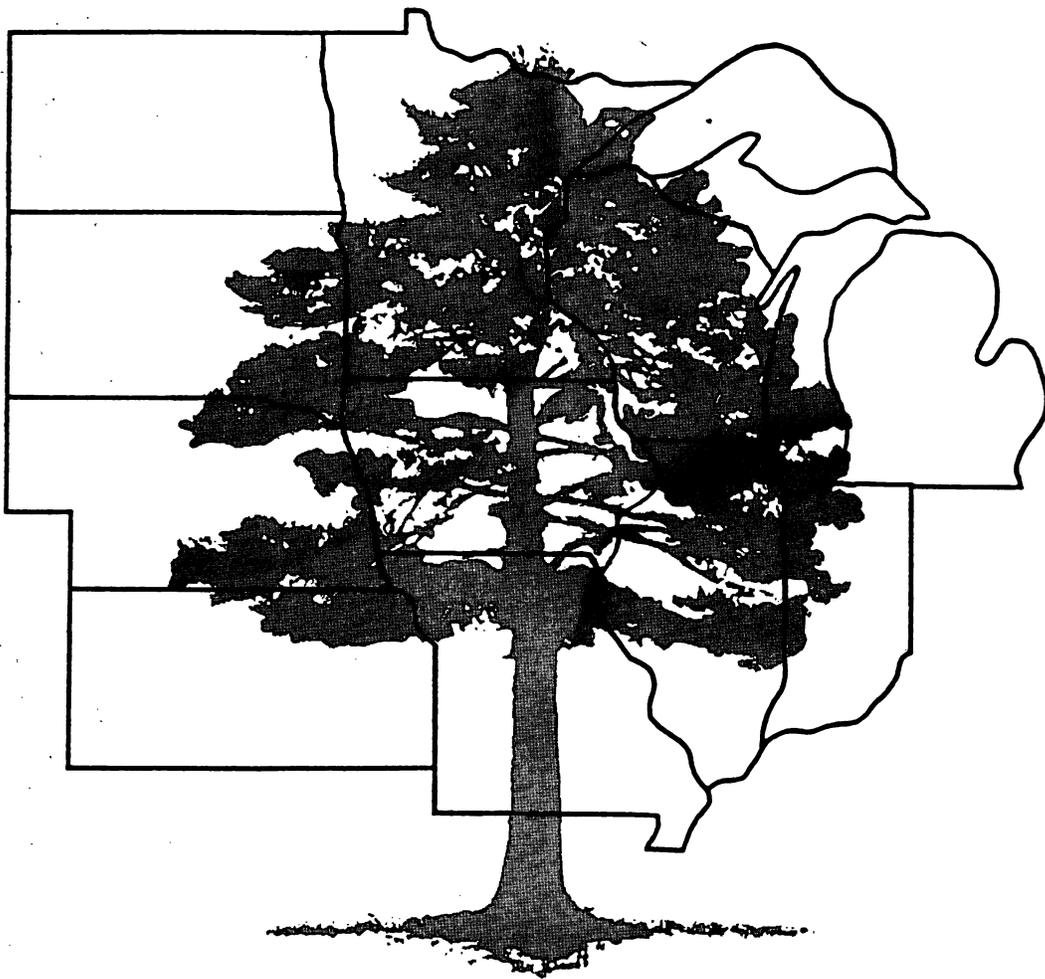


Ostrom  
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**NORTH CENTRAL REGION  
FOREST INVENTORY AND ANALYSIS**

**FIELD INSTRUCTIONS**  
**MICHIGAN, 1991**



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

**NORTH CENTRAL FOREST EXPERIMENT STATION**

**FOREST INVENTORY AND ANALYSIS**

**FIELD MANUAL**

**MICHIGAN, 1991**

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

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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.

Federal legislation mandates that periodic inventories and assessments be made of the Nation's forest resources. The U.S. Forest Service has the responsibility for meeting this mandate.

Anyone who establishes a permanent plot should recognize that he or she hereby assumes responsibility for furnishing workers with a complete picture of conditions on the plot at the time of its establishment. Not only must each plot be properly marked and all measures be in near perfect order, but all notes and records must be complete. Otherwise, the plots may fail to yield the desired results and those who in later years become responsible for their care and for the analysis of the data, may be led to serious mistakes.

(U.S. Department of Agriculture, Forest Service 1935)

Each forest experiment station has been assigned to provide statistics for a number of specific states (11 states for the North Central Station). Statistics from each station must be presented in a manner that permits aggregation with those from the other stations in order that uniform regional and national statistics may be produced. The experiment stations are further directed to cooperate with other agencies and individual states, in order to provide additional resource information.

Permanent Forest Inventory plots measured during the previous survey will be remeasured to obtain information on changes that have taken place between surveys. Some of these changes will be reflected in land use, growth, and removals. Therefore, it is important that every plot and every tree tallied previously be accounted for at the time of remeasurement.

Most instructions that apply to a new measurement plot also hold true for a remeasurement plot. When necessary, specific instructions are given for a remeasurement plot.

It may be helpful to consult the previous survey manual for procedure or definition changes between the time of the previous and current surveys. Copies are available in the field offices.

## FIELD EQUIPMENT

The following equipment is necessary to measure required items at field locations. Field personnel should check to make sure they have this equipment, and that it is in good working order.

- Pocket Stereoscope
- 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.) - one per crew or vehicle
- Wheeler Pentaprism - one per crew or vehicle
- Cruiser's Vest
- Tree Marking Scribe
- Tree Paint
- One Yellow Stake
- Ten Metal Pins
- Flagging
- Safety Pin
- Data Recorder or field plot sheet
- Hip chain

## FIELD PROCEDURES

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

Precise measurement and classifications are essential to keep field-technique errors to a minimum. Errors in classification or 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.

Nine-digit codes (sequential plot numbers) are recorded by photo interpreters to identify consecutive plot numbers in each county. All plots receive numbers. Plot numbers identify sample plot locations on aerial photographs. A plot header sheet is completed for all plots sent to the field offices.

For each plot, field crews receive a plot header sheet and aerial photographs, with the sample location marked. A remeasurement plot also includes the original plot sheet and aerial photographs. For remeasurement plots, check that the plot number on the original plot sheet matches the "Old plot number" on the plot header sheet.

Information obtained at each sample location will be recorded on an electronic data recorder and/or a plot sheet. A sample plot header sheet is located in the appendix of this manual for reference.

The following pages describe tally items. Headings show the tally item name and number and the prompt (in parentheses) that appears on the data recorder.

## ITEM 1 OWNERSHIP (OWN, OTEN)

Field personnel visit county court offices to get 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 Ranger District or Forest Supervisor's office. Ownership information on public lands (other than USFS) can usually be obtained from their 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 (OWN)** Record the ownership class using the following two-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 and Municipal
2*	Forest Industry (Must process own products.)
4*	Farmer
6*	Miscellaneous Private Corporate
7*	Miscellaneous Private Individual

\*For Ownership Class codes 2 through 7, the second digit indicates ownership size (commercial forest land only) in the United States. Indicate size in acres by using one of the following codes:

<u>Code</u>	<u>Acres of Commercial forest land</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 <u>actual</u> number of acres owned for all tracts 5000+ acres in the "Notes" section.)

## ITEM 1. OWNERSHIP CONTINUED

### How To Collect Ownership Information

- Go to the county courthouse and find the Assessor's office. Explain who you are and what you are doing.
- To find the owner's name for each plot, you will need to use a current plat book or the large set of plat sheets. You may need to find a "parcel number" first, and then refer to a card file or a computer terminal to find the owner. Each courthouse is unique, so your methods may vary from county to county.
- By cross referencing the plat book with the current aerial photography, you can get a pretty good estimate of acres in forest land owned by each individual. They may have another method more accurate. Make sure to watch in the plat book for other parcels of land owned by the same person. Total all of the forested parcels together to obtain the second digit of the ownership class.

Ownership Class and is recorded for the following plots:

- All plots established on Commercial forest land, Ground Land Use (GLU) 20, 21, 22.
- All remeasurement plots reclassified nonforest land due to removal of timber.

Ownership accuracy is noted on the plot header sheet for each of these ownership items:

- Owner name and address
- Owner area class

For each of the above ownership items use one of the following codes:

<u>Code</u>	<u>Definition</u>
1	Unknown - best estimate.
2	Poor - courthouse records unclear or an unreliable source.
3	Good - verified in courthouse or by owner.

Note: Ownership accuracy is noted only on the plot header sheet and is not entered into the data recorder.

## ITEM 2 SAMPLE KIND (SK)

The plot Sample Kind indicates the information to be collected, and identifies whether the plot was previously measured. The following is a list of Sample Kind codes and their descriptions:

<u>Code</u>	<u>Description</u>
1	<b>Full New Measurement</b> Take all measurements including volume measurements (items 34 - 40). This is a new plot, with no old trees to locate.
2	<b>Full Remeasurement</b> Relocate and measure all old trees, also measure new trees. Take volume measurements as in Sample Kind #1.
6	<b>Partial Remeasurement</b> Relocate and measure all old trees, also measure new trees. Volume measurements (items 34 - 40) are not needed.
7	<b>Partial New Measurement</b> This is a new plot with no old trees to relocate. Volume measurements and are not needed. [except Tree Grade (item 37)].

## ITEM 3 PLOT LOCATION

### Establishment of Baseline

The first step in locating the forest sample location is to locate two features on the ground that are easily noticed on the photograph. The two features should be at least 10 chains apart for scale 1:20,000 and 20 chains apart for scale 1:40,000 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.

Pinprick both features on the photograph and circle the pinpricks on the back of the photos. Draw the baseline 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 half degree and record it on the back of the photograph. Disregard magnetic declination.

### ITEM 3. PLOT LOCATION CONTINUED

#### Starting Point

A starting point is used to initially locate a sample plot and to relocate a sample plot on later inventories.

When selecting the starting point, make sure it is readily identifiable on the ground and on the photograph. It should be as near as possible to the sample location, yet not on the same acre as the sample plot. Select a prominent tree located at the edge of a field or clearing, or at a bend in a stream, or any landmark easy to find on the next survey.

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 four-inches high located just above where the DBH measurement was taken and a three-inches 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 plot header sheet under "Starting Point Description." Include the landmarks you used to locate SP. Specify details such as:

- Species, DBH and the face on which the tree is painted.
- Any nearby road, fence, pasture, etc. and the tree's location in relation to that feature.
- Any noticeable characteristic of the SP tree, such as a fork at 10 feet, multiple stems, deer stand, etc.

#### Azimuth and Distance Computation

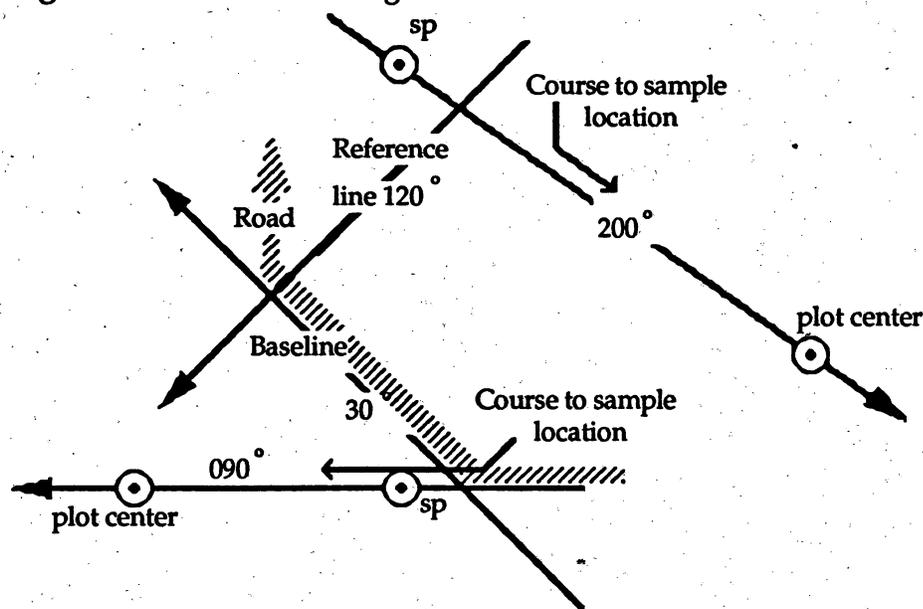
On the back of the photograph, draw a straight line through the center of the starting point pinprick and the center of the sample location pinprick. Extend this line to intersect the baseline. Lines should extend well beyond the intersection to allow reading the backsight off the 360-degree protractor to check the accuracy of the angle being measured.

If the baseline and the line to the sample location do not intersect on the photograph, draw a straight line that will intersect the baseline and the course to sample location line. Indicate the directions of the sample location line and the baseline by putting an arrow at the end of each line. Measure the angle between these lines, starting from the baseline.

### ITEM 3 PLOT LOCATION CONTINUED

Invert the transparent photo scale and align the 360-degree protractor over the azimuth of the baseline to get the azimuth of the sample location line. The azimuth is read directly off the protractor once the azimuth of the baseline is correctly aligned on the inverted 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 the protractor is precisely aligned.

Figure 1 - Azimuth settings



**Important:** East-west azimuths are reversed when working on back of photo.

Refer to Figure 1. Measure on the photograph the distance from the starting point (SP) to the plot center (PC) to the nearest 1/4 chain using a transparent photo scale. (Each crew member is supplied with various photo scales which correspond to the scale of the aerial photograph.) Hold the photo up to the light and carefully measure, from the center of one pinprick to the center of the other. (Sometimes it helps to use your stereoscopes as a magnifier.) Record both distance and direction on the back of the photograph and on the plot sheet under "Course to Sample Location".

### ITEM 3 PLOT LOCATION CONTINUED

#### Chaining

Using compass and tape, run a course on the computed azimuth. Distance correction for slope will be necessary when slope exceeds 10 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. The appropriate slope correction can then be found in Table 1. The correct adjustment should be added at the same percent slope.

Table 1--Slope Correction  
(Distance is measured on slope)

Percent	Feet		
	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
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. **Important:** Make sure that photograph location agrees with ground location.

### ITEM 3 PLOT LOCATION CONTINUED

#### 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 under the course to sample location on the plot header sheet and remove the first pin. The initial pin is referred to as a turning point. The second pin becomes the location of the 10-point cluster.

#### Plot Location Procedure For Remeasurement Plots

Using both the old and new photographs, locate the starting point, or SP. If the SP pinprick is missing from the old photo, refer to the starting point description on the old plot sheet and determine the SP location according to the azimuth and distance to plot center, PC. Another aid to SP 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 SP might logically be located.

Once the SP tree is located, inspect to see that it is suitable. If the SP is 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, SP description, and the remeasured DBH to item 3 on the new plot sheet. On the new photo, pinprick the SP and record the course to sample location on the back of the photo.

A new starting point should be established if the original SP is not suitable, cannot be relocated, or the plot location was visualized. Record the course to sample location, SP description, and SP DBH on the new plot sheet. After the SP 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.

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-inch wire pins and bits of flagging at each point, blazed trees, and witness trees (painted with an "X").

### ITEM 3 PLOT LOCATION CONTINUED

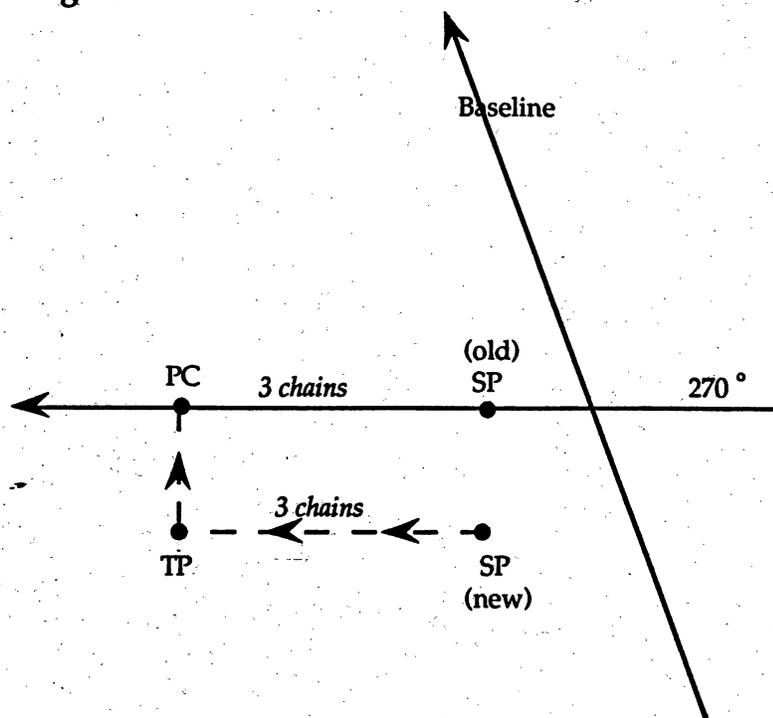
In the event that, after chaining the prescribed distance, no evidence of the old plot can be found, several alternatives for locating PC are available:

- Using the original SP, look for landmarks to discern if the plot is in the area. Look especially for mistaken openings, trails, etc.
- Search an area of five chains around the end of the approach line(s).
- Return to the SP, check the photo work, and try rechaining.
- Check the photo work to see if the original crew chained in the opposite direction.
- Pick a new SP, establish a new approach line, and chain in from there.

An easy way to establish a new SP, when needed, is to inspect the vicinity of the original SP for a suitable replacement. There are three options you can choose once this replacement is chosen:

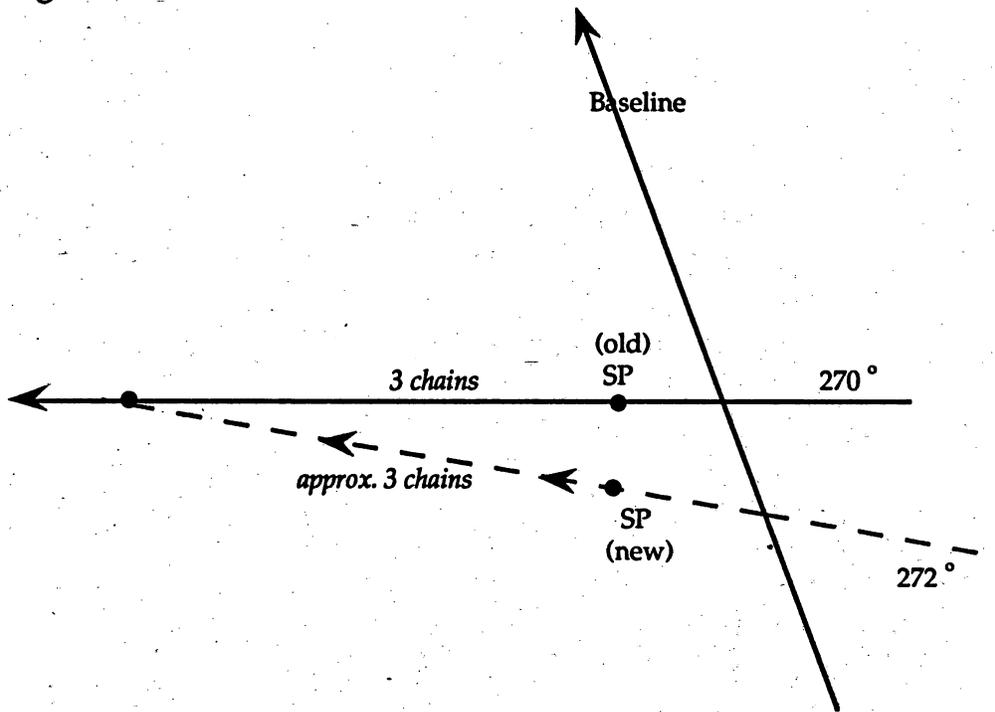
1. If the new SP is close by, pick the tree on the photo and use the original course to sample location. Leave a marker where you finally land in the woods and look for plot center. It should be approximately the same distance and azimuth that the old SP is from the new SP. Once PC is found, make a turning point from your marker to PC. (Figure 2A)

Figure 2A



### ITEM 3 PLOT LOCATION CONTINUED

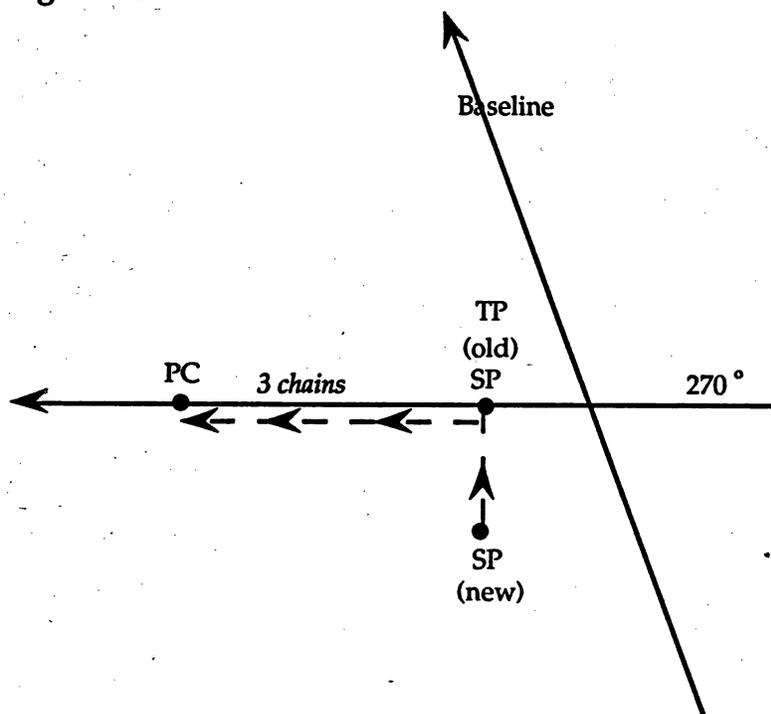
Figure 2B



2. Depending on how far the new SP is from the old SP, you may try adding or subtracting a degree or two (whichever is appropriate) and follow this azimuth into the plot. Adding a few feet onto the old distance may be helpful. Use a marker to show where you ended your chaining. Scan the area for the plot center and then make the necessary turning point to plot center. (Figure 2B)

### ITEM 3 PLOT LOCATION CONTINUED

Figure 2C



3. Measure the distance and azimuth from the new SP to the original SP. Record this information in the course to sample location. Record the old course to sample location to the right of this new course. At this time, a new SP has been established and the original SP is used as a turning point in the course to sample location. (Figure 2C) Note: This is the least desirable choice, for it may result in having two turning points--one at the beginning and one at the end.

### ITEM 3 PLOT LOCATION CONTINUED

Occasionally, while chaining in you may pass near or over PC. Minimize the length of a turning point, or perhaps eliminate the need for a turning point, by reducing the chaining distance--backtrack along the line of approach.

#### **If unable to locate a Remeasurement plot**

If you and your partner can't find a remeasurement plot, bring it to the attention of the person in charge. After two crews have thoroughly searched for the plot without success, the second crew will establish the plot at the correct location.

When there has been no disturbance to the area, a new sample plot is established. Change the Sample Kind on the plot sheet to a new full measurement (S.K. #1) if the plot was a full remeasurement (S.K. #2). If the plot was a partial remeasurement (S.K. #6), change the Sample Kind to a partial new measurement (S.K. #7). Record the Sample Kind change in the "Notes" section.

Where there has been a major disturbance (i.e., the area has been clearcut and bulldozed), a remeasurement should be established as near 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 data recorder and the current data collected to reflect whether the original trees were cut or dead. Tally items needed for these trees are given in the Tree History section.

#### **Remeasurement plot in the wrong location**

If a remeasurement plot was put in the wrong location (i.e. not in the same location as the photo pinprick), re-establish the plot in that wrong location. If the error is significant (use the black circle as a guide), re-pinprick the new photo where the plot is actually located.

In the "Notes:" section of the plot sheet, indicate that the plot was put in a different location. Record the distance and azimuth (use photo scale) from the original pinprick on the new photo to the location where the plot is actually located.

Bring such plots to the attention of the person in charge. It should be assumed that the plot is located in the correct location, unless evidence of the plot is found in the wrong place (i.e., pins, paint or flagging).

### ITEM 3 PLOT LOCATION CONTINUED

#### Point Location

When some evidence of the old plot has been found, look for trees 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, marked with a piece of galvanized or aluminum wire--bent into a loop with a piece of blue 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 this 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. The crew should then calculate the proper distance and azimuth to Point #1, or plot center, and begin to search for plot center.

When PC is found, it should be remarked in the prescribed manner. If the distance between PC and the end of the approach line exceeds three percent of the chaining distance, a turning point needs to be established. The distance and azimuth from the end of the approach line to PC should be recorded on the back of the new photo and on the new plot sheet under "Course to Same Location". Remove the blue flagging at the turning point location.

It is very important that each individual point be located as accurately as possible. Finding each point is a challenge, because 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 trees, identifiable from the paint, are available, use the triangulation method to relocate the point. If this is not possible, due to lack of trees or other 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, thus reducing the area to be searched. Each point after PC should be marked in the prescribed manner.

#### ITEM 4 GROUND LAND USE (GLUO, GLUC)

Once plot center has been established, carefully examine, select and record the present primary land use classification as determined from ground examination.

For remeasurement plots, it is important to determine what, if any, land use changes have occurred between the previous inventory and the remeasurement. Fill in ground land use as it is at the time of remeasurement.

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 one 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. 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 363 feet long. A square area needs to be 209 feet on a side, and a circular area needs to be 235 feet in diameter.

