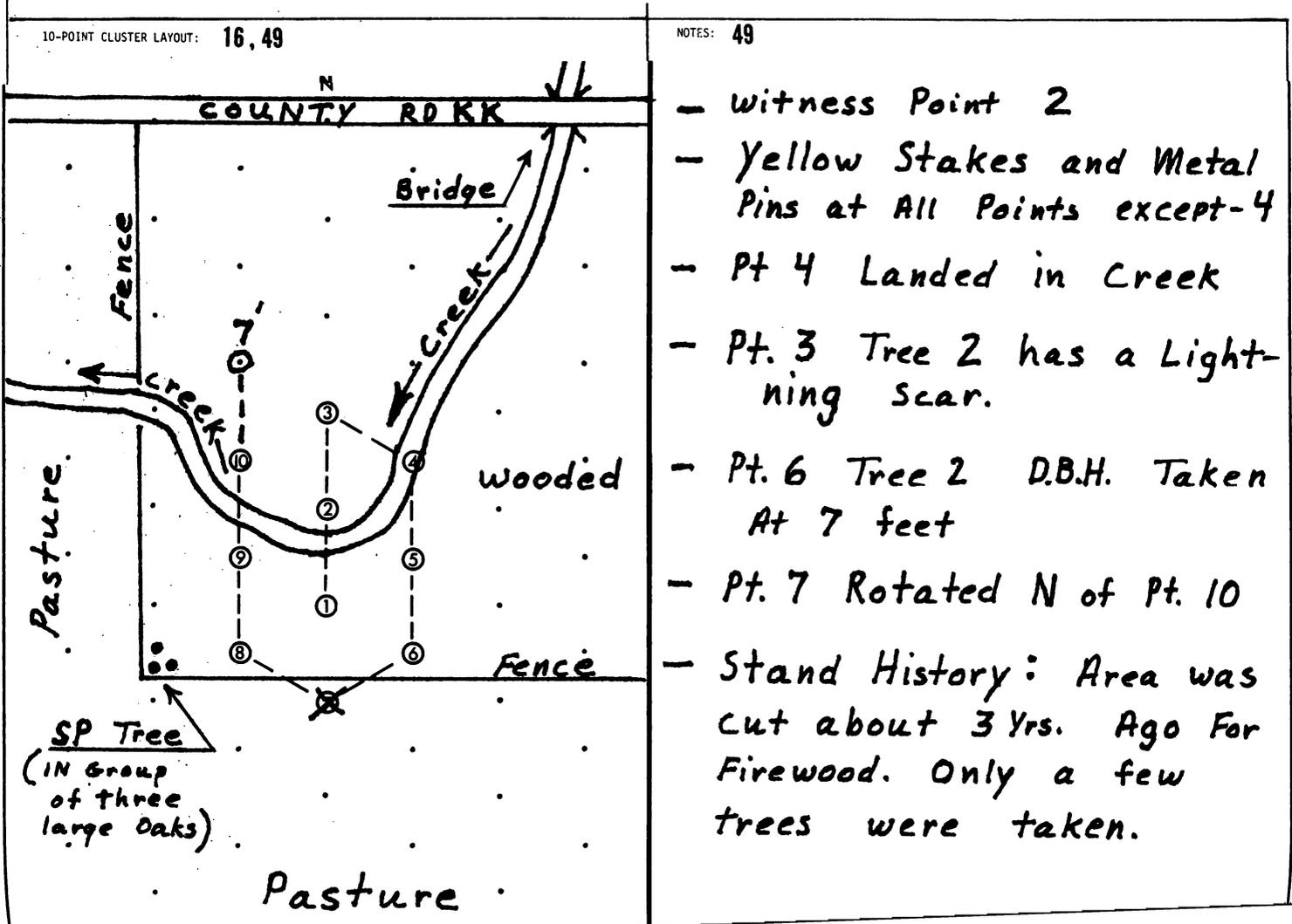
DISTANCE (Four Digits):

The distance to road will be measured in chains to the nearest  $\frac{1}{2}$  chain. (0000 to 999.5 chains)

Sketch and Notes 49

Items on the back of the forest inventory sample record provide information on the location of the field sample, the layout of the 10-point cluster and description of any disturbances within the area. This information will be used primarily in reestablishing the plot on future remeasurements. It should be recorded in legible and understandable terms. Any physical features that will assist in accurately relocating the plot should be drawn onto the 10-point cluster layout. This would include changes in timber type, old logging roads, forest and nonforest boundaries, streams, drainages, particular disturbances, etc. Clarification of any particular procedure or situations encountered on the plot will be explained in the notes so that remeasurement crews can take them into consideration.

EXHIBIT 49



PI LAND USE, Item 50.

This is a two-digit land-use code as estimated by photo interpretation, using the following codes:

WISCONSIN PI CODES

<u>PI CODE</u>	<u>DESCRIPTION</u>
11	Very good sawtimber (super class)
12	Good sawtimber
13	Medium-poor sawtimber
14	Very good poletimber (super class)
15	Good poletimber
16	Medium-poor poletimber
17	Good seedling-saplings
18	Medium-poor seedling-saplings
21	Plantation Very good sawtimber (super class)
22	Plantation Good sawtimber
23	Plantation Medium-poor sawtimber
24	Plantation Very good poletimber (super class)
25	Plantation Good poletimber
26	Plantation Medium-poor poletimber
27	Plantation Good seedling-saplings
28	Plantation Medium-poor seedling-saplings
30	Questionable Forest
40	Unproductive forest land (not reserved)
41	Unproductive forest land (reserved)
45	Forest land (reserved)
47	Forest land (urban and other)
50	Non-forest with trees
51	Non-forest with trees (urban and other)
60	Non-forest without trees
61	Non-forest without trees (reserved)
62	Non-forest without trees (urban and other)
70	National Grasslands
80	Noncensus water
90	Census water

State, Item 51.

Record the appropriate two-digit code from the list of standard codes.

State Code for Wisconsin is 55

Unit, Item 52.

Record appropriate one-digit code from code list of survey units.

Unit Codes

- Unit 1 - Northeastern Unit
- Unit 2 - Northwestern Unit
- Unit 3 - Central Unit
- Unit 4 - Southwestern Unit
- Unit 5 - Southeastern Unit

County, Item 53.

Record the appropriate two-digit code from code list of counties.

County Codes

Unit 1 - Northeastern Unit

- 01 Florence
- 02 Forest
- 03 Langlade
- 04 Lincoln
- 05 Menominee
- 06 Marinette
- 07 Oconto
- 08 Oneida
- 09 Shawano
- 10 Vilas

Unit 2 - Northwestern Unit

- 01 Ashland
- 02 Barron
- 03 Bayfield
- 04 Burnett
- 05 Douglas
- 06 Iron
- 07 Polk
- 08 Price
- 09 Rusk
- 10 Sawyer
- 11 Taylor
- 12 Washburn

Unit 3 - Central Unit

- 01 Adams
- 02 Chippewa
- 03 Clark
- 04 Eau Claire
- 05 Jackson
- 06 Juneau
- 07 Marathon
- 08 Marquette
- 09 Monroe
- 10 Portage
- 11 Waupaca
- 12 Waushara
- 13 Wood

Unit 4 - Southwestern Unit

- 01 Buffalo
- 02 Crawford
- 03 Dunn
- 04 Grant
- 05 Iowa
- 06 La Crosse
- 07 Lafayette
- 08 Pepin
- 09 Pierce
- 10 Richland
- 11 St. Croix
- 12 Sauk
- 13 Trempealeau
- 14 Vernon

Unit 5 - Southeastern Unit

- 01 Brown
- 02 Calumet
- 03 Columbia
- 04 Dane
- 05 Dodge
- 06 Door
- 07 Fond du Lac
- 08 Green
- 09 Green Lake
- 10 Jefferson
- 11 Kenosha
- 12 Kewaunee
- 13 Manitowoc
- 14 Milwaukee
- 15 Outagamie
- 16 Ozaukee
- 17 Racine
- 18 Rock
- 19 Sheboygan
- 20 Walworth
- 21 Washington
- 22 Waukesha
- 23 Winnebago

National Forest, Item 54.

When a sample plot falls on National Forest lands, record a 2-digit code for this item. Zero out this item for sample locations on other lands.

National Forest Codes for Wisconsin

Chequamegon National Forest = 02  
Nicolet National Forest = 06

National Forest Ranger District, Item 55.

For sample plots falling on National Forest Lands, record the appropriate 2-digit code for the ranger district:

National Forest Ranger District Codes

Chequamegon Ranger Districts:

Park Falls	01
Glidden	02
Medford	03
Hayward	04
Washburn	05

Nicolet Ranger Districts:

Three Lakes	01
Eagle River	02
Florence	03
Lakewood	04
Laona	05

Zero out this item for sample locations on other lands.

## Definition of Terms, Item 56.

Terms used in this handbook are defined below.

1. Acceptable Trees. Growing-stock trees of commercial species that meet specified standards of size and quality.
2. Bureau of Land Management Lands. Federal land administered by the Bureau of Land Management.
3. Clear Panel. A section of hardwood tree surface one-fourth the circumference of the tree and at least 2 feet long free of limbs, knots, bumps and other indications of defect which preclude clear cuttings.
4. Commercial Forest Land. Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)
5. Commercial Species. Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hawthorn and sumac).
6. Cull. Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.
7. Crown Class. A classification of trees based on dominance in relation to adjacent trees in the stand as indicated by crown development and amount of light received from above and the sides. Crown classes recognized by the Forest Survey include:
  - a. Open Crown. Trees with crowns which have received full light from above and from all sides throughout all or most of the life of the trees, particularly during early development.
  - b. Dominant Trees. Trees with well-developed crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides.
  - c. Codominant Trees. Trees with crowns forming the general level of the crown cover and receiving full light from above, but comparatively little from the sides; usually with medium-sized crowns more or less crowded on the sides.

- d. Intermediate Trees. Trees with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.
  - e. Overtopped Trees. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.
8. Diameter Classes. A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). (Note: DBH is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches DBH inclusive).
  9. Face. A section of the tree surface one-fourth the circumference of the tree extending the full length of the log.
  10. Farm. Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals \$50 or more annually or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least \$250. Places having less than the \$50 or \$250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce products in sufficient quantity to meet the requirements of the definition.
  11. Farm Operator. A person who operates a farm, either doing the work himself or directly supervising the work.
  12. Farmer-Owned Lands. Lands owned by farm operators. (Note: These exclude land leased by farm operators from nonfarm owners, such as railroad companies and states.)
  13. Farmer-Owned Leased. Lands owned by farm operators, but leased to forest industry.
  14. Forest Industry Lands. Lands owned by companies or individuals operating wood-using plants.
  15. Forest Lands. Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is 1 acre.

