

**NORTH CENTRAL FOREST EXPERIMENT STATION**

**FOREST INVENTORY AND ANALYSIS**

**FIELD MANUAL**

**MICHIGAN, 1991**

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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.

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## 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 efficiency in the collection of timber resource statistics and comparability of the resource data compiled by different units. Precise measurement and classification is essential to keep field-technique errors to a minimum. Errors in classification or tree measurement are expanded several hundred times in the processing phase of the Forest Survey. An accumulation of even small errors may lead to erroneous inventory results.

Photo interpreters record nine-digit codes (sequential plot numbers) to identify consecutive plot numbers in each county. All sample plot locations receive nine-digit numbers and are identified on aerial photographs. Field tally sheets are completed for all plots sent to the field offices.

Each plot sent to the field offices has field tally sheets and aerial photographs, with the sample location marked. A remeasurement plot also includes the original field tally sheets and aerial photographs. For remeasurement plots, check that the plot number on the original field tally sheets matches the "Old plot number" on the new sheets.

Information obtained at each sample location is recorded on an electronic data recorder and/or the field tally sheets. See the sample field tally sheets (plot header sheets) in the appendix.

Permanent forest inventory plots measured during the previous survey are remeasured to obtain information on changes that have taken place between surveys. Some of these changes are 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.

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

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.

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 CLASS (OWN)**

Field personnel visit county court offices to collect ownership information for all plot center locations. Owner's name and address, ownership class, and size (commercial forest land only) are acquired from tax and ownership records.

Ownership information for National Forest land may be obtained from the land status atlas located at the Ranger District or Forest Supervisor's office. Ownership information on other public lands usually can 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<br/>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 actual 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. The courthouse 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 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 locate. Volume measurements 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 finding 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 (SP) is established for the purpose of locating a sample plot. It should be as near as possible to the sample location, yet not on the same acre as the sample plot.

When selecting the starting point, make sure it is readily identifiable on the ground and on the photograph. Select a prominent tree located at the edge of a field or clearing, 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 facing the direction of normal approach. Paint "SP" (in letters four-inches tall) just above where the diameter breast height (DBH) measurement was taken. Paint a three-inches tall "SP" near ground level. Use discretion in painting trees on private lands and in well-travelled areas.

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**

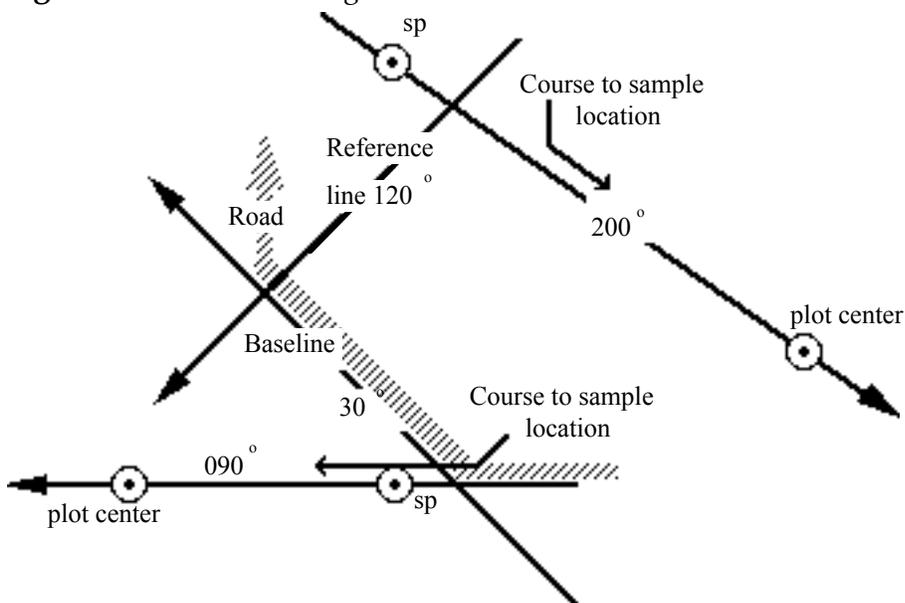
On the back of the photograph, draw a straight line through the center of the starting point pinprick and the center of the sample location pinprick. Extend this line to intersect the baseline. Lines should extend well beyond the intersection to allow reading the backsight off the 360-degree protractor 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 quarter chain using a transparent photo scale. (Photo scales, corresponding to the aerial photography, are supplied.) 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 is necessary when slope exceeds 10 percent. Using the Suunto clinometer, 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 "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 "Starting Point Description" on the old plot sheet and determine the SP location according to the azimuth and distance to plot center, PC. 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. Also check the sketch of the area on the back of the original plot sheet.

Once the SP tree is located, inspect to see that it is suitable. If the SP is suitable, the cruiser rescribes, repaints, and remeasures DBH. The tallier checks the "Course to Sample Location" on the plot sheet to see if it seems reasonable. The tallier then transfers 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.

Establish a new starting point if the original SP is not suitable, cannot be found, or the plot location was visualized. Record the course to sample location, SP description, and SP DBH on the new plot sheet. After re-establishing the SP, chain the computed azimuth and distance along the approach line and mark the location.

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). Look for 10-inch wire pins and bits of flagging at each point, blazed trees, and witness trees (painted with an "X").

After finding plot center, establish a turning point if the distance between PC and the end of the approach line exceeds three percent of the chaining distance.

### ITEM 3 PLOT LOCATION *CONTINUED*

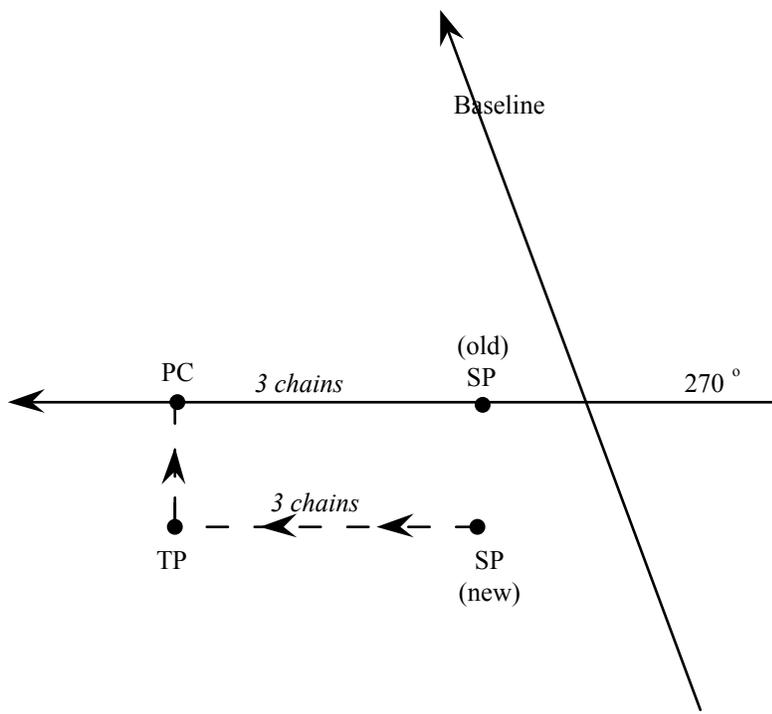
In the event that, after chaining the prescribed distance, no evidence of the old plot can be found, the following alternatives for locating PC are available.

- 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 available once you've found a replacement.

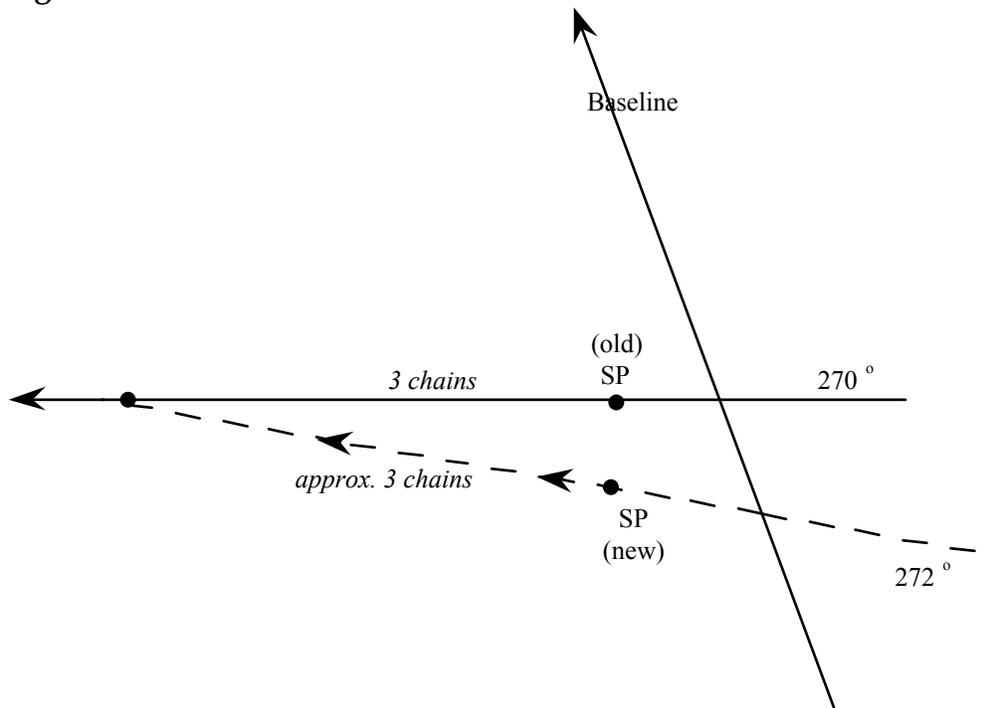
1. If the new SP is close by, pick the tree on the photo and use the original course to sample location. Leave a marker where you finally land in the woods and look for plot center. It should be approximately the same distance and azimuth that the old SP is from the new SP. Once PC is found, make a turning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

**Figure 2A**



ITEM 3 PLOT LOCATION CONTINUED

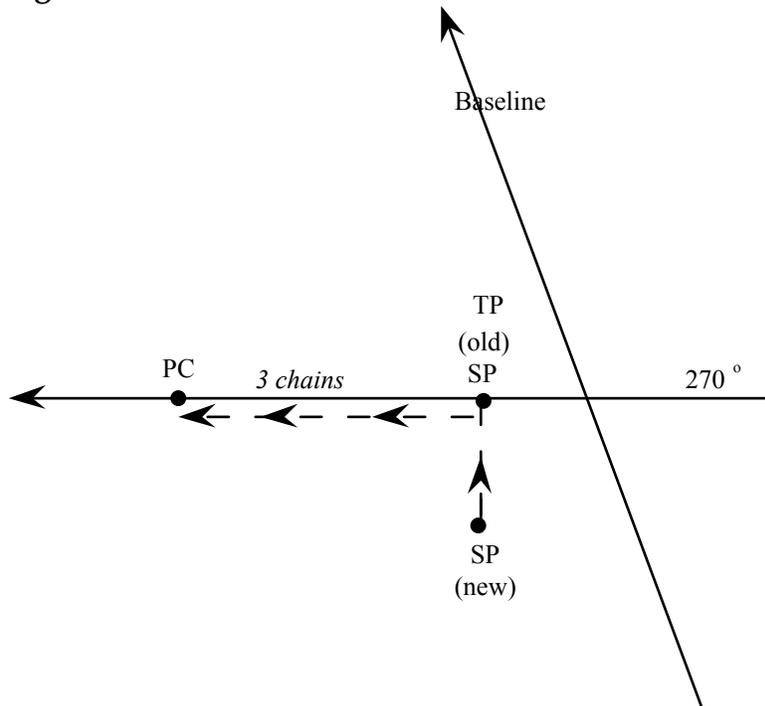
Figure 2B



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 "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.