Photo Interpretation Codes - (Information only - will be on the plot header sheet)

#### PI Code      Description

17	Urban natural forest land
18	Non-urban natural forest land
19	Reserved/deferred natural forest land
27	Urban plantation forest land
28	Non-urban plantation forest land
29	Reserved/deferred plantation forest land
30	Questionable forest land
51	Nonforest with trees, cropland
52	Nonforest with trees, pasture
53	Nonforest with trees, wooded strip
54	Nonforest with trees, windbreak
55	Nonforest with trees, marsh
56	Nonforest with trees, farmstead/rural homestead
57	Nonforest with trees, urban
59	Nonforest with trees, reserved
61	Nonforest without trees, cropland
62	Nonforest without trees, pasture
65	Nonforest without trees, marsh
66	Nonforest without trees, farmstead/rural homestead
67	Nonforest without trees, urban
68	Nonforest without trees, rural, non-agricultural
69	Nonforest without trees, reserved

## ITEM 4 GROUND LAND USE CONTINUED

### FOREST LAND

Land not currently developed for nonforest use and having at least 16.7 percent stocking of all live 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 one acre and 120 feet in width. (See definitions--especially nonstocked forest land.)

Use one of the following two-digit codes:

#### Code

- 20 **Timberland** 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 Timberland** 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. The Forest Type, Stand Age, and Stand Size Class should reflect the planted species. If the plantation has failed, give the plot a GLU code 20. (If land is used for Christmas tree production, see code 46.)

#### 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.)

## ITEM 4 GROUND LAND USE CONTINUED

### Noncommercial Forest Locations (code 40, 41, 45, 46)

If point one falls in a forest of marginal productivity, site index should be measured first. All commercial species found within the plot area must be measured and determined unproductive (code 40) before classifying the plot as Noncommercial unproductive forest land. The tallier must use judgement 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).

Use one of the following two-digit codes for Noncommercial forest land locations:

#### Code

- 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. Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness. Vegetation, if present, is widely spaced and scrubby, or tree growth cannot be established. Based on site index under 15 for northern white-cedar, under 20 for black spruce and tamarack, under 25 for eastern redcedar 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 withdrawn from timber utilization for exclusive use in Christmas tree production. There must be evidence of annual shearing, or other management practices that indicate the exclusive use.

#### ITEM 4 GROUND LAND USE CONTINUED

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

Old Plot No./Dot No.	Distance to Road	Physio-class
State	National Forest	Stand Origin
Unit	Ranger District	Stand History
County	Ownership Class	Date
Sample Kind	Ground Land Use	BA/Acre
Stand Area	GLU - reason for change	Forest Type-Stand-Size Class
Distance to Water	Aspect-Position-Slope	Stand Age

BA/acre, Forest Type-Stand Size Class, and Stand Age may be estimated. Site index will be recorded or estimated for GLU codes 40, 41, and 45.

#### NONFOREST LAND

##### Nonforest Locations

Locations interpreted as questionable on aerial photographs will require a field check in accordance with an improved sampling design. Some locations interpreted as forest on aerial photographs will turn out to be nonforest, upon field examination.

Land currently developed for use other than growing trees; and/or land that has never had 16.7 percent stocking in forest trees, five inches in DBH or larger.

##### Nonforest Land with Trees

Nonforest plots which have at least one or more trees, five inches in DBH or larger, within the visual acre about PC. The visual acre must be in the same land use.

#### ITEM 4 GROUND LAND USE CONTINUED

Use one of the following two-digit codes when on Nonforest land with trees:

##### Code

- 51 **Cropland with trees** Cropland with scattered inclusions of single trees or small groups of 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). Exception: Stocking may exceed 16.7 percent if, and only if, trees present are seedlings (sprouts), showing evidence of regular pasture maintenance. Examples of pasture maintenance are:
- bush hogged periodically
  - evidence of being bush hogged (maximum height of seedlings three to four feet and basal scars present on trees)
  - area periodically treated with herbicides
- 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.  
Timeline: from two years up to the time it reaches 16.7 percent stocked.  
Caution: Do not confuse this with non-stocked forest land which should have a GLU code 20 and Stand-Size Class code 4.
- 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 feet wide, 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.

ITEM 4 GROUND LAND USE CONTINUED

Nonforest Land with Trees CONTINUED

Code

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 timberland 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 from grazing and heavy browsing of the herbaceous and woody understory. The above should indicate that the primary use of the land is something other than wood production or the protection of buildings. The 25 percent stocking rule will be used to help determine primary land use in fairly homogeneous areas. In clumps, openings, and other inclusions, judgement must be used.

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. It is extremely unlikely that such land would be used for timber products on a continuing basis. Example: wooded creek bottom surrounded by houses.

72 **Urban and other with trees** Area with trees that is developed for residential, industrial, recreational, or other urban use. For example city park, cemetery, golf course, maintained backyard.

\* Note: A plot will be established for plots with GLU 57 and 59, and a plot sheet completed.

For a Nonforest land with trees plot with GLU 51-56, 58, 71 or 72, record the following on the plot sheet:

Old Plot No./Dot No.	National Forest	Date
State	Ranger District	Forest Type-
Unit	Ownership Class*	Stand-Size Class
County	Ground Land Use	
Sample Kind	GLU - reason for change	

\* Ownership class is needed only for remeasurement plots that were forested (GLU 20, 21, and 22) at the time of the last inventory.

~~Sample~~ Forest Type-Stand Size Class, ~~and~~ ~~sample~~ may be estimated.

Collected in 01/19/11

## ITEM 4 GROUND LAND USE CONTINUED

### Nonforest Land without Trees

No tree species present in the visual plot area. Use the following two-digit codes when on Nonforest land without trees:

#### Code

- 61 **Cropland without trees** Presently cropped or fallow up to two years.
- 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 rights-of-way. This include railroads, powerlines, pipelines, and maintained roads. A right-of-way of any width qualifies as non-forest land--this is an exception to the one acre/120 feet rule.
- 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).

ITEM 4 GROUND LAND USE CONTINUED

Nonforest Land without Trees CONTINUED

For a Nonforest land without trees plot with GLU 61-69, 80 or 90, record the following on the plot sheet:

Old Plot No./Dot No.	National Forest
State	Ranger District
Unit	<del>Photo log</del>
County	Date
Sample Kind	*Ownership class
Ground Land Use	<del>Ownership class</del>
GLU - reason for change	

Corrected ON  
ORIGINAL

\*Note: Ownership class is needed only for remeasurement plots which were forested (GLU 20, 21, 22) at the time of the prior survey.

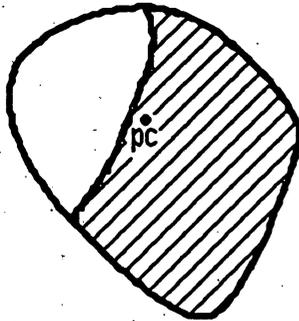
Remember, a plot will be established for the following Ground Land Uses:

Commercial forest	(GLU 20, 21, 22)
Wide windbreak	(GLU 57)
Wooded pasture	(GLU 59)

In all other cases, only the appropriate "header" information is required (although on remeasurement plots you will need to account for all original tally trees).

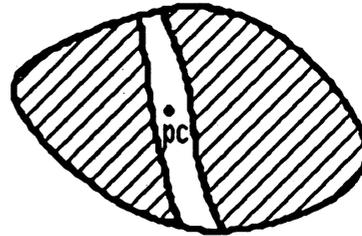
ITEM 4 GROUND LAND USE CONTINUED

Figure 3 - The following examples have been included to aid in assigning Ground Land Use. Shaded areas represent forest.



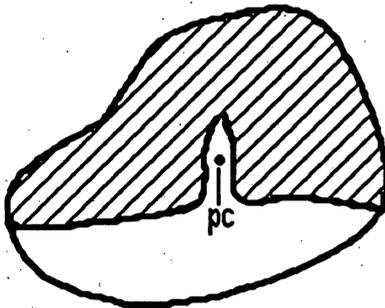
1.

Forest Dot falls on forest land larger than one acre in size.



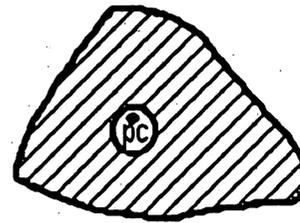
2.

Forest Dot falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least two sides.



3.

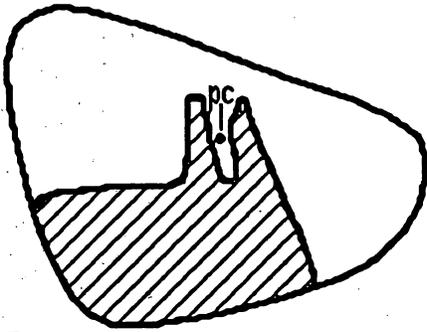
Forest Dot falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least two sides.



4.

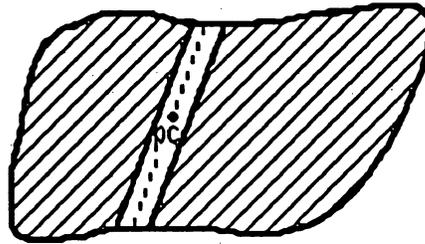
Forest Dot falls on nonforest land (less than one acre in size) that is surrounded by forest land.

Figure 3 CONTINUED



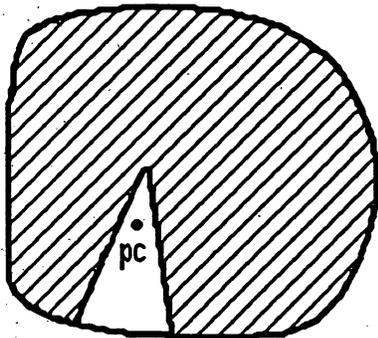
5.

**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.



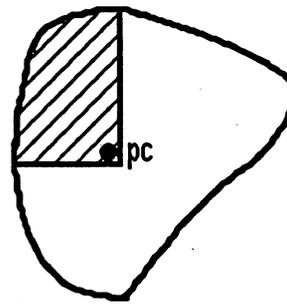
6.

**Nonforest** Dot falls in improved road less than 120 feet wide. Improved roads and powerline clearings of any width are nonforest.



7.

**Forest** Dot falls on nonforest land (less than 120 feet in width). If point had fallen in area 120+ feet 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°) 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.

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

## ITEM 4 GROUND LAND USE CONTINUED

### REASON FOR CHANGE (CAUS)

Record on the header sheet the original ground land use, current ground land use, and reason for change (if any). If both original and current ground land uses are the same, reason for change will be recorded as "0". If a change in ground land use has occurred, indicate the process that caused the change with one of the codes below.

<u>Code</u>	<u>Reason that caused the land use change</u>
0	No change
1	Definition - Use only if current GLU code was unavailable on prior survey.
2	Legislation
3	Natural - Use also when you simply disagree with prior crew on GLU call.
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 timber cut
8	Planting
9	Other, Man - Includes fencing to exclude livestock.

For new plots, no GLU change will be recorded unless there has been a change since the date of the photography.

For a remeasurement plot with a ground land use change between surveys, one of these cases will apply:

- If there has been a change from noncommercial or nonforest to commercial forest (or wide windbreak or wooded pasture), a remeasurement plot will be established and all trees will receive a tree history reflecting ingrowth or ongrowth.
- If a previously established plot now falls on noncommercial or nonforest land, except for wide windbreak or wooded pasture, the plot will not be established. The original trees will need to be accounted for, and the appropriate header items completed.

See Tree History (item 23), for details about accounting for old trees in unusual situations.

**ITEM 6 POSITION, ASPECT, SLOPE, SLOPE LENGTH, SLOPE SHAPE (POS, ASP, SLP, LEN, S)**

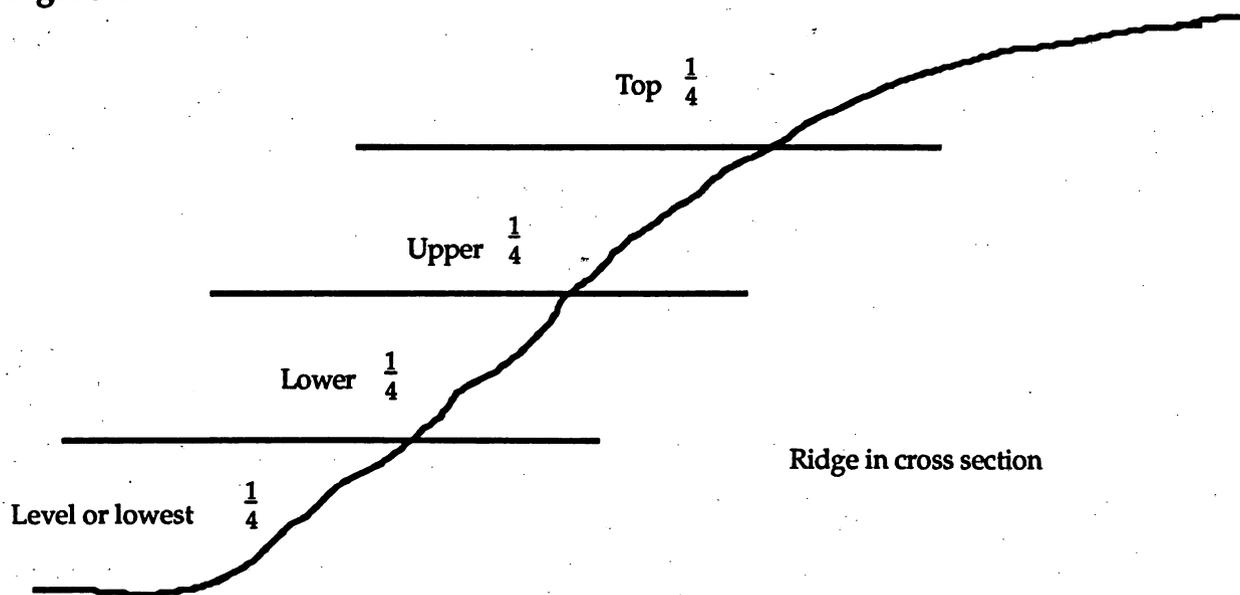
To determine how Position, Aspect, Slope, Slope Length, and Slope Shape affect a stand, these five items will be measured. It is important to understand that all five items tie together or compliment each other. Thus, record the macro features only. Record the appropriate codes in the header information.

**POSITION (POS) (one-digit)**

Represents the location of the majority of the points in reference to topography of the immediate area. (Figure 4)

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

**Figure 4**



**ITEM 6 POSITION, ASPECT, SLOPE, SLOPE LENGTH, SLOPE SHAPE CONTINUED**

**ASPECT (ASP) (three-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°, the code is 036. Direction due North will be recorded as 001.

**SLOPE (SLP) (two-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 percent slope is recorded as 35. All slope percentages 100+ percent will receive a code 99.

**SLOPE LENGTH (LEN) (four-digits)**

On the slope where the majority of the points fall, estimate total slope length to the nearest half chain (from 0000 to 999.5 chains). Slope length is measured to record the distance from the point where water starts to flow down slope (upper slope - ridge top) to the point where runoff enters a well defined channel, or at the bottom of the slope where deposition begins. Slope length is easily determined by looking at the aerial photos in stereo and measuring along the direction of aspect. For flatland and bottomland, record slope length as 0000.

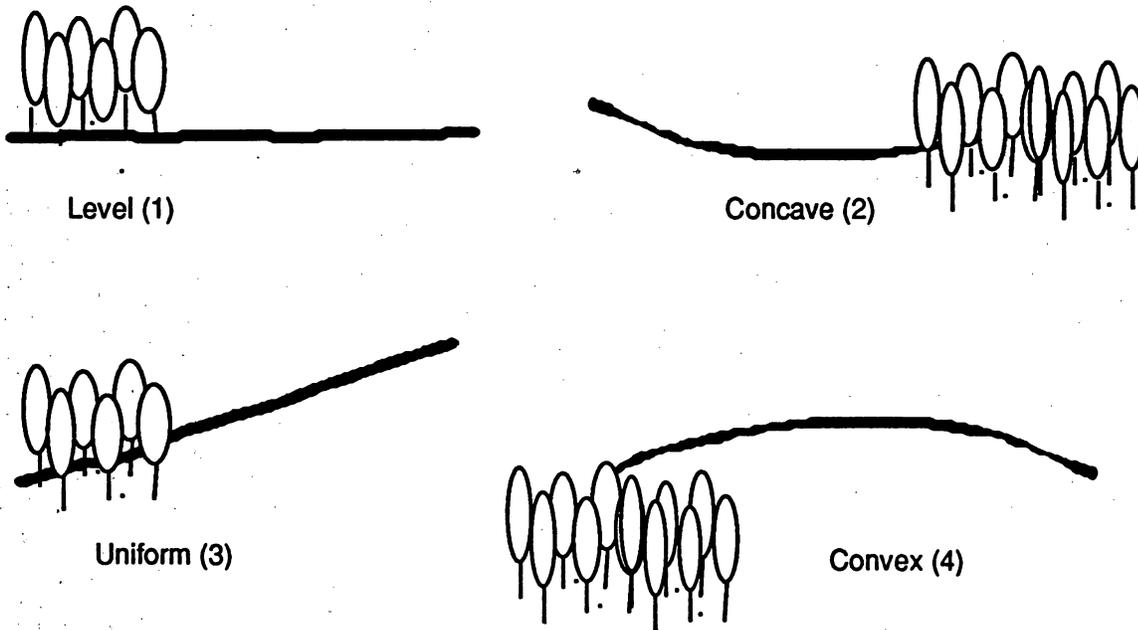
ITEM 6 POSITION, ASPECT, SLOPE, SLOPE LENGTH, SLOPE SHAPE CONTINUED

SLOPE SHAPE (SHP) (one digit)

Along with slope percent, indicates the relative erodibility of the majority of the sample points. A convex shape is often found on the upper part of a slope and indicates an area with potential erodibility and rapid runoff. A concave shape is found on the lower part of the slope profile and has good water holding capacity. (Figure 5)

<u>Code</u>	<u>Slope Shape</u>
1	Level
2	Concave
3	Uniform
4	Convex

Figure 5 - Slope shape



## ITEM 7. PHYSIOGRAPHIC CLASS (PHYS)

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

<u>Code</u>	<u>Physiographic Class</u>
3	<b>Xeric sites</b> Very dry soils where excessive drainage seriously limits both growth and species occurrence. Example: sandy jack pine plains.
4	<b>Xeromesic sites</b> 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	<b>Mesic sites</b> Deep well drained soils. Soil and water relationship most favorable to management opportunities. Growth and species occurrence limited only by climate.
6	<b>Hydromesic sites</b> Moderately wet soils where insufficient drainage or frequent flooding limit growth and species occurrence to some extent. Example: better drained bottomland hardwood sites.
7	<b>Hydric sites</b> Very wet sites where excess water seriously limits both growth and species occurrence. Examples: wet, frequently flooded river bottoms and spruce bogs.

## ITEM 8 STAND ORIGIN (SORI)

Record the stand origin of the sample area using the following one-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.

If Stand Origin is anything other than code 1, write a note in the "Notes" section of the plot sheet.

## ITEM 9 STAND HISTORY (SHIS)

Stand history reflects the kind of disturbance on five or more of the sample points. For new sample plots, stand history reflects this disturbance over the last 20 years. For remeasurement plots, this code reflects the disturbance since the last inventory. Stand history cannot exceed the remeasurement period. Explain the kind and extent of any disturbance in the "Notes" section of the plot sheet.

**First digit** Use the appropriate code for the first digit to describe what has happened:

<u>Code</u>	<u>Occurrence</u>
0	<b>No Disturbance</b> No evidence to indicate any of the following:
1	<b>Grazing</b> Significant disturbance has been caused by livestock grazing. Evidence of livestock grazing would include: the absence of an understory, exposed tree roots and mineral soil, dead standing timber, severe erosion, and cow patties.
2	<b>Timber Stand Improvement</b> There is evidence that some trees have been deadened or removed (or vines cut) through some type of pre-commercial thinning, pruning, or selective firewood harvest.
3	<b>Commercial Clear Cut</b> All merchantable stems, or stems down to some minimum diameter, have been removed. Some large diameter cull-trees may have been left, but in general all merchantable material has been removed.
4	<b>Partial Harvest Cut</b> Less than 50 percent of merchantable stems have been removed. Usually only large diameter, old, or otherwise high value stems are removed in this type of cut.
5	<b>Natural</b> Significant disturbance has been caused by fire, wind, flooding, insect or disease agents.
6	<b>Man-caused</b> Significant disturbance has resulted directly or indirectly as a result of human activities (i.e., alteration of natural drainage, chemical spraying, salt damage from oil wells, or acid water run off, etc.
7	<b>Planting of Forest Land</b>
8	<b>Planting of Non-Forestland</b> Areas that were once old field sites, reclaimed strip mines, pasture, or crop land that were planted to commercial tree species (usually about 300 trees per acre).
9	<b>Natural Regeneration of Non-Forestland</b> Areas that are reverting to forest vegetation. This would include old field sites.

**ITEM 9 STAND HISTORY (SHIS) CONTINUED**

**Second digit** Use one of the following codes for the second digit to indicate how long ago the occurrence took place:

<u>Code</u>	<u>Time</u>
0	No disturbance
1	1-4 years
2	5-10 years
3	11-15 years
4	16-20 years

**ITEM 10 SEED SOURCE (SEED)**

Seed Source 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 five or more points:

1. There is a tree of commercial species that is capable of producing seed at a distance from the point not exceeding the total height of that tree.
2. Natural seedlings are present within the 16.6 foot fixed-radius plot.
3. Hardwoods are expected to have sprouts within the 16.6 foot fixed-radius plot.

Select and record the appropriate one-digit code from among the following:

<u>Code</u>	<u>Seed Source</u>
1	Adequate softwood
2	Adequate hardwood
3	Adequate softwood and hardwood
4	Inadequate, all species

## ITEM 11 CONIFER UNDERSTORY (CONU) (four-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 or inadequate conifer stocking for future stands.

In order for a stand to be adequately stocked, conifers must be present on at least five sample points (within 16.6 feet of point centers).

## ITEM 12 PHOTO AGE (PHAG)

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 the appropriate one-digit code.

<u>Code</u>	<u>Photo Age</u>
1	One growing season or less
2	Two growing seasons
3	Three growing seasons
4	Four growing seasons
5	Five growing seasons
6	Six growing seasons
7	Seven growing seasons
8	Eight growing seasons
9	Nine or more growing seasons

If photo age is greater than nine years, write the actual age of the photos in the "Notes" section of the plot sheet.

## ITEM 12 PHOTO AGE CONTINUED

An easy method to arrive at the correct figure is to count the number of "July 1st's" between the date of photography and the date of field work. For example, suppose you are taking measurements on 6-23-91; and your photos are dated 6-01-84, the photo age would be seven years, or code 7. The '84, '85, '86, '87, '88, '89 and '90 growing seasons are included. The '91 growing season will not count until July 1st, 1991.

## ITEM 13 DATE OF SURVEY (ODAT, CDAT)

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

<u>First two digits</u>		<u>Second two digits</u>	
<u>Code</u>	<u>Month</u>	<u>Code</u>	<u>Year</u>
01	January	86	1986
02	February	87	1987
03	March	88	1988
04	April	89	1989
05	May	90	1990
06	June	91	1991
07	July	92	1992
08	August	93	1993
09	September	94	1994
10	October	95	1995
11	November	96	1996
12	December	97	1997

Example: A plot completed in June, 1991 would be coded 0691.

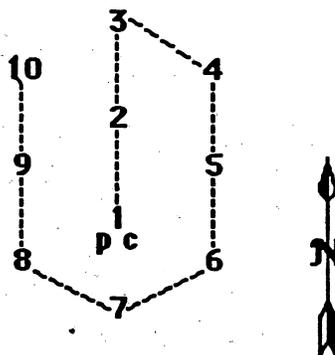
## ITEM 16 PLOT DESIGN

The pattern of sample points is designed to obtain a uniform distribution of points over approximately one acre. Measured distances between sequential points is 70 horizontal feet (see Figure 6).

Figure 6

From Point to Point  
Azimuth

1	2	00
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 are located and marked with metal pins and flagging. The entire 10 points should be restricted to the same land use. An exception to this rule is discussed in "Substitute points".

### Shifted Points

If point one or any other of the nine points at a sample location falls within a tree trunk, shift the point location back along the approach line a distance of two 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 (Rotated) Points

If any of the points two-through-10 fall on land with a land use different than the plot's recorded land use, 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 10 points are in the same land use.

Exception rule: There are three cases when all 10 points do not have to be in the same GLU. No substitute points are needed between these three GLUs since all are considered Commercial forest land:

1. GLU 20 - 21
2. GLU 20 - 22
3. GLU 21 - 22

## ITEM 16 PLOT DESIGN CONTINUED

### Procedure for rotating a point

After establishing all possible regular points, use the following steps to search for a suitable location for establishing a substitute point:

1. Consider locations 70 feet horizontal distance from the highest numbered established regular point. First consider the location 0 azimuth from the point. If this location is unsuitable, consider in turn locations at azimuth 60°, 120°, 180°, 240°, and 300°. When a suitable location has been found, establish the lowest numbered substitute point.
2. If Step 1 fails to yield a suitable point, repeat Step 1 at each of the next highest numbered regular points in turn.
3. If Step 1 and 2 have been exhausted and a suitable point still has not been found, repeat Step 1 at each substitute (rotated) point in turn beginning with the lowest numbered point.

If more than one point is to be substituted, repeat Steps 1 and 2 to establish the second lowest numbered substitute point next, and continue in order until all points to be substituted are established. The general rule for substituting a point is:

- Rotate the lowest point to be rotated off the highest established point, until exhausted.
- Then rotate the lowest point yet to be rotated off the lowest already established rotated point (lowest off highest, then lowest off lowest).