Roadside, streamside, and shelterbelt strips of timber must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet in width.) Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

16. Forest Trees. Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.
17. Forest Types. A classification of forest land based upon the species forming a plurality of live "tree stocking". (Note: Types shall be determined on the basis of species plurality of all live commercial trees that contribute to stocking; that is, up to maximum of 16 percent of each plot point.)
18. Growing-stock Trees. Live trees of commercial species qualifying as acceptable trees. (Note: Excludes rough, rotten, and dead trees.)
19. Growing-stock Volume. Net volume in cubic feet of growing stock trees 5.0 inches D.B.H. and over from a 1-foot stump to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem no longer meets pulpwood specifications.
20. Hardwoods. Dicotyledonous trees, usually broad-leaved and deciduous.
21. Idle Farmland. Includes former croplands, orchards, improved pastures and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.
22. Improved Pasture. Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.
23. Indian Lands. Tribal lands held in fee but administered by the Federal government.
24. Land Area
  - a. Bureau of the Census. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs estuaries, and canals less than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area.

b. Forest Survey. The same as the Bureau of Census, except minimum width of streams, etc is 120 feet and minimum size of lakes, etc is 1 acre.

25. Limb. That part of the tree above the stump which does not meet the requirement for sawlogs and upper-stem portions, including all live, sound branches to a minimum of 4 inches D.O.B
26. Log Grades. A classification of logs based on external characteristics as indicators of quality or value.
27. Logging Residues. The unused portions of trees cut or killed by logging.
28. Maintained Road. Any road, hard topped or other surfaces, that is plowed or graded at least once a year. Right of ways that are cut or treated to limit herbaceous growth are included in this area.
29. Merchantable. Refers to a pulpwood or sawlog section that meets pulpwood or sawlog specifications, respectively.
30. Miscellaneous Federal Lands. Federal lands other than National Forest, lands administered by the Bureau of Land Management, and Indian lands.
31. Miscellaneous Private Lands. Privately owned lands other than forest-industry and farmer-owned lands.
32. Mortality. Standing or down dead trees that have died within the last three years.
33. National Forest Land. Federal lands which have been legally designated as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead Jones Title III lands.
34. Net Volume. Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.
35. Noncommercial Forest Land. (a) Unproductive forest land incapable of yielding crops of industrial wood, because of adverse site conditions and (b) productive-reserved forest land.

36. Noncommercial Species. Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.
37. Nonforest Land. Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1-to-40 acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and more than 1 acre in size, to qualify as nonforest land.)
38. Nonstockable. Areas of forest land not capable of supporting seedlings of commercial species, because of the presence of rock, water, etc.
39. Nonstocked Land. Commercial forest land less than 16.7 percent stocked with growing-stock trees.
40. Other Federal Lands. Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal Agencies.
41. Overgrown Knot. The scar left in the bark by a limb completely overgrown, but still outlined by the circular configuration in the bark.
42. Overstocked Areas. Areas where growth of trees is significantly reduced by excessive numbers of trees. (Note: Stands will be considered overstocked if stocking is 133 percent or more, when 100 percent represents the minimum level of stocking required to make full use of the site.)
43. Ownership. Property owned by one owner, regardless of the number of parcels in a specified area.
44. Poletimber Stands. (See stand-size class.)
45. Poletimber Trees. Growing-stock trees of commercial species at least 5.0 inches in DBH, but smaller than sawtimber size.

46. Productive-Reserved Forest Land. Forest land sufficiently productive to qualify as commercial forest land, but with drawn from timber utilization through statute, administration, designation, or exclusive use for Christmas-tree production as indicated by annual shearing.
47. Prospectively. As used in this manual it refers to the moment a tree will reach sawtimber size at DBH.
48. Rangeland. Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.
49. Primitive Roads. Roads that are not maintained and are primarily used by vehicles not intended for highway use (i.e. old logging roads).
50. Rotten Trees. Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.
51. Rough Trees. (a) Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.
52. Roundwood Products. Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes sawlogs, veneer logs and bolts; cooper-age logs and bolts; pulpwood, fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

46. Productive-Reserved Forest Land. Forest land sufficiently productive to qualify as commercial forest land, but with drawn from timber utilization through statute, administration, designation, or exclusive use for Christmas-tree production as indicated by annual shearing.
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53. Salvable-mortality Trees. Standing or down dead trees that are considered merchantable by Regional standards and have died within the last 3-years.
54. Saplings. Live trees 1.0 inch to 5.0 inches in diameter at breast height.
55. Sapling-Seedling Stands. (See stand-size class.)
56. Sawlog. A log meeting minimum standards of diameter, length and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.
57. Sawlog Portion. That part of the bole of sawtimber trees between the stump and the sawlog top, being a 9.0 DOB for hardwoods and a 7.0 DOB for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)
58. Sawlog Top. The point on the bole of sawtimber trees above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches DOB for softwoods and 9.0 inches DOB for hard woods.
59. Sawtimber Stands. (See stand-size class.)
60. Sawtimber Trees. Live trees of commercial species containing at least a 12-foot sawlog or two sawlogs 8 feet or longer, and meeting Regional specifications for freedom from defect. Soft woods must be at least 9.0 inches in diameter breast height. Hardwoods must be at least 11.0 inches in diameter.
61. Sawtimber Volume. Net volume of the sawlog portion of live sawtimber in board feet International 1/4-inch rule.
62. Seedlings. Live trees less than 1.0 inch in diameter at breast height that are expected to survive.
63. Site Classes. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.
64. Softwoods. Coniferous trees, usually evergreen having needles or scale-like leaves.
65. Sound Knot or Limb. Knots or limbs intergrown or encased with the surrounding wood and with no indication of decay. Bark may not be present on the limbs.

46. Productive-Reserved Forest Land. Forest land sufficiently productive to qualify as commercial forest land, but with drawn from timber utilization through statute, administration, designation, or exclusive use for Christmas-tree production as indicated by annual shearing.
47. Prospectively. As used in this manual it refers to the moment a tree will reach sawtimber size at DBH.
48. Rangeland. Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.
49. Primitive Roads. Roads that are not maintained and are primarily used by vehicles not intended for highway use (i.e. old logging roads).
50. Rotten Trees. Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.
51. Rough Trees. (a) Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.
52. Roundwood Products. Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes sawlogs, veneer logs and bolts; cooper-age logs and bolts; pulpwood, fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

53. Salvable-mortality Trees. Standing or down dead trees that are considered merchantable by Regional standards and have died within the last 3-years.
54. Saplings. Live trees 1.0 inch to 5.0 inches in diameter at breast height.
55. Sapling-Seedling Stands. (See stand-size class.)
56. Sawlog. A log meeting minimum standards of diameter, length and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.
57. Sawlog Portion. That part of the bole of sawtimber trees between the stump and the sawlog top, being a 9.0 DOB for hardwoods and a 7.0 DOB for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)
58. Sawlog Top. The point on the bole of sawtimber trees above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches DOB for softwoods and 9.0 inches DOB for hard woods.
59. Sawtimber Stands. (See stand-size class.)
60. Sawtimber Trees. Live trees of commercial species containing at least a 12-foot sawlog or two sawlogs 8 feet or longer, and meeting Regional specifications for freedom from defect. Soft woods must be at least 9.0 inches in diameter breast height. Hardwoods must be at least 11.0 inches in diameter.
61. Sawtimber Volume. Net volume of the sawlog portion of live sawtimber in board feet International 1/4-inch rule.
62. Seedlings. Live trees less than 1.0 inch in diameter at breast height that are expected to survive.
63. Site Classes. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.
64. Softwoods. Coniferous trees, usually evergreen having needles or scale-like leaves.
65. Sound Knot or Limb. Knots or limbs intergrown or encased with the surrounding wood and with no indication of decay. Bark may not be present on the limbs.

66. Stand-Size Class. A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point will be considered in determining stand-size class.)
- a. Sawtimber Stands. Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.
  - b. Poletimber Stands. Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.
  - c. Sapling-Seedling Stands. Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.
67. State, County, and Municipal Lands. Lands owned by states, counties, and local public agencies, or municipalities, or lands leased to these governmental units for 50 years or more.
68. Stocking. The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard. (Note: Also see stocking explanation in section 21.5 of Forest Survey Handbook.)
69. Timber Products. Roundwood products and plant byproducts. (Note: Timber products output includes roundwood products cut from growing stock on commercial forest land; from other sources, such as cull trees, salvable dead trees, limbs, and saplings; from trees on noncommercial and nonforest lands, and from plant byproducts.)
70. Tree Size Class. A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.
71. Unproductive Forest Land. Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation steepness, and rockiness.)

Upper Stem Portion. That part of the bole of sawtimber trees above the sawlog top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Urban Forest Land - Locationally Reserved. Land that would otherwise meet the criteria for commercial forest land, but is in an urban-suburban area surrounded by commercial, industrial or residential development.

Urban and Other Areas. Areas within the legal boundaries of cities, and towns suburban areas developed for residential, industrial, or recreational purposes; schoolyards, cemeteries, pads; railroads; airports; beaches; powerlines; and other right-of-way; or other nonforest land not included in any other specified land use class.

ter

- ) Bureau of the Census. Streams, sloughs, estuaries, and canals more than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds more than 40 acres in area.
- | Forest Survey. The same as the Bureau of the Census, except minimum of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.



# Tatum Guides, continued

FOREST SURVEY TATUM GUIDE  
North Central Forest Experiment Station -- April 1981

PLOT TALLY  
(Plot Measurements) AD

## 4 GROUND LAND USE

CODE	FOREST LAND
20	Commercial
21	Pastured commercial
22	Plantation
40	Unproductive forest land
41	Reserved forest land-Unproductive
45	Reserved forest land-Productive
46	Christmas tree plantation
<b>NONFOREST WITH TREES</b>	
51	Cropland with trees
52	Improved pasture w/ trees
53	Wooded strip (Natural)
54	Idle farmland with trees
55	Marsh with trees
56	Windbreak (less than 120')
57	Windbreak (greater than 120')
58	Shelterbelt
59	Wooded pasture
71	Urban forest land-Locationally reserved
72	Urban and other with trees
<b>NONFOREST WITHOUT TREES</b>	
61	Cropland
62	Improved pasture
64	Idle farmland
65	Marsh
66	Other farmland
67	Urban and other
68	Rights-of-way
69	Nonforest-reserved
80	Noncensus water
90	Census water

43 BASAL AREA PER ACRE (SQUARE FEET PER ACRE)

B.A. = # of trees x 3.75 (37.5-factor prism)

# Trees	B.A.	# Trees	B.A.	#Trees	B.A.
01	004	21	079	41	154
02	008	22	082	42	158
03	011	23	086	43	161
04	015	24	090	44	165
05	019	25	094	45	169
06	023	26	098	46	172
07	026	27	101	47	176
08	030	28	105	48	180
09	034	29	109	49	184
10	038	30	112	50	188
11	041	31	116	51	191
12	045	32	120	52	195
13	049	33	124	53	199
14	052	34	128	54	202
15	056	35	131	55	206
16	060	36	135	56	210
17	064	37	139	57	214
18	068	38	142	58	218
19	071	39	146	59	221
20	075	40	150	60	225

## 44 FOREST TYPE-SIZE CLASS

FOREST TYPE (TWO DIGITS):  
Record from Flow chart

SIZE CLASS (ONE DIGIT):

CODE

- 1 SAWTIMBER STAND
- 2 POLETIMBER STAND
- 3 SAPLING-SEEDLING STAND
- 4 NONSTOCKED STAND

## 5 USE TREND

First two digits:	Third digit:	10	.3	.5
Commercial forest on both occasions:	0 No change	15	.7	1.1
10 No change	1 Definition	20	1.3	2.0
01 Forest type change	2 Legislation	25	2.0	3.0
02 Stand-size change	3 Natural	30	2.9	4.4
03 Forest type and size change	4 Herbicide	35	3.9	5.9
All other situations:	5 Clearing--not used	40	5.1	7.6
First digit = present class	6 Clearcut--used	45	6.4	9.6
Second digit = previous class	7 Partial cut	50	7.8	11.7
1 Commercial forest	8 Planting	55	9.3	14.0
2 Productive reserved forest	9 Other--man	60	11.0	16.5
3 Unproductive forest		70	14.6	21.9
4 Cropland		80	18.5	27.8
5 Pasture		90	22.8	34.2
6 Idle farmland		100	27.3	41.0
7 Wooded pasture				
8 Urban, recreation, wooded strips, rights-of-ways and others				
9 Water and marsh				

## SLOPE CORRECTION TABLE

Distance is measured on slope.