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.

### ITEM 3 PLOT LOCATION *CONTINUED*

#### **Point Location**

After finding some evidence of the old plot, 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.

Match by comparing current tree species, azimuths, distances, and DBH to the old figures for trees on the original plot sheet. Once it is determined to which point the trees belong, use triangulation 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.

Triangulate by measuring back azimuths and distances of several known trees from the old plot sheet. The intersection of these back azimuths and distances provides a small area in which to search for the wire pin marking each respective point.

After finding the old pin, place a new pin next to it. (Leave about two inches of the wire projecting above the ground.) If the old pin cannot be found, triangulate to accurately re-establish the point in the original location.

It is very important to locate each individual point as accurately as possible. Finding each point is a challenge--most of the flagging disintegrates, the wires rust and appear just like twigs or roots. 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 triangulate to the missing point. You can then determine the general location of the missing point and reduce the area to search.

### ITEM 3 PLOT LOCATION *CONTINUED*

#### **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 (SK #1) if the plot was a full remeasurement (SK #2). Change the sample kind on the plot sheet to a new partial measurement (SK #7) if the plot was a partial remeasurement (SK #6). 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 is established as near as possible to the old PC. All new trees receive a tree history reflecting ongrowth or ingrowth (31, 32, 61 or 62). Transfer original tree data to the data recorder. Collect current data indicating whether the original trees were cut or died. See Tree History, item 23, for details about tally items needed for these trees.

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

If a remeasurement plot was established 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 where the plot is actually located.

Bring such plots to the attention of the person in charge. It is 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 4 GROUND LAND USE (GLUO, GLUC)

Once plot center is established, carefully examine, select and record the present primary land use classification. Land use class is determined by the location of plot center (as defined by the pinprick on the photo), provided the area surrounding the pinprick is at least one acre and 120 feet in width. One acre is 43,560 square feet. To meet the minimum-size requirement, a strip of land 120 feet wide needs 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.

Measure forest boundaries at the point where a vertical line is dropped from the outside edge of the forest crowns. When uneven boundaries exist, the tallier must use an imaginary line to distinguish forest from nonforest.

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

**Photo Interpretation Codes** appear on the plot header sheet and are listed below for information only.

| <u>PI Code</u> | <u>Description</u>                                 |
|----------------|----------------------------------------------------|
| 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

Forest land is land not currently developed for nonforest use and has (or formerly had) at least 16.7 percent stocking of all live forest trees of any size. 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 are 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 primarily used for wood production, but is being grazed. (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 1 of the sample location falls on land that qualifies as commercial forest land, establish the sample location. Record information for all required tally items on the plot sheet. Include all header sheet items and refer to the Tally Items section.

## ITEM 4 GROUND LAND USE *CONTINUED*

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

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

If Point 1 falls in a forest of marginal productivity, measure site index 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 judges whether the unproductive area is over one acre in size; if it is, the area is classified as unproductive. Refer to Site Index, item 42, for more information.

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 that is withdrawn from timber utilization, by a public agency or by law, and 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 is 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.     | National Forest         | Stand History*   |
| State                    | Ranger District         | Date             |
| Unit                     | Ownership Class         | BA/Acre          |
| County                   | Ground Land Use         | Forest Type-     |
| Sample Kind              | GLU - reason for change | Stand-Size Class |
| Stand Area               | Aspect-Position-Slope   | Stand Age        |
| Water Type/Area/Distance | Physio-class*           |                  |
| Road Type/Distance       | Stand Origin*           |                  |

\*Do not record Physio-class, Stand Origin, or Stand History on a plot with GLU 45.

Record site tree species and site index for a plot with GLU code 40, 41, or 45. BA/acre, Forest Type-Stand Size Class, and Stand Age may be estimated. Estimating basal area per acre is described in item 43, Basal Area per Acre.

### NONFOREST LAND

#### Nonforest Locations

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

Some locations interpreted as nonforest on aerial photographs require a field check. Some locations interpreted as forest on aerial photographs turn out to be nonforest upon field examination.

#### Nonforest Land with Trees

These areas are nonforest plot locations that have one or more trees, 5.0" DBH or larger, within the visual acre surrounding 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 for 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 is GLU 20 and should have a stand-size class code 4.
- 55 **Marsh with trees** Land that is less than 16.7 percent stocked with live trees; characteristically supports low, generally herbaceous or shrubby vegetation and 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, protecting 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, 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 more than 16.7 percent stocked in all trees, but less than 25 percent stocked in growing stock (20 class) trees, that would qualify as pastured timberland except 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. Evidence indicates that the primary use is something other than wood production or the protection of buildings. The 25 percent stocking rule applies when determining primary land use in fairly homogeneous areas. In clumps, openings, and other inclusions, use your best judgement.
  
- 71 **Urban forest land** Locationally reserved land that would 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 is 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, farmsteads with trees.

\*Establish the plot and complete a plot header sheet on sample locations with GLU 57 or GLU 59.

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 a remeasurement plot that was forested (GLU 20, 21, or 22) at the time of the last inventory, and for all plots on National Forest land.

Forest type-stand size class may be estimated.

## ITEM 4 GROUND LAND USE *CONTINUED*

### Nonforest Land without Trees

These areas are nonforest plot locations that have no tree species present in the visual plot area. Use the following two-digit codes for 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 includes railroads, powerlines, pipelines, and maintained roads. A right-of-way of any width qualifies as non-forest land--this is an exception to the minimum-size requirement of one acre and 120 feet.
- 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 plot located on nonforest land without trees, GLU 61-69, 80 or 90, record the following on the plot sheet.

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

\*Ownership class is needed only for a remeasurement plot that was forested (GLU 20, 21, or 22) at the time of the last survey, and all plots on National Forest land.

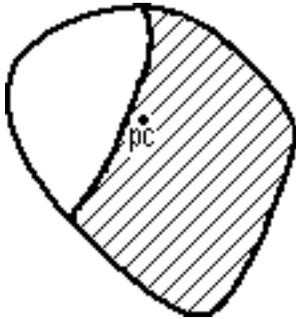
In summary, establish a plot on sample locations with the following ground land uses:

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

All sample locations with other land use codes require only the appropriate header information (although on remeasurement plots, you need to account for trees tallied on the previous survey).

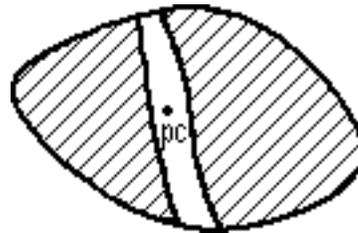
ITEM 4 GROUND LAND USE CONTINUED

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



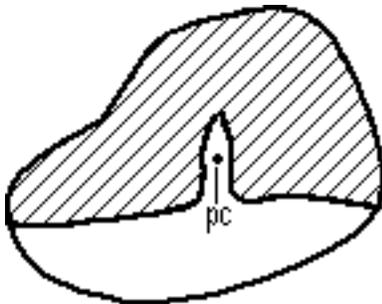
1.

**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.

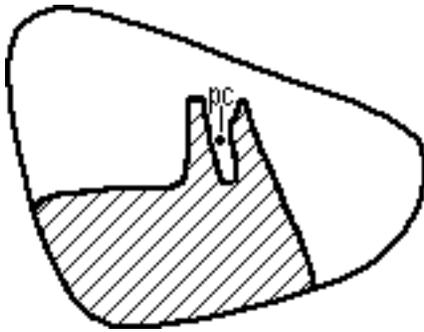
**Forest** Dot falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least two sides.



4.

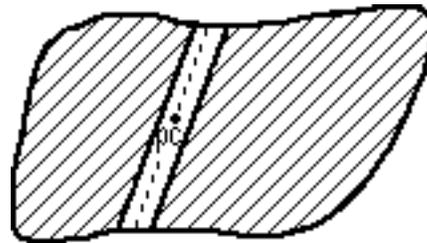
**Forest** Dot falls on nonforest land (less than one acre in size) that is surrounded by forest land.

Figure 3 CONTINUED



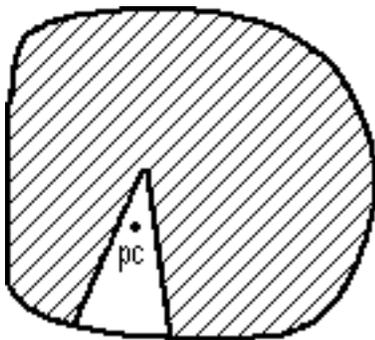
5.

**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.



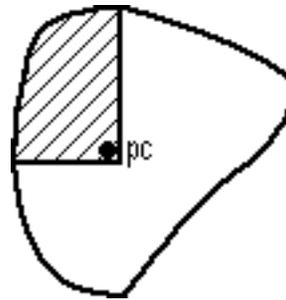
6.

**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 is 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 (see appendix for the GLU codes used on the previous survey). |
| 2           | Legislation                                                                                                                             |
| 3           | Natural - Use also when you simply disagree with prior crew on GLU call. Explain in the "Notes" section of the plot sheet.              |
| 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 is 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 the following applies.