When a substitute point is used, record its location in the "Notes" section on the plot sheet, also show it on the plot diagram.

**Unusual situations** On Remeasurement plots, two unusual situations may occur: First, for a point that was previously rotated out of Nonforest or Noncommercial forest which has since turned into Commercial forest land, remeasure the substitute point.

Second, for a point that was previously established on Commercial forest land which has since become Nonforest or Noncommercial forest, the original trees must be accounted for (see Tree History, item 23, for details), and a new substitute point must be established. All trees tallied on the substitute point will receive a Tree History reflecting ongrowth or ingrowth. Continue tree numbers on the substitute point where they left off on the original point. Keep in mind that the minimum area requirements of 120 feet and one acre in size apply to each point, just as they do at PC.

**ITEM 16 PLOT DESIGN CONTINUED**

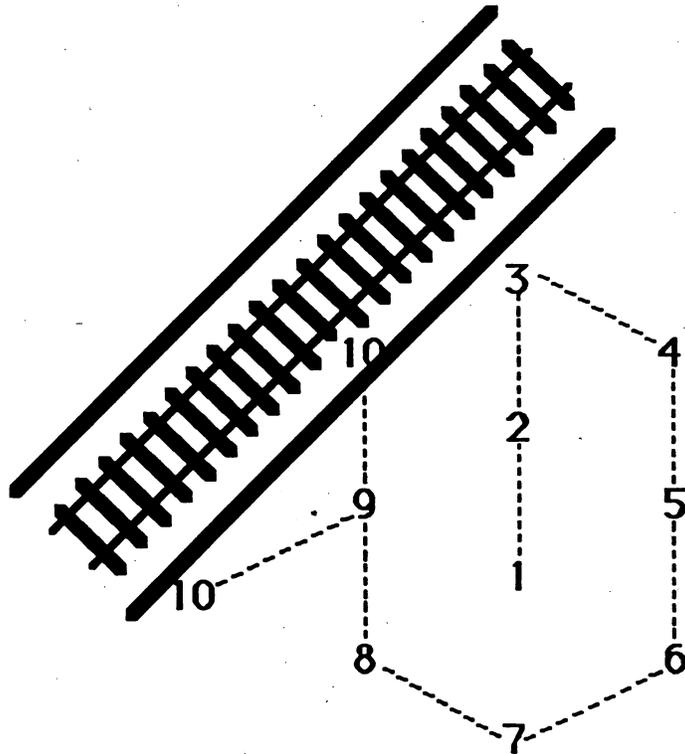
Figures 7, 8, and 9 present situations concerning substitute points:

**Figure 7**

In this example, Point 1 fell in Commercial forest (land use 20).

Since all 10 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 point.

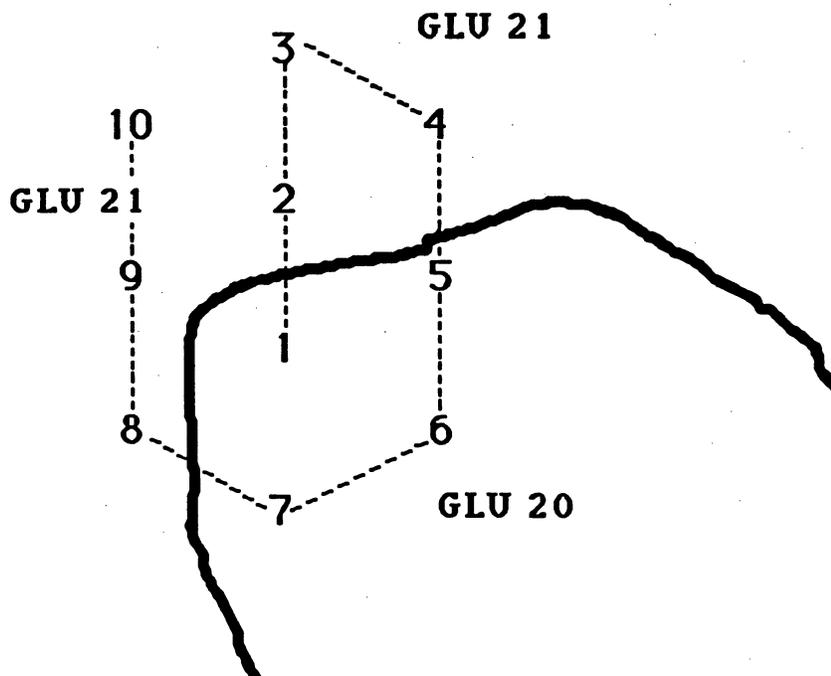


\* The exceptions to this are: between GLU's 20 - 21, 20 - 22, and 21 - 22.

**Figure 8**

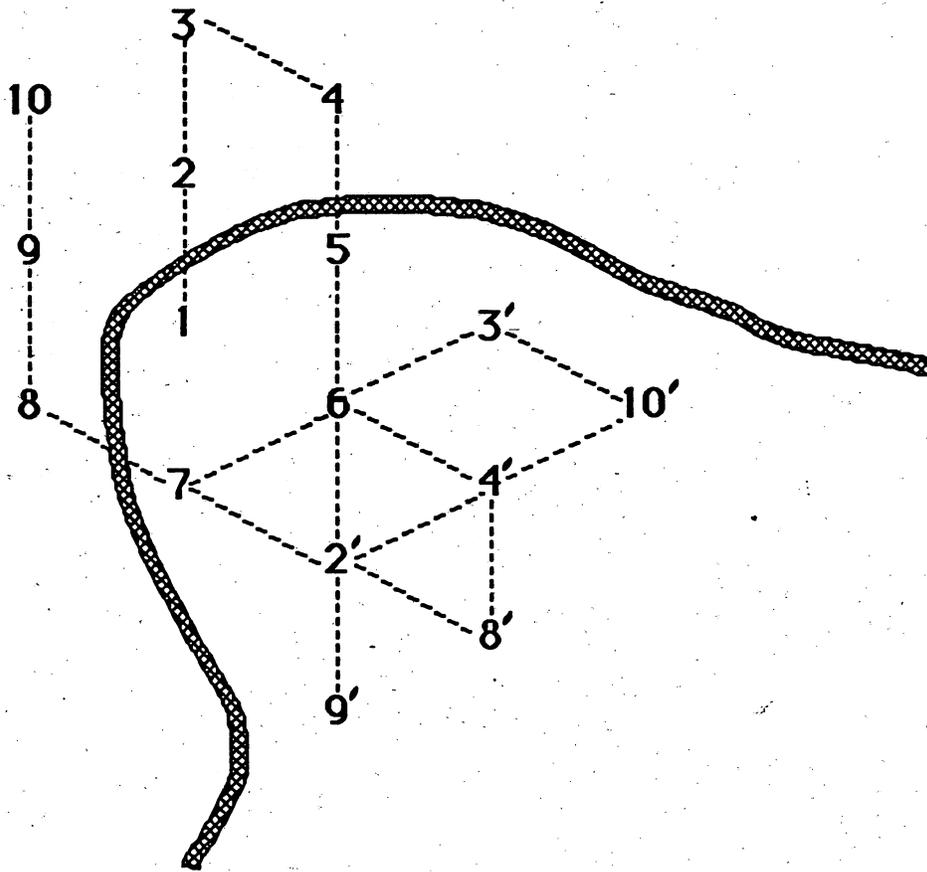
In this example, no substitute points are needed, since both land uses (GLU 20 and GLU 21) are considered Commercial forest land.

Show any changes in ground land use on the cluster diagram on your plot sheet.



# ITEM 16 PLOT DESIGN CONTINUED

Figure 9



In this example (Figure 9), 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, because 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.

## ITEM 16 PLOT DESIGN CONTINUED

### Witness Point

All established plots will be witnessed. 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:

- Located within 100 feet of the witness point
- Not likely to die or be cut before the next survey
- Species easily located in the stand
- At least 5.0" DBH (or at least 2.0" DBH if no 5.0" + DBH is 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 plot header sheet:

- Species
- DBH
- Azimuth
- Slope distance  
(to nearest 1/10th foot from witness point center to the center of the tree at the base)

Some items require measurements to decimal fractions of inches or feet. For these items, it is understood that the last digit represents a decimal fraction. For example, a tree DBH of 23.4 inches is coded 234. Decimal points are never placed in coded entries.

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.

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 plot sheet.

For 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. Remember to remove old witness paint if new witness trees are used.

## ITEM 16 PLOT DESIGN CONTINUED

### Point Reference

On many plots, certain points within the 10-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, and points where only seedlings are tallied.

All established points with no data that could be used to re-establish a point location (i.e. no azimuths or distances to any tree) must be referenced. Reference trees will be marked above DBH and at the base with a scribe mark and painted on the side of the tree facing the point. Unlike witness trees, there is no set rule for painting a reference tree, but it is best to paint the tree with a number corresponding to the point being referenced. This method makes it easier for field crews on the next inventory to identify which point they have located.

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, Azimuth, Slope Distance (to the nearest tenth of a foot), and DBH (to the nearest tenth of an inch) to the reference tree in the "Reference Tree" block on the plot sheet.

## TALLY ITEMS

### ITEM 17 BIOMASS STUDY "SHRUBS" (SNUM, SPP, SHIS, COV, DIAC, FREQ)

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 for all remeasurement plots (SK 2 & 6) from leaf flush (about May 1) to leaf fall (about September 30).

#### SHRUB NUMBER (SNUM)

For each point, begin with shrub number 51 and increase. Each species diameter class will have a shrub number.

#### SPECIES (SPP)

For shrub species list, see appendix.

#### TREE HISTORY/SHRUB HISTORY (SHIS)

Tall, woody perennials, 80 class. Other perennials 81 class.

#### PERCENT COVER (COV)

Given in percent of ground cover. This applies only to 81-class shrubs, and is left blank for 80-class shrubs.

#### DIAMETER CLASS (DIAC)

Diameter of stem six inches from the ground. This applies only to 80-class shrubs, and is left blank for 81-class shrubs.

#### FREQUENCY OF STEMS PRESENT (FREQ)

Enter the number of stems present in each species diameter class for Shrub 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 51+) and also on the 6.8' fixed-radius plot if there are no trees  $\geq 5.0$ " DBH on the point. Any tree 1.0" DBH or larger on the point will not be recorded in the Biomass Study.

**ITEM 17 BIOMASS STUDY "SHRUBS" CONTINUED**

Use the codes below for Diameter class (Tree History 80) and percent ground cover (Tree History 81).

<u>Tree History 80</u>		<u>Tree History 81</u>	
<u>Code</u>	<u>Diameter (measured along stem six inches from the ground)</u>	<u>Code</u>	<u>Percent ground cover</u>
001*	0.0 - .19"	001	solitary plant, less than 1%
002	.2 - .29"	002	1 - 10%
003	.3 - .39"	003	11 - 20%
004	.4 - .49"	004	21 - 40%
005	.5 - .99"	005	41 - 70%
010	1.0 - 1.49"	006	More than 70%
015	1.5 - 1.99"		
020	2.0 - 2.49"		
025,030, etc. 1/2" diameter classes continue			

\* Also used on any woody stemmed shrub or tree less than six inches tall.

**EVIDENCE OF BROWSING (BROW) - (3 digits)**

The percent of the number of stems by species and stem diameter class for tall, woody perennials and the percent of the ground cover by species for other perennials that show evidence of the stems, twigs and foliage being browsed. The purpose of collecting this data is to help measure the impact that deer and other browsing animals are having on regeneration, species composition, and the lower vegetation layer. Record general percent categories.

## ITEM 18 VARIABLE-RADIUS PLOT

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.

Figure 10 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 inches, must be closer than 20.7 feet (horizontal distance) at DBH to be considered "in" using a basal area factor prism of 37.5. Table 2 in the appendix shows the limiting distances for the 37.5 basal area factor prism.

Use your prism carefully. The prism should be held directly above point center--this is crucial, especially for small, nearby trees. Watch out for flat or triangular trees. On steep slopes, "in" trees may appear to be "out". Check all trees that are close either way.

On new plots, dead trees 5.0" DBH or larger within the variable-radius plot will be tallied if they have died within the last three years.

**Note:** It is possible, but very rare for a leaning tree less than 5.0" DBH to be on stick (on the variable-radius plot) but out of the fixed-radius plot. Such a tree counts towards Basal Area but is not tallied.

## ITEM 19 FIXED-RADIUS PLOT (1/300 ACRE)

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 1-10** Tally all live saplings (trees  $\geq 1.0$ " DBH, but  $< 5.0$ " DBH) within the fixed radius plot.

**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 percent stocking, record live seedlings (trees  $< 1.0$ " DBH) until 16 percent stocking is reached on that point.

**ITEM 19 FIXED-RADIUS PLOT (1/300 ACRE) CONTINUED**

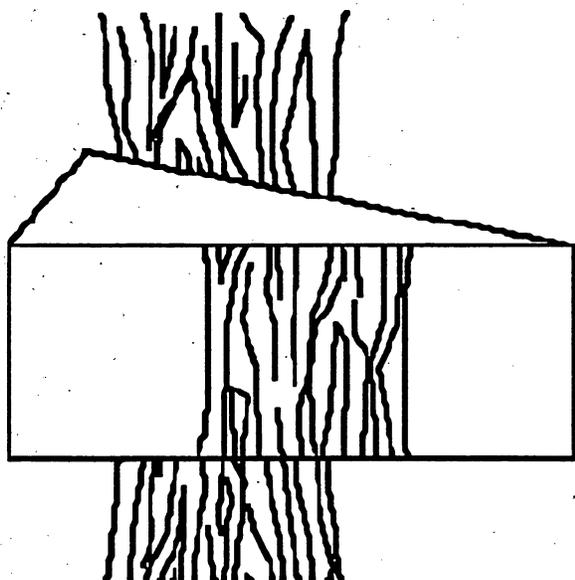
Minimum height requirement to be considered a seedling is six inches for softwood and one foot for hardwood species. DBH for seedlings is recorded as 000.

When tallying seedlings, record the most dominant (tallest) seedling sized trees first. When equal dominance occurs use the following order of preference:

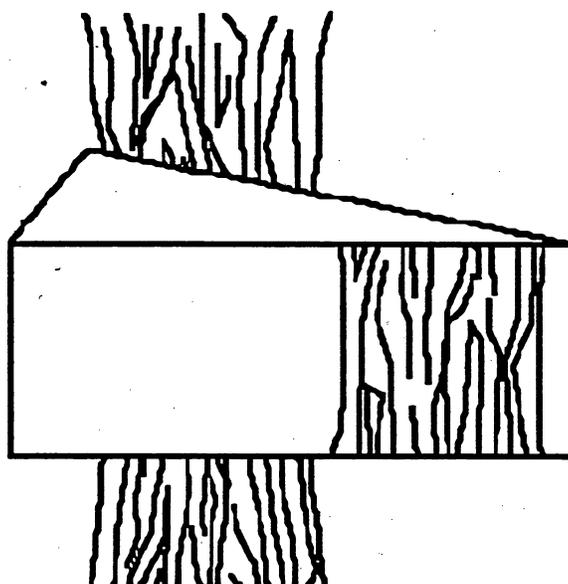
1. 20-class Commercial tree species
2. Non-commercial tree species
3. poorly formed or diseased commercial tree species

**Figure 10 - Variable radius plot**

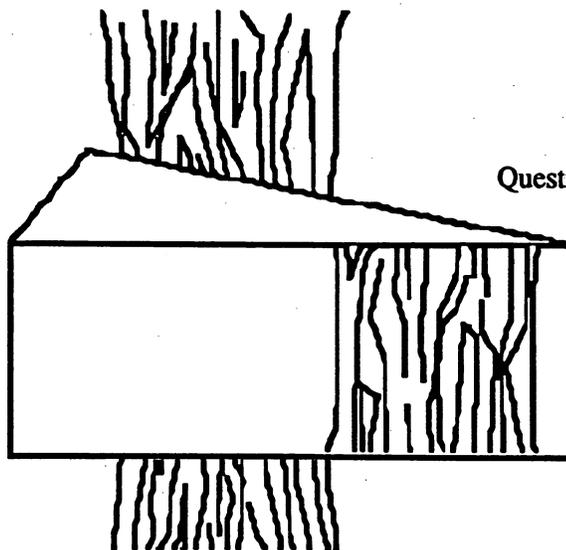
Within the variable plot



Outside the variable plot



Questionable tree



## ITEM 20 POINT BASAL AREA COUNT (BACT)

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 under tree #40.

Note: Stand basal area per acre is discussed later in item 43

## ITEM 21 TREE NUMBER (T #)

Record a tree number (two digits if required) for all line entries including trees and stumps, point number with or without a cover class, and all biomass entries. Site trees for the plot will also be given tree numbers.

For each

Point

Will be assigned:

01 - 39

Consecutively for trees and stumps

40

For basal area count, cover class points, point class records

41 - 49

To the plot site trees

51 - 99

Consecutively for all biomass entries

### **For remeasurement plots**

Number previously measured trees using old tree number. Stumps, dead trees and seedlings on the old tally sheet will be disregarded, and their old tree numbers not used. In addition, on Points 4 - 10, trees < 5.0" DBH will also be disregarded, and their old tree numbers not used (such a tree may be tallied as ingrowth or ongrowth, with a new tree number).

New trees (ongrowth and ingrowth) will be numbered consecutively, proceeding clockwise from 0 azimuth starting with the next available tree number. The tallier and cruiser must work together to locate the original trees and add new trees in the proper sequence.

## ITEM 22 TREE SPECIES (SPP)

Record a three-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.

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) must be given their proper species code on the current survey. If the tree is missing, the tallier should use his best judgment in assigning a species. (See appendix for species list.)

## ITEM 23 TREE HISTORY (THIS)

Tree History is a two-digit code which reflects a tree's previous and current status.

### **New plots**

The first digit is always 0 on a new measurement plot.

Use the following codes for the second digit of Tree History on a new measurement plot:

<u>Code</u>	<u>Tree History</u>
1	Growing stock live
2	Cull live
4	Dead Salvable-mortality
5	Dead Mortality

## ITEM 23 TREE HISTORY CONTINUED

### Remeasurement plots

The first digit describes the tree's previous status.

<u>Code</u>	<u>Tree History</u>
1	Growing stock live
2	Cull live
3	Ingrowth
4	Dead Salvable-mortality
5	Dead Mortality
6	Ongrowth

The second digit describes the current tree status.

<u>Code</u>	<u>Tree History</u>
0	No Status
1	Growing stock live
2	Cull live
4	Dead Salvable-mortality
5	Dead Mortality
7	Stump Salvaged dead
8	Stump Utilized
9	Stump Not utilized

### Ingrowth

Ingrowth trees are those that were not tallied or were seedlings the previous survey. They are now 1.0" 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  $\geq 5.0$ " DBH. Assign ingrowth Tree History (31, 32, 34 or 35) according to current tree class.

## ITEM 23 TREE HISTORY CONTINUED

### 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  $\geq 1.0$ " DBH tallied as live on the previous survey cannot receive a Tree History of ongrowth (for Points 1 - 3 only). Assign ongrowth Tree History (61, 62, 64 or 65) according to present tree class.

Salvable-mortality A dead tree containing at least one 4' section that is at least 50 percent sound.

Mortality A dead tree containing no merchantable volume at least 50 percent sound.

Note: Remember that old trees on Points 4 - 10 that were  $< 5.0$  DBH will not be remeasured as old trees, but will be considered ingrowth/ongrowth trees regardless of what they were called on the last survey. They will be given new tree numbers and the old tree numbers will not be used.

Following are instructions (numbered 1 through 10) for remeasurements in reference to tallying trees and Tree History codes.

#### 1. New Live Trees (Tree History Codes 31, 32, 61 and 62)

For ingrowth and ongrowth trees, tally all required items with the exception of original tree data (this includes DBH, Tree class, Crown ratio, and Crown class). These items should be zeroed out. All seedlings will receive an ingrowth Tree History (31 or 32). If there has been a land use change from Noncommercial or Nonforest back to Commercial forest, a remeasurement plot will be established and all trees will receive a Tree History reflecting ingrowth or ongrowth (31, 32, 61, 62)

#### 2. Original Tally Trees Still Alive (Tree History Codes 10, 11, 12, 20, 21 and 22)

All live trees tallied as live the previous survey must be accounted for, old tree number and old DBH transferred to the data recorder from the 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 except no status trees will be filled in according to guidelines set for sawtimber, pole timber and sapling sized trees.

## ITEM 23 TREE HISTORY CONTINUED

### 3. Missing Trees (Tree History Codes 14, 15, 17, 18, 19, 25, 27, 28 and 29)

Live trees tallied on the last survey, but now missing, must be accounted for and classified as dead or cut. (See No. 4 and No. 5 below for required tally items.)

### 4. 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. Standards for salvable-mortality trees remain the same as for a regular plot. Trees qualifying as mortality or salvable-mortality will require the following entries on the data recorder.

Pole-sized trees Enter data for the items listed below:

- Point number
- Species
- DBH (original and current)
- Tree Class (original and current)
- Crown Class (original)
- Tree number
- Tree History
- Damage/Death
- Crown Ratio (original)
- Tree Cavity

Sawtimber-sized trees Enter data for the items listed below:

- Point number
- Species
- DBH (original and current)
- Tree Class (original and current)
- Crown Class (original)
- Tree number
- Tree History
- Damage/Death
- Crown Ratio (original)
- Tree Cavity

For trees under 5.0" DBH on Points 1 - 3 Enter data for the items listed below:

- Point number
- Species
- DBH (original and current)
- Tree Class (original and current)
- Crown Class (original)
- Tree number
- Tree History
- Damage/Death
- Crown Ratio (original)

If the tree is so badly decomposed that accurate DBH, ~~total length, sawlog length and top DBH~~ 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 code 25 and fill in items for mortality trees outlined above.

*Correction  
made on  
original*

## ITEM 23 TREE HISTORY CONTINUED

### 5. Trees Cut Since Last Survey (Tree History Codes 17, 18, 19, 27, 28, and 29)

For trees tallied as live on the last survey and have since been cut, enter data for the items listed below:

- Point number
- Species
- DBH (original and current)
- Tree Class (original and current)
- Crown Class (original)
- Tree number
- Tree History
- Damage/Death
- Crown Ratio (original)

Stumps of live trees tallied on the last survey need to be tallied on remeasurement plots. There is no 16.6' fixed-radius plot for stumps. For salvaged dead trees (17 and 27), record cause of death. If there is no way to determine cause of death, record unknown (code 900) but make an effort, especially in recently dead trees.

### 6. Stumps, Seedlings, and Trees < 5.0" DBH on Points 4 - 10, Tallied Last Survey

Stumps, seedlings, and trees < 5.0" DBH from the previous inventory will be disregarded and their entry not transferred to the remeasurement plot sheet.

### 7. Trees Tallied or Omitted from the Last Survey By Error

We assume that work completed on the last survey was done as accurately as possible and is correct. Record trees and tree history codes as they are even if you are suspicious or positive that an error was made on the last survey. Three situations will arise:

Tree History Codes 61, 62, 31, 32 If a tree was not tallied last survey, but should have been, and should be tallied now, record the tree as ingrowth or ongrowth.

Tree History codes 11, 12, 21, 22, 17, 27, 18, 28, 19, 29, 14, 15, 25 If a tree was tallied last survey, but should not have been, and should be tallied now, transfer old information and treat tree as if it was tallied correctly.

If a tree was tallied last survey, but should not have been, and should not be tallied now, drop the original tree from the sample (do not record Tree History of 10 or 20). Scrape the old paint off the tree. Adjust original BA/Acre, if appropriate, on the computer cribsheet.

## ITEM 23 TREE HISTORY CONTINUED

### 8. Displaced Trees (Tree History Codes 10, 20, 31, 32, 61 and 62)

A tree may have been physically moved either onto or off of the plot by logging or wind. For trees displaced onto the plot and not tallied on the last survey, tally all current items and assign a Tree History of ingrowth or ongrowth.

Trees tallied the previous survey and displaced from the plot will be considered no status trees. They will receive a Tree History of 10 or 20.

For all trees with a Tree History of 10 or 20, enter data for these items:

- Point number
- Species
- DBH (original)
- Crown Ratio (original)
- Tree number
- Tree History
- Tree Class (original)
- Crown Class (original)

No current information needs to be recorded. Be sure to adequately explain the exact circumstances in the "Notes" section of the plot sheet. Trees tallied live on the last survey, now dead and displaced off of the plot, will be tallied as dead trees.

### 9. Ongrowth or Ingrowth Dead trees Codes 64, 65, 34, 35)

Trees  $\geq 5"$ , that were too small the last survey, that have grown onto the plot and died, will be recorded. Use of code 34 or 35 is possible but unlikely; the only case being a tree in the 6.8' plot that attained 5.0", died, and was displaced off stick.

### 10. Dead Trees (Tree History Codes 44, 45, 55, 48, 49, 59)

Trees  $\geq 5.0"$  and dead on the original survey will be accounted for if they are still standing or if they have been cut. Salvability standards remain the same. Items required are the same as for Number 4, "Trees Alive Last Survey, Now Dead", however there is no original Crown Ratio or Crown Class. Cause of death should be transferred from old plot sheet. Dead trees last survey, now on the ground or missing (rotted away) can be disregarded.

## ITEM 23 TREE HISTORY CONTINUED

### Special Instructions when GLU has changed between surveys

If a remeasurement plot is being established for the first time due to a GLU change, all trees will receive a Tree History reflecting ingrowth or ongrowth (codes 31, 32,, 34, 35, 61, 62, 64, or 65).