Percent	66'	70'	99'
10	.3	.3	.5
15	.7	.8	1.1
20	1.3	1.4	2.0
25	2.0	2.2	3.0
30	2.9	3.1	4.4
35	3.9	4.2	5.9
40	5.1	5.4	7.6
45	6.4	6.8	9.6
50	7.8	8.3	11.7
55	9.3	9.9	14.0
60	11.0	11.6	16.5
70	14.6	15.5	21.9
80	18.5	19.7	27.8
90	22.8	24.2	34.2
100	27.3	29.0	41.0

## CONVERSION TABLE

CHAINS TO FEET

1/6 ch = 11.0'
1/4 ch = 16.5'
1/3 ch = 22.0'
1/2 ch = 33.0'
2/3 ch = 44.0'
3/4 ch = 49.5'
5/6 ch = 55.0'
1 ch = 66.0'
1 1/6 ch = 77.0'
1 1/4 ch = 82.5'
1 1/3 ch = 88.0'
1 1/2 ch = 99.0'

## 45 STAND AGE

Record actual age

## LIMITING DISTANCES FOR B.A.F. 37.5 PRISM

(1.421 feet per inch DBH)

DBH (inches)	Tenths of inches									DBH (inches)	
	0	1	2	3	4	5	6	7	8		9
1	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.6	2.7	1
2	2.8	3.0	3.1	3.3	3.4	3.6	3.7	3.8	4.0	4.1	2
3	4.3	4.4	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.5	3
4	5.7	5.8	6.0	6.1	6.2	6.4	6.5	6.7	6.8	7.0	4
5	7.1	7.2	7.4	7.5	7.7	7.8	8.0	8.1	8.2	8.4	5
6	8.5	8.7	8.8	9.0	9.1	9.2	9.4	9.5	9.7	9.8	6
7	9.9	10.1	10.2	10.4	10.5	10.7	10.8	10.9	11.1	11.2	7
8	11.4	11.5	11.7	11.8	11.9	12.1	12.2	12.4	12.5	12.6	8
9	12.8	12.9	13.1	13.2	13.4	13.5	13.6	13.8	13.9	14.1	9
10	14.2	14.4	14.5	14.6	14.8	14.9	15.1	15.2	15.3	15.5	10
11	15.6	15.8	15.9	16.1	16.2	16.3	16.5	16.6	16.8	16.9	11
12	17.1	17.2	17.3	17.5	17.6	17.8	17.9	18.0	18.2	18.3	12
13	18.5	18.6	18.8	18.9	19.0	19.2	19.3	19.5	19.6	19.8	13
14	19.9	20.0	20.2	20.3	20.5	20.6	20.7	20.9	21.0	21.2	14
15	21.3	21.5	21.6	21.7	21.9	22.0	22.2	22.3	22.5	22.6	15
16	22.7	22.9	23.0	23.2	23.3	23.4	23.6	23.7	23.9	24.0	16
17	24.2	24.3	24.5	24.6	24.7	24.9	25.0	25.2	25.3	25.4	17
18	25.6	25.7	25.9	26.0	26.1	26.3	26.4	26.6	26.7	26.9	18
19	27.0	27.1	27.3	27.4	27.6	27.7	27.9	28.0	28.1	28.3	19
20	28.4	28.6	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	20
21	29.8	30.0	30.1	30.3	30.4	30.6	30.7	30.8	31.0	31.1	21
22	31.3	31.4	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.5	22
23	32.7	32.8	33.0	33.1	33.3	33.4	33.5	33.7	33.8	34.0	23
24	34.1	34.2	34.4	34.5	34.7	34.8	35.0	35.1	35.2	35.4	24
25	35.5	35.7	35.8	36.0	36.1	36.2	36.4	36.5	36.7	36.8	25
26	36.9	37.1	37.2	37.4	37.5	37.7	37.8	37.9	38.1	38.2	26
27	38.4	38.5	38.7	38.8	38.9	39.1	39.2	39.4	39.5	39.6	27
28	39.8	39.9	40.1	40.2	40.4	40.5	40.6	40.8	40.9	41.1	28
29	41.2	41.4	41.5	41.6	41.8	41.9	42.1	42.2	42.3	42.5	29
30	42.6	42.8	42.9	43.1	43.2	43.3	43.5	43.6	43.8	43.9	30

## 6 ASPECT-POSITION-SLOPE

ASPECT (THREE DIGITS):	POSITION (ONE DIGIT):
Record actual azimuth	1 ch = 66.0'
1/6 ch = 11.0'	1 1/6 ch = 77.0'
1/4 ch = 16.5'	1 1/4 ch = 82.5'
1/3 ch = 22.0'	1 1/3 ch = 88.0'
1/2 ch = 33.0'	1 1/2 ch = 99.0'
2/3 ch = 44.0'	
3/4 ch = 49.5'	
5/6 ch = 55.0'	
1 ch = 66.0'	
1 1/6 ch = 77.0'	
1 1/4 ch = 82.5'	
1 1/3 ch = 88.0'	
1 1/2 ch = 99.0'	

SLOPE (TWO DIGITS):  
Record slope percent (%)

## 7 PHYSIOGRAPHIC CLASS

- 3 Xeric sites Very dry droughty sites where excessive drainage seriously limits both growth and species occurrence. Example--Jack pine plains.
- 4 Xeromesic sites Moderately dry sites where excessive drainage limits growth and species occurrence to some extent. These include the red pine-jack pine associations on sandy and gravelly soils.
- 5 Mesic sites Soil-water relationships favorable to tree growth, with growth and species occurrence limited only by climate. These are the deep, well drained soils, usually well suited to agriculture.
- 6 Hydromesic sites Poor drainage or frequent flooding limits species occurrence. These include the better drained bottomland hardwood sites and the hardpan soils of a coniferous forest.
- 7 Hydric sites Growth and species occurrence seriously limited by excess water. These are the frequently flooded river bottoms and spruce bogs.

## 8 STAND ORIGIN

- 1 Natural stand with no evidence of artificial regeneration.
  - 2 More than 40 percent of the sample location occupied by trees originating from artificial planting or seeding.
  - 3 Less than 40 percent of the sample location estimated to be occupied by trees originating from artificial planting or seeding.
- Explain if other than "1"

## 9 STAND HISTORY

- | First digit:                             | Second digit:    |
|--|------------------|
| 1 No disturbance                         | 0 No disturbance |
| 2 TSI                                    | 1 1-4 years      |
| 3 Clearcut                               | 2 5-10 years     |
| 4 Partial harvest cut                    | 3 11-15 years    |
| 5 Natural--fire, bugs, disease           | 4 15-20 years    |
| 6 Man-caused--drainage, spray            |                  |
| 7 Planting of forest land                |                  |
| 8 Planting of nonforest land             |                  |
| 9 Natural regeneration of nonforest land |                  |
- Explain if other than "10"

## 10 SEED SOURCE

- | CODE                               |
|------------------------------------|
| 1 Adequate softwoods               |
| 2 Adequate hardwoods               |
| 3 Adequate softwoods and hardwoods |
| 4 Inadequate all species           |

## 11 CONIFER UNDERSTORY

- | CODE (FIRST DIGIT):        |
|----------------------------|
| 1 None or inadequate       |
| 2 Planted--should succeed  |
| 3 Planted--needs treatment |
| 4 Natural--should succeed  |
| 5 Natural--needs treatment |

CODE (2nd, 3rd, 4th DIGITS):  
Record prevalent species

## 14 RECREATIONAL OPPORTUNITIES

First Digit:

- 1 Primitive
- 2 Semi-primitive nonmotorized
- 3 Semi-primitive motorized
- 4 Roaded natural
- 5 Rural
- 6 Urban

Third Digit:

- 0 None
- 1 Locked gate
- 2 Keep out
- 3 No trespassing
- 4 No hunting
- 5 No fishing
- 6 No dumping
- 7 Other signs
- 8 Owner contact
- 9 Other evidence

# Tatum Guides, continued

FOREST SURVEY TATUM  
North Central Forest Experiment Station--April 1981  
Hardwood and Softwood Log Grades

## GRADE 1 HARDWOOD LOGS

Minimum log length	Minimum clear length	Possible combinations of clear cuttings <sup>1/</sup>		
		13"-15" d.i.b. <sup>2/</sup> (butt logs only)	16"-19" d.i.b.	20"+ d.i.b.
10	8.3	8 - 0	8 - 0	8 - 0 5 - 3 4 - 4
12	10.0	10 - 0	10 - 0 5 - 5	10 - 0 7 - 3 6 - 4 5 - 5

<sup>1/</sup> Any number in a combination may be increased but not decreased.  
<sup>2/</sup> Ash and basswood Grade 1 butt logs may be 12" d.i.b.

## GRADE 2 HARDWOOD LOGS

Minimum log length	Minimum clear length	Possible combinations of clear cuttings <sup>1/</sup>			
		11" d.i.b. Cutting combinations	12" d.i.b. Cutting combinations	Feet	
8	-	-	-	6.0	6 - 0 3 - 3
10	8.3	8 - 0	6.7	7 - 0	4 - 3
12	10.0	10 - 0	8.0	8 - 0	5 - 3 4 - 4 3 - 3 - 3

<sup>1/</sup> Any number in a combination may be increased but not decreased.

## GRADE 3 HARDWOOD LOGS

Minimum log length	Minimum clear length	Minimum d.i.b.	Possible combinations of clear cuttings <sup>1/</sup>
feet	feet	inches	feet
8	4	8	4 - 0 2 - 2
10	5	8	5 - 0 3 - 2 2 - 2 - 2
12	6	8	6 - 0 4 - 2 3 - 3 2 - 2 - 2

<sup>1/</sup> Any number in a combination may be increased but not decreased.