- If there has been a change from noncommercial or nonforest to commercial forest (or wide windbreak or wooded pasture), a remeasurement plot is established and all trees 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 is not established. The original trees 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**

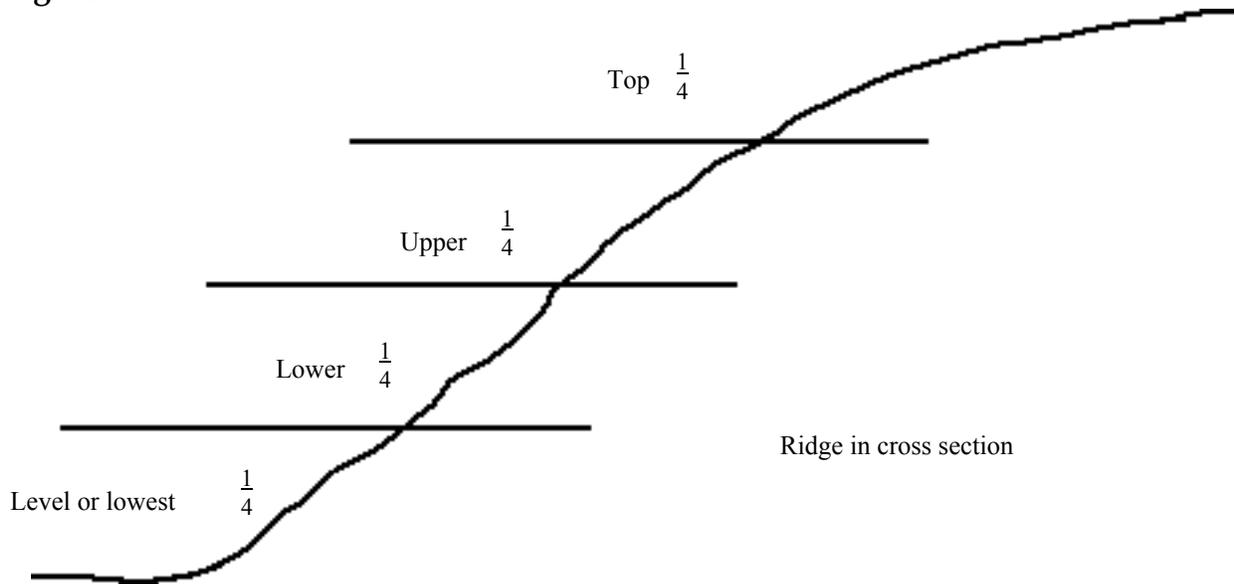
To determine how position, aspect, slope, slope length and slope shape affect a stand, these five items are measured. It is important to understand that all five items tie together or compliment each other. Thus, record the macro features only. Record the appropriate codes in the header information.

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

Positon 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)

Aspect represents the direction of drainage for the majority of the sample points. It is recorded as the azimuth of this direction. For instance, if the direction of drainage is 36°, the code is 036. Direction due North is recorded as 001.

### **SLOPE (SLP)** (two-digits)

Slope is the average percent deviation from horizontal over the entire 10 sample points. The recorded code is a measure of this percentage. For example, record 35 percent slope as 35. All slope percentages 100+ percent receive code 99. If slope percent is other than zero, record slope length.

### **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 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 with zero slope, record slope length as 0000. For all slope percents other than zero, record slope length.

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

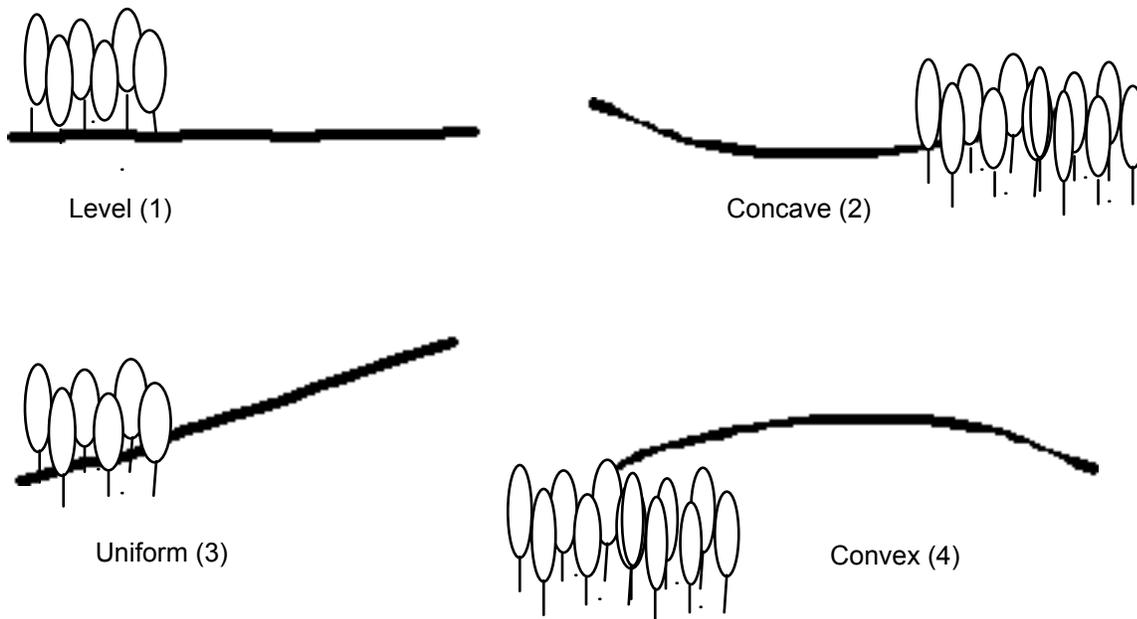
SLOPE SHAPE (SHP) (one digit)

Slope shape, along with slope percent, indicates the relative erodibility of the majority of the sample points. A convex shape (code 4) is often found on the upper part of a slope and indicates an area with potential erodibility and rapid runoff. A concave shape (code 2) is found on the lower part of the slope profile and has good water holding capacity. (Figure 5)

Record the appropriate code for slope shape.

| <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 is 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, explain 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, describe the disturbance over the last 20 years. For remeasurement plots, describe the disturbance since the last inventory. Stand history cannot exceed the remeasurement period.

**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 caused by livestock grazing. Evidence of livestock grazing includes: 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 generally 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 **Natural Regeneration of Non-Forestland** Areas that are reverting to forest vegetation. Areas that were once old field sites, marshes, etc.

## ITEM 9 STAND HISTORY (SHIS) CONTINUED

Explain the kind and extent of the disturbance in the "Notes" section of the plot sheet.

**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 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 17-foot fixed-radius plot.
3. Hardwoods are expected to have sprouts within the 17-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 indicates 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 17 feet of point centers).

**ITEM 12 PHOTO AGE (PHAG)**

Photo age represents the number of growing seasons between the photo date and the date of the field work. July 1st is 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 the field work. For example, suppose you are taking measurements on 6-23-92, and your photos are dated 6-01-86. The photo age is six years, or code 6. The '86, '87, '88, '89, '90, and '91 growing seasons are included. The '92 growing season does not count until July 1st, 1992.

## 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        |

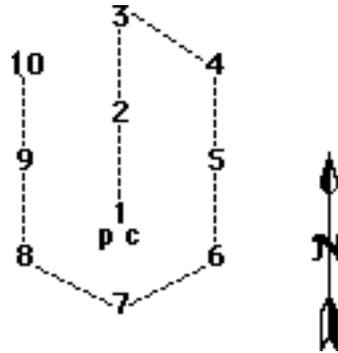
**Example:** A plot completed in June, 1992 is coded as 0692.

**ITEM 16 PLOT DESIGN**

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

**Figure 6**

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



After Point 1 has been established, locate and mark the other nine points with wire pins and flagging. The entire 10 points are restricted to the same land use. An exception to this rule is discussed in "Substitute points."

**Shifted Points**

If Point 1 (or any other point 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. Record such changes in the "Notes" section of the plot sheet.

**Substitute (Rotated) Points**

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

Exception: There are three cases when all 10 points do not have to be in the same land use. No substitute points are needed between the following GLUs because all are considered commercial forest land:

- GLU 20 - 21
- GLU 20 - 22
- GLU 21 - 22

## ITEM 16 PLOT DESIGN *CONTINUED*

### **Procedure for rotating a point**

After establishing all possible regular points, use the following steps to find 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  $0^\circ$  azimuth from the point. If this location is unsuitable, consider, in turn, locations at azimuth  $60^\circ$ ,  $120^\circ$ ,  $180^\circ$ ,  $240^\circ$ , and  $300^\circ$ . When a suitable location is 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 substituted, repeat Steps 1 and 2 to establish the next lowest-numbered substitute point, continue in order until all substituted points 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, and show it on the 10-Point Cluster Diagram.

**Unusual situations** On remeasurement plots, two unusual situations may occur.

First, a point originally rotated out of nonforest or noncommercial forest that has since turned into commercial forest land, remeasure the substitute point.

Second, a point originally established on commercial forest land that has since become nonforest or noncommercial forest, account for the original trees (see Tree History, item 23, for details), and establish a new substitute point. All trees tallied on the substitute point 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-size requirement of one acre and 120 feet in width applies to each point, just as it does at PC.

ITEM 16 PLOT DESIGN CONTINUED

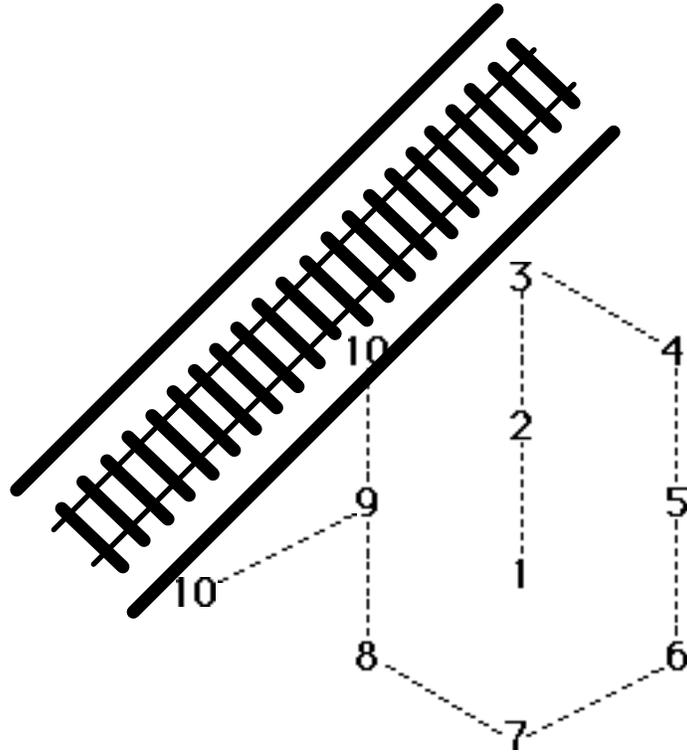
Figures 7, 8, and 9 illustrate situations concerning substitute points.

Figure 7

In this example, Point 1 fell in commercial forest (GLU 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 (GLU 68).