When a previously established plot no longer needs to be put in due to a GLU change, the original trees should be accounted for according to the following guidelines:

- **Reserved areas with trees still standing (GLU 41 or 45)**

Trees will be assigned a Tree History code 10 or 20. Required tally items are listed in No. 8 on the previous page. For points previously cover classed, record Point number and Tree/Cover Class. For each point, also transfer the original BA count. Ignore previously dead trees.

- **Nonforest areas that are a result of clearing (GLU 61 - 69, 80, or 90)**

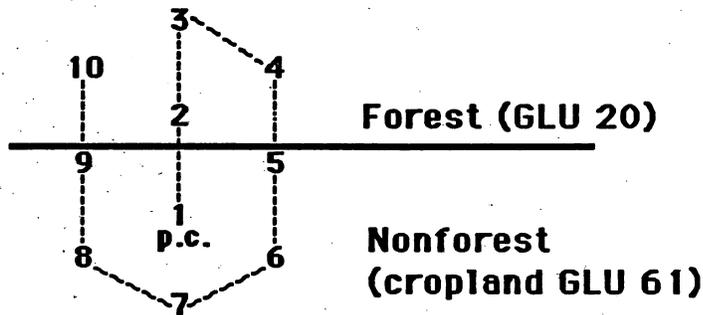
Trees will be assigned a Tree History of 18, 19, 28, 29, 48, 49, or 59 depending on whether the cleared trees were utilized or not. Field crews will make their best estimate from owner contact, field examination, etc. in areas where it isn't clear as to utilization. Example: Owner says he utilized all the larger oaks and pushed the other trees over to the side of the field. All larger oaks would receive a tree history of cut and utilized and other trees would receive a not utilized tree history. The required tally items for stumps are listed in No. 5 on the previous pages.

- **Nonforest areas that have been partially cleared (GLU 46, 51 - 56, 58, 61 - 69, 80, or 90)**

Field crews are to determine the cause of the land use change. North Central analysts are mainly concerned with getting an estimate of the cut and utilized portion of the sample. Field crews will make an effort to determine the cut and utilized trees and assign them a cut and utilized tree history. Trees still standing will receive a no status history. Required tally items for stumps and for no status trees are listed in Numbers 5 and 8 on the previous pages. See the examples on the next page.

ITEM 23 TREE HISTORY CONTINUED

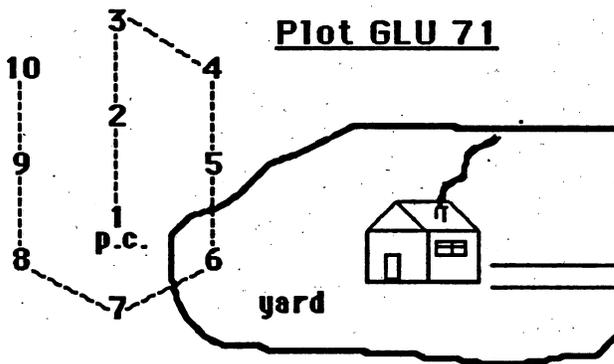
PLOT GLU 61



Example 1

Assign trees on Points 1, 5, 6, 7, 8, and 9 a tree history of cut and utilized or cut-not utilized. Assign trees on Points 2, 3, 4, and 10 a tree history of 10 or 20.

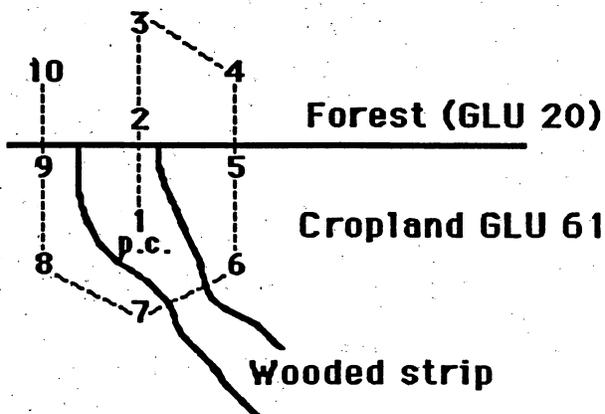
Plot GLU 71



Example 2

Assign Points 1-5 and 7 - 10 a tree history of 10 or 20. Assign Point 6 a tree history of cut and utilized or cut and not utilized.

Plot GLU 53



Example 3

Assign trees on Points 1, 2, 3, 4, and 10 a no status tree history (10 or 20). Assign trees on Points 5, 6, 7, 8, and 9 a tree history of cut and utilized or cut and not utilized.

## ITEM 24 TREE DISTANCE (DIST)

Record distances on all live trees tallied (except seedlings) on Points 1 - 10. The distance recorded will be slope distance to the nearest foot from point center to the near face of each tree at its base. Record a two-digit code.

Record a three-digit code for all distances given in the witness tree block and the reference tree block. The distance recorded will be Slope Distance to the nearest tenth of a foot from point center to the center at the base of each tree. The last digit represents a decimal fraction.

## ITEM 25 DIAMETER BREAST HEIGHT (DBHO, DBHC)

Diameter at breast height (DBH) is taken 4.5 feet above the ground, measured on the uphill side of the tree. Record a three-digit code for each tree tallied.

DBH is recorded to the last 0.0". 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 > 1.0" DBH.

On the side of the tree facing point center, paint a two-inch horizontal scribed mark just above the upper tape at the point where DBH is measured. Within the one-foot stump facing point center, paint a two-inch vertical scribed mark to facilitate remeasurement plotwork, in the event the tree is cut. Do not scribe small, thin-barked trees. Do not scribe trees under three-inches. Scribe marks should not penetrate the cambium.

It is essential that the measurements be accurate since trees will, at prism points, be determined as "in" or "out" of the tally, depending in part on their DBH. For remeasured plots, it is important that DBH be taken at the same point.

## ITEM 25 DIAMETER BREAST HEIGHT *CONTINUED*

Irregularities at DBH (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 > 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 3.5' above the fork (use rule only once per tree).

**Important:** Use care in determining where the tree forks--extend the centerlines of the two stems to their junction. Don't equate the point where daylight can be seen with the point where the tree forks. Figures 11 and 12 illustrate the proper methods for obtaining DBH.

### DBH for remeasurement plots

Original Transfer any original DBH as it appears on the original plot sheet. If paint or scribe mark is found, do not move the measurement location.

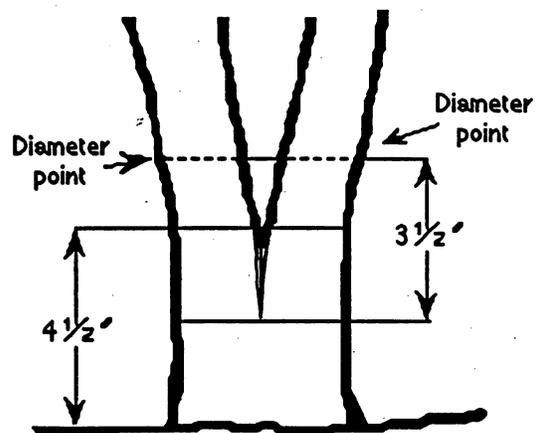
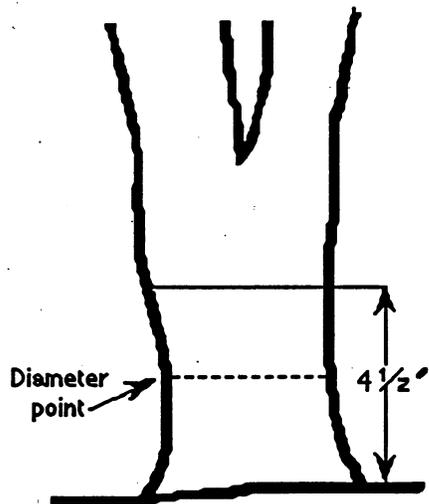
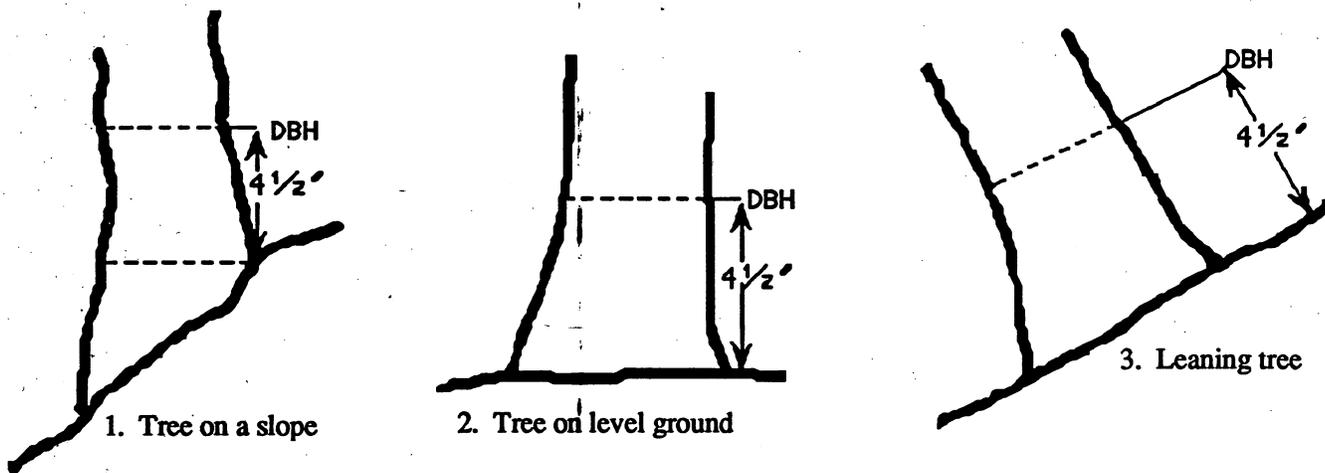
Current Check to see that the original DBH was taken in the correct place. If DBH was correct, remeasure, rescribe, and repaint this original measurement. It is extremely important to measure the same place if the measurement was initially correct; look carefully for evidence of paint at DBH.

If the previous measurement was taken on a deformity, cannot be located, or some other error was made, move the current DBH to the correct place on the bole, and record the new measurement.

If the tree is now dead at DBH, it will be considered a dead tree. If a new leader has taken over and is 1.0" DBH, it will be given a Tree History of ingrowth or ongrowth. If the tree is not at least 1.0" DBH, it will be taken as a seedling, if seedlings are needed to reach 16 percent stocking. If the tree is taken as a seedling, it will be recorded twice--once as a dead tree and once as a seedling.

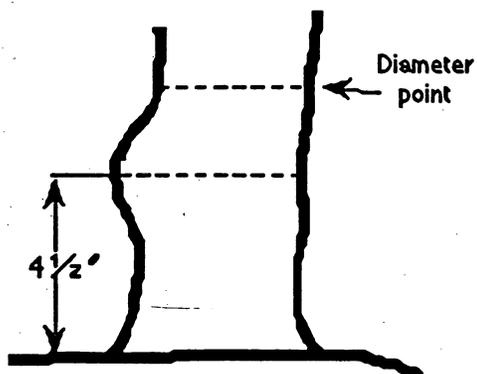
ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

Figure 11 - Diameter breast high measurement in a variety of situations

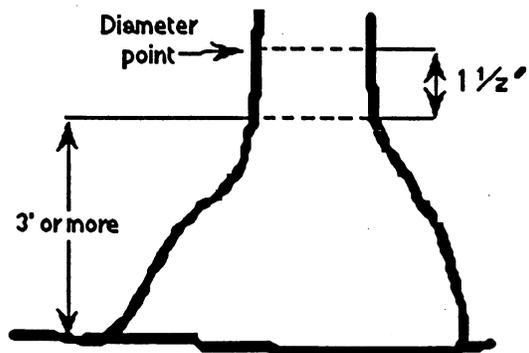


4. Tree forking at or above  $4\frac{1}{2}$  feet

5. Tree forking below  $4\frac{1}{2}$  feet



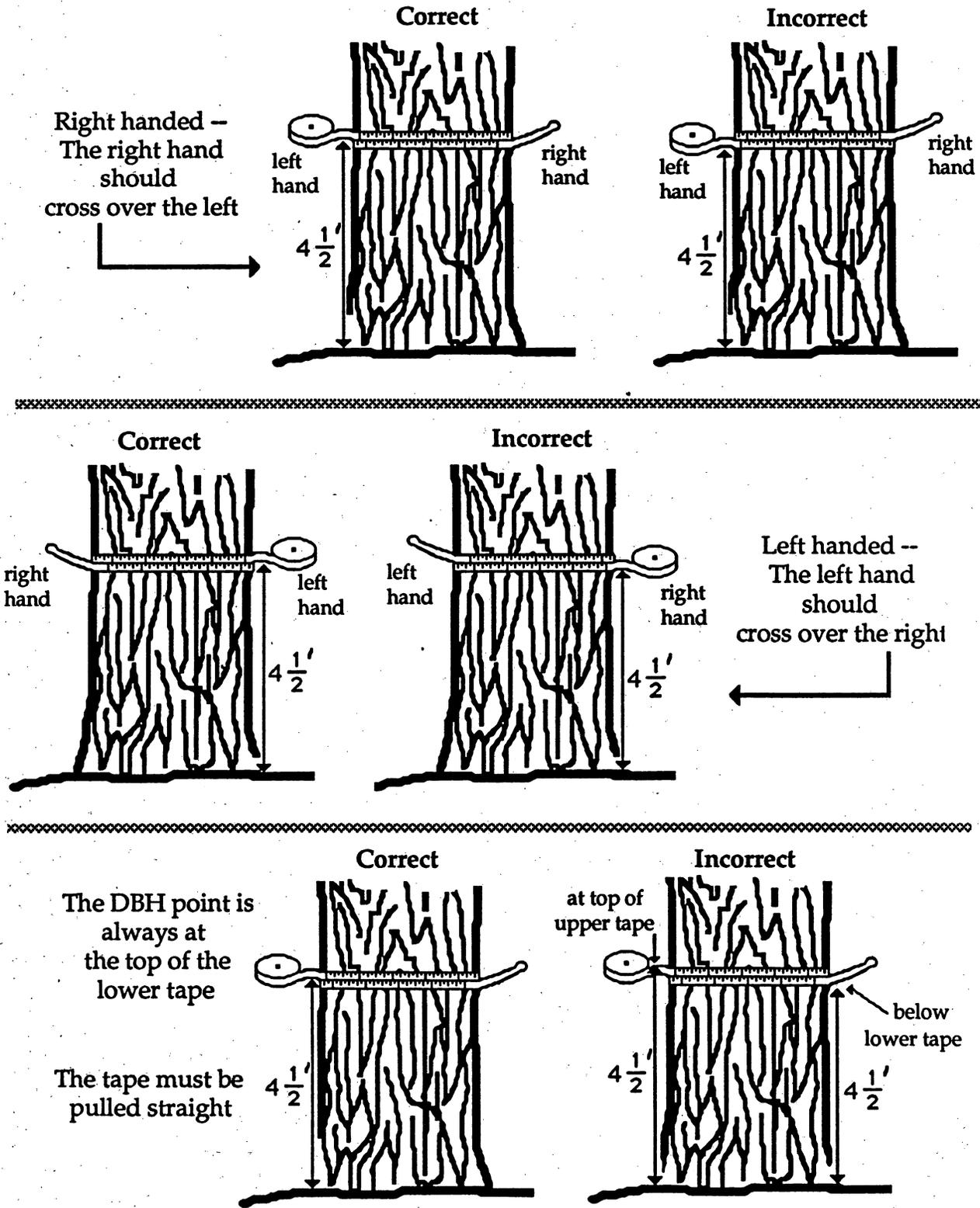
6. Tree deformed at  $4\frac{1}{2}$



7. Bottlenecked tree

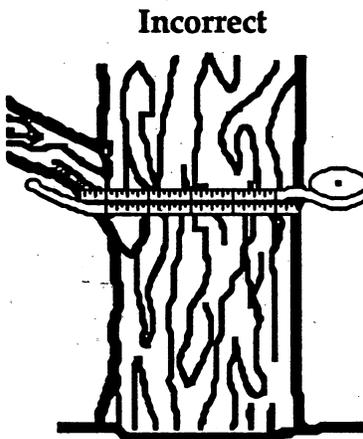
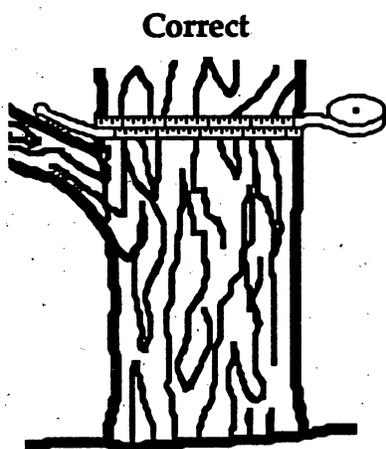
ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

Figure 12 - Using the diameter tape



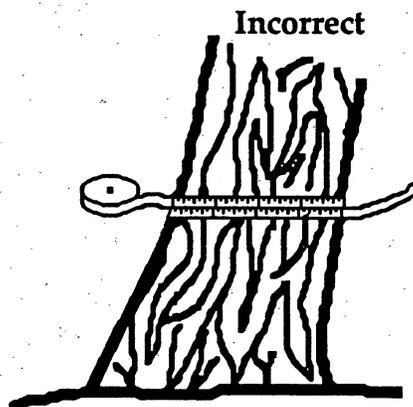
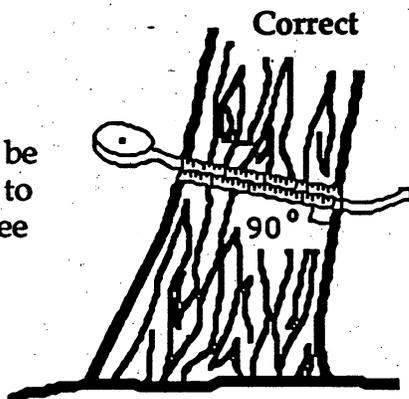
ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

Figure 12 CONTINUED



Don't position the tape at an abnormal place on the bole

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



## ITEM 26 TREE AZIMUTH (AZM)

Record azimuth on all live trees tallied (except seedlings) on Points 1 through 10. The azimuth recorded will be a three-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 zero degree azimuth will be tallied as 001.

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.

### **For remeasurement plots**

Record current azimuth readings at the time of remeasurement. For example, you encounter a tree whose old azimuth was 358 °, and the current azimuth is 1°, record the current azimuth as 001. This may lead one to presume changing the Tree number. Do not do this. Never change a Tree number.

## ITEM 27 DAMAGE OR CAUSE OF DEATH (DAM)

For live trees record presence of damage or pathogen activity if it is serious enough to reduce the quality or vigor of the tree. For dead trees, cause of death will be recorded.

A complete list of damage codes and coding criteria (minimum severity requirements) appears in the appendix of this manual.

To use a damage/death code, the pest or damage must:

- Be identified using the coding criteria. If the pest/damage does not satisfy the coding criteria, it must be coded to a more general code, such as the 900's, unknown, uncoded damage codes. The damage must meet the severity rating for that particular damage code. For example, an insect defoliator is coded only when it is causing > 20 percent defoliation. Another example, a Hypoxylon canker on a branch would not be coded since its severity rating is "any occurrence on the bole."
- Use the most specific code possible. Avoid general injury codes if possible. For example, Eutypella canker code has preference over bole canker code, which has preference over unknown/uncoded canker.

**ITEM 27 DAMAGE OR CAUSE OF DEATH CONTINUED**

When two or more pests occur on a tree, record the most significant and important pest. The following three situations will apply:

1. Record the agent causing the most severe damage. An agent which will cause death will take precedence over one causing volume loss, which takes precedence over one causing growth or quality loss. For example, a canker low on the main bole takes precedence over decay higher on the stem, but decay low on the main bole takes precedence over a canker high in the crown.
2. Record permanent damage before temporary or seasonal damage. For example, decay or canker would take precedence over insect defoliation, even if defoliation was 100 percent on a hardwood tree.
3. Record bole damage over branch damage.

Death codes are the same as damage codes, i.e. when coding the cause of death, choose a code from the entire list of damage codes. If the tree is dead and the cause can be determined, code the cause of death. If the cause is unknown, and the tree is salvageable, code the damage rather than unknown death, if there is a damage.

Prioritization

Highest priority

Specific pest  
Death or potential death

> General Pest  
> Volume reduction

Lowest priority

> Damage or injury  
> Growth slowed quality reduction

Cull trees, except noncommercial species, must have a damage code other than "000".

Seedlings and saplings, unless a specific damage is observed, should be considered growing stock. Excessive sweep and crook will not be considered a specific damage code for seedlings and small saplings ~~(2.0" DBH or smaller)~~.

*Correction: make original  
(Less THAN 3.0 inches DBH)*

A damage code will not be recorded to indicate the reason for not qualifying as a better tree grade. Damage codes are given in the appendix section of this manual.

## ITEM 28 TREE CLASS OR COVER CLASS (TCO, TCC)

### Tree Classification (two digits)

Tree Class reflects the tree's suitability for timber products. Tree Class is basically a check for the straightness and soundness of the sawlog portion on a sawtimber tree or the potential sawlog portion on a poletimber tree or sapling. Not considered in determining Tree Class are: tree vigor, predicted death, and plot site index.

Use one of the following codes for Tree Class:

#### Code

- 20 **Growing Stock Tree** Any live tree of commercial species that is sawtimber size and has at least one merchantable 12-foot sawlog or two merchantable 8-foot sawlogs meeting minimum log grade requirements. At least one-third of the gross board foot volume of the sawlog portion must be merchantable material. (The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods and the 7.0" top DOB for softwoods.) A merchantable sawlog must be at least 50 percent sound at any point.

Any poletimber size tree that has the potential to meet the above specifications. 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 may 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 an 8.0" DBH needs 3" of diameter growth to become sawtimber size. If diameter growth is uniform then the DBH minus two inches (eight minus two) or six inches, identifies the potential sawlog top. This system works for both hardwoods and softwoods.

A seedling or sapling will be considered growing stock unless a specific damage is observed. A seedling or small sapling (less than three inches) 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.

ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

Code

20 Growing Stock Tree CONTINUED

Required tally items for 20-class trees: For growing stock trees on full permanent plots Bole length will be recorded to the highest possible 4.0" top DOB, or to that point where the central stem or branch breaks into limbs and above which there is no 4.0" DOB. 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 or missing wood to the 4.0" top. 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.

30 Rough Cull Any tree of noncommercial species.

Any tree of commercial species that is sawtimber size and does not have any merchantable sawlog. 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 DOB for hardwoods and the 7.0" top DOB for softwoods.

Any pole size tree that does not have the potential to meet the specifications for growing stock because of forks, limb stoppers, or excessive sweep or crook. Assume 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 considered in determining tree class.

Required tally items for 30-class trees: Record Bole length to a 4.0" top DOB. Cubic foot cull should include actual rot or missing wood only. For sawtimber trees, zero-out Sawlog length, Sawlog top DOB, Board foot cull and Tree grade. Crown ratio and Crown class should be accurately recorded. Except for noncommercial species, the damage code must not be "000". Code any tree cavity.

ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

Code

- 31 **Short-log Cull** Any live sawtimber size tree of commercial species that has at least one 8-foot sawlog, but less than a 12-foot sawlog, meeting minimum log grade specifications.

Any live sawtimber size tree of commercial species that has less than one-third of the volume of the sawlog portion in merchantable logs, but has at least one 8-foot or longer sawlog meeting minimum log grade specifications. Short sawlog must be 50 percent sound at any point. (The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods and the 7.0" top DOB for softwoods.) Note: Pole size trees never receive a Tree Class code 31.

Required tally items for 31-class trees: Record Bole length to a 4.0" top DOB. On forked trees, bole length will be recorded using the fork that contains the highest sawlog. Cubic foot cull should include actual rot or missing wood only. Record Sawlog length and Sawlog top DOB to the height where the highest merchantable log terminates. Board foot cull should include all unmerchantable sections in the sawlog portion, and the unusable board foot volume within the merchantable sawlog. Tree grade will usually be code 5, due to length and/or position in tree. Crown ratio and Crown class will be accurately determined. Damage code cannot be "000". Code any tree cavity.

- 40 **Rotten Cull** Any live tree of commercial species that is sawtimber size and does not have any merchantable sawlog. Over one-half of the volume in the sawlog portion does not meet minimum log grade specifications primarily because of rot or missing sections. (The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods and the 7.0" top DOB for softwoods.)

Any pole size tree that does not have the potential to meet the specifications for growing stock because of rot. Assume that all live trees will eventually attain sawlog size at DBH. Predicted death, tree vigor, or plot site index are not considered in determining tree class.

Required tally items for 40-class trees: Record Bole length to a 4.0" top DOB. Cubic foot cull should include actual rot or missing wood only. Zero-out Sawlog length, Sawlog top DOB, Board foot cull and Tree grade. Accurately record Crown ratio and Crown class. Damage code must not be "000" and must reflect rot or disease. Cubic foot cull seldom exceeds 90 percent of total cubic volume.

## ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

**Summary** If any of the requirements for growing stock (Tree Class 20) are not met, the tree is considered cull. If a short sawlog is present, the Tree Class is 31 and sawlog information is recorded. If no sawlog is present, Tree Class is either 30 or 40. If a pole size tree does not have the potential to meet sawlog standards, it is either Tree Class 30 or 40.

### 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 on the next page and record in the point class record entry line and record a tree number of 40.