## GRADE 4 HARDWOOD LOGS

Position in tree	Butt and upper
D.I.B., small end, inches	8"+
Length without trim, feet	8"+
Clear cuttings	No requirements, not graded on cutting basis.
Sweep allowance, maximum	½ d.i.b. of small end for half logs and ¼ d.i.b. for logs 16' long.
Sound surface defects permitted:	
Single knots	Any number, none to have a knot collar diameter in excess of 1/3 of the log diameter at point of occurrence.
Whorled knots	Any number provided the sum of the collar diameter does not exceed 1/3 of the log diameter at point of occurrence.
Holes	Any number not exceeding knot specifications if they do not extend over 3" into contained tie or timber.
Unsound defects permitted:	
Surface	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie or timber they shall not exceed size, number, and depth or limits of sound knots.
Interior	None permitted except one shake not more than 1/3 the width of contained tie or timber and one split not over 5" long.

## LOG GRADES FOR SOFTWOOD LOGS

### Grade 1

- Logs must be 16" or larger, 10' or longer, and with deduction for defect not over 30 percent of gross scale.
- Logs must be at least 75 percent clear on each of three faces.
- All knots outside clear cutting must be sound and not over 2½" in size.

### Grade 2

- Logs must be 12" or larger, 10' or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.
- Logs must be at least 50 percent clear on each of three faces or 75 percent clear on two faces.

### Grade 3

- Logs must be 6" or larger, 8' or longer, and with a net scale after deduction for defect of at least 50 percent of the gross contents of the log.

Note: A) Diameters are d.i.b. at small end of log.  
B) Percent clear refers to percent clear in one continuous section.

## TRIAL LOG GRADES FOR EASTERN WHITE PINE

Log grade	Minimum size diameter inches	Minimum length <sup>1/</sup> feet	Sweep or crook allowance percent	Total cull allowance including sweep percent	Maximum weevil injury number	Allowable knot size (inches) <sup>2/</sup> on 3 best faces or minimum clearness on 4 faces inches
1	12 & 13	8-16	20	50	0	4 faces clear full length
	14+	10-16	20	50	0	2 faces clear full length, or 4 faces clear 50% length (6' min. length) or 3/
2	6+	8-16	30	50	0	Sound knots 1.e. 4/ D/6 and less than 3 5/8 Unsound knots: 1.e. 1 1/4" and for: butt, lots 1.e. D/12 upper logs 1.e. D/10 or 4 faces clear 50% of length
3	6+	8-16	40	50	8' logs 1 weevil 10'+ logs: 2 weevils	Sound knots 1.e. D/3 and less than 5" Unsound knots 1.e. D/6 and less than 2 1/2"
4	6+	8-16	50	50	No limit	No limit

- <sup>1/</sup> Plus trim.  
<sup>2/</sup> Disregard all knots less than ½" diameter in all grades.  
<sup>3/</sup> The sum of the diameter of sound knots plus twice the sum of the diameter of unsound knots (in inches) is less than or equal to ¼ the diameter of the log (inches).  
<sup>4/</sup> 1.e. means less than or equal to.  
<sup>5/</sup> D means d.i.b. of log at location of knot.

## JACK PINE & RED PINE LOG GRADES

**Grade 1** Logs with 3 or 4 clear faces.<sup>1/</sup>

**Grade 2** Logs with 1 or 2 clear faces.

**Grade 3** Logs with no clear faces.

After the tentative log grade is established from above, the log will be degraded one grade for each of the following, except that no log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

- Sweep.** Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one third the diameter inside bark at small end.
- Heart rot.** Degrade any tentative 1 or 2 log one grade if conk, massed hyphae, or other evidence of advance heart rot is found anywhere in it.

<sup>1/</sup> A face is one fourth of the circumference in width extending full length of the log. Clear faces are those free of knots measuring more than ½" in diameter, overgrown knots of any size, holes more than ¼" in diameter. Faces may be rotated to obtain the maximum number of clear ones.

# Tatum Guides, continued

## FOREST SURVEY TATUM GUIDE

North Central Forest Experiment Station--April 1961

### CROOK DEDUCTION IN BOARD FEET

Crook : depart- ture (in.):	Crook : length (ft.):	Scaling diameter of section with crook (in.)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

### Volume Tables

#### CUBIC FOOT VOLUME OF SHORT LOGS

DOB midpoint	Log Length (feet)									
	1	2	3	4	5	6	7	8	9	10
5	.3	.4	.5	.6	.7	.8	.9	1.0	1.0	1.1
6	.3	.5	.6	.8	.9	1.0	1.2	1.3	1.5	1.6
7	.4	.6	.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2
8	.5	.7	1.0	1.3	1.5	1.8	2.1	2.4	2.6	2.8
9	.5	.9	1.2	1.6	1.9	2.3	2.6	3.0	3.3	3.6
10	.5	1.0	1.4	1.9	2.4	2.9	3.4	3.9	4.4	4.8
11	.8	1.3	1.8	2.4	2.9	3.4	4.0	4.5	5.0	5.5
12	.8	1.4	2.2	2.9	3.6	4.3	5.0	5.7	6.4	7.1
13	1.1	1.8	2.6	3.4	4.1	4.9	5.6	6.4	7.1	7.8
14	1.1	2.1	3.0	4.0	5.0	5.9	6.9	7.8	8.8	9.7
15	1.5	2.5	3.5	4.5	5.6	6.6	7.6	8.6	9.6	10.6
16	1.6	2.8	4.1	5.3	6.6	7.8	9.1	10.3	11.6	12.8
17	1.9	3.3	4.6	5.9	7.2	8.5	9.9	11.2	12.5	13.8
18	2.1	3.7	5.2	6.8	8.4	10.0	11.6	13.2	14.7	16.3
19	2.5	4.2	5.8	7.5	9.1	10.8	12.4	14.1	15.8	17.4
20	2.7	4.6	6.6	8.6	10.5	12.5	14.4	16.4	18.3	20.3
21	3.1	5.2	7.2	9.2	11.3	13.3	15.4	17.4	19.4	21.4
22	3.3	5.7	8.1	10.5	12.8	15.2	17.6	19.9	22.3	24.6
23	3.8	6.3	8.8	11.2	13.7	16.1	18.6	21.1	23.5	25.9
24	4.1	6.9	9.8	12.6	15.4	18.2	21.0	23.8	26.6	29.4
25	4.6	7.5	10.4	13.4	16.3	19.2	22.1	25.0	27.9	30.8
26	4.9	8.2	11.6	14.9	18.2	21.5	24.8	28.1	31.4	34.6
27	5.4	8.9	12.3	15.7	19.1	22.5	25.9	29.3	32.7	36.1
28	5.8	9.7	13.5	17.4	21.2	25.0	28.9	32.7	36.5	40.3
29	6.4	10.4	14.3	18.3	22.2	26.2	30.1	34.0	38.0	41.9
30	6.8	11.2	15.7	20.1	24.5	28.9	33.2	37.6	42.0	46.4

#### GROSS CUBIC FOOT TREE VOLUME

DOB midpoint	Log Length (feet)									
	1	2	3	4	5	6	7	8	9	10
5	1.0	1.3	1.6	2.0	2.2	2.5	2.8	3.1	3.3	3.5
6	1.3	2.0	2.2	2.6	3.0	3.4	3.8	4.1	4.4	4.8
7	1.8	2.6	2.9	3.4	3.9	4.4	4.8	5.3	5.8	6.2
8	2.4	3.6	4.0	4.2	4.8	5.4	6.1	6.7	7.3	7.9
9	3.0	4.3	4.8	5.2	5.9	6.7	7.4	8.2	9.0	9.7
10	3.9	5.0	5.7	6.9	7.1	8.0	9.0	9.9	10.8	11.7
11	4.5	5.8	6.0	8.4	9.5	10.6	11.1	12.8	14.0	15.1
12	5.7	7.4	8.5	9.2	9.8	11.1	12.4	13.7	15.1	16.4
13	6.4	8.3	9.6	10.5	11.3	12.8	14.7	15.9	17.4	19.2
14	7.8	10.3	11.9	13.0	13.8	14.7	16.5	18.2	20.0	21.8
15	8.6	11.3	13.2	14.5	15.6	16.7	18.7	20.7	22.8	24.9
16	10.3	13.7	16.0	17.7	18.8	19.9	21.1	23.4	25.7	28.1
17	11.2	14.8	17.4	19.3	20.8	22.1	23.6	26.2	28.8	31.5
18	13.2	17.6	20.8	23.1	24.8	26.2	27.5	29.2	32.1	35.1
19	14.1	18.8	22.3	25.0	27.0	28.6	30.3	32.3	35.6	38.9
20	16.4	22.0	26.2	29.4	31.7	33.6	35.2	37.0	39.2	42.9
21	17.4	23.3	27.9	31.4	34.1	36.3	38.3	40.5	43.0	47.1
22	19.9	26.9	32.3	36.4	39.6	42.1	44.2	46.3	48.6	51.5
23	21.0	28.4	34.1	38.6	42.2	45.0	47.6	50.0	52.8	56.1
24	23.8	32.3	39.0	44.3	48.4	51.7	54.5	57.0	59.6	62.7
25	25.0	33.9	41.0	46.7	51.2	54.9	58.1	61.0	64.1	67.1
26	28.1	38.2	46.4	53.0	58.2	62.4	66.0	69.1	72.2	75.5
27	29.3	39.8	48.5	56.0	61.6	65.8	69.8	73.4	77.0	80.8
28	32.7	44.6	54.5	62.4	68.9	74.2	78.7	82.6	86.2	90.0
29	34.0	46.4	56.7	65.2	72.1	77.9	82.8	87.2	91.4	95.7
30	37.6	51.6	63.1	72.7	80.6	87.1	92.6	97.4	101.8	106.2

1/ Source: 3-variable volume equation by Gevorkiantz modified by Stone and Hahn.

1/ Source: 3-variable volume equation by Gevorkiantz modified by Stone and Hahn.

### GROSS BOARD FOOT VOLUME OF SHORT LOGS

DOB midpoint	Log Length (feet)									
	1	2	3	4	5	6	7	8	9	10
7	2	6	10	12	14	16	18	20	20	21
8	4	8	12	16	19	20	22	23	24	26
9	6	10	14	18	21	22	24	26	28	29
10	8	12	16	22	28	31	34	36	39	42
11	10	14	19	23	30	32	36	38	42	44
12	12	18	24	30	36	40	45	49	53	58
13	14	21	29	36	42	47	52	56	61	66
14	16	23	32	40	46	52	58	64	70	77
15	18	25	34	41	48	54	61	68	74	81
16	20	29	41	49	57	66	74	82	91	99
17	23	33	42	51	60	69	77	86	95	104
18	27	38	49	60	70	81	92	103	114	124
19	28	39	51	62	73	85	96	107	119	130
20	31	44	58	72	85	99	112	126	139	153
21	32	46	60	74	89	103	117	131	145	159
22	35	52	68	84	102	118	135	152	168	184
23	36	54	71	88	106	123	140	157	174	192
24	40	60	80	100	120	140	160	180	200	219
25	42	62	83	104	124	145	166	186	207	227
26	46	70	93	117	140	164	187	211	234	257
27	48	72	96	121	145	169	193	218	242	266
28	52	80	107	135	162	189	217	244	271	298
29	54	82	111	139	167	195	223	252	280	308
30	59	91	122	154	186	217	249	280	311	343

1/ Source: 3-variable volume equation by Gevorkiantz modified by Stone and Hahn.