Substitute Point 10 was established at the first suitable location, 70 feet horizontal distance from Point 9, the highest regular point.

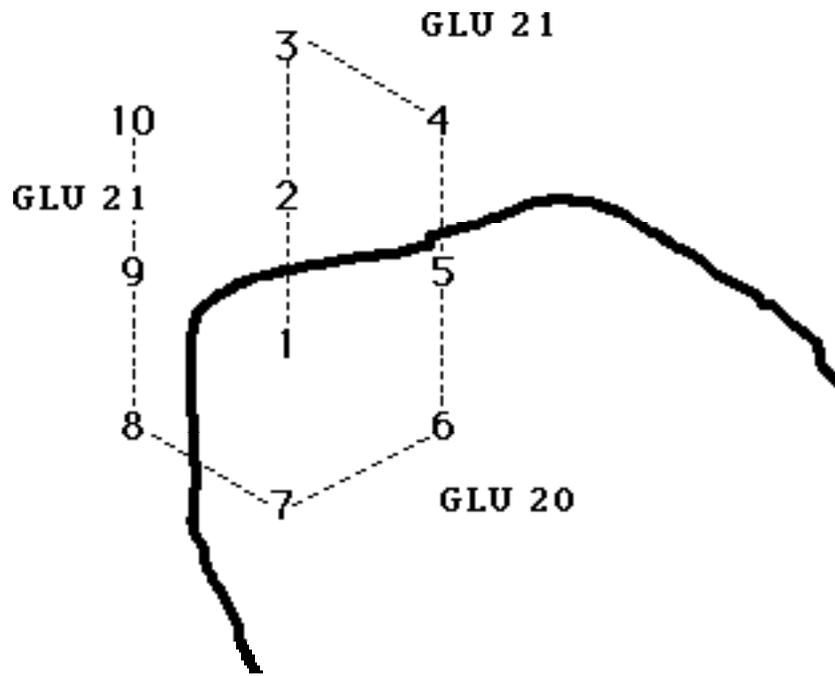


\*Exceptions to this are between  
GLU 20 - 21  
GLU 20 - 22  
GLU 21 - 22.

**Figure 8**

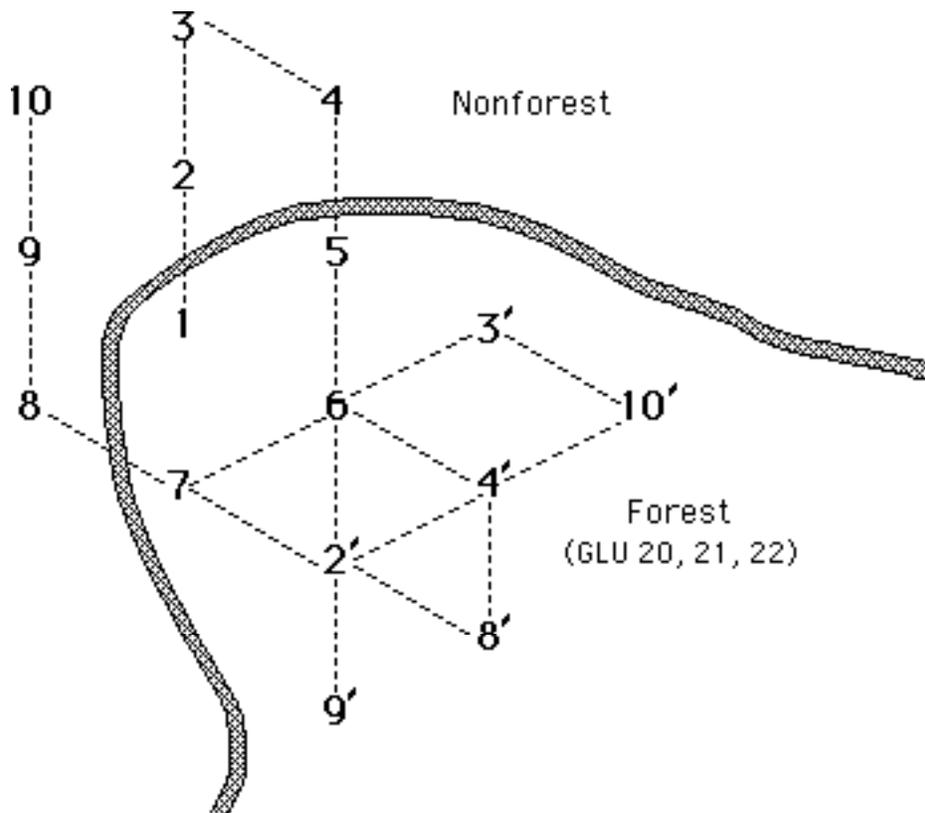
In this example, no substitute points are needed, since both land uses (GLU 20 and GLU 21) are considered commercial forest land.

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 that 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

Designate a witness point on all established plots. Reference Point 1 (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" and the following witness tree data on the plot sheet.

- Species
- DBH
- Azimuth
- Slope distance  
(to nearest tenth of a 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, 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 scribe and paint "X" on the side of the tree facing the witness point.

When an acceptable witness tree is absent, a rock or other permanent feature may be used instead of a witness tree. Describe it and give distances, etc. in the "Notes" section of the plot sheet.

For remeasurement plots, find and inspect the witness trees established on the last survey. 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. Remove the witness paint--scrape the old paint off the tree if a new witness tree is used.

## ITEM 16 PLOT DESIGN *CONTINUED*

### Point Reference

On many plots, certain points within the 10-point cluster lack information useful in determining their location on future surveys. Examples 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 azimuth or distances to any tree) must be referenced. Mark reference trees above DBH and at the base with a scribe mark and paint on the side of the tree facing the point. Unlike witness trees, there is no set rule for painting a reference tree, however 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 survey to identify which point they have found.

Reference trees should have the following characteristics:

- located within 70 feet of the 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).

Record the point number, azimuth, slope distance (to the nearest tenth of a foot), and DBH (to the nearest tenth of an inch) for the reference tree in the "Reference Tree" grid of the plot sheet.

## TALLY ITEMS

### ITEM 17 BIOMASS STUDY "SHRUBS"

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 and SK #6) from leaf flush (about May 1st) to leaf fall (about September 30th).

#### **SHRUB NUMBER (SNUM)**

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

#### **SPECIES (SPP)**

See shrub species list in the appendix.

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

Classify tall, woody perennials as tree history code 80. Other perennials, classify as tree history code 81. See listing under shrub species in the appendix.

#### **PERCENT COVER (COV)**

Code as a percent of ground cover, percent cover applies only to 81-class shrubs, and is left blank for 80-class shrubs. See table on the following page.

#### **DIAMETER CLASS (DIAC)**

Classify shrub stem diameter, six inches from the ground. This applies only to 80-class shrubs, and is left blank for 81-class shrubs. See table on the following page for codes.

#### **FREQUENCY OF STEMS PRESENT (FREQ)**

Enter the number of stems present in each species diameter class for Tree History 80. This column is left blank for Tree History 81.

Note: Only seedlings may be recorded twice, once on the Biomass Study (with a number of 51 or larger) and also on the 6.8' fixed-radius plot if needed to meet stocking. Any tree 1.0" DBH or larger on the point is not 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)**

**Three 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. This data helps determine the impact of deer and other browsing animals 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, are tallied if each tree is within the limiting distance of the 37.5 basal area factor prism.

Figure 10 illustrates a tree within the variable plot, a tree outside the variable plot, and a questionable tree. Check a questionable tree for its 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 37.5 basal area factor prism. Table 2 in the appendix shows the limiting distances for the 37.5 basal area factor prism.

Use your prism carefully. Hold the prism directly above point center. Watch out for flat or triangular trees. On steep slopes, "in" trees may appear to be "out." Check all trees if close either way.

On new plots, dead trees, 5.0" DBH or larger, within the variable-radius plot are tallied if they are salvable. See item 28, Tree Class, for more information on tallying dead trees.

Note: A leaning tree, < 5.0" DBH, outside the fixed-radius plot but within the limiting distance of the prism, 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 stems 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 there are not enough trees present on a point to reach 16.7 percent stocking, tally live seedlings (trees < 1.0" DBH) until 16.7 percent stocking is reached.

Note: A leaning tree, 5.0" DBH or larger, within the fixed-radius plot but outside the variable-radius plot, is not tallied.

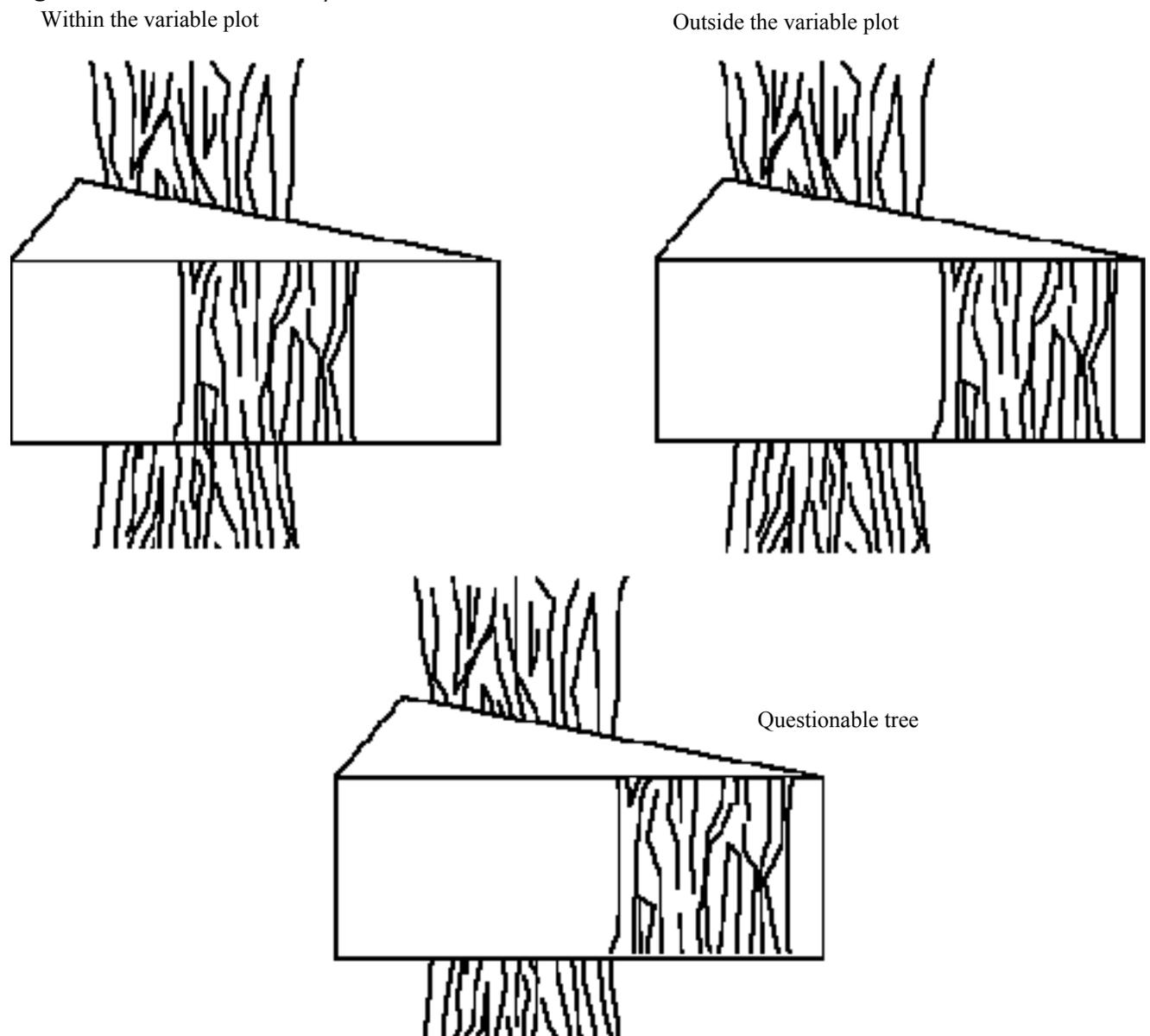
**ITEM 19 FIXED-RADIUS PLOT (1/300 ACRE) CONTINUED**