#### 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 codes 81-Rocks, 82-Water, 83-Other.

### **For remeasurement plots**

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, determine and record 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 record the original cover class in this instance.

If a point was not cover classed on the prior survey, and is currently cover classed, record a current cover class code on the point class record line, and then record previous trees as cut or dead. A Tree number of 40 is recorded on the point class record.

## ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

### Dead Trees

The following tally items are required for dead trees:

- Tree number
- DBH
- Cause of Death
- Tree Cavities
- Species
- Tree History
- Tree Class

Volume measurements or tree grade are never needed for a dead tree. Unless specified, all tally items will be recorded using rules from the appropriate sections on live trees in this manual.

DBH Take into consideration any distortion (lost bark, cracks, splits, shrinkage, etc.) to best estimate the diameter the tree was at time of death. This is for both mortality and salvable-mortality trees.

Mortality trees All required information will be projected back to the time of death except tree cavities, which will be recorded as they exist now. Many mortality trees won't look very good, but will be given a Tree Class of 20 if that's what they were at the time of death. Mortality trees are recorded only on remeasurement plots.

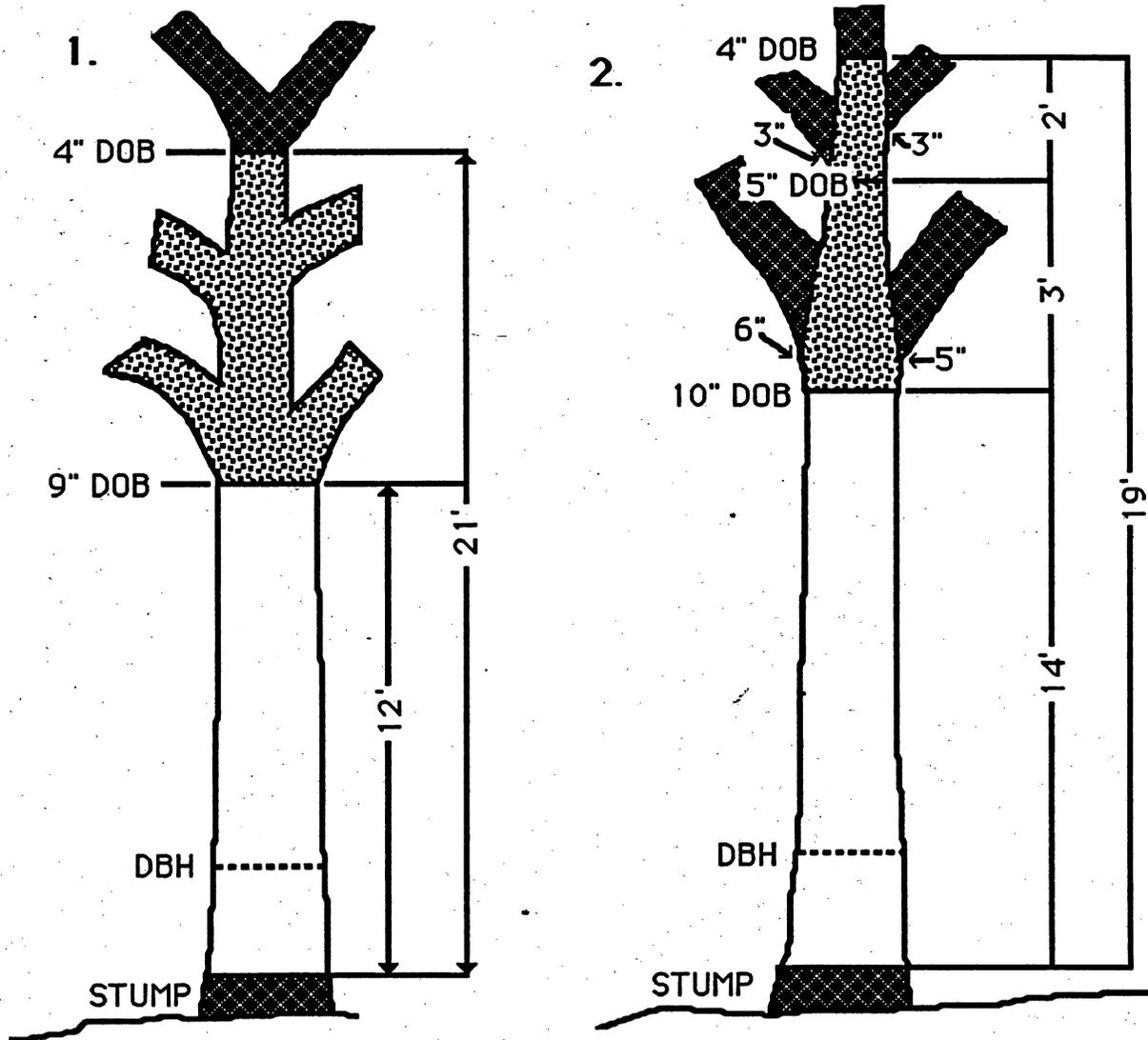
Salvable-Mortality trees All required information will reflect the tree's present condition. Pretend the tree is alive today and record your information as such.

**Summary:** First, determine whether the tree is a mortality tree or salvable-mortality tree. Next, project the tree to the correct place in time (the present for salvable-mortality trees and time of death for mortality trees). Finally, record required information according to this manual.

On the following pages are 9 selected examples (Figure 13) explaining tree classification. Hardwood trees are represented in the illustrations, however softwoods may be applied using a minimum 7.0" Sawlog top DOB.

ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

Figure 13- How to handle tree measurements for all tree classes

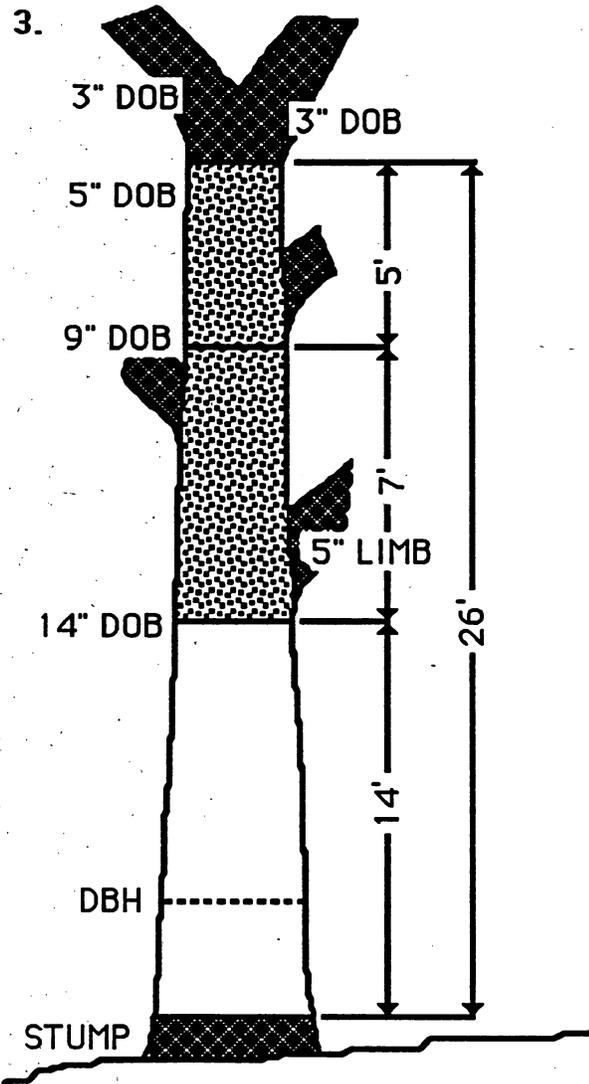


1. A GROWING-STOCK HARDWOOD SAWTIMBER TREE Sawlog length terminates at 9" top DOB. The sawlog meets both minimum log grade specifications and the minimum 12-foot qualification for a growing-stock tree. The upper stem portion contains no cull and terminates at 4" DOB. Sawlog length is recorded as 12 feet; bole length as 21 feet.

2. A HARDWOOD GRADED 1, 2, OR 3 OR A SOFTWOOD SAWTIMBER TREE Sawlog portion is terminated by limbs creating a full diameter stopper. Each limb is over 2" in diameter, and their sum exceeds the diameter at the stopping point (10" DBH). The sawlog contains no cull and meets minimum grade specifications. Sawlog length is 14 feet. The upper stem portion contains no cull and terminates at 4" DOB, 5 feet above the sawlog portion. Bole length is 19 feet. Cull cubic is 0 for the tree.

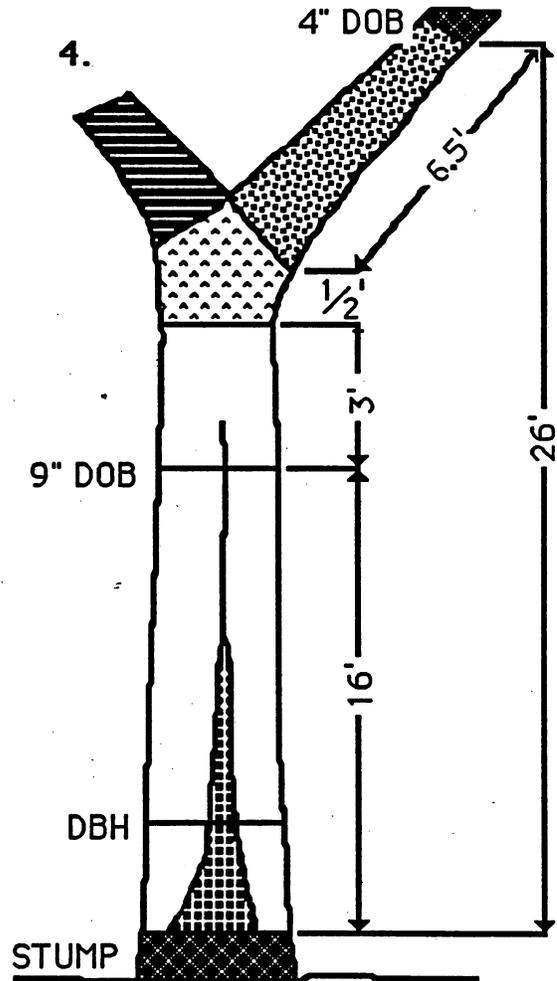
-  Sawlog
-  Upper stem (Pulpwood)
-  1-foot stump, top, and limbs

Figure 13 continued



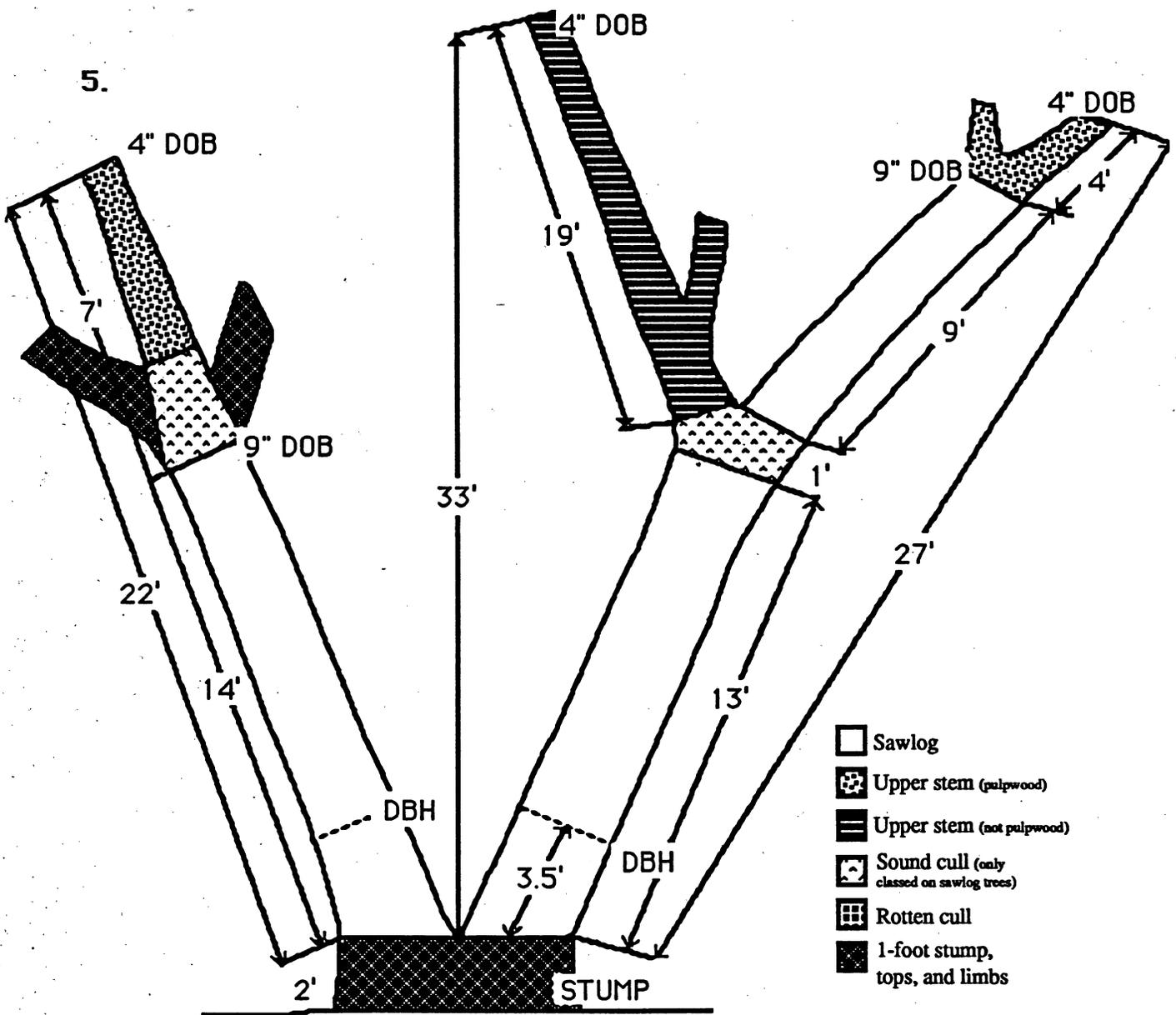
3. A GROWING-STOCK HARDWOOD, GRADE 4, SAWTIMBER TREE There are no sawlogs in the 21-foot sawlog portion that have minimum clear panel length to meet hardwood factory log grade 3 specifications, but the bottom 14 feet contain no rot or sweep and will meet hardwood construction grade 4 specifications. 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. Bole length is terminated at 26 feet with a 5-inch top DOB because of a fork with two 3-inch diameter limbs. Cull board feet and cull cubic feet are zero.

-  Sawlog
-  Upper stem (pulpwood)
-  Upper stem (not pulpwood)
-  Sound cull (only classed on sawlog trees)
-  Rotten cull
-  1-foot stump, tops, and limbs



4. A HARDWOOD SAWTIMBER TREE The sawlog length is 16 feet to the 9" DOB. The bottom 2 feet are over 50 percent rotten and does 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 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 cubic foot volume loss due to rot in the first 16 feet.

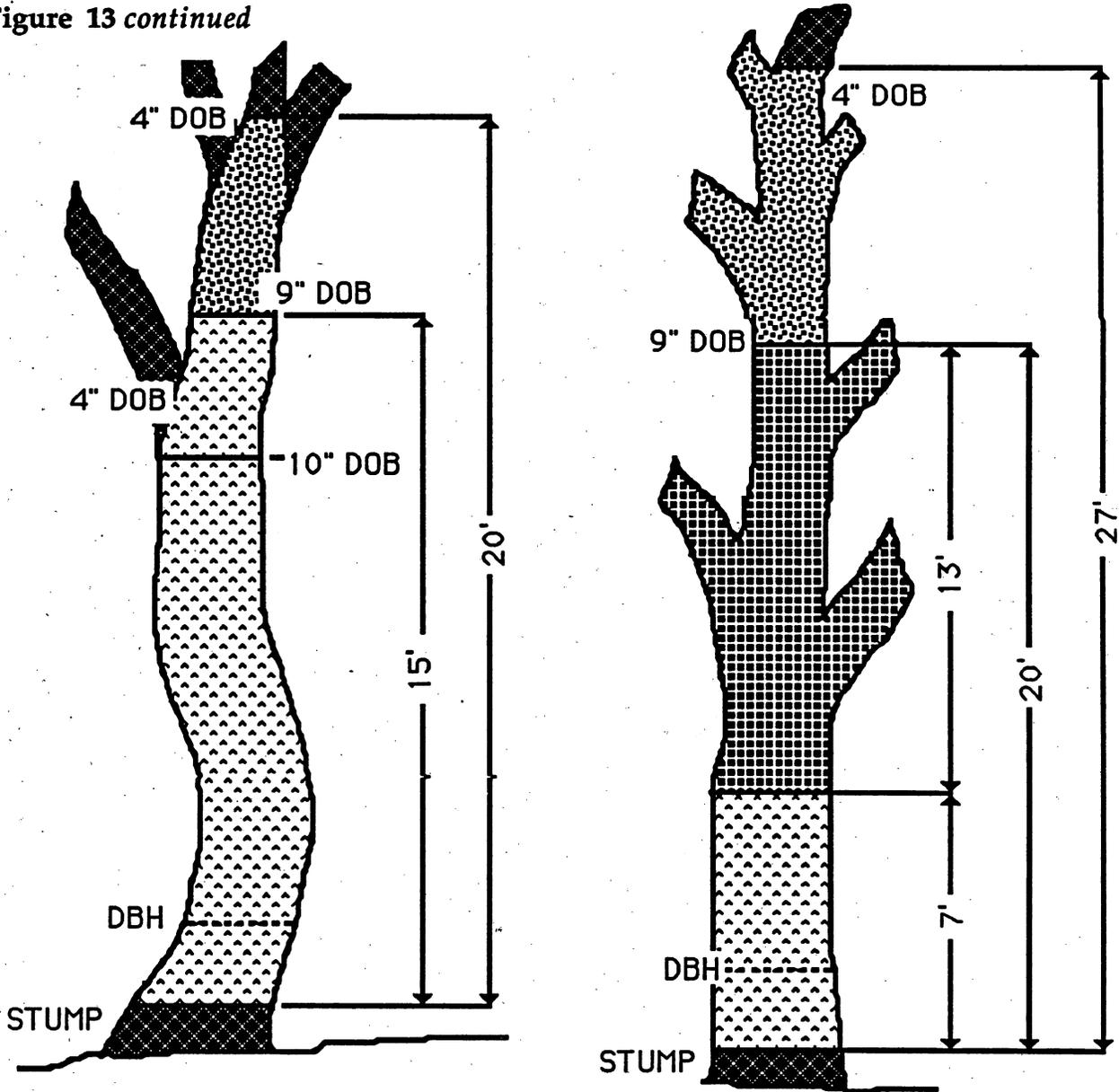
Figure 13 continued



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 tree) meets log grade specifications. The bole length is 22 feet and the sawlog length is 14 feet. Cull board feet is zero and cubic foot cull is zero.

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 would include 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.

Figure 13 continued



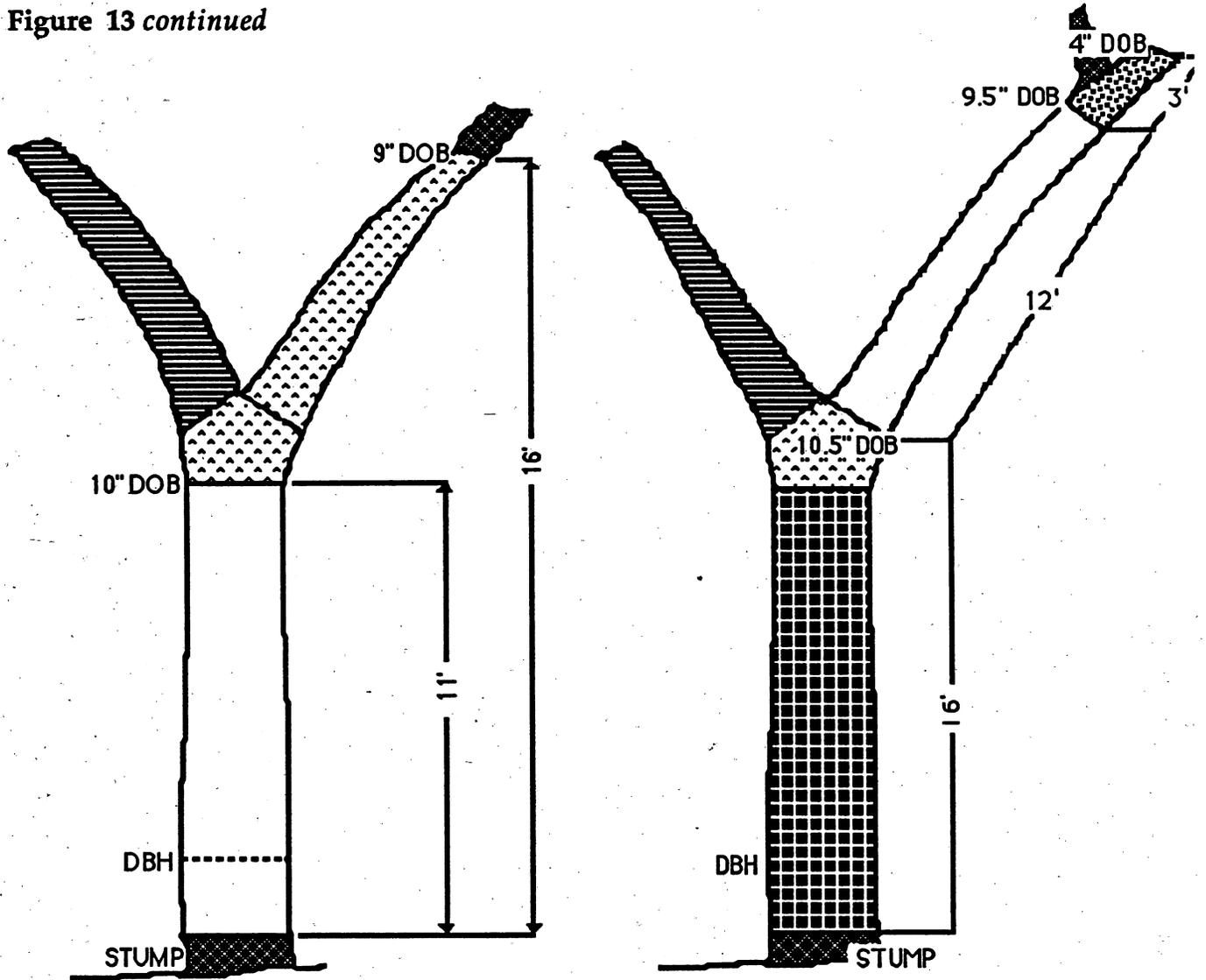
6. A ROUGH HARDWOOD SAWTIMBER TREE Sawlog portion is 15 feet long. There is no sawlog present that will meet minimum hardwood log grades 1-4. Minimum clear panel length is not present for grade 3 and sweep plus a 1/3 diameter limb stopper prevents grade 4. Since more than half the board foot volume is lost as sound cull, it is a rough tree (tree class 30). Dash out sawlog information. Bole length is taken 20 feet to the 4-inch DOB. Cull cubic foot 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 half the board foot volume loss is due to rot, the tree is a rotten cull tree (tree class 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.

-  Sawlog
-  Upper stem (pulpwood)
-  Upper stem (not pulpwood)
-  Sound cull (only classed on sawlog trees)
-  Rotten cull
-  1-foot stump, tops, and limbs

connection mnb

Figure 13 continued



8. A TREE CLASS 31 The sawlog portion is 16 feet to the 9.0" DOB. The tree does not contain a 12-foot merchantable sawlog, or two 8-foot merchantable sawlogs, because of a fork at 11 feet. This classifies the tree as a cull and since it contains a merchantable sawlog at least 8 feet long, it is a tree class 31. Sawlog length is recorded as 011, sawlog to DOB 100, and board foot cull 0000. Bole length and cubic foot cull are handled in the same way as for other trees, culling out for rot and missing wood only.

9. 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" DOB. 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 1-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 DOB 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 in the same way as for other trees, culling out for rot and missing wood only.

- |   |   |
|---|---|
|  Sawlog                    |  Sound cull (only classed on sawlog trees) |
|  Upper stem (pulpwood)     |  Rotten cull                               |
|  Upper stem (not pulpwood) |  1-foot stump, tops, and limbs             |

ITEM 29 CROWN RATIO (CRO, CRC)

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 one-digit code for all live trees one 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.

If the original crown ratio on remeasurement plots is missing, record an estimate. Otherwise, record the original crown ratio.

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

change so 9 = crown 81-100  
Correction mmB

### ITEM 30 CROWN CLASS (CCO, CCC)

Record a one-digit code to show crown class of all live trees one inch DBH and larger. Crown class should be determined based on the individual tree's dominance in relation to adjacent trees in the stand, as indicated by crown development and amount of light received from above and the sides. If the original crown class on remeasurement plots is missing, record an estimate; otherwise, record the original crown class.

<u>Code</u>	<u>Crown Class</u>
1	<b>Open grown</b> 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	<b>Dominant</b> 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	<b>Codominant</b> 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	<b>Intermediate</b> 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	<b>Overtopped</b> Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.
6	<b>Supra canopy</b> Trees, usually mature or over-mature, with crowns 25% or more higher than the majority of dominant and codominant trees in the stand.

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.

### ITEM 31 STOCKING PERCENT (STK)

Stocking percent is used to determine forest type and the number of trees to be tallied. It is not necessary to record stocking percent, since the data recorder will automatically compute and assign stocking percents. If the tallier chooses to record stocking percent, it should be recorded on all ten points using a two-digit code. Example: Four percent is recorded as 04; and 2.4 percent is recorded as 24.