1/ Source: 3-variable volume equation by Gevorkiantz modified by Stone and Hahn.

### THREE VARIABLE INTERNATIONAL BOARD FOOT LOOKUP TABLE

#### SWEEP DEDUCTION IN BOARD FEET

Sweep : depart- ture (in.):	Sweep : length (ft.):	Scaling diameter of section with sweep (in.)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
2	1	1	2	2	3	4	5	6	7	8	9	9	10	10	11
3	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
4	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
5	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
6	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
7	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
8	1	1	2	2	3	4	4	5	6	7	7	8	8	9	10
9	1	1	2	2	3	4	4								

FOREST SURVEY FIELD INSTRUCTIONS  
SUPPLEMENTAL REMEASUREMENT INSTRUCTIONS

# REMEASUREMENT INSTRUCTIONS

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# 1981 WISCONSIN REMEASUREMENT INSTRUCTIONS

## USFS, Forest Survey

### Introduction

Permanent Forest Inventory plots measured in 1968 will be remeasured to obtain information on changes which took place between surveys. Some of these changes will be reflected in land use, growth, and removals. It is therefore important that every plot and tree tallied previously be accounted for at the time of remeasurement.

Most instructions which apply to a new sample kind #1 will hold true for a full remeasurement plot. Partial remeasurement plots will be primarily used to measure land use trends and stand disturbances. This remeasurement supplement will cover those additional items which are required for remeasurement plots.

Copies of the present and previous survey manuals are available at the Forest Survey Field Office. It may be helpful to consult these manuals if there are questions on procedure or definition changes between the time of the past and present surveys.

### Methods

#### 1. Preparation

Each remeasurement crew will be equipped with the original plot sheet and aerial photograph, plus a remeasurement plot sheet and new photographs. The first step towards remeasurement is to check the plot sheets and photographs to see that the plot number from the old sheet coincides with the "old plot number" entry on the remeasurement plot sheet.

The old plot number is the printed "sequential plot number" in the extreme upper left hand corner of the original plot sheets. This 3-digit "sequential plot number" should be preceded by a 0 to make the 4-digit "old plot number" required on the new plot sheet.

A check should also be made to see that the plot center is correctly pinpricked on both photos. If the pinpricks are in different locations on the old and new photographs, field inspection will be necessary to ascertain which, if either, of the pinprick locations is correct. If the pinprick on the original photo does not quite coincide with the ground check, estimate the error and record this information in the "Notes" section on the plot sheet. If the pinprick on the new photo is grossly incorrect, prick the photo in the correct place, and record the error in the "Notes" section on the plot sheet. Once all photo and plot sheets appear to be in order, the crew can begin location of the plot in the field.

## II. Plot Location

### A. Starting Point

The following procedures should be used for both partial and full remeasurement plots (sample kind #2 and #8).

Using both the old and new photographs, the starting point, or S.P., should be located. If the S.P. pinprick is missing from the old photo, refer to the starting point description on the old plot sheet and determine the S.P. location according to the azimuth and distance to plot center, P.C. Another aid to S.P. location is checking the sketch of the area on the back of the original plot sheet. Pay close attention to any openings on the photo, such as clearings, roads, woods trails, lakes and streams where the S.P. might logically be located.

Once the S.P. tree is located, it should be inspected to see that it is still suitable according to guidelines established in Item 3 of the Forest Survey Field Manual. If the S.P. is still suitable, the cruiser should rescribe, repaint, and remeasure DBH, while the tallier inspects the course to sample location on the plot sheet to see if it seems reasonable. The tallier should then transfer the original course to sample location, S.P. description, and the remeasured DBH to Item 3 on the new plot sheet, pin prick the S.P. and record course to sample location on the new photo.

In the event that the original S.P. cannot be relocated, or if the S.P. is not suitable, a new starting point should be established according to Forest Survey standards (Item 3). Record the course to sample location, S.P. description, and S.P. DBH on the new plot sheet and make a note that the new approach line differs from the original used on the previous survey.

An easy way to establish a new S.P. tree, when needed, is to inspect the vicinity of the original S.P. for a suitable replacement. Measure the distance and azimuth from this new S.P. to the original S.P. Record these figures in the notes, along with the course to sample location from the original S.P. In this way, a new S.P. tree has been established and the original S.P. tree then becomes a turning point in the course to sample location.

In cases where visual plot locations were used, a new S.P. must be established. If the P.C. appears equally well in both the old and new photos, and upon fieldchecking no change has taken place, look in the areas surrounding the photo pinprick to locate P.C. on the ground. Once the plot center is located on the ground, select an S.P. that is suitable and do the necessary azimuth and distance calculations for the proper course to sample location. This can be done before or after the plot work has been completed, depending on circumstances.

If any change has taken place between the original and current photographs, P.C. may be difficult to locate. Study both the old and new photos and try to select the area that looks most likely to be the plot location. Look in the "Notes" section of the original plot sheet for any clues that might be helpful. Look for similar areas in which the plot might have been located by mistake.

### B. Plot Location

Once the S.P. has been re-established, the crew should chain the computed azimuth and distance along the approach line. Once chaining is completed, the cruiser should mark the location with a piece of flagging or yellow stake.

Both members of the crew should then begin to search the area for evidence of the old plot. Items to look for are paint on the tree bases (vertical line) and at DBH (horizontal line). Other evidence includes 10" wire pins and bits of flagging at each point, blazed trees, and witness trees (painted with an "X").

### C. Alternatives to Plot Location:

In the event that, after chaining the prescribed distance, no evidence of the old plot can be found, several alternatives for location are available. These are:

1. If using a newly established S.P., estimate the distance and azimuth from the new S.P. location to the original S.P. location. Find the location of the original S.P., and follow the original course to sample location.
2. Using the original S.P., look for landmarks to discern if the plot is in that area. Look especially for mistaken openings, trails, etc.
3. Search several chains around the end of the approach line(s).
4. Return to the S.P., check the photo work, and try rechaining.
5. Check the photo work to see if the original crew chained in the opposite direction.
6. Pick a new S.P., establish a new approach line, and chain in from there.

There have been, and may be, cases where a plot cannot be relocated, even if it was done correctly originally. For a full remeasurement plot (sample kind #2), if after a thorough search you are sure there has been no disturbance, and there is no way to relocate the plot,

bring it to the attention of the person in charge of remeasurement. If, after exhausting all possibilities and two crews have tried finding the plot, write a full explanation on the front of the plot sheet and it must be dropped from the sample.

Any land use changes must be recognized (see section III of this supplement).

For a partial remeasurement plot (sample kind 8), if after a thorough search PC cannot be located, a new plot should be established as close as possible to the original plot center. Since partial remeasurement plots are used to measure changes in land use and disturbance between surveys, it is not of primary importance that the original plot center be located. Refer to sections III and IV of this supplement for an explanation of items to be measured.

#### D. Point Location (Sample kind # 2)

When some evidence of the old plot has been found, look for several trees which have been marked at the base and at DBH with white paint. When several of these trees are found in close proximity, examine the original plot sheet and try to match these trees to trees on one of the original points. This matching is accomplished by comparing present tree species, azimuths, distances, and DBH's to the original figures for trees on the original plot sheet.

Once it is determined to which point the trees belong, triangulation may be used to find the point center, most of which were marked with a 10" piece of galvanized or aluminum wire, bent into a loop with a piece of flagging tied through it. Triangulation is accomplished by measuring back azimuths and distances from several known trees from the old plot sheet. The intersection of these back azimuths and distances will provide a small area in which to search for the wire marking each respective point center. Not all points were marked in the above manner. If the wire cannot be located, it may be because it was never put in to mark the point. (This is most common on points that were cover classed, or on which only seedlings occurred). It is then up to the crew to use triangulation to accurately mark the point from which the point measurements were taken.

Once an individual point center has been relocated, it should be remarked in the prescribed manner with wire, plastic flagging, and a yellow plastic stake. The crew should then calculate the proper distance and azimuth to point #1, or plot center, and begin to search for plot center. When P.C. is found, it should be remarked with flagging, wire, and a yellow plastic stake. The distance and back azimuth to the end of the approach line should be recorded on the back

of the plot sheet and current photo with the original course to sample location information. The end of the approach line then becomes a turning point in the course to sample location. Distance and azimuth from the turning point (end of approach line) to plot center need not be recorded if the distance does not exceed 3% of the length of the chaining distance. Remove the blue flagging at the turning point location.

Finding each individual point is a challenge, since most of the flagging disintegrates, the wires rust and appear just like twigs or roots, or the point center was never permanently marked. Therefore, the best method is to run out 70 feet from the last point at the proper azimuth, mark the spot, and search by running your hands through the area. If several identifiable trees are available, use these for triangulation, since this reduces the area to be searched. If this is not possible, due to lack of trees or other extenuating circumstances, locate several adjacent points, and use these to triangulate to the missing point. The general location of the missing point can then be found.

Use of a metal detector is invaluable in locating pins. The detector should be properly tuned (see instruction manual for directions) and passed over the area to be searched. When there is an abrupt rise in pitch of the tone, search directly below the disc, and the original pin should be found.

It is highly important that each individual point be located as accurately as possible. The crew should continue the search for each pin until they have expended every reasonable effort. If the exact point cannot be found, find several trees that belonged to that point originally, and use the method of triangulation to relocate it. Use at least three original trees (if possible) and find the intersection of their respective azimuth and distances. Each consecutive point after P.C. should be marked in the prescribed manner by using plastic flagging, wire, and a yellow plastic stake in addition to the original pin.

### III. Ground Land Use

An important aspect of remeasurement is to determine what, if any, land use changes have occurred between the original survey and the remeasurement. Field crews should determine land use change and record the appropriate data under Items 4, 5, and 9 of the Forest Survey Field Manual.

Remeasurement tree data must be taken on all plots except those that were classified as nonforest or noncommercial forest on the previous survey, and remain nonforest or noncommercial forest at the time of remeasurement. If a plot remains nonforest or noncommercial forest, it is treated as a regular nonforest or noncommercial forest plot

according to Ground Land Use, Item 4 of the Forest Survey Field Manual. Be careful to follow survey rules when classifying these plots to be sure they were nonforest or noncommercial forest on the prior survey as well as at the time of remeasurement. On the 1968 survey, commercial forest locations had a 10% stocking in tree species. Minimum site productivity levels are the same as current standards.

If there has been a land use change from noncommercial or nonforest back to commercial forest, full remeasurement plots will be established and all trees will receive a tree history reflecting ongrowth or ingrowth (31, 32, 61 or 62). For definitions of both ongrowth and ingrowth, see section V, A and B of this supplement. Partial remeasurement plots will be established according to sample kind #7 rules of the Forest Survey Field Manual (see Appendix iv).

Plots that fell in Christmas tree plantations on the prior survey were classified as commercial forest land, and were done as full measurement plots. There has been a definitional change since then, and these plantations are now classified as Christmas Tree Plantations Ground Land Use code 46.