The minimum height required 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**



## ITEM 21 TREE NUMBER (T #)

Record a tree number (two digits if required) for all line entries including trees and stumps, and all biomass entries. Site trees for the plot are also given tree numbers.

For each

| <u>Point</u> | <u>Assign:</u>                                   |
|--------------|--------------------------------------------------|
| 01 - 40      | consecutive tree numbers for trees and stumps    |
| 41 - 49      | to the plot site trees                           |
| 51 - 99      | consecutive tree numbers for all biomass entries |

### **For remeasurement plots**

Number previously measured trees using old tree numbers. Stumps, dead trees and seedlings on the old tally sheet are disregarded, and their old tree numbers are not used. (Include a dead tree if it is still standing or if cut.) In addition, on Points 4 - 10, trees < 5.0" DBH are disregarded, and the old tree numbers are not used. (Such a tree may be tallied as ingrowth or ongrowth, with a new tree number.)

Number new trees (ongrowth and ingrowth) consecutively, proceeding clockwise from 0° azimuth starting with the next available tree number. Tallier and cruiser work together locating original trees and adding new trees in the proper sequence.

## ITEM 22 TREE SPECIES (SPP)

Record a three-digit species code for all shrubs and trees, live or dead. Codes from 010 to 299 are for softwoods, and from 300 to 998 are for hardwoods. Within these groups, species codes are listed in sequence by scientific name. Vacant codes may be assigned for important exotics as needed.

Verify the tree species codes for trees tallied the previous survey and correct if necessary. If you change a tree species code, explain it in the "Notes" section on the plot sheet. Assign tree species codes as needed for new trees. For a tree identified as a noncommercial species on the prior survey (species code 999), assign the proper species code on the current survey. If the tree is missing, the tallier makes a best judgement in assigning a species. (See appendix for species list.)

## ITEM 23 TREE HISTORY (THIS)

Tree history is a two-digit code reflecting the previous and the current status of a tree.

### **New plots**

The first digit is always 0 on a new measurement plot (SK #1 and SK #7).

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 |

## ITEM 23 TREE HISTORY CONTINUED

### Remeasurement plots

The first digit describes the previous status of a tree.

| <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 were not tallied (or were seedlings) the previous survey. They are now < 5.0" DBH and occur on the fixed-radius plot.

Tally all ingrowth trees  $\geq 1.0$ " DBH on Points 1 - 10. Tally seedlings (trees < 1.0" DBH) if necessary to reach 16.7 percent stocking for each point. Assign ingrowth tree history (31 or 32) according to the current tree class.

## ITEM 23 TREE HISTORY CONTINUED

### Ongrowth

Ongrowth trees were not tallied (or were seedlings) the previous survey. They are now  $\geq 5.0$ " DBH and occur on the variable-radius plot.

Tally all ongrowth trees on Points 1 - 10. Assign ongrowth tree history (61, 62, 64 or 65) according to the current tree class.

Note: Trees tallied during the previous survey on Points 4 - 10 that were less than 5.0" DBH are not remeasured as old trees, but are considered either ingrowth or ongrowth trees regardless of what they were called on the last survey. They are given new tree numbers and the old tree numbers are not used.

### Dead trees

Salvable-mortality A dead tree containing at least one 8-foot section that is at least 50 percent sound.

Mortality A dead tree containing no merchantable volume (has no 8' or longer section that is at least 50 percent sound).

The following are instructions (numbered 1 through 10) for tallying trees on remeasurement plots and assigning 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 (DBH, tree class, crown ratio, and crown class). These items are zeroed out. All seedlings 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 is established and all trees 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)

Account for all live trees tallied as live during the previous survey. Transfer old tree number and old DBH from the plot sheet to the data recorder, and complete all new items to survey standards. Use the proper tree history code to reflect both the original and current tree conditions. All entries, except no status trees, are 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)

Account for live trees tallied on the last survey, but are now missing, and classify as dead or cut. (See No. 4 and No. 5 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 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 an accurate DBH measurement cannot be made, use the original information or estimate this figure 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 complete items for mortality trees outlined above.

## 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)
- Crown Class (original)
- Tree number
- Tree History
- Damage/Death (THIS 17 or 27 only)
- Crown Ratio (original)

Stumps of live trees tallied on the last survey are tallied on remeasurement plots. There is no 17' fixed-radius plot for stumps. For salvaged dead trees (codes 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 with 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 are 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 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 regard as if the tree 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 10 or 20). Scrape the old paint off the tree. Adjust original BA/acre, if appropriate, on the computer sheet.

## 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 during the previous survey and displaced from the plot are considered no status trees. They 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 as live during the last survey, now dead and displaced off of the plot, are tallied as dead trees.

### 9. Ongrowth Dead trees (Tree History Codes 64, 65)

Trees  $\geq 5$ " DBH, that were too small the last survey, that have grown onto the plot and died, are recorded.

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

Trees  $\geq 5.0$ " DBH and dead on the original survey are 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 No. 4, "Trees Alive Last Survey, Now Dead," however there is no original crown ratio or crown class. Transfer cause of death from old plot sheet. Trees dead 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

When establishing a remeasurement plot for the first time because of a land use change, all trees receive a tree history reflecting ingrowth or ongrowth (codes 31, 32, 61, 62, 64, or 65).

When a previously established plot no longer needs measurements due to a land use change, account for the original trees according to the following guidelines.

- **Reserved areas with trees still standing (GLU 41 or 45) and Unproductive forest (GLU 40)**

Trees are 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. Ignore previously dead trees.

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

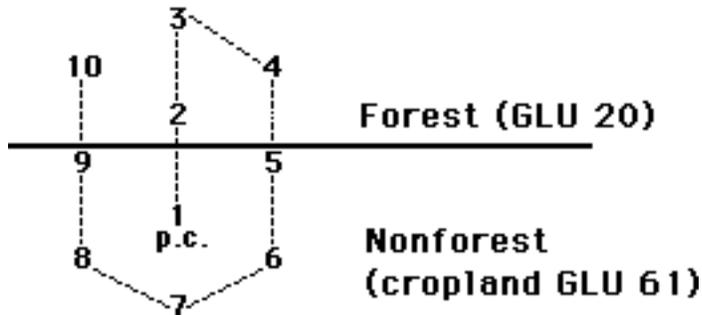
Trees are assigned a tree history of 18, 19, 28, 29, 48, 49, or 59 depending on whether the cleared trees were utilized or not. Use your best estimate from owner contact, field examination, etc. if utilization isn't clear. Example: Owner says all the larger oaks were utilized and the other trees were pushed to the side of the field. All larger oaks receive a tree history of cut and utilized and other trees receive a not utilized tree history. The required tally items for stumps are listed in No. 5.

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

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. Make an effort to determine the cut and utilized trees and assign a cut and utilized tree history. Trees still standing receive a no status history. Previously tallied trees which have died receive a dead tree history (see No. 4). Required tally items for stumps and for no status trees are listed in No. 5 and No. 8 on the previous pages. See the examples on the next page.

ITEM 23 TREE HISTORY CONTINUED

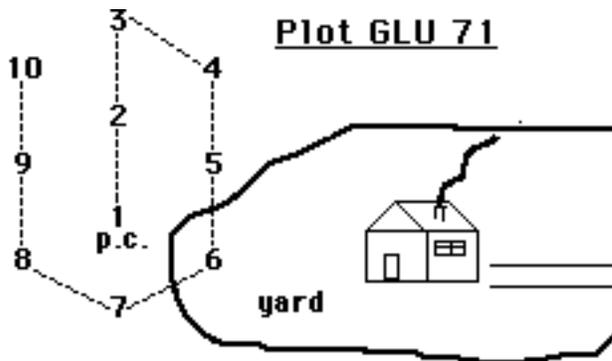
**PLOT GLU 61**



**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.

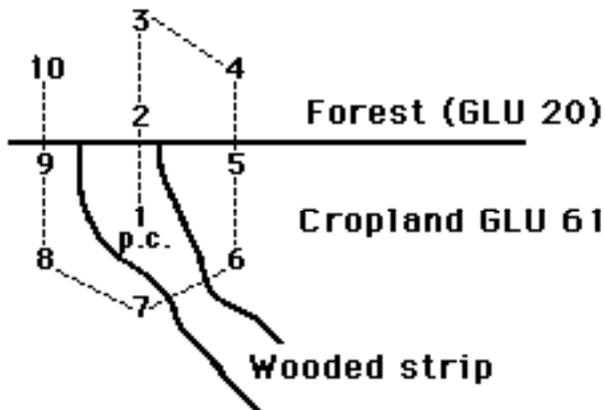
**Plot GLU 71**



**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 is the 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 grid and the reference tree grid of the plot header sheet. The distance recorded is 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 tenth-inch. 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 field work, in the event the tree is cut. Do not scribe small, thin-barked trees. Do not scribe trees < 3.0" DBH. Scribe marks should not penetrate the cambium.

It is essential that the measurements are accurate since trees are determined as "in" or "out" of the tally depending in part on their DBH. For remeasured plots, it is important that DBH measurements are 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. Measure butt-swelled trees at a point 1.5 feet above the end of the swell if the swell is more than 3-feet 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 feet above the fork (apply this 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.