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 is assigned to live trees according to the tree's DBH class.

A maximum of 16.7 percent stocking will be assigned to each point. The last tree to contribute to 16.7 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 16.7 percent. For example, on a point with four 5.0" or larger trees, the tree given a point occupancy of four will receive only 1.9 percent, which would bring the total to the 16.7 percent stocking necessary for that point.

<u>One or more live trees 5.0" or larger DBH on the point</u>		<u>No live trees 5.0" or larger DBH 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	0.4	Seedling	2.0
<i>Seedlings</i>	<i>2.0</i>		

### ITEM 32 POINT OCCUPANCY (POCC)

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 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.

*Corrections  
made on  
original  
7-1-91*

**ITEM 32 POINT OCCUPANCY CONTINUED**

Record point occupancy using the following one-digit codes:

<u>Code</u>	<u>Point Occupancy</u>
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.

**ITEM 33 TREE CAVITIES (TCAV)**

At each sample point, examine all live and dead trees 5.0" DBH and larger for cavities that could be used as nesting, resting or storage by birds or mammals. For the largest cavity record a two-digit code to indicate the size of the cavity entrance hole and location of the cavity in the tree. The first digit indicates 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" DOB.) Cavity size is largest diameter ball that could fit through the existing hole.

<u>First Digit</u>		<u>Second Digit</u>	
<u>Code</u>	<u>Size of opening (inches)</u>	<u>Code</u>	<u>Location of cavity (feet)</u>
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
9	9+	9	60+

## ITEM 34 SAWLOG LENGTH (SAWL)

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" DOB. (diameter outside bark) for softwood sawtimber and 9.0" DOB 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. Record sawlog length to the last whole foot. Example: Sawlog length of 14.8' would be recorded as 14.

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 saw log length above the limitation. Limitations or "stoppers" for hardwoods grades 1, 2, and 3 and for all softwoods are any limb (live or dead) or group of 2.0" or larger limbs (live or dead) 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, aim at obtaining the longest sawlog length. For example, bucking between staggered limbs within a one-foot span whose combined diameters exceed the DOB at point of occurrence may give a longer sawlog length.

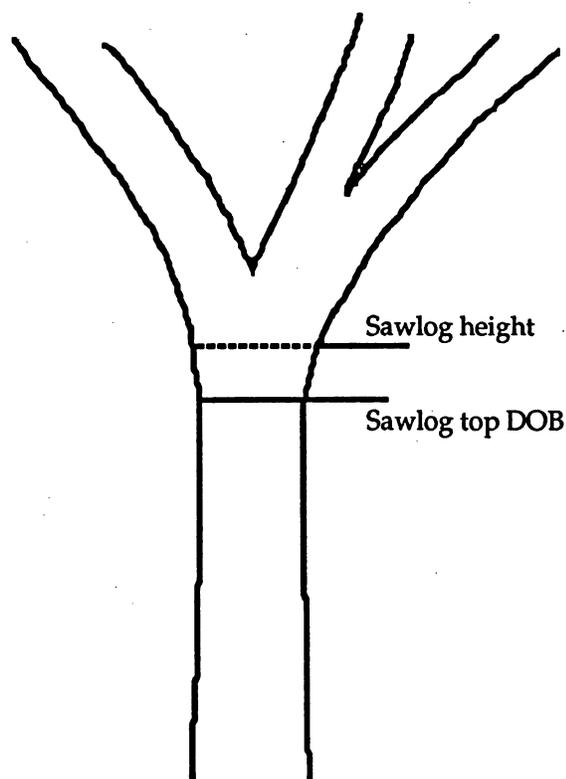
In situations where limbs are a limiting factor in determining merchantable length, length will be taken to the point where the limbs divide the diameter of the merchantable section (Figure 14).

As long as a merchantable log, eight feet or longer, is present above an unmerchantable section, no sawlog length reduction will be made because of an unmerchantable piece.

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

Use the 30-foot height pole for heights up to about 40 feet. For heights over 40 feet use the clinometer.

Figure 14



### ITEM 35 SAWLOG TOP DIAMETER OUTSIDE BARK (SDOB)

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 DOB recorded for softwoods will be 7.0" and 9.0" for hardwoods. For trees with sawlog length terminating before reaching minimum top DOB, 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. Sawlog top DOB is easily measured with the Wheeler Pentaprism ("Dobber").

### ITEM 36 BOARD FOOT CULL (CULB)

Board-foot cull is the volume within the sawlog portion of trees that cannot be recovered for use as lumber because of rot, sweep, crook, forks, or other defects. The following are included in Cull volumes:

- The entire volumes of tree sections that do not meet minimum log grade requirements.
- The entire volume in any one-foot or longer section of a tree less than 50 percent sound.
- The cull volume only, in any one-foot or longer section of a tree greater than 50 percent sound.
- Computed volumes for sweep and crook.
- 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 DOB 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 zero "0" in board-foot cull on sawtimber-sized trees.

## ITEM 37 LOG GRADE / TREE GRADE (LGR)

Grade trees that qualify on all full new measurement, full remeasurement, and partial new measurement plots. (Sample kinds 1, 2, & 7)

**First digit** For a hardwood sawtimber tree (tree class 20), grade the sawlog portion of the tree using "Hardwood Tree Grades for Factory Lumber" (USDA Forest Service Research Paper NE-333). The table on the next page contains the specifications for hardwood tree grades. Use the table and the following steps to determine tree grade:

- Measure DBH.
- Establish the location of all defect indicators on the surface of the butt 16-foot log, and then locate the best 12-foot section.
- Estimate inside bark diameter at the top of the 12-foot section to the nearest inch.
- Estimate scalable defect in the 12-foot section selected previously.
- The grade of the 12-foot section becomes the tree's grade, unless the grade can be improved by using a 14- or 16-foot section

For a hardwood sawtimber tree that does not qualify as tree grade 3, but meets specifications for hardwood construction lumber logs (tie and timber) assign a grade 4. For a hardwood sawtimber tree that does not meet minimum tree grade specifications, but has a 12-foot section above the butt log or two 8-foot sections that meets log grade requirements, assign a log grade of 5.

See USDA Forest Service General Technical Report NE-1, "A Guide to Hardwood Log Grading," for the specifications for construction class (grade 4) logs, and for upper logs.

For a softwood sawtimber (20 class) tree, grade first merchantable 16-foot log or shorter length down to 12 feet if a 16-foot log is not present. Use the grading rules in the "Tatum Guides" to assist in determining log grade.

For a softwood 31-class tree, grade the log that is present. For a hardwood 31-class tree, assign a grade 5.

ITEM 37 LOG GRADE / TREE GRADE CONTINUED

TABLE OF HARDWOOD TREE GRADES FOR FACTORY LUMBER

Grade factor	Tree grade 1	Tree grade 2	Tree grade 3
Length of grading zone (feet)	Butt 16	Butt 16	Butt 16
Length of grading section <sup>a</sup> (feet)	Best 12	Best 12	Best 12
DBH, minimum (inches)	16 <sup>b</sup>	13	11
Diameter, minimum inside bark at top of grading section (inches)	13 <sup>b</sup> 16 20	11 <sup>c</sup> 12	8
Clear cuttings (on the 3 best faces) <sup>d</sup>			
Length, minimum (feet)	7 5 3	3 3	2
Number on face (maximum)	2	2 3	e
Yield in face length (minimum)	5/6	4/6	3/6
Cull deduction (including crook and sweep, but excluding shake) maximum within grading section (percent)	9	9 <sup>f</sup>	50

- a Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors such as diameter and cull deduction.
- b In basswood and ash, DIB at top of grading section must be 12 inches and DBH must be 15 inches.
- c Grade 2 trees can be 10 inches DIB at top of grading section if otherwise meeting surface requirements for small grade 1s.
- d A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.
- e Unlimited.
- f Fifteen percent crook and sweep or 40 percent total cull deduction are permitted in grade 2, if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40 percent.

### ITEM 37 LOG GRADE / TREE GRADE CONTINUED

Second and third digit For hardwoods given a grade 2, 3, 4, or 5, record the limiting quality factor that is keeping the log from moving into a better quality grade.

<u>Code</u>	<u>Limiting Factor</u>
00	Not applicable, already a grade 1
10	Diameter
20	Length
30	Clear cuttings
40	Sweep and crook
50	Cull
60	Position in tree
70	Multiple factors
80	Diameter and and clear cutting

### ITEM 38 BOLE LENGTH (BOLL)

Bole length of all trees 5.0" DBH and larger should be determined between the top of a one-foot stump and 4.0" diameter outside bark, or to the point where the central stem or branch breaks into limbs and above which there is no 4.0" DOB. In the case of 20-class sawlog size trees forking above DBH, bole length is taken on the same trunk as sawlog length.

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.

Use a clinometer on heights over 40 feet. Important: Never zero out bole length, even if no merchantable volume is present.

### ITEM 39 BOLE LENGTH TOP DOB (BDOB)

Top DOB will be measured to the highest possible 4.0" DOB or where the central stem or branch breaks into limbs and above which there is no 4.0" DOB. Use a three-digit code to record bole top DOB to the last 0.1". Bole length top DOB 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.

#### ITEM 40 CUBIC-FOOT CULL (CULC)

For all live and dead trees, cubic-foot cull is the cubic-foot volume of decayed or missing wood up to the bole length top.

Cubic-foot cull may be computed by determining the length of the section affected, and the midpoint DOB. 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).

#### ITEM 42 SITE INDEX (SI)

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. Site index will be determined in the field using available site index curves appropriate for the area.

#### **Site Tree Data**

For all trees measured for site index information record the following:

- A tree history code of 99
- Tree number starting with #41
- Species
- DBH
- Total height under bole length
- Total age under bole length top DOB
- The years added to age at DBH under cull cubic feet

For remeasurement plots, a new site index will be recorded.

## ITEM 42 SITE INDEX CONTINUED

### Site Tree Selection

On each plot measure a minimum of three site index trees. As a general rule, you should first use tree species that are of the plot forest type. If none are available, use any suitable tree, as long as a site index curve is available for it.

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 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. 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. 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. Do not select high value trees.

Note the locations of the site trees on the 10-point cluster diagram. Record site tree data on the point closest to the site tree.

## ITEM 42 SITE INDEX CONTINUED

### Growth Intercept Method

If suitable trees are not available to use with site index curves, the growth intercept method of measuring site index is an alternative. This method has been proposed and tables developed for some tree species that have limbs showing distinct annual whorls (i.e. 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. You should know what species have these tables available and how to use them. If this method is used, mention it in the "Notes" section and record height, age and diameter as usual on the plot sheet.

For red pine:

<u>Height growth during the 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

### 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 following minimum site indices:

<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.)

## ITEM 42 SITE INDEX CONTINUED

### Techniques of Site Data Collection

Careful measurement of tree height and age are essential to get a good estimate of site index.

#### Tree Height

This measurement is 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

This measurement 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. In winter, it is best to remove your borer from the tree before taking time to count the core.

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 may 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 with you. Later, try soaking the core, shaving one side of it clean and holding it up to or under a strong light. Count growth rings more than once and have your partner count them to reach agreement on the tree age.

#### Site Index

Record the highest value obtained for site index on the plot sheet.

#### Site Tree Species

Record a three-digit code for the species of tree borer in determining site index.

## FIELD AND OFFICE PROCEDURES

### ITEM 43 BASAL AREA PER ACRE (OBA, CBA)

A three-digit code is used to record the basal area per acre for the plot. BA/Acre is determined by adding all trees counted for basal area on all 10 sample points, then multiplying the total number of trees counted by 3.75. Total BA/Acre may be determined directly from Table 5 (below). For remeasurement plots, the original basal area per acre is recorded on the plot header sheet. The stand basal area will be calculated by the data recorder, if you correctly enter all the "stick" counts.

Table 5 shows BA/Acre with the use of a 37.5 factor prism.

**TABLE 5--Basal Area per Acre\***

*(Square feet per acre)*

# Trees	BA	# Trees	BA	# Trees	BA
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	022	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

\* BA = # of trees x 3.75 (37.5 -factor prism)

#### ITEM 44 FOREST TYPE-STAND/ SIZE CLASS (OFTS, CFTS)

##### **Forest type (first and second digit)**

Forest type is calculated in the St. Paul office based on plurality of stocking of all live trees.

For new sample plots, record the appropriate two-digit code based on a visual estimate while in the plot area. Forest type is based on the flowchart on the state supplement sheet. If there is insufficient stocking, use your best judgment. FIA analysts use your estimate as a check against your data, and as the forest type in cases of insufficient stocking.

For remeasurement plots, the original forest type is recorded on the plot header sheet in St. Paul and remains unchanged.

##### **Stand Size Class (third digit)**

Normally, this item is calculated in the St. Paul office. On new sample plots it is not necessary for you to exactly calculate stand size class in the field. A visual estimate is sufficient. However, one primary use of stand size class is to correctly estimate the stand age of the sample location. If you don't know the stand size class, how can you accurately estimate stand age?

The best solution to this "Catch 22" is to record your best estimate for stand size class and stand age. If there is any doubt at all in your mind that the stand size class may be different, then record the stand age(s) for the other possible stand size class(es) in the Notes section of the plot sheet.

If 10 or fewer trees are recorded, enter the estimated size class. This is assumed to be correct by the St. Paul office. For remeasurement plots, the original stand size is recorded on the plot header sheet in St. Paul and remains unchanged.

## ITEM 44 FOREST TYPE-STAND/ SIZE CLASS CONTINUED

The following are rules for determining stand size class:

- Use stocking percents of all live trees to calculate stand-size class.
- Separate and total the stocking percents of all live trees into one of the three categories:

seedling-sapling  
poletimber  
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

**Note:** (new sample plots) The use of the size and stocking percent (item 31) codes is optional. If you are fairly sure of forest type and stand size class, you may skip these entries. Stocking percent and size are not recorded in St. Paul and are for your benefit in determining forest type and stand size class. The stocking rules still apply.

See appendix for Forest Type codes.

#### ITEM 45 STAND AGE (OAGE, CAGE)

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 must reflect stand size class. Below are some guidelines for stand age estimations with each stand size class. These are just guidelines; but, if your stand age differs from these guidelines please put a note in the Notes section of the plot header sheet. For remeasurement plots, the original stand age will be recorded on the plot header sheet in St. Paul.

<u>Stand size class</u>	<u>Stand age ranges (years)</u>
Sawtimber stands	> 40 for hardwoods > 30 for softwoods
Poletimber stands	Minimum 20; Maximum 80
Sapling & seedling stands	< 20
Nonstocked stands	Automatic stand age of 001

Stand age will be recorded with a three-digit code to the nearest year. A stand 49 years old will be recorded 049. Nonstocked stands (stand size class code 4) receive an automatic stand age of 001.

#### ITEM 46 STAND AREA (AREA)

The size of the forest type stand-size density condition that the plot falls in will be determined by a photo interpreter in St. Paul and recorded on the plot sheet in acres. Stand area is the extent of a continuous forested area of the same forest type, stand-size class and stand density.

**ITEM 47 DISTANCE TO WATER (WTYP, WARE, WDIS)**

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.

**TYPE OF WATER (WTYP) (one digit)**

<u>Code</u>	<u>Type of Water</u>
1	Streams and Flowages
2	Lakes
3	Swamps
4	Farm ponds
5	Reservoirs

**WATER AREA (WARE) (three digits)**

Area is measured in width for streams and flowages in feet. (000 to 999 feet) + 33 feet. For lakes, swamps and farm ponds, area is measured in acres (000 to 999 acres) + 5 acres

**WATER DISTANCE (WDIS) (four digits)**

The distance to the body of water measured to the nearest 1/2 chain. (0000 to 999.5 chains)

**ITEM 48 DISTANCE TO ROAD (RTYP, RDIS)**

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

**TYPE OF ROAD (RTYP) (one digit)**

<u>Code</u>	<u>Type of Road</u>
1	Paved - Four lanes
2	Paved - Two lanes
3	Improved - gravel

**DISTANCE (RDIS) (four digits)**

The distance to road will be measured in chains to the nearest half-chain (0000 to 999.5 chains).

#### ITEM 49 SKETCH AND NOTES

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 is used primarily in re-establishing the plot on future remeasurements.

Make sure that this information is legible and understandable. Any physical features that will assist in accurately relocating the plot should be drawn onto the 10-Point Cluster Diagram. This would include changes in timber type, old logging roads, forest and nonforest boundaries, streams, drainages, particular disturbances, etc.

Be sure to describe any particular procedure or situation encountered on the plot. Explain in the "Notes" section so that remeasurement crews can take them into consideration.

Aerial photos are usually not the property of the project. They may or may not be available at the next inventory.

The plots may be used by other than Forest Service personnel for other uses. The sketch for all forest and nonforest plots should contain as much information as is necessary to enable someone to find the starting point of the course to the plot. The sketch should include a reference to a town, a numbered or named road, intersections, or easily identified landmarks.

#### ITEM 51 STATE (ST)

Record the appropriate two-digit code from the appendix.

#### ITEM 52 UNIT (UNIT)

Record the appropriate one digit code for unit number (see appendix).

#### ITEM 53 COUNTY (CTY)

Record the appropriate two-digit county code (see appendix).

#### ITEM 54 NATIONAL FOREST RANGER DISTRICT (NFRD)

National Forest and Ranger District codes are listed in the appendix.

**ITEM 58 POINT CLASS RECORD, POINT TYPE/ SIZE (Assigned tree number 40)**

A point class record for each Point one through 10 will be recorded. If the forest type and/or stand size class for the point is noticeably different than the general type/size for the plot, as evidenced by a noticeable type and/or size change while traversing the plot, record this in the Damage/Death column (item 27) of the #40 tree.

The point forest type must meet minimum area classification requirements of one-acre and 120 feet in width to qualify as a separate type. Looking at the plot location on the aerial photo can also help to determine if type and size are different on some of the points.

Record forest type in the first two digits and stand size in the third. The point class record line (tree #40) should also be used to record cover class if no live trees are recorded on the point. Record cover classes in the Tree/Cover class column (item 28) of the #40 tree. Basal area tree count will also be recorded under the Basal Area column (item 20) of the #40 tree. If a different forest type does occur on the plot, sketch the location on the plot layout on the plot header sheet.

## ITEM 56 DEFINITION OF TERMS

The following are definitions of terms used in this handbook.

**Acceptable Trees** Growing-stock trees of commercial species that meet specified standards of size and quality.

**Bureau of Land Management Land** Federal land administered by the Bureau of Land Management.

**Clear Panel** A section of hardwood tree surface one-fourth the circumference of the tree and at least two feet long free of limbs, knots, bumps and other indications of defect which preclude clear cuttings.

**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. Same as timberland)

**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).

**Cull** Portions of a tree that are unusable for industrial wood products, because of rot, form, or other defect.

**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:

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.

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.

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.

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. *continued*

## ITEM 56 DEFINITION OF TERMS CONTINUED

### Crown Class *continued*

**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.

**Supra Canopy** Trees, usually mature or over-mature, with crowns 25% or more higher than the majority of dominant and codominant trees in the stand.

**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 six-inch class includes trees 5.0 through 6.9 inches DBH inclusive).

**Face** A section of the tree surface one-fourth the circumference of the tree extending the full length of the log.

**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.

**Farm Operator** A person who operates a farm, either doing the work himself or directly supervising the work.

**Farmer-Owned Land** Land owned by farm operators. (Note: This excludes land leased by farm operators from nonfarm owners, such as railroad companies and states.)

**Farmer-Owned Leased** Land owned by farm operators, but leased to forest industry.

**Forest Industry Land** Land owned by companies or individuals operating wood-using plants.

**Forest Land** Land not currently developed for nonforest use and having at least 16.7 percent stocking of all live forest trees of any size or formerly having 16.7 percent stocking. Roadside or streamside strips of land 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 one acre and 120 feet in width. *continued*

## ITEM 56 DEFINITION OF TERMS CONTINUED

### Forest Land *continued*

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, non-commercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

**Forest Trees** Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

**Forest Type** 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.)

**Growing-stock Trees** Live trees of commercial species qualifying as acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

**Growing-stock Volume** Net volume in cubic feet of growing stock trees five inches DBH and over from a one-foot stump to a minimum four-inch top diameter outside bark of the central stem or to the point where the central stem no longer meets pulpwood specifications.

**Hardwoods** Dicotyledonous trees, usually broadleaved and deciduous.

**Idle Farmland** Includes former croplands, orchards, improved pastures and farm sites not tended within the past two years and presently less than 16.7 percent stocked with trees.

**Improved Pasture** Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.

**Indian Land** Tribal lands held in fee by the Federal government but administered for Indian tribal groups and Indian trust allotments.

### Land Area

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.

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 one acre.

## ITEM 56 DEFINITION OF TERMS *CONTINUED*

**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 four inches DOB.

**Log Grades** A classification of logs based on external characteristics as indicators of quality or value.

**Logging Residues** The unused portions of trees cut or killed by logging.

**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.

**Merchantable** Refers to a pulpwood or sawlog section that meets pulpwood or sawlog specifications, respectively.

**Miscellaneous Federal Lands** Federal lands other than National Forest, lands administered by the Bureau of Land Management, and Indian lands.

**Miscellaneous Private Lands** Privately owned lands other than forest-industry and farmer-owned lands.

**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.

**Net Volume** Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

### **Noncommercial Forest Land**

1. Unproductive forest land incapable of yielding crops of industrial wood, because of adverse site conditions.
2. Productive-reserved forest land.

**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.

## ITEM 56 DEFINITION OF TERMS CONTINUED

**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 one-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 one acre in size, to qualify as nonforest land.)

**Nonstockable** Areas of forest land not capable of supporting seedlings of commercial species, because of the presence of rock, water, etc.

**Nonstocked Land** Commercial forest land less than 16.7 percent stocked with growing-stock trees, but greater than 16.7 percent in all trees.

**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.

**Overgrown Knot** The scar left in the bark by a limb completely overgrown, but still outlined by the circular configuration in the bark.

**Overstocked Area** 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.)

**Ownership** Property owned by one owner, regardless of the number of parcels in a specified area.

**Poletimber Stands** (See stand-size class.)

**Poletimber Trees** Growing-stock trees of commercial species at least five inches in DBH, but smaller than sawtimber size.

**Productive-Reserved Forest Land** Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administration, designation, or exclusive use for Christmas-tree production as indicated by annual shearing.

**Prospectively** As used in this manual it refers to the moment a tree will reach sawtimber size at DBH.

**Rangeland** Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.

## ITEM 56 DEFINITION OF TERMS CONTINUED

**Primitive Roads** Roads that are not maintained and are primarily used by vehicles not intended for highway use (i.e. old logging roads).

**Rotten Trees** Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs eight 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.

### **Rough Trees**

1. 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.
2. All live trees of noncommercial species.

**Roundwood Products** Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes sawlogs, veneer logs and bolts; cooperage logs and bolts; pulpwood, fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

**Salvable-mortality Trees** Standing or down dead trees that are considered merchantable by Regional standards and have died within the last three years.

**Saplings** Live trees one inch to 4.9 inches in diameter at breast height (DBH).

**Sapling-Seedling Stands** (See stand-size class.)

**Sawlog** A log meeting minimum standards of diameter, length and 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.

**Sawlog Portion** That part of the bole of sawtimber trees between the stump and the sawlog top, being nine inches DOB for hardwoods and seven inches DOB for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)

**Sawlog Top** The point on the bole of sawtimber trees above which a sawlog cannot be produced. The minimum sawlog top is seven inches DOB for softwoods and nine inches DOB for hard woods.

**Sawtimber Stands** (See stand-size class.)

## ITEM 56 DEFINITION OF TERMS CONTINUED

**Sawtimber Trees** Live trees of commercial species containing at least a 12-foot sawlog or two sawlogs eight feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least nine inches in diameter breast height. Hardwoods must be at least 11.0 inches in diameter.

**Sawtimber Volume** Net volume of the sawlog portion of live sawtimber in board feet International 1/4-inch rule.

**Seedlings** Live trees less than one inch in diameter at breast height (DBH).

**Site Class** A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

**Softwoods** Coniferous trees, usually evergreen having needles or scale-like leaves.

**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.

**Stand-Size Class** A classification of forest land based on the size class of all live 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.)

**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.

**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.

**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.

**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.

**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.)

## ITEM 56 DEFINITION OF TERMS CONTINUED

**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.)

**Tree Size Class** A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

**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 four 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, roads; railroads; airports; beaches; powerlines; and other rights-of-way; or other nonforest land not included in any other specified land use class.

### **Water**

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 one acre.