For any full remeasurement plot presently classified as nonforest or noncommercial forest land, or Christmas tree plantation, which was formerly classified as commercial forest land, all live trees greater than or equal to 1.0" DBH tallied at the time of the last survey will be assigned a tree history of 10 or 20. Transfer the original information from the original plot sheet, items 13 (original), 43 (original), 44 (original), 45 (original), 42, 16, 21, 22, 23, 25 (original), 28 (original), 29 (original), and 30 (original) and fill in the heading according to survey standards in Item 4 and 5 of the Forest Survey Field Manual. Partial remeasurement plots will be established according to sample kind #7 rules of the Forest Survey Field Manual.

In areas where there have been major disturbances, (i.e. all trees missing, land use change on one or more points except point 1, changes in stand-size class etc.) the field crew is to ascertain what the nature of the disturbance was. In these situations where the old plots cannot be found (i.e., the area has been clearcut and bulldozed), a full remeasurement plot must be established as close as possible to the old PC. All new trees will receive a tree history reflecting ongrowth or ingrowth (31, 32, 61, or 62). Original tree data will be transferred to the new plot sheet and current data collected to reflect the original trees as cut or dead. Tally items needed for these are listed under Missing Trees and Trees cut since Last Survey. Use Items 4, 5, and 9 of the Forest Survey Field Manual to reflect the exact change or disturbance that has occurred between

surveys. For full remeasurement plots, all ingrowth, ongrowth, and live trees > 1.0" that were tallied on the last survey will have to be accounted for. If an individual point has been altered so much that the need for substitute points arises, refer to the rules in section X, B of this supplement. Partial remeasurement plots will be established according to sample kind #7 rules of the Forest Survey Field Manual.

For full remeasurement plots, if a point is found to be in the wrong location, leave it where it is and remeasure it as long as the point remains in the same land use as point #1. If the incorrectly placed point is not within the same land use as point #1, the point will be rotated back into the land use of point #1 (using rules found in Item 16 of the Forest Survey Field Manual, and the trees on the original point will be dropped from the sample. Any changes affecting original Basal Area should be made on the remeasurement plot sheet, and recorded in the notes section. All trees on the new point will be assigned a tree history reflecting ongrowth or ingrowth (also see section X., B. of this supplement).

#### IV. Plot Measurements

Once point #1 (P.C.) has been located and the ground land use determined, actual remeasurement can begin. Two types of plots will be remeasured in Wisconsin.

1. Sample kind #8, partial remeasurement plots, are used to determine trends in land use and stand disturbance between surveys. Therefore, only the following information needs to be recorded from the original plot sheet: a.) Old plot number, b.) Original date Item 13 c.) Original BA/Acre, Item 43, d.) Original Forest type-stand-size class, Item 44, e.) Original stand age, Item 45. Refer to Section XI of this supplement for definitions of these measurements. No original tree data will be recorded. The plot will be treated as a partial measurement plot (sample kind #7).

2. Sample kind #2, full remeasurement plots, will be tallied according to Forest Survey Field Manual instructions for a full measurement plot (sample kind #1), along with the appropriate remeasurement codes outlined in this chapter. In some respects plot measurements will be performed exactly as a full permanent plot. However, there are many additions and exceptions on a remeasurement plot.

Some entries on a remeasurement plot require current measurements and original measurements. Current measurements are those made at the time of remeasurement. Original measurements are those made on the last survey, and are to be transferred from the old plot sheet to the new plot sheet. Original entries to be transferred include:

Item 13. Date. Also see section XI, Item 13 of this supplement.

Item 43. B.A./acre. Also see section XI, Item 43 of this supplement.

Item 44. Forest type-stand-size class. Also see section XI, Item 44 of this supplement.

Item 45. Stand Age. Also see section XI, Item 45 of this supplement.

Item 25. DBH: It is critical that the DBH measurement be accurately relocated on previously measured trees. The new measurement must be taken at this same place, if the original measurement was correctly placed. The original DBH must be transferred to the remeasurement plot sheet by the tallier. If the original DBH is clearly incorrect, correct it according to procedures outlined in section VII., G. of this supplement. If the original DBH cannot be located, correctly place the current DBH, and compute the original DBH by boring the tree as outlined in section VII., G. of this supplement. If the original DBH was correctly placed, old trees should be repainted and rescribed at the exact point where the DBH was last measured. If the tree is now dead where DBH was taken last time, measure the current DBH in live material, and estimate the original DBH at that point. If the tree is not 1.0" DBH or larger at 4 1/2 feet, it will be treated as a dead tree (tree history 15 or 25), and will only be taken as a seedling if seedlings are needed to reach 16% stocking. If the tree is taken as a seedling, it will be recoded twice--once as a dead tree and once as a seedling. Scribe and paint all new trees.

Item 28. Tree or Cover Class: The tallier will transfer the original tree-cover class exactly as it appears on the original plot sheet. This entry is to be changed only if an illegal code was used. Make a note and bring it to the attention of the person in charge of remeasurement before making this change. Record the current tree-cover class according to survey standards.

Item 29. Crown Ratio: The tallier must transfer the original crown ratio to the remeasurement plot sheet, and then determine and record the current crown ratio. If the original crown ratio is clearly incorrect, estimate what it was at the time of the last survey, and record this in the original crown ratio entry. Make a note of any changes original crown ratio.

Item 30. Crown Class: The tallier must transfer the original crown class to the remeasurement plot sheet, and then record the current crown class. If the original crown class is clearly incorrect, it should be corrected to reflect what it was at the time of the last survey. Make a note of any changes in original crown class.

## V. Tree History

Tree history for remeasurement plots differs from the normal codes used on newly established plots. Remeasurement tree history codes are used to record the change from what the tree history was at the time of the last survey to what it is at the present time. In assigning tree history codes, it is important to accurately determine what the tree history was previously, as well as what it is currently. It is up to the crew's best judgement to make these decisions. When both the present and previous tree histories are decided upon, the crew should consult the list of codes for tree history. Tree history Codes (Item 23) are found in the Forest Survey Field Manual and with the Tatum guides. Choose the proper code from the alternatives listed. Record this code for each tree 1.0" DBH and larger tallied as live on the previous survey and for each additional tree recorded on the remeasurement.

All the terminology contained within the tree history codes is found in the Forest Survey Field Manual with the exception of ingrowth and ongrowth. These are defined below:

A. Ingrowth: Ingrowth trees are those that were not tallied or were seedlings at the time of the last survey, but are now 1.0" DBH or larger, not on prism count, and occur on the fixed radius plot. In addition, all seedlings tallied during the current remeasurement will receive a tree history reflecting ingrowth.

All ingrowth trees must be tallied on points 1-10. Seedlings need only be tallied on points with no trees  $> 5.0$ " DBH, as on a regular #1 plot. Assign ingrowth tree history (31 or 32) according to present tree class.

B. Ongrowth: Ongrowth trees are defined as those trees that were too small to be included on the variable radius plot on the prior survey, but are now large enough to qualify for prism count. All ongrowth trees must be tallied on points 1-10. Trees  $> 1.0$ " DBH tallied as live on the last survey cannot receive a tree history of ongrowth. Assign ongrowth tree history (61 or 62) according to present tree class.

## VI. FIXED RADIUS PLOT

A 6.8 foot fixed radius plot was used in Wisconsin on the 1968 survey.

Tallied trees (missing, live, or dead) will be counted clockwise from 0° azimuth, taking each tree in order. This rule applies whether the tree is an ongrowth, ingrowth, or a previously measured tree.

VII. Items to be Tallied (Full Remeasurement Plots)

A. New Trees (Tree History codes 31, 32, 61, and 62):  
For ingrowth and ongrowth trees, tally all required items with the exception of original DBH, crown ratio, crown class, and tree-cover class. These four items should be lined out. All seedlings will receive an ingrowth tree history (31 or 32).

B. Original Tally Trees Still Alive (tree history codes 10, 11, 12, 20, 21, and 22):

All live trees tallied as live at the last survey must be accounted for, the original information transferred to the new plot sheet, and all new items completed to survey standards. Use the proper tree history code to reflect both the original and current tree conditions. All entries for these trees will be filled in accordance to guidelines set for sawtimber, pole timber, and sapling sized trees.

C. Missing Trees (tree history codes 18, 19, 25, 28, and 29):

Live trees tallied on the last survey but now missing, must be accounted for and classified as dead or cut. See Section D. and E. for required tally items.

D. Trees Alive at the Last survey, Now Dead (tree history codes 14, 15 and 25):

All trees tallied as live on the last survey that have since died qualify as mortality trees, and these are the only dead trees that need to be accounted for. Standards for salvable-mortality trees remain the same as a regular plot (see Item 23 of the Forest Survey Field Manual). Trees qualifying as mortality or salvable-mortality will require the following entries on the new plot sheet:

Pole-sized trees--enter items 16, 21, 22, 23, 25 (original and current), 27, 28 (original and current), 29 (original), 30 (original), 33, 38, 39, 40.

Sawtimber-sized trees--enter items 16, 21, 22, 23, 25 (original and current), 27, 28 (original and current), 29 (original), 30 (original), 33, 34, 35, 36, 38, 39, 40.

For trees under 5.0" DBH, enter items 16, 21, 22, 23, (25 (original and current), 27, 28 (original and current), 29 (original), 30 (original)). Dash out items 33 through 41.

If the tree is so badly decomposed that accurate DBH, bole length, sawlog length, and top D. O. B. measurements cannot be made, use the original information or estimate these figures to the best of your ability.

By definition, trees that were cull at the previous survey that have since died cannot be salvable-mortality trees. Assign tree history 25 and fill in items for mortality trees outlined above.

E. Trees Cut Since Last Survey (Tree History codes 18, 19, 28, and 29):

For trees that were tallied as live on the last survey and have been cut since that time, record the following items on the new plot sheet: 16, 21, 22, 23, 25, (original and put stump diameter in current DBH entry), 26 (stump height), 28 original), 29 (original) and 30 (original). If the stump is not measurable, estimate the stump diameter and height at the time the tree was cut. Only stumps of live trees tallied on the last survey need to be tallied on remeasurement plots. There is no 16.6 foot fixed radius plot for stumps on remeasurement plots.

F. Stumps, Dead Trees, and Seedlings Tallied At Time of Last Survey:

Stumps, dead trees, and seedlings on the old tally sheet will be disregarded, and their entry not transferred to the remeasurement plot sheet.

G. Trees Tallied Last Time Through Error:

If a tree looks suspicious as to whether it was large enough to have been included on the variable radius plot on the last survey, the crew should check its original diameter against its limiting distance. If the tree being questioned is large enough to currently meet its limiting distance, an increment core of the outer portion of the tree should be taken. Count back the number of years since the last survey, measure its growth to the nearest .05", double it, and subtract this figure from the current DBH to obtain the original DBH. Measure the distance against the original DBH in the limiting distance table to see if the tree should have been included. If the tree was not large enough to qualify at the last survey but is now, it will receive a tree history code reflecting ongrowth. If it was not large enough last time, and is still not large enough, omit it from the sample, and make a note in the "Notes" section.