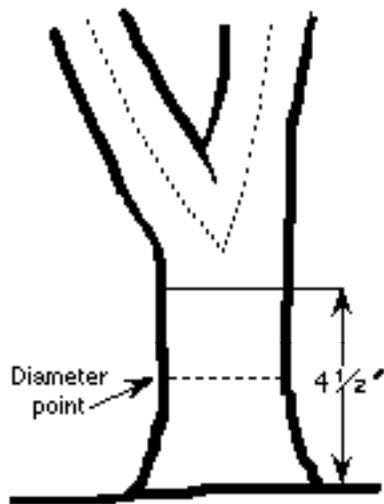
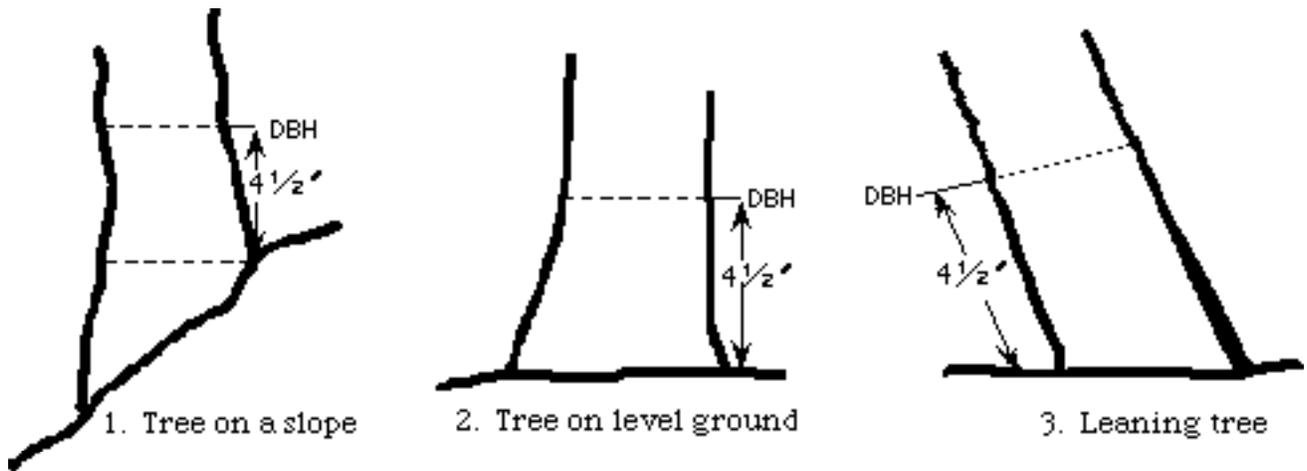
Current Check to see that the original DBH was taken in the correct place. If DBH was correct, remeasure, rescribe, and repaint this original measurement. It is extremely important to measure the same place if the measurement was initially correct; look carefully for evidence of paint at DBH.

Remeasure DBH at the original location, make a note on the plot sheet if DBH was previously measured high or low. Measure DBH at the correct place on the bole if the previous measurement was taken on a deformity or cannot be located.

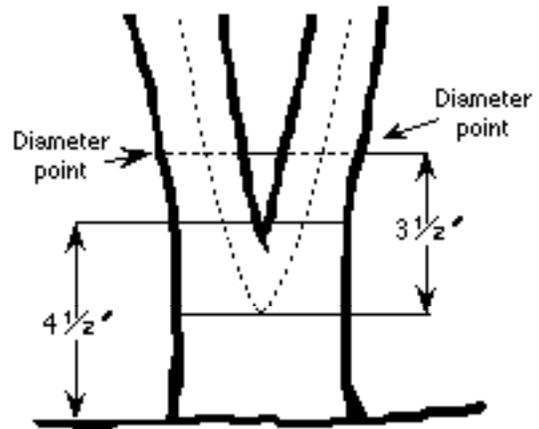
A tree now dead at DBH is considered a dead tree. If a new leader has taken over and is  $\geq 1.0$ " DBH, give it a tree history of ingrowth or ongrowth. If the tree is not at least 1.0" DBH, it is taken as a seedling, if seedlings are needed to reach 16.7 percent stocking. If the tree is taken as a seedling, it is recorded twice--once as a dead tree and once as a seedling.

ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

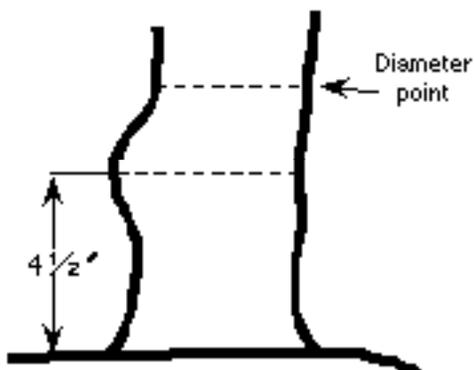
Figure 11 - Diameter breast high measurement in a variety of situations