**APPENDIX**

ITEM 4 GROUND LAND USE (GLUO)

**MICHIGAN (1980) ORIGINAL GROUND LAND USE CODES**

<u>Code</u>	<u>Land use</u>
20	Commercial forest land
21	Pastured commercial forest land
40	Unproductive forest land
45	Productive reserved forest land
46	Christmas tree production land
51	Cropland with trees
52	Improved pasture with trees
53	Wooded strips
54	Idle farmland with trees
55	Marsh with trees
57	Wide windbreak
58	Windbreak
59	Wooded pasture
61	Cropland without trees
62	Improved pasture without trees
64	Idle farmland without trees
65	Marsh
66	Other farmland
67	Urban and other nonforest land
80	Noncensus water
90	Census water

ITEM 17 BIOMASS STUDY "SHRUBS" (SPP)

MICHIGAN SHRUB SPECIES

Code	Tree History	Common Name	Scientific Name
230	81	Yew	<i>Taxus canadensis</i>
353	80	Speckled alder	<i>Alnus rugosa</i>
380	80	Bog birch	<i>Betula pumila</i>
490	80	Dogwood (gray, alternate-leafed)	<i>Cornacae</i>
592	80	Black alder, mountain holly, winterberry	<i>Ilex verticillata</i>
764	80	Sandcherry	<i>Prunus pumila</i>
849	81	Sweetfern	<i>Comptonia peregrina</i>
853	80	Witch hazel	<i>Hamamelis virginiana</i>
855	80	Juneberry	<i>Amelanchier spp.</i>
856	80	Beaked hazel	<i>Corylus cornuta</i>
858	80	American hazel	<i>Corylus americana</i>
859	80	Buckthorn species	<i>Rhamnus spp.</i>
861	80	Leatherwood	<i>Dirca palustris</i>
862	80	Viburnum, Nannyberry	<i>Viburnum spp.</i>
863	80	Elderberry	<i>Sambucus spp.</i>
864	80	Sumac	<i>Rhus spp.</i>
865	81	Gooseberry-currant	<i>Ribes spp.</i>
873	81	Black huckleberry	<i>Gaylussacia bassata</i>
874	81	Blueberry, Bilberry	<i>Vaccinium spp.</i>
880	80	Buffaloberry	<i>Shepherdia spp.</i>
902	81	Poison ivy	<i>Rhus radicans</i>
909	81	Bearberry	<i>Arctostta paylos</i>
912	80	Buttonbush	<i>Cephalanthus occidentalis</i>
913	80	Russian or Autumn olive	<i>Eleagnus spp.</i>
979	80	Willow species (clumped)	<i>Salix spp.</i>
980	80	Willow sp.(single stemmed)	<i>Salix spp.</i>
982	81	Grape	<i>Vitis spp.</i>
997	80	Other species	(Tall, woody perennials)
998	81	Other species	(Other perennials)

**ITEM 22 TREE SPECIES (SPP)**

**MICHIGAN TREE SPECIES**

Code	Common Name	Scientific Name
012	Balsam fir	<i>Abies balsamea</i>
068	Eastern redcedar	<i>Juniperus virginiana</i>
071	Tamarack	<i>Larix laricina</i>
091	Norway spruce	<i>Picea abies</i>
093	Engelmann spruce	<i>Picea engelmanni</i>
094	White spruce	<i>Picea glauca</i>
095	Black spruce	<i>Picea mariana</i>
105	Jack pine	<i>Pinus banksiana</i>
125	Red pine	<i>Pinus resinosa</i>
129	White pine	<i>Pinus strobus</i>
130	Scotch pine	<i>Pinus sylvestris</i>
133	Austrian pine	<i>Pinus nigra</i>
241	Northern white-cedar	<i>Thuja occidentalis</i>
261	Eastern hemlock	<i>Tsuga canadensis</i>
313	Boxelder	<i>Acer negundo</i>
314	Black maple	<i>Acer nigrum</i>
315*	Striped maple	<i>Acer pennsylvanicum</i>
316	Red maple	<i>Acer rubrum</i>
317	Silver maple	<i>Acer saccharinum</i>
318	Sugar maple	<i>Acer saccharum</i>
319*	Mountain maple	<i>Acer spicatum</i>
331	Ohio buckeye	<i>Aesculus glabra</i>
341*	Ailanthus, tree-of-heaven	<i>Ailanthus altissima</i>
371	Yellow birch	<i>Betula alleghaniensis</i>
372	Sweet birch	<i>Betula lenta</i>
373	River birch	<i>Betula nigra</i>
375	Paper birch	<i>Betula papyrifera</i>
391*	American hornbeam(musclewood)	<i>Carpinus caroliniana</i>
402	Bitternut hickory	<i>Carya cordiformis</i>
403	Pignut hickory	<i>Carya glabra</i>
405	Shellbark hickory	<i>Carya laciniosa</i>
407	Shagbark hickory	<i>Carya ovata</i>
409	Mockernut hickory	<i>Carya tomentosa</i>
421	American chestnut	<i>Castanea dentata</i>
462	Hackberry	<i>Celtis occidentalis</i>
471*	Eastern redbud	<i>Cercis canadensis</i>
491	Flowering dogwood	<i>Cornus florida</i>

\* Noncommercial tree species.

## ITEM 22 TREE SPECIES (SPP) CONTINUED

## MICHIGAN TREE SPECIES CONTINUED

Code	Common Name	Scientific Name
500*	Hawthorn	<i>Crataegus spp.</i>
531	American beech	<i>Fagus grandifolia</i>
541	White ash	<i>Fraxinus americana</i>
543	Black ash	<i>Fraxinus nigra</i>
544	Green ash	<i>Fraxinus pennsylvanica</i>
552	Honeylocust	<i>Gleditsia triacanthos</i>
571	Kentucky coffeetree	<i>Gymnocladus dioicus</i>
601	Butternut	<i>Juglans cinerea</i>
602	Black walnut	<i>Juglans nigra</i>
621	Yellow poplar	<i>Liriodendron tulipifera</i>
641*	Osage-orange	<i>Maclura pomifera</i>
660*	Apple	<i>Malus spp.</i>
682	Red mulberry	<i>Morus rubra</i>
693	Black tupelo	<i>Nyssa sylvatica</i>
701*	Eastern hophornbeam (ironwood)	<i>Ostrya virginiana</i>
731	Sycamore	<i>Platanus occidentalis</i>
741	Balsam poplar	<i>Populus balsamifera</i>
742	Eastern cottonwood	<i>Populus deltoides</i>
743	Bigtooth aspen	<i>Populus grandidentata</i>
746	Quaking aspen	<i>Populus tremuloides</i>
761*	Pincherry	<i>Prunus pensylvanica</i>
762	Black cherry	<i>Prunus serotina</i>
763*	Chokecherry	<i>Prunus virginiana</i>
802	White oak	<i>Quercus alba</i>
804	Swamp white oak	<i>Quercus bicolor</i>
806	Scarlet oak	<i>Quercus coccinea</i>
809	Northern pin oak	<i>Quercus ellipsoidalis</i>
823	Bur oak	<i>Quercus macrocarpa</i>
826	Chinkapin oak	<i>Quercus muehlenbergii</i>
830	Pin oak	<i>Quercus palustris</i>
832	Chestnut oak	<i>Quercus prinus</i>
833	Northern red oak	<i>Quercus rubra</i>
837	Black oak	<i>Quercus velutina</i>
851*	Mountain ash	<i>Sorbus</i>
901	Black locust	<i>Robinia pseudoacacia</i>
921*	Peachleaf willow	<i>Salix amygdaloides</i>
922	Black willow	<i>Salix nigra</i>
923*	Diamond willow	<i>Salix eriocephala</i>
931	Sassafras	<i>Sassafras albidum</i>
951	American basswood	<i>Tilia americana</i>
972	American elm	<i>Ulmus americana</i>
975	Slippery elm	<i>Ulmus rubra</i>
977	Rock elm	<i>Ulmus thomasi</i>

\* Noncommercial tree species.

**ITEM 27 DAMAGE OR CAUSE OF DEATH (DAM)**

**MICHIGAN DAMAGE CODES AND CODING CRITERIA**

Code	Damage or Death	Hosts	Severity
000	Healthy	All species	<20% crown affected, no volume/degrade loss
100	Insect Defoliators	All species	>20% foliage affected
101	Budworms	Conifers	
104	Sawflies	Pines	
110	Forest tent caterpillar	Oaks, aspens N. hardwoods	
112	Large aspen tortrix	Aspens	
113	Gypsy moth	Hardwoods	Any occurrence
130	Shoot and Branch Insects	All species	Any occurrence on leader, >20% shoots/branches affctd
131	White pine weevil	White pine	
133	Saratoga spittlebug	Pines	
134	Scales	Hardwoods	
140	Branch Gall Insects	All species	
143	Saperda shoot borer	poplars	>20% branches affected
150	Bole Borers	All species	Any occurrence on bole
151	Two-lined chestnut borer	Oaks	
154	Sugar maple borer	Sugar maple	
155	Dioryctria borer	Red pine	
159	Pine bark adelgid	White pine	
170	Bark Beetles	Conifers	>20% crown dead/dying
171	Ips spp	Pines	
190	Root/Root Collar Insects	Conifers	Entire crown off color; dead tree
191	Root collar weevil	Hard pines	
200	Foliage Diseases	All species	>20% foliage affected
201	Needlecasts	Pines	
202	Anthraxnose	Hardwoods	
210	Shoot Blights	All species	Any occurrence on leader, >20% shoots/branches affctd
212	Scleroderris	Red, jack, scots pines	
214	Diplodia tip blight	Pines	

ITEM 27 DAMAGE OR CAUSE OF DEATH CONTINUED

Code	Damage or Death	Hosts	Severity
220	Mistletoes	Black and white spruces, jack pine, tamarack,	Any occurrence
231	Black knot	Black cherry	Any occurrence
233	Gall rusts	Jack, scots pine	Any occurrence
240	Bole Rusts	Pines	Any occurrence on bole
241	White pine blister rust	White pine	
242	Stem rusts of hardpines	Pines	
250	Bole Cankers	Hardwoods	Any occurrence on bole
251	Eutypella canker	Maple	
252	Hypoxylon canker	Aspens	
253	Cytospora canker	Spruces	
254	Nectria canker	Hardwoods	
257	Butternut canker	Butternut	
260	Stem Decay	All species	Any occurrence on bole
261	Phellinus pini	Conifers	
262	Phellinus tremulae	Aspens	
263	Inonotus obliquus	Birches	
271	Ash yellows	Ashes	Any occurrence
273	Beech bark disease	Beech	Any occurrence
281	Dutch elm disease	Elms	Any occurrence
282	Oak wilt	Oaks	Any occurrence
291	Annosus root rot	Conifers	Any occurrence
292	Armillaria root rot	All species	>20% crown dieback
300	Weather	All species	>20% crown affected; Any damage to leader or bole cambium
301	Hail		
302	Wind		
303	Lightening		
304	Frost cracks		
305	Frost kill (foliage and shoots)		
306	Winter drying		
307	Flooding		
308	Drought		
309	Ice/snow		
311	Sunscald		

ITEM 27 DAMAGE OR CAUSE OF DEATH CONTINUED

Code	Damage or Death	Hosts	Severity
400	Animal Damage	All species	Any damage to leader or bole cambium
401	Browse		
402	Moose/Elk/Deer		
403	Rabbit		
404	Beaver		
405	Squirrel		
406	Porcupine		
408	Sapsucker		
409	Cattle/domestic animals		
500	Fire	All species	>20% crown affected; Any damage to leader or bole cambium
600	Suppression	All species	Any damage to leader
760	Vine damage	All species	Any occurrence
800	Logging/TSI	All species	>20% crown affected;
810	Mechanical Damage	All species	Any damage to leader or bole cambium
820	Soil Compaction	All species	cambium
830	Vehicle Damage	All species	Any occurrence
860	Chemical	All species	>20% crown affected
861	Pesticides	All species	
900	Unknown/Uncoded - Dead	All species	Use on dead trees only
901	Unknown/Uncoded - Defoliation	All species	>20% foliage affected
902	Unknown/Uncoded - Discoloration	All species	>20% foliage affected
903	Unknown/Uncoded - Decline/Dieback	All species	>20% crown affected
904	Unknown/Uncoded - Breakage	All species	>20% crown affected; any occurrence on bole
905	Unknown/Uncoded - Abnormal Growth or Form in the Crown	All species	>20% crown affected
906	Unknown/Uncoded - Canker	All species	Any occurrence on bole
907	Unknown/Uncoded - Crack	All species	Any occurrence on bole
908	Unknown/Uncoded - Abnormal Growth or Form on the Bole	All species	any occurrence causing a volume loss

811  
Barbed  
Wire,  
Nails,  
Metal

ITEM 44 FOREST TYPE (OFTS, CFTS)

**MICHIGAN FOREST TYPES**

<u>Code</u>	<u>Forest type</u>
01	<b>Jack pine</b> Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)
02	<b>Red pine</b> Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)
03	<b>White pine</b> Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)
06	<b>Exotic</b> Forests in which species not native to Michigan comprise a plurality of the stocking. (Mostly Scotch pine in plantations.)
11	<b>Balsam fir</b> Forests in which balsam fir and white spruce comprise a plurality of the stocking with balsam fir the most common. (Common associates include white spruce, aspen, maple, birch, northern white-cedar, and tamarack.)
12	<b>Black spruce</b> Forests in which swamp conifers comprise a plurality of the stocking with black spruce the most common. (Common associates include tamarack and northern white-cedar.)
14	<b>Northern white-cedar</b> Forests in which swamp conifers comprise a plurality of the stocking with northern white-cedar the most common. (Common associates include tamarack and black spruce.)
15	<b>Tamarack</b> Forests in which swamp conifers comprise a plurality of the stocking with tamarack the most common. (Common associates include black spruce and northern white-cedar.)
16	<b>White spruce</b> Forests in which white spruce and balsam fir comprise a plurality of the stocking with white spruce the most common. (Common associates include balsam fir, aspen, maple, birch, northern white-cedar, and tamarack.)
50	<b>Oak-hickory</b> Forests in which northern red oak, white oak, bur oak, or hickories, singly or in combination, comprise a plurality of the stocking. (Common associates include jack pine, beech, yellow-poplar, elm, and maple.)

ITEM 44 FOREST TYPE CONTINUED

MICHIGAN FOREST TYPES CONTINUED

- | <u>Code</u> | <u>Forest type</u>  |
|-------------|---|
| 70          | <b>Elm-ash-cottonwood</b> Forests in which low-land elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include birch, spruce, and balsam fir.)   |
| 80          | <b>Maple-beech-birch</b> Forests in which sugar maple, beech, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine, elm, hemlock, and basswood.) |
| 91          | <b>Aspen</b> Forests in which quaking aspen or bigtooth aspen, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, balsam fir, and paper birch.)  |
| 92          | <b>Paper birch</b> Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)  |

ITEM 53 COUNTY (CTY)

**MICHIGAN (STATE CODE 26) COUNTY CODES BY UNIT**

UNIT 1 - EASTERN UPPER PENINSULA

01 Alger  
02 Chippewa  
03 Delta  
04 Luce  
05 Mackinac  
06 Menominee  
07 Schoolcraft

UNIT 2 - WESTERN UPPER PENINSULA

01 Baraga  
02 Dickinson  
03 Gogebic  
04 Houghton  
05 Iron  
06 Keweenaw  
07 Marquette  
08 Ontonagon

UNIT 3 - NORTHERN LOWER PENINSULA

01 Alcona  
02 Alpena  
03 Antrim  
04 Arenac  
05 Bay  
06 Benzie  
07 Charlevoix  
08 Cheboygan  
09 Clare  
10 Crawford  
11 Emmet  
12 Gladwin  
13 Grand Traverse  
14 Iosco  
15 Isabella  
16 Kalkaska  
17 Lake  
18 Leelanau  
19 Manistee  
20 Mason  
21 Mecosta  
22 Midland  
23 Missaukee  
24 Montmorency  
25 Newaygo

UNIT 3- N. LOWER, continued

26 Oceana  
27 Ogemaw  
28 Osceola  
29 Oscoda  
30 Otsego  
31 Presque Isle  
32 Roscommon  
33 Wexford

UNIT 4 - SOUTHERN LOWER PENINSULA

01 Allegan  
02 Barry  
03 Berrien  
04 Branch  
05 Calhoun  
06 Cass  
07 Clinton  
08 Eaton  
09 Genesee  
10 Gratiot  
11 Hillsdale  
12 Huron  
13 Ingham  
14 Ionia  
15 Jackson  
16 Kalamazoo  
17 Kent  
18 Lapeer  
19 Lenawee  
20 Livingston  
21 Macomb  
22 Monroe  
23 Montcalm  
24 Muskegon  
25 Oakland  
26 Ottawa  
27 Saginaw  
28 St. Clair  
29 St. Joseph  
30 Sanilac  
31 Shiawassee  
32 Tuscola  
33 Van Buren  
34 Washtenaw  
35 Wayne

**ITEM 54 NATIONAL FOREST RANGER DISTRICT (NFRD)**

**MICHIGAN NATIONAL FORESTS AND RANGER DISTRICT CODES**

**Hiawatha National Forest - Code 10**

<u>Code</u>	<u>Ranger District</u>
2	Manistique
3	Munising
1	Rapid River
5	St. Ignace
4	Sault Ste. Marie

**Huron-Manistee National Forest - Code 04**

<u>Code</u>	<u>Ranger District</u>
1	Baldwin
2	Cadillac
7	Harrisville
3	Manistee
5	Mio
6	Tawas
4	White Cloud

**Ottawa National Forest - Code 07**

<u>Code</u>	<u>Ranger District</u>
1	Bergland
2	Bessemer
3	Iron River
4	Kenton
5	Ontonagon
6	Watersmeet

MICHIGAN TATUM GUIDES #1

MICHIGAN BIOMASS LIST (SHRUBS), ITEM 17

MICHIGAN DAMAGE OR DEATH, ITEM 27

MICHIGAN TREE SPECIES, ITEM 22

Code	Common Name
012	Balsam fir
068	Eastern redcedar
071	Tamarack
091	Norway spruce
093	Engelmann spruce
094	White spruce
095	Black spruce
105	Jack pine
125	Red pine
129	White pine
130	Scotch pine
133	Austrian pine
241	Northern white-cedar
251	Eastern hemlock
313	Bowelder
314	Black maple
315*	Striped maple
316	Red maple
317	Silver maple
318	Sugar maple
319*	Mountain maple
331	Ohio buckeye
341*	Allanhus, tree-of-heaven
371	Yellow birch
372	Sweet birch
373	River birch
375	Paper birch
391*	American hornbeam(musclewood)
402	Bitternut hickory
403	Fignut hickory
405	Shellbark hickory
407	Shagbark hickory
409	Mockernut hickory
421	American chestnut
462	Hackberry
471*	Eastern redbud
491	Flowering dogwood
500*	Hawthorn
531	American beech
541	White ash
543	Black ash
544	Green ash
552	Honeylocust
571	Kentucky coffeetree
601	Butternut
602	Black walnut
621	Yellow poplar
641*	Osage-orange
660*	Apple
682	Red mulberry
693	Black tupelo
701*	Eastern hophornbeam (ironwood)
731	Sycamore
741	Balsam poplar
742	Eastern cottonwood
743	Bigtooth aspen
746	Quaking aspen
761*	Pincherry
762	Black cherry
763*	Chokecherry
802	White oak
804	Swamp white oak
806	Scarlet oak
809	Northern pin oak
823	Bur oak
826	Chinkapin oak
830	Pin oak
832	Chestnut oak
835	Northern red oak
837	Black oak
851*	Mountain ash
901	Black locust
921*	Peachleaf willow
922	Black willow
923*	Diamond willow
931	Sassafras
951	American basswood
972	American elm
975	Slippery elm
977	Rock elm

\* Noncommercial tree species.

STOCKING PERCENT, ITEM 31

DBH	Stocking %	DBH	Stocking %
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	0.4	Seedling	2.0

Code	Tree History	Common Name
230	81	Yew
353	80	Speckled alder
380	80	Bog birch
490	80	Dogwood (gray, alternate-leaved)
592	80	Black alder, mountain holly, winterberry
764	80	Sandcherry
849	81	Sweetfern
853	80	Witch hazel
855	80	Juneberry
856	80	Beaked hazel
858	80	American hazel
859	80	Buckhorn species
861	80	Leatherwood
862	80	Viburnum, Nannyberry
863	80	Elderberry
864	80	Sumac
865	81	Gooseberry-currant
873	81	Black huckleberry
874	81	Blueberry, Bilberry
880	80	Buffaloberry
902	81	Poison ivy
909	81	Bearberry
912	80	Buttonbush
913	80	Russian or Autumn olive
979	80	Willow species (clumped)
980	80	Willow sp. (single stemmed)
982	81	Grape
997	80	Other species
998	81	Other species

TREE HISTORY 80

Code	Diameter measured along stem 6" from ground
001*	0.0-.19"
002	.2-.29"
003	.3-.39"
004	.4-.49"
005	.5-.99"
010	1.0-1.49"
015	1.5-1.99"
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.

TREE HISTORY, ITEM 23

Code	Tree History
0	No status
1	Growing stock live
2	Cull live
3	Ingrowth
4	Dead (salvage-mortality)
5	Dead (mortality)
6	Ongrowth
7	Stump (salvaged dead)
8	Stump (utilized)
9	Stump (not utilized)

CROWN RATIO, ITEM 29

Code	Percent
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
0	91-100

TREE HISTORY 81

Code	% ground cover
001	solitary plant, less than 1%
002	1-10%
003	11-20%
004	21-40%
005	41-70%
006	More than 70%

TREE or COVER CLASS, ITEM 28

Code	Class
20	Acceptable tree
30	Rough tree
31	Short sawtimber tree
40	Rotten tree
51	Inhibiting vegetation- grass
52	Inhibiting veg- shrubs
53	Inhibiting veg- vines
54	Inhibiting veg- other
60	Nonstocked - not overtopped
70	Nonstocked - overtopped
81	Nonstockable - rocks
82	Nonstockable - water
83	Nonstockable - other

CROWN CLASS, ITEM 30

Code	Class
1	Open grown
2	Dominant
3	Codominant
4	Intermediate
5	Overtopped
6	Supra canopy

TREE CAVITIES, ITEM 33

Code (inches)	Size of opening	Code (feet)	Location of cavity
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
9	9+	9	60+

Code	Disease or damage
000	Healthy
100	Insect Defoliators
101	Budworms
104	Sawflies
110	Forest tent caterpillar
112	Large aspen tortrix
113	Gypsy moth
130	Shoot and Branch Insects
131	White pine weevil
133	Saratoga spittlebug
134	Scales
140	Branch Gall Insects
143	Saperda shoot borer
150	Bole Borers
151	Two-lined chestnut borer
154	Sugar maple borer
155	Dioryctria borer
159	Pine bark adelgid
170	Bark Beetles
171	Ips spp
190	Root/Root Collar Insects
191	Root collar weevil
200	Foliage Diseases
201	Needlecasts
202	Anthracoose
210	Shoot Blights
212	Scleroderis
214	Diplodia tip blight
220	Mistletoes
231	Black knot
233	Call rusts
240	Bole Rusts
241	White pine blister rust
242	Stem rusts of hardpines
250	Bole Cankers
251	Eutypella canker
252	Hypoxylon canker
253	Cytospora canker
254	Nectria canker
257	Butternut canker
260	Stem Decay
261	Phellinus pini
262	Phellinus tremulae
263	Inonotus obliquus
271	Ash yellows
273	Beech bark disease
281	Dutch elm disease
282	Oak wilt
291	Armosus root rot
292	Armilaria root rot
300	Weather
301	Hail
302	Wind
303	Lightening
304	Frost cracks
305	Frost kill (foliage and shoots)
306	Winter drying
307	Flooding
308	Drought
309	Ice/snow
311	Sunscald
400	Animal Damage
401	Browse
402	Moose/Elk/Deer
403	Rabbit
404	Beaver
405	Squirrel
406	Porcupine
408	Sapsucker
409	Cattle/domestic animals
500	Fire
600	Suppression
760	Vine damage
800	Logging/ISI
810	Mechanical Damage
820	Soil Compaction
830	Vehicle Damage
860	Chemical
861	Pesticides
900	Unknown/Un-coded - Dead
901	Unknown/Un-coded - Defoliation
902	Unknown/Un-coded - Discoloration
903	Unknown/Un-coded - Decline/Dieback
904	Unknown/Un-coded - Breakage
905	Unknown/Un-coded - Abnormal Growth or Form in the Crown
906	Unknown/Un-coded - Canker
907	Unknown/Un-coded - Crack
908	Unknown/Un-coded - Abnormal Growth or Form on the Bole

MICHIGAN TATUM GUIDE #2

ASPECT, POSITION, SLOPE, ITEM 6

Aspect - Record the actual azimuth

Position:  
Code

- 1 Top 1/4
- 2 Upper 1/4
- 3 Lower 1/4
- 4 Level or lowest 1/4

Slope - Record the actual percent slope

Slope Shape  
Code

- 1 Level
- 2 Concave
- 3 Uniform
- 4 Convex

Slope Correction

(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
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

CONVERSION TABLE - CHAINS TO FEET

1/6 chain = 110'	11/6 chain = 77.0'
1/4 chain = 165'	11/4 chain = 82.5'
1/3 chain = 220'	11/3 chain = 88.0'
1/2 chain = 330'	11/2 chain = 99.0'
2/3 chain = 440'	
3/4 chain = 495'	
5/6 chain = 550'	
1 chain = 660'	

WATER, ITEM 47

Code Type of Water

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

Area -

in width for streams and flowages  
(000 to 999 feet) +/- 33 feet  
in acres for lakes, swamps and farm ponds  
(000 to 999 acres) +/- 5 acres

Distance - to the nearest 1/2 chain

ROAD, ITEM 48

Code Type of Road

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

Distance - to nearest 1/2 chain

GROUND LAND USE, ITEM 4

Code FOREST LAND

- 20 Commercial forest land
- 21 Pastured commercial forest land
- 22 Plantations
- 40 Unproductive forest land
- 41 Reserved forest land-unproductive
- 45 Reserved forest land-productive
- 46 Christmas tree plantations

Code NONFOREST WITH TREES

- 51 Cropland with trees
- 52 Improved pasture w/ trees
- 53 Wooded strip (natural)
- 54 Idle farmland with trees
- 55 Marsh with trees
- 56 Narrow windbreaks (< 120')
- 57 Wide windbreaks (> 120')
- 58 Shelterbelt
- 59 Wooded pasture
- 71 Urban forest land
- 72 Urban and other with trees

Code NONFOREST WITHOUT TREES

- 61 Cropland
- 62 Improved pasture
- 64 Idle farmland
- 65 Marsh
- 66 Other farmland
- 67 Urban and other areas
- 68 Rights-of-way
- 69 Nonforest (reserved)
- 80 Noncensus water
- 90 Census water

GROUND LAND USE REASON FOR CHANGE

Code Reason

- 0 No change
- 1 Definition
- 2 Legislation
- 3 Natural
- 4 Herbicide
- 5 Clearing (land cleared-timber not utilized)
- 6 Clearcut (land cleared - timber is utilized)
- 7 Partial timber cut
- 8 Planting
- 9 Other man (includes fencing to exclude livestock)

PHYSIOGRAPHIC CLASS, ITEM 7

Code Physiographic Class

- 3 Xeric sites - very dry sites
- 4 Xeromesic sites - moderately dry sites
- 5 Mesic sites - soil/water relationship-favorable
- 6 Hydromesic sites - poor drainage
- 7 Hydric sites - frequently flooded river bottoms

STAND ORIGIN, ITEM 8

Code Stand Origin

- 1 Natural stand with no evidence of artificial regeneration.
- 2 40 percent or more of the sample trees originating from artificial regeneration
- 3 Less than 40 percent of the trees originating from artificial regeneration

Explain, if code is other than 1

STAND HISTORY, ITEM 9

First digit (what happened)

- 0 No disturbance
- 1 Grazing
- 2 Timber stand improvement
- 3 Commercial clear cut
- 4 Partial harvest cut
- 5 Natural
- 6 Man-caused
- 7 Planting of forest land
- 8 Planting of non-forestland
- 9 Natural regeneration of non-forestland

Second digit (how long ago)

- 0 No disturbance
- 1 1-4 years
- 2 5-10 years
- 3 11-15 years
- 4 16-20 years

SEED SOURCE, ITEM 10

Code Seed Source

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

MICHIGAN FOREST TYPE/SIZE CLASS, ITEM 44

Code Forest type

- 01 Jack pine
- 02 Red pine
- 03 White pine
- 06 Exotic (Scots pine)
- 11 Balsam fir
- 12 Black spruce
- 14 Northern white-cedar
- 15 Tamarack
- 16 White spruce
- 50 Oak
- 70 Elm-ash-cottonwood
- 80 Maple-basswood.
- 91 Aspen
- 92 Paper birch

Code Stand-size Class

- 1 Sawtimber stands
- 2 Poletimber stands
- 3 Sapling and seedling stands
- 4 Nonstocked stands

CONIFER UNDERSTORY, ITEM 11

First digit

Code Condition

- 1 None or inadequate
- 2 Planted - should succeed
- 3 Planted - need treatment
- 4 Natural - should succeed
- 5 Natural - needs treatment

Second, Third, and Fourth Digits

Record prevalent species

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	29.6	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

# MICHIGAN TATUM GUIDE #3

## JACK PINE AND RED PINE LOG GRADES

- GRADE 1 Logs with 3 or 4 clear faces \*
- 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 defects, 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.