An alternative method for correcting mistaken original DBH's is to measure the place where the original DBH was taken. Then, measure the correct DBH location. Subtract the original, incorrect DBH from the current incorrect DBH to obtain a "correction factor". By subtracting this "correction factor" from the current correct DBH, a more accurate original DBH is obtained. This method should not be used when DBH placement discrepancies are greater than 6" because, in theory, this practice is based on uniform taper of the tree bole. Distances greater than 6" are likely to provide taper that is not uniform. The boring method described above should be used in these cases where there is a 6" or more discrepancy between original and current placement.

For trees that are questioned on the fixed radius plot, simply measure the ground distance to see if it is outside the fixed radius plot. Remember that if changes are made as to missed or incorrectly tallied trees, the original BA/acre figure must be adjusted according to whether additions or subtractions were made.

#### H. Trees Omitted From the Last Survey By Error (tree history codes 11, 12, 21, and 22):

Follow the same procedures outlined above to check trees that appear to have been omitted on the prior survey, but should have been tallied. This includes trees that were omitted from the original fixed radius plot because the tree was not needed, or for any other reason. For trees that are determined to have been missed on the last survey, compute the original DBH (see section VII., G. of this supplement). When selecting the tree history code, treat the tree as if it had been tallied on the last survey. Estimate, as accurately as possible, the original DBH (Item 25), tree class (Item 28), crown ratio (Item 29) and crown class (Item 30). Tally all required items. Make a note on the back of the plot sheet of all trees omitted on the prior survey.

Remember that if changes are made as to missed or incorrectly tallied trees, the original BA/acre figure must be adjusted according to whether additions or subtractions were made.

#### I. Displaced Trees (tree history codes 11, 12, 21, 22, 26, 27, 31, 32, 35, 36, 61, 62):

A tree may have been physically moved, for example, by logging activity, since the last survey. An apparent discrepancy in tree measurements may be explained by such a disturbance. Tally items according to whether the tree was originally on the plot or not, and where it is now. For trees displaced onto the plot and not tallied on the last survey, tally all current items and assign a tree history of ongrowth. For trees displaced off the plot and tallied previously, transfer all original information to the new plot sheet. Record all current information, and treat the tree as if it had not been moved

and was still on the plot. These trees should receive a tree history according to the exact circumstances. Be sure to adequately explain the exact circumstances in the "Notes" section of the plot sheet.

Keep in mind that all live trees 1.0" DBH or larger tallied on the previous survey must be accounted for. All new trees qualifying as ingrowth or ongrowth must also be tallied according to survey standards on points 1-10. Trees present on the last survey but now missing must be accounted for as cut or dead on the new plot sheet.

### VIII. Cruising Duties

The cruising duties are essentially the same for full remeasurement plots as they are for a sample kind #1 plot. Exceptions are:

1. The cruiser must assist the tallier in locating new trees (ingrowth, ongrowth), live trees remaining, cut trees, dead trees, and missing trees. The easiest way to accomplish this is to have the tallier tell the cruiser what to look for when accounting for original trees (i.e. DBH, azimuth, distance, species). Trees should be done in order, proceeding clockwise from 0° azimuth.

2. Rescribe, remeasure, and repaint original trees, in addition to scribing, measuring, and painting new trees.

3. Take the time to inspect each DBH, and determine if it was correctly located. If not initially correct, the cruiser should establish the correct location on the bole, measure current DBH, and adjust the original DBH according to section VII., G. of this supplement.

4. Determine if trees should have been tallied last time, either on the old fixed radius plot or the variable radius plot.

5. If the tallier requests it, the cruiser should assist by doing the pentaprism (dobber)work.

6. It is important to allow the tallier enough time to complete each tree. DON'T RUSH!!

For partial remeasurement plots (sample kind #8) once PC has been established, cruising duties are the same as for a sample kind #7 plot.

### IX. Tallying Duties

The tallying duties for a full remeasurement plot remain the same as a sample kind #1 plot, except for the following items:

1. Transfer the original date and stand age to the remeasurement plot sheet after completion of the plot. Check these figures for accuracy.

2. Check original DBH, crown ratio, and crown class for accuracy. Transfer these figures to the new plot sheet.

3. Transfer original tree class to new plot sheet--DON'T CHANGE IT!!

4. Determine what happened to each individual original tree, and tally appropriate entries.

**\*\*NOTE\*\*** For both tallier and cruiser, communication is more important than on a regular plot. The tallier must convey information on the old plot sheet, and the cruiser must relay what he sees to the tallier.

For partial remeasurement plots (sample kind #8), once PC has been established tallying duties are the same as for a sample kind #7 plot.

## X. Miscellaneous

### A. Witness Trees

The purpose of witnessing a plot is to establish a permanent marker in the vicinity of the plot center to ensure relocation of the plot. Therefore, for full remeasurement plots, the witness trees established on the last survey must be located and inspected. Remeasure and rescribe at DBH and the base if they are still suitable witness trees. If the witness trees are missing or in poor shape (not expected to live until the next survey), select new witness trees. These trees should be marked and recorded in the same manner prescribed in the Forest Survey Field Manual (Item 16). For partial remeasurement plots, witness trees should be assigned as they are on sample kind #7 plots.

### B. Ten Point Cluster Design

The basic ten point cluster system that forest survey is currently using was also used on the last survey. Variations to that cluster existed then, and they do now, depending on whether the point fell on commercial forest land, nonforest, or noncommercial forest land. Points falling in nonforest or noncommercial forest were rotated on the previous survey using the same guidelines that are used to rotate points on the present survey. This point rotation was noted on the back of the original plot sheet. By checking these diagrams, the crew should be able to relocate substitute points easily.

For points on the previous survey that were placed in commercial forest land and that remain in commercial forest land (as defined in the Forest Survey Field Manual), remeasure the exact point and tally it as any other point would be tallied. Use the appropriate remeasurement tree history code.

For points that were rotated out of nonforest or noncommercial forest which has since turned to commercial forest land, remeasure the substitute point. See also section III of this supplement.

For points on the previous survey that were placed on commercial forest land that are presently nonforest or noncommercial forest land, all trees 1.0" DBH or larger that were tallied as live on the last survey must be accounted for. Assign these trees a tree history code of 10 or 20 and transfer the original information to the remeasurement plot sheet. Then, the crew must rotate the point according to standards set forth in Item 16 of the Forest Survey Field Manual. This new substitute point is then measured according to remeasurement standards, and all trees tallied on the substitute point will receive a tree history reflecting ongrowth or ingrowth (code 31, 32, 61 or 62). Continue the tree numbers on the substitute point where they left off on the original point.

In addition, if an individual point has no information which enable it to be relocated on future remeasurements, it should be referenced according to item 16 of the Forest Survey Field Manual.

#### XI. Plot Sheet Instructions

The following sections each pertain to individual entries on the remeasurement plot sheet. Remeasurement plots differ from regular plots by having some items transferred directly from the original plot sheet. These items were enumerated in section IV of this supplement.

This section is designed to provide reference for items defined and explained in the Forest Survey Field Manual that are needed for remeasurement plots. In addition, new items and explanations on tallying procedures are also listed. The number preceding each category is the reference number which enables the crew to look up the desired item in the Forest Survey Field Manual. Items are listed in order as viewed on the remeasurement plot sheet, moving from left to right.

Old Plot Number: The old plot number entered on the remeasurement plot sheet consists of the printed sequential plot number at the top of the old plot sheet, preceded by a zero. This number is transferred by the photo interpreters in St. Paul. Check the old plot number for accuracy on the remeasurement plot sheet.

- Item 51 State:
- Item 52 Unit: Wisconsin has been divided into five units, each with a set number of remeasurement plots.
- Item 53 County:
- Item 2 Sample Kind: The proper code for a full remeasurement plot's sample kind will be #2. The proper code for a partial remeasurement plot's sample kind will be #8.
- Item 46 Stand Area: The stand area will be determined in St. Paul by the photo interpreters. Check this entry in the field to determine its accuracy.
- Item 47 Distance to Water: Distance to water will be computed by photo interpreters. Check this figure for accuracy.
- Item 48 Distance to Road: Distance to roads will be computed by photo interpreters as in distance to water. Check for accuracy.
- Item 54 National Forest: National Forest will be completed by photo interpreters. Check for accuracy.
- Item 55 Ranger District: Ranger District will be computed by photo interpreters. Check for accuracy.
- Item 1 Ownership Class: Ownership classes will be obtained from county tax ownership records and plat books.
- Item 1 Owner Tenure: Use the same procedure as outlined for ownership class.
- Item 4 Ground Land Use: fill in as it is at the time of remeasurement, using Item 4 of the Forest Survey Field Manual as your reference. Also see section III of this supplement.
- Item 5 Use Trend: Fill in as it is at the time of remeasurement, using Item 5 of the Forest Survey Field Manual as your reference. Except for commercial forest land on both occasions, the first two digits describe land use change between surveys, not since the date of photography. The third digit indicates the process that caused it. Be sure to code for definitional changes in forest type or size class.

- Item 6 Aspect-Position-Slope: Record current aspect-position-slope as appears at the time of remeasurement.
- Item 7 Physiographic Class: Record the physiographic condition as it appears at the time of remeasurement.
- Item 8 Stand Origin: Record the probable cause for stand origin as on a regular plot. If stand origin is other than 1, be sure to list the planted or seeded species in the notes.
- Item 9 Stand History: This code should reflect any changes since the last survey.
- Item 10 Seed Source: Record seed source as it appears at the time of remeasurement.
- Item 11 Conifer Understory: Describe the actual conifer understory condition at the time of remeasurement.
- Item 12 Photo Age: Record the number of growing seasons that have elapsed between the date on the new photo and the time of the field check, using a breakoff date of July 1st for each growing season.
- Item 13 Date: Two dates are recorded on each remeasurement plot sheet.
- a) Original: Transfer the original date using the format found in Item 13 of the Forest Survey Field Manual.
  - b) Current: Fill in the proper code, using the format found in Item 13 of the Forest Survey Field Manual.
- Item 43 Basal Area/Acre
- a) Original: Transfer this entry from the original plot sheet to the remeasurement plot sheet. If a tree was omitted or incorrectly added to the basal area count on the previous survey, the original basal area entry will have to be adjusted accordingly before transfer.
  - b) Current: After completion of the plot, compute and record current basal area/acre using the prism count total.
- Item 44 Forest Type-Stand-Size-Class:
- a) Original: This is entered on the remeasurement plot sheets in St. Paul, and is not to be changed. There has been a definitional change in determining forest

type. In the 1968 survey, forest type was assigned on the basis of species plurality, whereas now it is determined by assigning stocking percentages. If this entry still appears wrong on the basis of plurality, attach a note to the plot sheet. This entry is always checked against the computer record in St. Paul before the plot is keypunched.

- b) Current: After completion of the plot, compute and record the current type-stand-size class according to present survey standards.