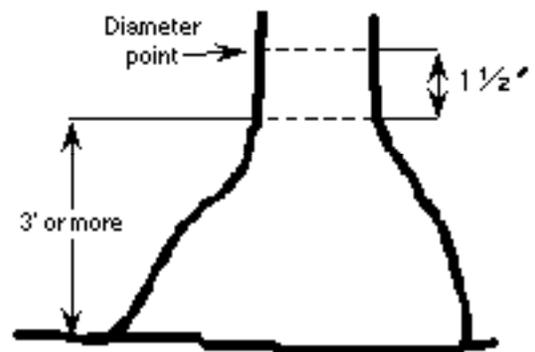
4. Tree forking at or above 4 1/2 feet



5. Tree forking below 4 1/2 feet



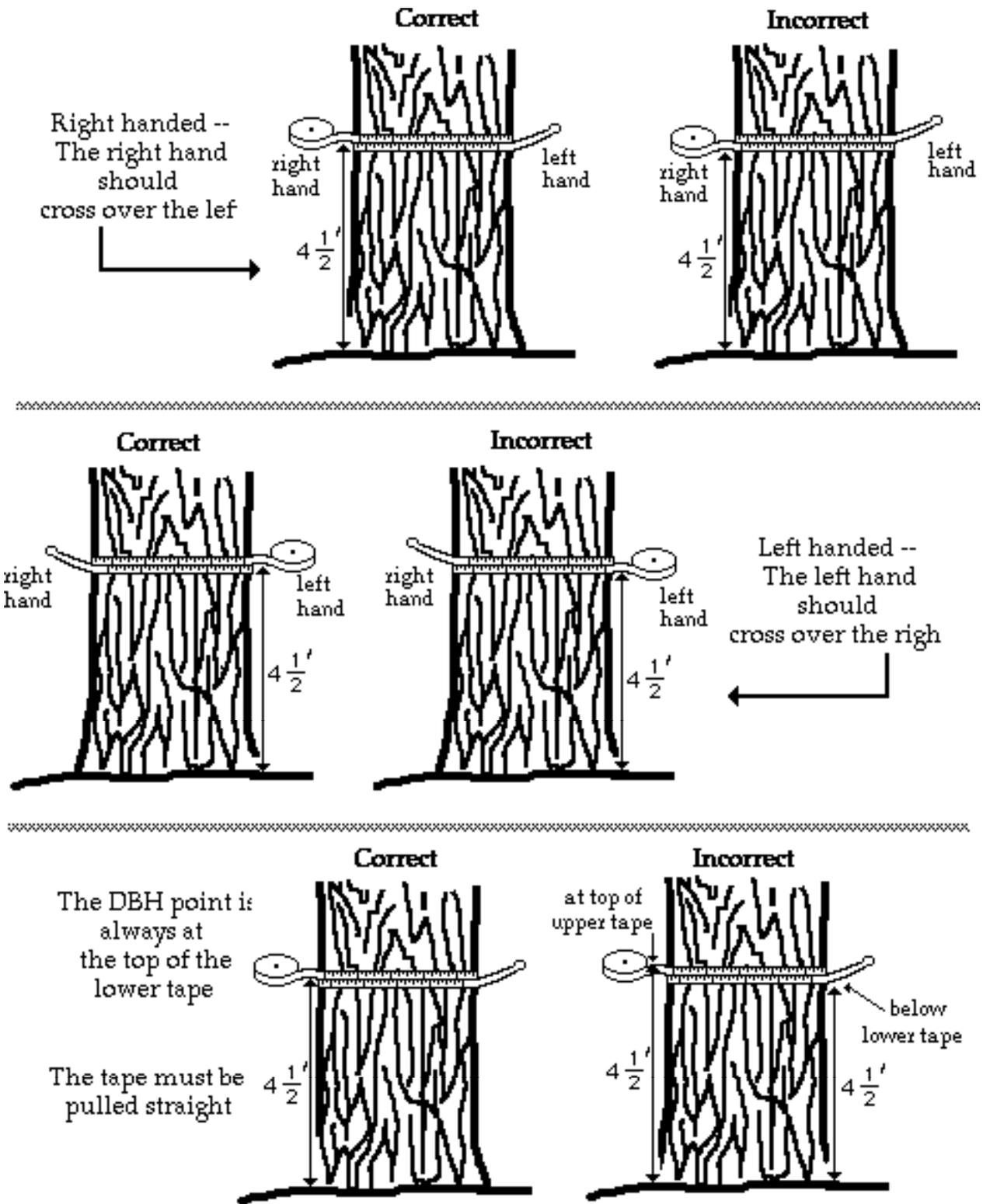
6. Tree deformed at 4 1/2



7. Bottlenecked tree

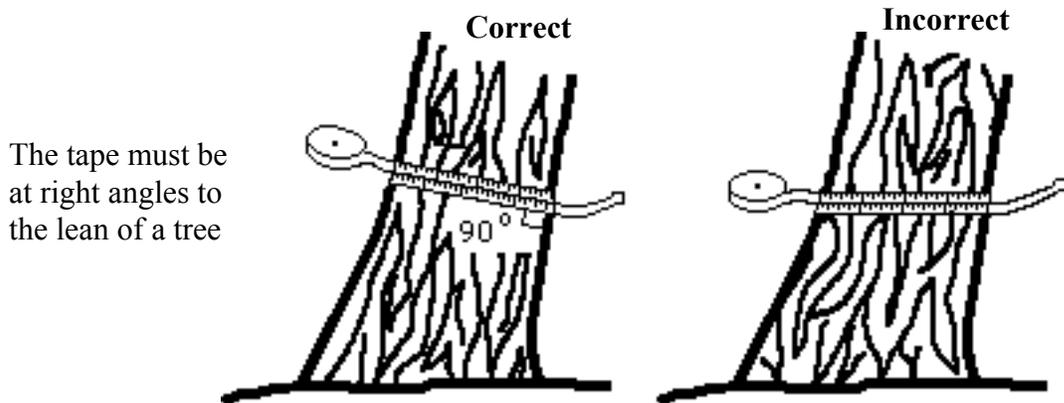
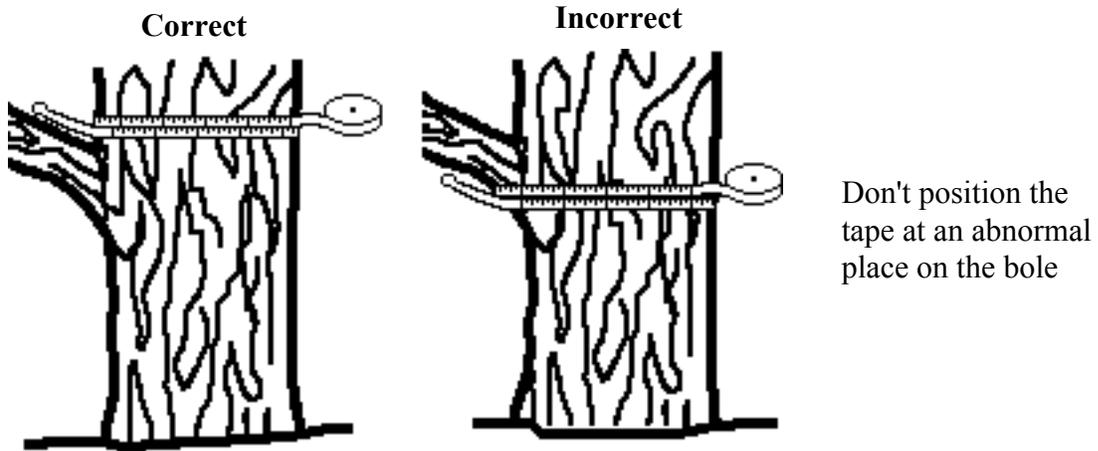
ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

Figure 12 - Using the diameter tape



ITEM 25 DIAMETER BREAST HEIGHT CONTINUED

Figure 12 CONTINUED



## **ITEM 26 TREE AZIMUTH (AZM)**

Record azimuth on all live trees tallied (except seedlings) on Points 1 through 10. The azimuth recorded is a three-digit code representing the magnetic azimuth from the point center to the center of the tree at its base. Examples: Nine is recorded as 009; 89 is recorded as 089; 347 is recorded as 347.

Zero-degree azimuth is not used. Any tree at 0° azimuth is tallied as 001.

Two trees on the same point cannot 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, a tree with an original azimuth of 358°, has a current azimuth of 1°, record the current azimuth as 001. This could 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. Record the cause of death for dead trees.

The pest or damage is identified using the coding criteria (minimum severity requirements). A complete list of damage codes and coding criteria appears in the appendix of this manual.

Follow these guides for assigning damage/death codes.

- Use the most specific code. Avoid general injury codes if possible. For example, *Eutypella* canker code has preference over bole canker code, which has preference over unknown/uncoded canker.
- The damage must meet the severity rating for its particular damage code. Examples: an insect defoliator is coded only when it is causing > 20 percent defoliation; a *Hypoxylon* canker on a branch is not coded because its severity rating is "any occurrence on the bole."
- If the pest/damage does not satisfy the coding criteria, it is coded to a more general code, such as one of the 900 codes, unknown, uncoded damage.

**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 applies.

1. Record the agent causing the most severe damage. An agent which will cause death takes 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 takes 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, when coding the cause of death, choose a code from the 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 damage.

| Prioritization           |   |                                 |
|--------------------------|---|---------------------------------|
| <u>Highest priority</u>  |   | <u>Lowest priority</u>          |
| Specific pest            | > | General Pest                    |
|                          | > | Damage or injury                |
| Death or potential death | > | Volume reduction                |
|                          | > | Growth slowed quality reduction |

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

Seedlings and saplings are considered growing stock, unless a specific damage is observed. Excessive sweep and crook is not considered a specific damage code for seedlings and small saplings (< 3.0" DBH).

A damage code is not recorded to indicate a 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 tree 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** 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. (Sawlog portion is the length between the one-foot stump and the 9.0" top diameter of outside bark, DOB, for hardwoods, or 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. Assume that pole-size trees will eventually attain sawlog size at DBH. In evaluating 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 potential sawlog height for poletimber trees, apply the two-inch rule as a guide. The two-inch rule assumes that a tree's diameter increases 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 method works for both hardwoods and softwoods.

Consider a seedling or sapling as growing stock unless a specific damage is observed. A seedling or small sapling (< 3.0" DBH) may not be culled on the basis of excessive sweep or crook. Assume that seedlings and saplings will eventually attain sawlog size at DBH.

ITEM 28 TREE CLASS OR COVER CLASS CONTINUED

Code

20 **Growing Stock** CONTINUED

Tally items for 20-class trees For growing-stock trees on full measurement plots, record bole length 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, record bole length using the fork with the highest sawlog. Record cubic-foot cull for the rotten or missing wood to the 4.0" top. Sawlog length is recorded to the top of the highest sawlog section meeting minimum sawlog requirements. Board-foot cull includes 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. Accurately record all remaining required information.

30 **Rough Cull** Any tree of noncommercial species.

Any tree of commercial species that is sawtimber size and has no 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, or 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 currently sawlog size will eventually attain sawlog size at DBH. Predicted death, tree vigor, and plot site index are not considered in determining tree class.

Tally items for 30-class trees Record bole length to a 4.0" top DOB. Cubic-foot cull includes actual rot or missing wood only. For sawtimber trees, zero-out sawlog length, sawlog top DOB, board-foot cull and tree grade. Accurately record crown ratio and crown class. The damage code must not be "000," except for noncommercial species. 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.

Tally items for 31-class trees Record bole length to a 4.0" top DOB. On forked trees, bole length is recorded using the fork that contains the highest sawlog. Cubic-foot cull includes 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 includes all unmerchantable sections in the sawlog portion, and the unusable board-foot volume within the merchantable sawlog. Tree grade is usually code 5, due to length and/or position in the tree. Accurately record crown ratio and crown class. Damage code cannot be "000". Code any tree cavity.

- 40 **Rotten Cull** Any live tree of commercial species that is sawtimber size and has no 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, or 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, and plot site index are not considered in determining tree class.

Tally items for 40-class trees Record bole length to a 4.0" top DOB. Cubic-foot cull includes 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 reflect rot or disease and must not be "000". 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. Using the codes given below, record cover class on the point data line.

#### Code    Cover Class

51-54 Inhibiting vegetation. Cover sufficiently dense to prevent establishment of tree seedlings. Use the following codes:

|           |          |
|-----------|----------|
| 51 Grass  | 53 Vines |
| 52 Shrubs | 54 Other |

60 Nonstocked not overtopped. Area sufficiently clear to permit establishment and development of one or more tree seedlings by natural or artificial methods.

70 Nonstocked overtopped. Area clear enough to permit establishment of seedlings, but sufficiently overtopped by tree crowns to prevent survival of tree seedlings.

81-83 Nonstockable. Not capable of supporting trees of commercial species because of the presence of rocks, water, etc. use the following codes:

|          |
|----------|
| 81 Rocks |
| 82 Water |
| 83 Other |

### **For remeasurement plots**

If a point was cover classed on the prior survey, and is cover classed this survey, determine and record the current cover class. Reference cover-classed points (see Point Reference under item 16, Plot Design).

If a point was cover classed on the prior survey, and live trees or seedlings are now present on the point, record them as ingrowth or ongrowth. There is no need to record the original cover class in this situation.

If a point was not cover classed on the prior survey, and is currently cover classed, record a cover-class code on the point data line. Account for trees tallied during the previous survey and record as cut or dead.

## ITEM 28 TREE CLASS OR COVER CLASS *CONTINUED*

### Dead Trees

Determine whether a dead tree is a mortality tree or salvable-mortality tree. A standing or down dead tree containing at least one 8-foot section that is at least 50 percent sound is a salvable-mortality tree. A standing or down dead tree containing no merchantable volume (has no 8-foot or longer section that is at least 50 percent sound) is a mortality tree.

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 are recorded using rules from the appropriate sections on live trees in this manual.

DBH Estimate the diameter of the tree at time of death, be sure to consider any distortion, lost bark, cracks, splits, shrinkage, etc. Do this for both mortality and salvable-mortality trees.

Mortality trees All required information is projected back to the time of death except tree cavities, which is recorded as they exist now. A mortality tree may not look very good, but assign a tree class of 20 if that's what it was at the time of death. Mortality trees are recorded only on remeasurement plots.