1. 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 the small end.
2. HEART ROT Degrade any tentative 1 or 2 log one grade if conk, massed hyphae, or other evidence of advanced heart rot is found anywhere in the log.

\* A face is one fourth of the circumference in width extending the full length of the log. Clear faces are those free of: knots measuring more than 1/2 inch in diameter, overgrown knots of any size, and holes more than 1/4 inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.

## LOG GRADES FOR ALL OTHER SOFTWOOD LOGS

### Grade 1

1. Logs must be 16" d.l.b. or larger, 10' or longer, and with deduction for defect, not over 30 % of gross scale.
2. Logs must be at least 75 % clear on each of three faces.
3. All knots outside clear cutting must be sound and not over 2 1/2" large.

### Grade 2

1. Logs must be 12" d.l.b. or larger, 10' or longer, and with a net scale after deduction for defect of at least 50 % of the gross contents of the log.
2. Logs must be at least 50 % clear on each of three faces or 75 % clear on 2 faces.

### Grade 3

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

Notes: Diameters are d.l.b. at small end of log  
% clear refers to % clear in one continuous section.

## EASTERN WHITE PINE SAWLOG GRADE SPECIFICATIONS

GRADING FACTOR	LOG GRADE 1	LOG GRADE 2	LOG GRADE 3	LOG GRADE 4
1 MINIMUM SCALING DIAMETER (inches)	14 <sup>1</sup>	6	6	6
2 MINIMUM LOG LENGTH (feet)	10 <sup>2</sup>	8	8	8
3 MAXIMUM WEEVIL INJURY (number)	NONE	NONE	2 INJURIES <sup>3</sup>	NO LIMIT
4 MINIMUM FACE REQUIREMENTS	Two full length or four 50% length good faces. <sup>4</sup> (In addition, log knots on balance of faces shall not exceed size limitations of grade 2 logs.)	NO GOOD FACES REQUIRED. Maximum diameter of log knots on three best faces:  SOUND RED KNOTS not to exceed 1/6 scaling diameter and 3 inch maximum.  DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/12 scaling diameter and 1 1/2 inch maximum.	SOUND RED KNOTS not to exceed 1/3 scaling diameter and 5 inch maximum.  DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/6 scaling diameter and 2 1/2 inch maximum.	Includes all logs not qualifying for No. 3 or better and judged to have at least one third of their gross volume in sound wood suitable for manufacture into standard lumber.
5 MAXIMUM SWEEP OR CROOK ALLOWANCE (percent)	20	30	40	66 2/3
6 MAXIMUM TOTAL SCALING DEDUCTION (percent)	50	50	50	66 2/3
<p>After the tentative log grade is established from face examination, the log will be reduced in grade whenever the following defects are evident:</p> <p>7 CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON BARK SURFACE<sup>5</sup></p> <p>Degrade one grade if present on one face Degrade two grades if present on two faces Degrade three grades if present on three or more faces</p> <p>8 LOG END DEFECTS: RED ROT, RING SHAKE, HEAVY STAIN AND PINE BORER DAMAGE OUTSIDE THE HEART CENTER OF THE LOG<sup>5</sup></p> <p>Consider log as having a total of 8 quarters (4 on each end) and degrade as indicated below: Degrade one grade if present in 2 quarters of log ends. Degrade two grades if present in 3 or 4 quarters of log ends. Degrade three grades if present in 5 or more quarters of log ends.</p>				
<p>1 12 and 13 inch logs with four full length good faces are acceptable. 2 8 foot logs with four full length good faces are acceptable. 3 8 foot Number 3 logs limited to one weevil injury. 4 Minimum 50% length good face must be at least 6 feet. 5 Factors 7 and 8 are not cumulative (total degrade based on more serious of the two). No log to be degraded below grade 4 if net scale is at least one third of gross scale.</p>				

# MICHIGAN TATUM GUIDE #4

## First digit- TREE GRADE

Table of hardwood tree grades for factory lumber

Grade factor	Tree grade 1	Tree grade 2	Tree grade 3
Length of grading zone (feet)	Butt 16	Butt 16	Butt 16
Length of grading section a/ (feet)	Best 12	Best 12	Best 12
DBH, minimum (inches)	16 b/	13	11
Diameter, minimum inside bark at top of grading section (inches)	13 b/	16 20	11 c/ 12
Clear cuttings (on the 3 best faces) d/			
Length, minimum (feet)	7	5 3	3 3 2
Number on face (maximum)	2	2 3	e/
Yield in face length (minimum)	5/6	4/6	3/6
Cull deduction (including crook and sweep, but excluding shake) - maximum within grading section (%)	9	9 f/	50

a/ Whenever a 14- or 16-foot section of the butt 16-foot log is better than the best 12-foot section, the grade of the longer section will become the grade of the tree. This longer section, when used, is the basis for determining the grading factors such as diameter and cull deduction.

b/ In basewood and ash, DIB at top of grading section must be 12 inches and DBH must be 15 inches.

c/ Grade 2 trees can be 10 inches DIB at top of grading section if otherwise meeting surface requirements for small grade 1's.

d/ A clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth of the surface of the grading section as divided lengthwise.

e/ Unlimited.

f/ 15% crook and sweep or 40% total cull deduction are permitted in grade 2, if size and surface of grading section qualify as grade 1. If rot shortens the required clear cuttings to the extent of dropping the butt log to grade 2, do not drop the tree's grade to 3 unless the cull deduction for rot is greater than 40%.

For hardwood sawtimber trees that do not qualify as tree grade 3, but meet the specifications for hardwood construction lumber logs (tie and timber) assign a grade 4 as we have in the past.

For hardwood sawtimber trees that do not meet minimum tree grade specifications, but have a 12 foot section above the butt log or two 8 foot sections that meet log grade requirements, assign a log grade of 5.

## 2nd and 3rd digit, LIMITING FACTOR

For trees given a hardwood factory log grade of 2, 3 or 4 record the limiting quality factor that is keeping the log from moving into a better quality grade.

Code	Limiting Factor
00	Not applicable, already a grade 1
10	Diameter
20	Length
30	Clear cuttings
40	Sweep and crook
50	Cull
60	Position in tree
70	Multiple factors
80	Diameter and and clear cutting

## LOG GRADES FOR SOFTWOOD LOGS

### Grade 1

1. Logs must be 16" d.l.b. or larger, 10' or longer, and with deduction for defect, not over 30 % of gross scale.
2. Logs must be at least 75 % clear on each of three faces.
3. All knots outside clear cutting must be sound and not over 2 1/2" large.

### Grade 2

1. Logs must be 12" d.l.b. or larger, 10' or longer, and with a net scale after deduction for defect of at least 50 % of the gross contents of the log.
2. Logs must be at least 50 % clear on each of three faces or 75 % clear on 2 faces.

### Grade 3

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

Notes: Diameters are d.l.b. at small end of log  
% clear refers to % clear in one continuous section.

## 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 basis of cuttings)
Sweep allowance, maximum	1/4 d.l.b. of small end for half logs, 1/2 d.l.b. for logs 16' long
Sound surface defects permitted:	
Single knots	Any number, none with a knot collar diameter over 1/3 of the log diameter at the point of occurrence.
Whorled knots	Any number provided the sum of the collar diameters don't exceed 1/3 of the log diameter at the point of occurrence.
Holes	Any number not exceeding knot specifications as long as 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 do, they can't 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.



MICHIGAN TATUM GUIDE #6

TWO VARIABLE CUBIC FOOT LOOKUP VOLUME TABLE

DBH	MERCHANTABLE HEIGHT (FEET)																		
	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44
5	1.0	1.1	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.4	2.5	2.7	2.8	2.9	3.1	3.2	3.3	3.4	3.5
6	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.7	3.9	4.1	4.3	4.4	4.6	4.8
7	1.8	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.9	4.1	4.4	4.6	4.8	5.1	5.3	5.5	5.8	6.0	6.2
8	2.3	2.6	2.9	3.3	3.6	3.9	4.2	4.5	4.8	5.1	5.5	5.8	6.1	6.4	6.7	7.0	7.3	7.6	7.9
9	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.5	5.9	6.3	6.7	7.1	7.4	7.8	8.2	8.6	8.9	9.3	9.7
10	3.3	3.8	4.3	4.8	5.3	5.7	6.2	6.6	7.1	7.6	8.0	8.5	9.0	9.4	9.9	10.3	10.8	11.3	11.7
11	4.0	4.5	5.1	5.6	6.2	6.8	7.3	7.9	8.4	9.0	9.5	10.1	10.6	11.2	11.7	12.3	12.8	13.4	14.0
12	4.6	5.3	5.9	6.6	7.2	7.9	8.5	9.2	9.8	10.5	11.1	11.8	12.4	13.1	13.7	14.4	15.0	15.7	16.4
13	5.3	6.1	6.8	7.6	8.3	9.1	9.8	10.6	11.3	12.1	12.8	13.6	14.4	15.1	15.9	16.7	17.4	18.2	19.0
14	6.0	6.9	7.8	8.6	9.5	10.4	11.2	12.1	13.0	13.8	14.7	15.6	16.5	17.3	18.2	19.1	20.0	20.9	21.8
15	6.8	7.8	8.8	9.8	10.7	11.7	12.7	13.7	14.7	15.7	16.7	17.7	18.7	19.7	20.7	21.7	22.8	23.8	24.9
16	7.6	8.7	9.8	11.0	12.1	13.2	14.3	15.4	16.5	17.7	18.8	19.9	21.1	22.2	23.4	24.5	25.7	26.9	28.1
17	8.5	9.7	11.0	12.2	13.5	14.7	16.0	17.2	18.5	19.7	21.0	22.3	23.6	24.9	26.2	27.5	28.8	30.1	31.5
18	9.4	10.8	12.2	13.6	14.9	16.3	17.7	19.1	20.5	22.0	23.4	24.8	26.2	27.7	29.1	30.6	32.1	33.6	35.1
19	10.3	11.9	13.4	14.9	16.5	18.0	19.6	21.1	22.7	24.3	25.9	27.4	29.0	30.6	32.3	33.9	35.6	37.2	38.9
20	11.3	13.0	14.7	16.4	18.1	19.8	21.5	23.3	25.0	26.7	28.5	30.2	32.0	33.8	35.6	37.4	39.2	41.0	42.9
21	12.3	14.2	16.1	17.9	19.8	21.7	23.6	25.5	27.4	29.3	31.2	33.1	35.1	37.0	39.0	41.0	43.0	45.1	47.1
22	13.4	15.5	17.5	19.5	21.6	23.6	25.7	27.8	29.9	31.9	34.1	36.2	38.3	40.5	42.6	44.8	47.0	49.3	51.5
23	14.5	16.7	19.0	21.2	23.4	25.7	27.9	30.2	32.5	34.7	37.0	39.3	41.7	44.0	46.4	48.8	51.2	53.6	56.1
24	15.7	18.1	20.5	22.9	25.4	27.8	30.2	32.7	35.2	37.6	40.1	42.7	45.2	47.7	50.3	52.9	55.6	58.2	60.9
25	16.9	19.5	22.1	24.7	27.4	30.0	32.7	35.3	38.0	40.7	43.4	46.1	48.9	51.6	54.4	57.2	60.1	63.0	65.9
26	18.1	20.9	23.8	26.6	29.4	32.3	35.1	38.0	40.9	43.8	46.7	49.7	52.7	55.7	58.7	61.7	64.8	67.9	71.1
27	19.4	22.4	25.5	28.5	31.6	34.7	37.7	40.8	43.9	47.1	50.2	53.4	56.6	59.8	63.1	66.4	69.7	73.1	76.5
28	20.7	24.0	27.3	30.5	33.8	37.1	40.4	43.7	47.1	50.4	53.8	57.2	60.7	64.2	67.7	71.2	74.8	78.4	82.1
29	22.1	25.6	29.1	32.6	36.1	39.6	43.2	46.8	50.3	53.9	57.6	61.2	64.9	68.6	72.4	76.2	80.0	83.9	87.8
30	23.5	27.2	31.0	34.7	38.5	42.3	46.1	49.9	53.7	57.6	61.4	65.3	69.3	73.3	77.3	81.4	85.5	89.6	93.8
31	25.0	28.9	32.9	36.9	40.9	45.0	49.1	53.1	57.2	61.3	65.4	69.6	73.8	78.1	82.4	86.7	91.1	95.5	100.0
32	26.4	30.7	34.9	39.2	43.5	47.8	52.1	56.4	60.7	65.1	69.5	74.0	78.5	83.0	87.6	92.2	96.9	101.6	106.4
33	28.0	32.5	37.0	41.5	46.1	50.6	55.2	59.8	64.4	69.1	73.8	78.5	83.3	88.1	92.9	97.9	102.8	107.8	112.9
34	29.6	34.3	39.1	43.9	48.7	53.6	58.4	63.3	68.2	73.2	78.1	83.2	88.2	93.3	98.5	103.7	109.0	114.3	119.7
35	31.2	36.2	41.3	46.4	51.5	56.6	61.7	66.9	72.1	77.4	82.6	87.9	93.3	98.7	104.2	109.7	115.3	120.9	126.7
36	32.8	38.2	43.6	48.9	54.3	59.7	65.2	70.6	76.1	81.7	87.2	92.9	98.5	104.3	110.0	115.9	121.8	127.8	133.8
37	34.6	40.2	45.9	51.5	57.2	62.9	68.7	74.4	80.2	86.1	92.0	97.9	103.9	110.0	116.1	122.2	128.5	134.8	141.2
38	36.3	42.3	48.2	54.2	60.2	66.2	72.3	78.3	84.5	90.6	96.8	103.1	109.4	115.8	122.2	128.8	135.3	142.0	148.7
39	38.1	44.4	50.6	56.9	63.2	69.6	76.0	82.4	88.8	95.3	101.8	108.4	115.1	121.8	128.6	135.4	142.4	149.4	156.5
40	39.9	46.5	53.1	59.7	66.4	73.0	79.7	86.5	93.2	100.1	107.0	113.9	120.9	127.9	135.1	142.3	149.6	157.0	164.4

DBH	MERCHANTABLE HEIGHT (FEET)																	
	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
5	3.6	3.7	3.9	4.0	4.1	4.2	4.3	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.9	5.0	5.1	5.2
6	4.9	5.1	5.3	5.4	5.6	5.7	5.9	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	7.5
7	6.4	6.7	6.9	7.1	7.3	7.6	7.8	8.0	8.2	8.4	8.7	8.9	9.1	9.3	9.5	9.8	10.0	10.2
8	8.2	8.4	8.7	9.0	9.3	9.6	9.9	10.2	10.5	10.8	11.1	11.4	11.7	12.1	12.4	12.7	13.0	13.3
9	10.1	10.4	10.8	11.2	11.6	12.0	12.4	12.7	13.1	13.5	13.9	14.3	14.7	15.1	15.6	16.0	16.4	16.8
10	12.2	12.7	13.1	13.6	14.1	14.6	15.0	15.5	16.0	16.5	17.0	17.5	18.1	18.6	19.1	19.6	20.2	20.7
11	14.5	15.1	15.7	16.2	16.8	17.4	18.0	18.6	19.2	19.8	20.4	21.1	21.7	22.3	23.0	23.7	24.3	25.0
12	17.1	17.7	18.4	19.1	19.8	20.5	21.2	22.0	22.7	23.4	24.2	24.9	25.7	26.5	27.2	28.0	28.9	29.7
13	19.8	20.6	21.4	22.2	23.1	23.9	24.7	25.6	26.4	27.3	28.2	29.1	30.0	30.9	31.9	32.8	33.8	34.8
14	22.8	23.7	24.6	25.6	26.5	27.5	28.5	29.5	30.5	31.5	32.5	33.6	34.6	35.7	36.8	37.9	39.1	40.2
15	25.9	27.0	28.1	29.2	30.3	31.4	32.5	33.7	34.8	36.0	37.2	38.4	39.6	40.9	42.1	43.4	44.7	46.1
16	29.3	30.5	31.7	33.0	34.2	35.5	36.8	38.1	39.4	40.8	42.1	43.5	44.9	46.4	47.8	49.3	50.8	52.3
17	32.8	34.2	35.6	37.0	38.4	39.9	41.4	42.8	44.3	45.9	47.4	49.0	50.6	52.2	53.9	55.5	57.2	59.0
18	36.6	38.2	39.7	41.3	42.9	44.5	46.2	47.8	49.5	51.3	53.0	54.8	56.6	58.4	60.2	62.1	64.1	66.0
19	40.6	42.3	44.1	45.8	47.6	49.4	51.3	53.1	55.0	56.9	58.9	60.9	62.9	64.9	67.0	69.1	71.3	73.4
20	44.8	46.7	48.6	50.6	52.6	54.6	56.6	58.7	60.8	62.9	65.1	67.3	69.5	71.8	74.1	76.4	78.8	81.3
21	49.2	51.3	53.4	55.6	57.8	60.0	62.3	64.5	66.9	69.2	71.6	74.0	76.5	79.0	81.6	84.1	86.8	89.5
22	53.8	56.1	58.5	60.8	63.2	65.7	68.1	70.7	73.2	75.8	78.4	81.1	83.8	86.6	89.4	92.2	95.1	98.1
23	58.6	61.1	63.7	66.3	68.9	71.6	74.3	77.0	79.8	82.7	85.5	88.5	91.4	94.5	97.5	100.7	103.8	107.1
24	63.6	66.4	69.2	72.0	74.9	77.8	80.7	83.7	86.8	89.8	93.0	96.2	99.4	102.7	106.1	109.5	112.9	116.5
25	68.9	71.8	74.9	77.9	81.1	84.2	87.4	90.7	94.0	97.3	100.7	104.2	107.7	111.3	114.9	118.7	122.4	126.3
26	74.3	77.5	80.8	84.1	87.5	90.9	94.4	97.9	101.5	105.1	108.8	112.5	116.4	120.2	124.2	128.2	132.3	136.4
27	79.9	83.4	86.9	90.5	94.2	97.8	101.6	105.4	109.2	113.2	117.1	121.2	125.3	129.5	133.8	138.1	142.5	147.0
28	85.8	89.5	93.3	97.2	101.1	105.1	109.1	113.2	117.3	121.5	125.8	130.2	134.6	139.1	143.7	148.4	153.1	158.0
29	91.8	95.8	99.9	104.1	108.3	112.5	116.8	121.2	125.7	130.2	134.8	139.5	144.3	149.1	154.0	159.0	164.1	169.3
30	98.1	102.4	106.7	111.2	115.7	120.2	124.9	129.6	134.3	139.2	144.1	149.1	154.2	159.4	164.7	170.1	175.5	181.1
31	104.5	109.1	113.8	118.5	123.3	128.2	133.1	138.2	143.3	148.4	153.7	159.1	164.5	170.1	175.7	181.4	187.3	193.2
32	111.2	116.1	121.1	126.1	131.2	136.4	141.7	147.0	152.5	158.0	163.6	169.3	175.1	181.1	187.1	193.2	199.4	205.8
33	118.1	123.3	128.6	134.0	139.4	144.9	150.5	156.2	162.0	167.9	173.9	179.9	186.1	192.4	198.8	205.3	212.0	218.7
34	125.2	130.7	136.3	142.0	147.8	153.7	159.6	165.7	171.8	178.0	184.4	190.8	197.4	204.1	210.9	217.8	224.9	232.0
35	132.5	138.3	144.3	150.3														

PLOT NUMBER NEW OLD DOT NUMBER STATE/UNIT/COUNTY(53) SAMPLE KIND(02) STAND AREA(46) CRUISER TALLY COUNTY NAME(53)

WATER(47) ROAD(48) NATIONAL RANGER OWNER PI  
TYPE AREA DISTANCE TYPE DISTANCE FOREST DIST. CLASS(01) LAND USE

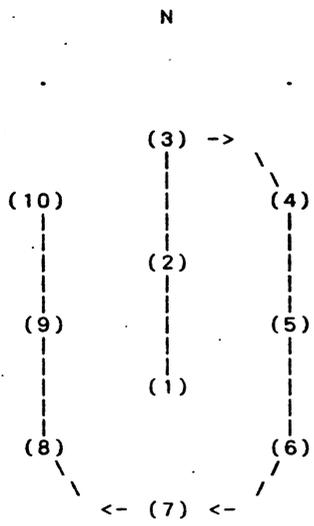
GROUND LAND USE(04) POSI- SLOPE PHYSIO. STAND STAND SEED CONIFER  
ORIG. CURR. REASON ASPECT TION PERCENT SHAPE LENGTH CLASS ORIGIN HISTORY SOURCE UNDERSTORY  
(06) (06) (06) (06) (06) (07) (08) (09) (10) (11)

DATE BASAL AREA/ACRE STAND TYPE & SIZE STAND AGE SITE S.I.  
(13) (43) (44) (45) INDEX SPECIES  
ORIGINAL CURRENT ORIGINAL CURRENT ORIGINAL CURRENT ORIG. CUR. (42) (43)

TOWNSHIP RANGE SECTION SUB-DIVISION PHOTO AGE FLIGHT NO. PHOTO NO. PHOTO SCALE

WEATHER COND: FIELD PHOTO 1: \_\_\_\_\_

10-POINT CLUSTER LAYOUT:(16),(49)



WORKSHEET:

POINT	1	2	3	4	5	6	7	8	9	10
BASAL AREA										
CONIFER UNDERSTORY										
SEED SOURCE										
STAND HISTORY										

WITNESS TREES:(16) POINT NUMBER \_\_\_\_\_

SPECIES	DBH (INCHES)	AZIMUTH (DEGREES)	DISTANCE (FEET)

REFERENCE TREES:(16)

PT. #	SPECIES	DIST.	AZIMUTH	MARK	DBH

NOTES:(49)

D.B.H. HIGH OR LOW		
POINT	TREE	HEIGHT





Hiawatha

William Spinner  
Forest Supervisor  
Hiawatha National Forest  
2727 North Lincoln Road  
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Hiawatha National Forest  
Manistique Ranger District  
Manistique, MI 49854  
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District Ranger  
Hiawatha National Forest  
Munising Ranger District  
Munising, MI 49862  
(906) 387-2512

District Ranger  
Hiawatha National Forest  
Rapid River Ranger District  
Rapid River, MI 49878  
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District Ranger  
Hiawatha National Forest  
St. Ignace Ranger District  
St. Ignace, MI 49871  
(906) 643-7900

District Ranger  
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Sault Ste. Marie Ranger District  
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Huron-Manistee

Jerry W. McCormick  
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Mio, MI 48647  
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