Item 45 Stand Age:

- a) Original: Transfer this entry from the old plot sheet to the current plot sheet. At the time of the last survey, stand age was expressed as a two-digit code. When recording the original age on the plot sheet, add a zero to the end the code. For example, a stand age of 06 (50-60 yrs. old), would be recorded as 060. If it appears that a mistake was made on the last measurement, correct it. (An example of a mistake would be a plot that had no disturbance and the age comes out younger than what the crew had recorded last time.)
- b) Current: Determine current stand age from three or more increment borings of representative trees.

Item 42 Site Index Take site index for each remeasurement plot just as on a new plot. Make sure site species is recorded.

Item 14 Recreational Opportunities: This item should be filled in according to the Forest Survey Field Manual for current conditions.

Item 20 Basal Area Count: Record the number of live trees 1.0" DBH and larger at each point that occurs within the radius of the 37.5 factor plot (appears on prism). Record this count in the left hand margin directly across from the first tree entry for that point.

Item 16 Point Number: Assign point number 1-10 (use 0 for 10 according to the system used on regular plots.

Item 21 Tree Number: Number each tree consecutively, proceeding clockwise from 0 azimuth, regardless of whether it was present on the original survey or not.

Item 22 Tree Species: The tree species for remeasured trees should be inspected and corrected if necessary. Assign tree species codes as needed for new trees. Those trees identified as noncommercial species on the prior survey (species code 999) which are now considered as shrubs can be dropped from the sample, and need not be accounted for.

Item 23 Tree History: Tree history differs from the procedures used on a new plot. See section V of this supplement for explanation of new terms. See Item 23 of the Forest Survey Field Manual for appropriate codes.

Item 24 Tree Distance: Record distance to the near face from the point center of each tree requiring an azimuth. Remember, this is the slope, not horizontal, distance. Record distances to saplings on points 4-10 if there are no pole or sawtimber sized trees present.

Item 25 DBH

- a) Original: Transfer any original DBH that appears to have been correct as it appears on the original plot sheet. For obvious errors both in placement and measurement of the original DBH, correct the entry using the method outlined below.
- b) Current: Check to see that the original DBH was taken in the correct place. If DBH was correct, remeasure, rescribe, and repaint this original measurement. It is extremely important to measure the same place if the measurement was initially correct, so look carefully for evidence of paint at DBH.

If the previous measurement was taken too low, too high, on a deformity, cannot be located, or another error was made, move the current DBH to the correct place on the bole, and record the new measurement. Keep in mind that the original DBH has to be correct as well when an error was made on the last survey. The original DBH can be corrected by measuring the current DBH at the correct spot, boring the tree, and subtracting the appropriate diameter growth according to the number of years elapsed since the last survey. In all cases the new and old DBH's should be closely compared to see if they are reasonable. Watch for both excessive growth and too little growth, and make a decision as to whether the original DBH was correct. Also see Section VII, G of this supplement.

Ongrowth and ingrowth trees will not receive an original DBH, and this can be lined out.

If the tree is now dead where DBH was taken last time, measure the current DBH in live material and estimate the original DBH at that point. If the tree is not at least 1.0" DBH at 4 1/2 feet, it will be treated as a dead tree (tree history 15 or 25 and will only be taken as a seedling if seedlings are needed to reach 16% stocking. If the tree is taken as a seedling, it will be recorded twice-once as a dead tree and once as a seedling.

Item 26 Tree Azimuth: Record in tree azimuth as it is at the time of remeasurement. Record azimuths on saplings on points 4-10, if there are no pole or sawtimber sized trees present.

Item 27 Damage-Cause of Death: For live trees record the presence of serious damage. For dead trees, code the most serious cause of death.

Item 28 Tree Class

a) Original: Transfer the code from the original plot sheet directly to the new plot sheet. Do not change the original tree class under any circumstances, unless an illegal tree class code was originally used. If an illegal tree class code is found, bring it to the attention of the person in charge of remeasurement before making a change.

b) Current: Assign tree class codes of 20, 30, 31, or 40 to each tree tallied. Ongrowth and ingrowth trees will not receive an original tree class.

Item 28 Cover Class: If a point was cover classed on the prior survey, two situations may be encountered. If the point is still cover classed on the current survey, record the original cover class and determine what the current cover class should be. Reference cover classed points. If live trees or seedlings are now present on the point, record them as ongrowth or ingrowth. There is no need to complete a separate line entry for the original cover class in this instance.

Item 29 Crown Ratio

- a) Original: Transfer the crown ratio recorded on the original plot sheet to the remeasurement plot sheet for each previously recorded tree. If the code recorded was obviously an error, correct it. A note of importance here is that the tallier must be certain that an error was made. The tallier in the field has more information available to him than anyone else; therefore, if an error is evident, he is in the best position to rectify it. If a change is made, a note must be on the back of the plot sheet to explain it. Do not make any changes to crown ratio on the original plot sheet.
- b) Current: Record the percent of total tree height that supports full, live, green, healthy foliage that is effectively contributing to the tree growth. Each tree that is tallied now, but not on the former survey (ongrowth, (or ingrowth) will receive only a current crown ratio.

Item 30 Crown Class

- a) Original: Transfer the crown class recorded on the original plot sheet for each previously recorded tree. If the code recorded was obviously an error, correct it. Again, use extreme caution in making any changes. Be able to justify the change. Do not make any changes to crown class on the original plot sheet. If a change is made, a note must be made on the back of the plot sheet to explain.
- b) Current: Crown classification primarily reflects the amount of sunlight received, rather than the conventional crown position classification.

Item 31 Stocking Percent: Record stocking percent as needed to determine current forest type-stand-size class when these categories are not visibly obvious. Use each live tree until required percentages are obtained at each point.

Stocking percents were assigned differently on the previous survey. Refer to the 1968 stocking percent rules in the appendix of this supplement.

Item 32 Point Tree Occupancy: If one or more live trees are recorded, show order of occupancy based on crown class, crown ratio, and DBH. Point occupancy may change from the original survey from such things as trees dying, others growing more prolifically, and many other external factors. As a result, point occupancy on the remeasurement may differ radically from the original survey.

Under the following headings record current measurements according to survey standards:

- Item 33 Tree Cavities
- Item 34 Saw Log Length
- Item 35 Saw Log Top D.O.B.
- Item 36 Cull Board Feet
- Item 37 Log Grade
- Item 38 Bole Length
- Item 39 Bole Length Top D.O.B.
- Item 40 Cull Cubic Feet
- Item 41 Internal Defect

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Joseph F. Panci  
Andrew P. Doman

## APPENDIX i

FULL REMEASUREMENT PLOTS-First digit describes previous tree class, second digit current tree class.

PARTIAL REMEASUREMENT AND NON-REMEASUREMENT PLOTS-First digit is always "0", second digit is current tree class.

0=No status  
1=growing stock live  
2=cull live  
3=ingrowth  
4=dead (salvable-mortality)  
5=dead (mortality)  
6=ongrowth  
7=stump (salvaged dead)  
8=stump (utilized)  
9=stump (not utilized)

Note: 3-is only valid as the first digit of the 2-digit code on full remeasurement plots (i.e. ingrowth to cull is coded "32").

6-is only valid as the first digit of the 2-digit code on full remeasurment plots (i.e. ongrowth to growing stock is coded "61").

0=is only valid as the first digit of tree history on partial remeasurement and non-remeasurement plots and the second digit on full remeasurement plots that have curently been denied access or are no longer commercial forest land, (i.e. "01" is a live growing stock tree on a non-remeasurement plot. "20" is a cull tree at the time of the previous remeasurement survey which is currently on denied access or non-commercial forest land).

## REMEASUREMENT FIELD EDIT PROCEDURES

These checks should be made in addition to the regular field edit procedures.

1. Check the old plot number. Add a zero before the number appearing in the upper left corner of the original plot sheet to obtain the 4-digit number entered on the remeasurement plot sheet.
2. Check to see that the original DBH, tree class, crown ratio, and crown class are correctly transferred to the new plot sheet, where appropriate.
3. Be sure the original date of survey, B.A./Acre, Forest type-stand-size class, and stand-age are correctly entered in the heading. Also, be sure the original and current data correspond with the changes that have occurred since the last survey.
4. When the forest type stand-size class has changed between surveys, make sure Land Use Trend reflects this change. Do not change the original forest type-stand-size class.
5. Be sure an adequate map is sketched of the area around the SP-PC and included on the new plot sheet. This is in addition to an adequate verbal SP description.
6. All live trees tallied on the last survey must be accounted for on the remeasurement plot sheet.
7. Tree or cover class must be entered on the new plot sheet exactly as it was on the original plot sheet unless an illegal code was used. No other exceptions!!
8. Be sure all corrections to the old data, unusual situations, etc. are adequately explained in the notes on the back of the plot sheet
9. Be sure sample kind is a #2, or #8.
10. Record azimuths and distances to saplings on points 4-10 if no pole or sawtimber sized trees are present. For points that just have seedlings or are cover classed, make sure points are referenced. Record this information in the "Notes" section.
11. Make sure dead trees are recorded properly on the remeasurement plot sheet.

12. Make sure the back of the new photo has been marked with azimuth and distance from SP to PC.
13. All seedlings are defined as ingrowth; assign tree history codes 31 or 32.
14. Check all tree history codes by comparing their current and original tree class and their distance from point center to see if the tree history is correct. If it is not, correct it.
15. Some species were recorded as noncommercial species on the previous survey which are now considered to be shrubs. These trees should be omitted from the remeasurement plot sheet, and a note made on the back.
16. The sample kind for old plot numbers on continuation sheets should be 1 or 7.

## 1968 Stocking Percent Rules

Stocking Percent, Item 36. Normally stocking percent was computed in the office. However, when it was necessary to determine stocking percent for field application the following percents were used.

<u>Point</u>	<u>Tree Size</u>	<u>Percent</u>
one or more 5.0" d.b.h. trees	5.0"+	4.7
	4.0-4.9	4.0
	3.0-3.9	2.4
	2.0-2.9	1.2
	1.0-1.9	.4
No trees 5.0" d.b.h. or larger	4.0-4.9	4.0
	3.0-3.9	3.5
	2.0-2.9	3.0
	1.0-1.9	2.5
No trees 1.0" d.b.h. or larger	seedling	4.0

SUMMARY - SAMPLE KIND 8, PARTIAL REMEASUREMENT PLOTS

Purpose: To identify trends in land use and disturbances between surveys.

Each crew will be provided with the old plot sheet and photo, to aid in locating the original plot. It is not of primary importance to locate the original plot center. Many of these plots were not permanently established. Therefore, locating PC could be difficult. Each crew should try to establish the "new" plot as close as possible to the old PC.

Only the following data should be transferred from the old plot sheet to the new plot sheet:

- a) Old plot number
- b) Original Date, item 13
- c) Original BA/Acre, item 43
- d) Original Forest Type-Stand Size Class, item 44
- e) Original Stand Age, item 45

Ground Land Use, Use Trend, and Stand History codes (items 4, 5 and 9) will be measured for the period of time between surveys. Any disturbances coded in Stand History must be recorded in the notes. These include, partial harvest cuts, grazing, TSI, etc. Other "header" information can be recorded according to this supplement.

All other tree information will be recorded according to the rules for sample kind 7, in the Forest Survey Field Manual.