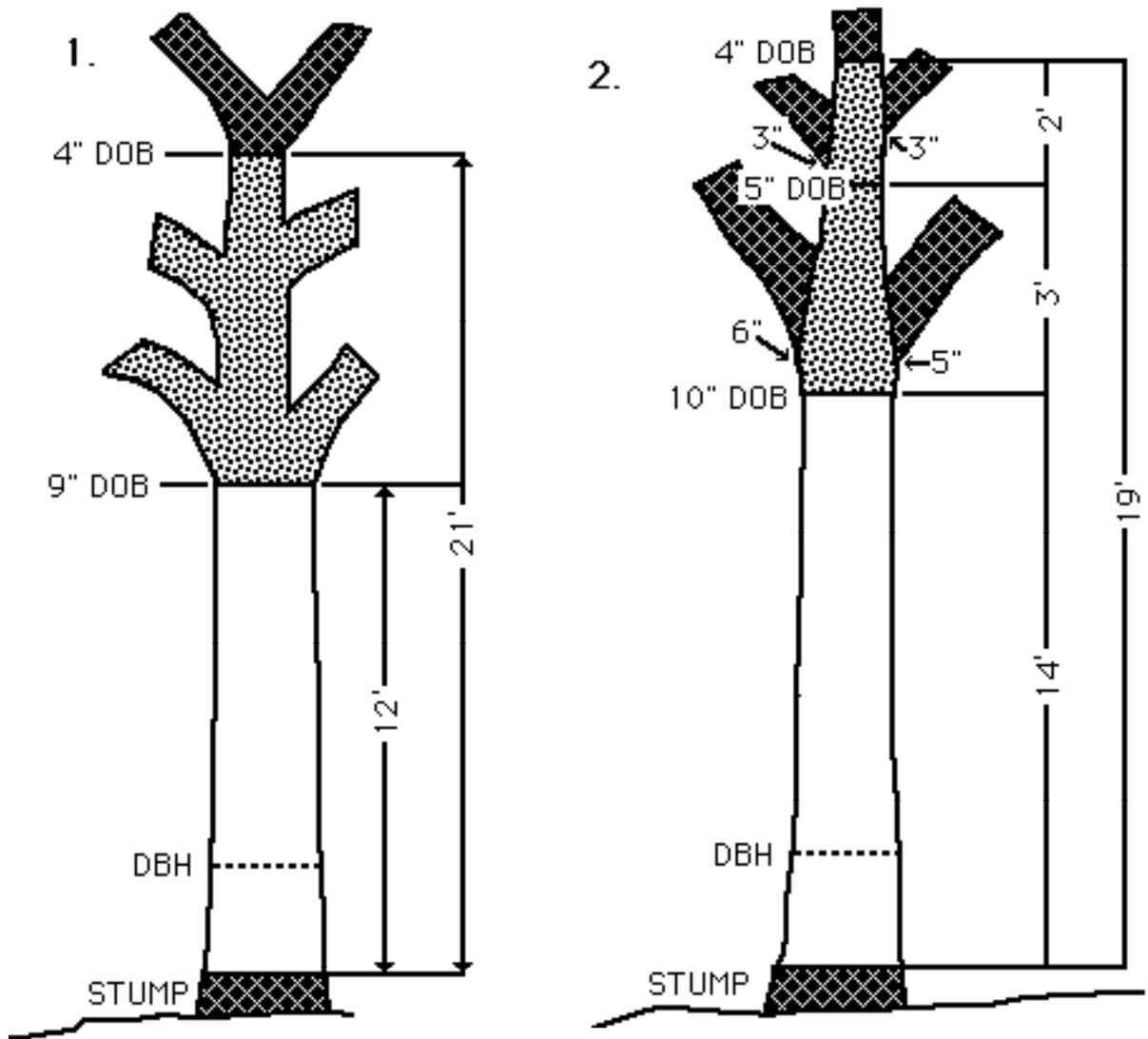
Salvable-mortality trees All required information reflects the present condition of the tree. Record your information as though the tree was alive today.

**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 nine selected examples (Figure 13) explaining tree classification. Hardwood trees are represented in the illustrations, however softwoods may be implied 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

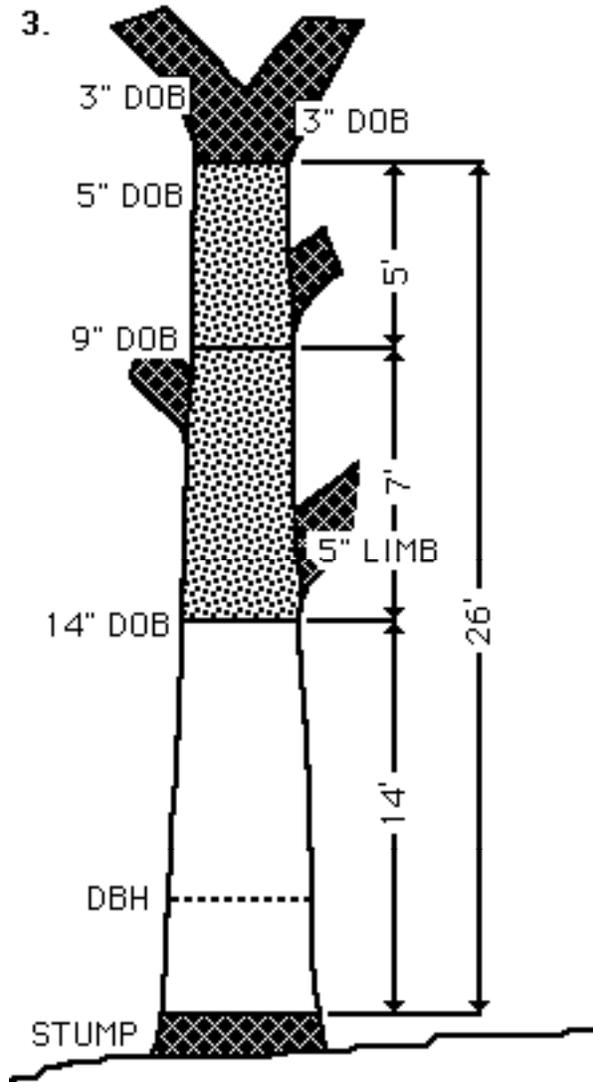
Sawlog length terminates at 9" top DOB. The sawlog meets both minimum log-grade specifications and the minimum 12-foot qualification for a growing-stock tree. The upper-stem portion contains no cull and terminates at 4" DOB. Sawlog length is recorded as 12 feet; bole length as 21 feet.

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. Cubic-foot cull is 0 for the tree.

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

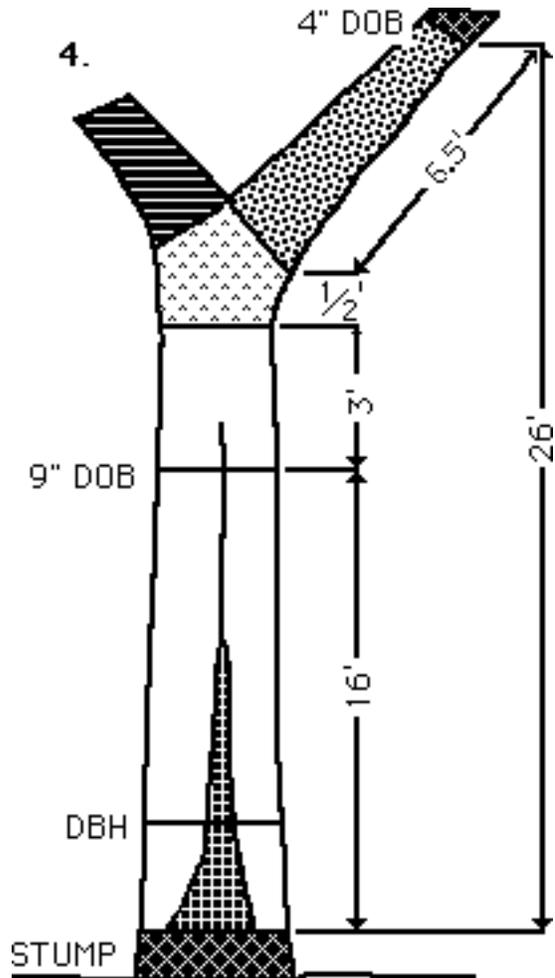
Figure 13 continued



**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 meets 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.

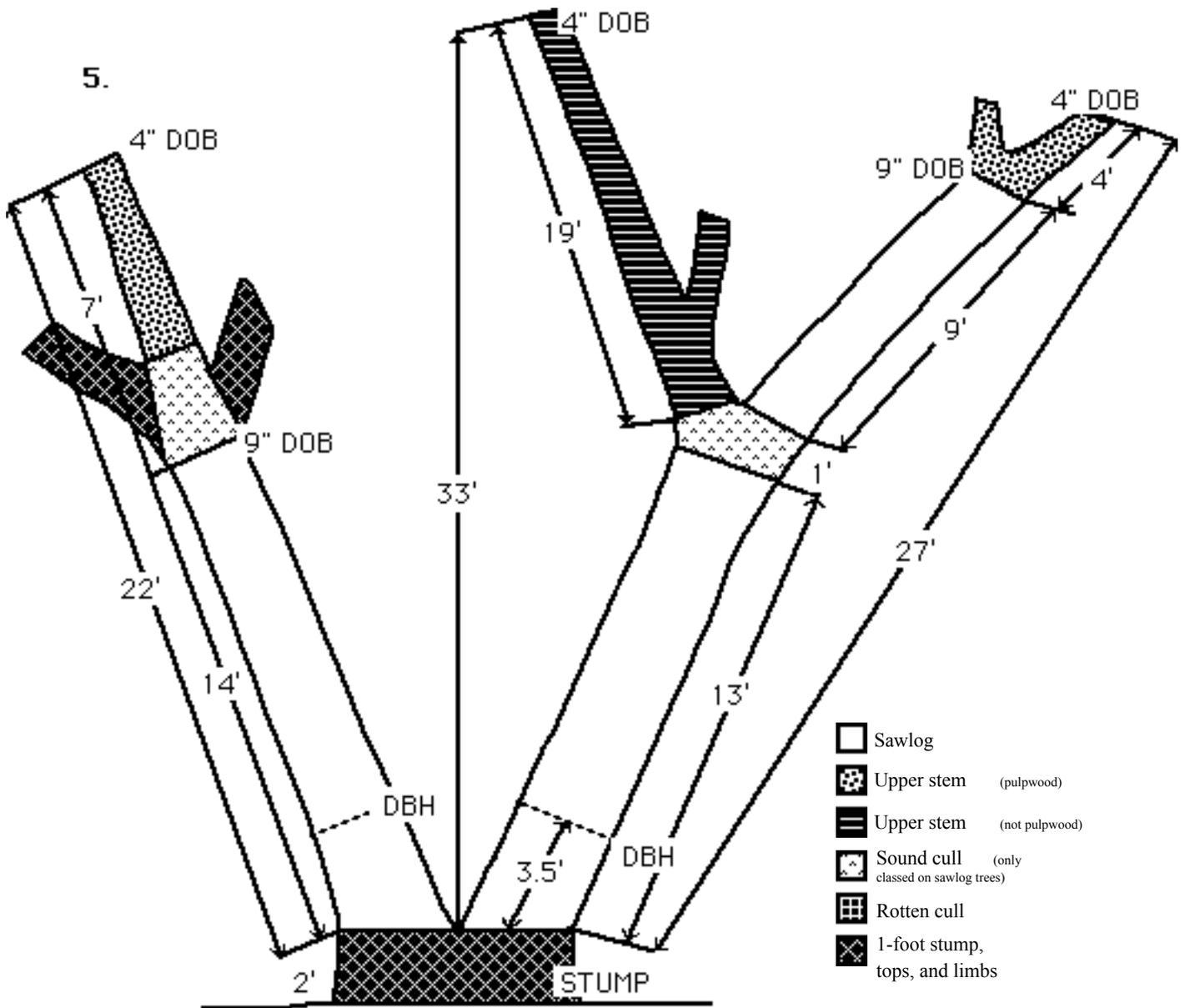
|                                                                                                             |                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
|  Sawlog                    |  Sound cull (only classed on sawlog trees) |
|  Upper stem (pulpwood)     |  Rotten cull                               |
|  Upper stem (not pulpwood) |  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 includes the entire board-foot volume in the bottom 2 feet, and the unusable board-foot volume in the next 14 feet. Cubic-foot cull includes the cubic-foot volume loss due to rot in the first 16 feet.

Figure 13 continued

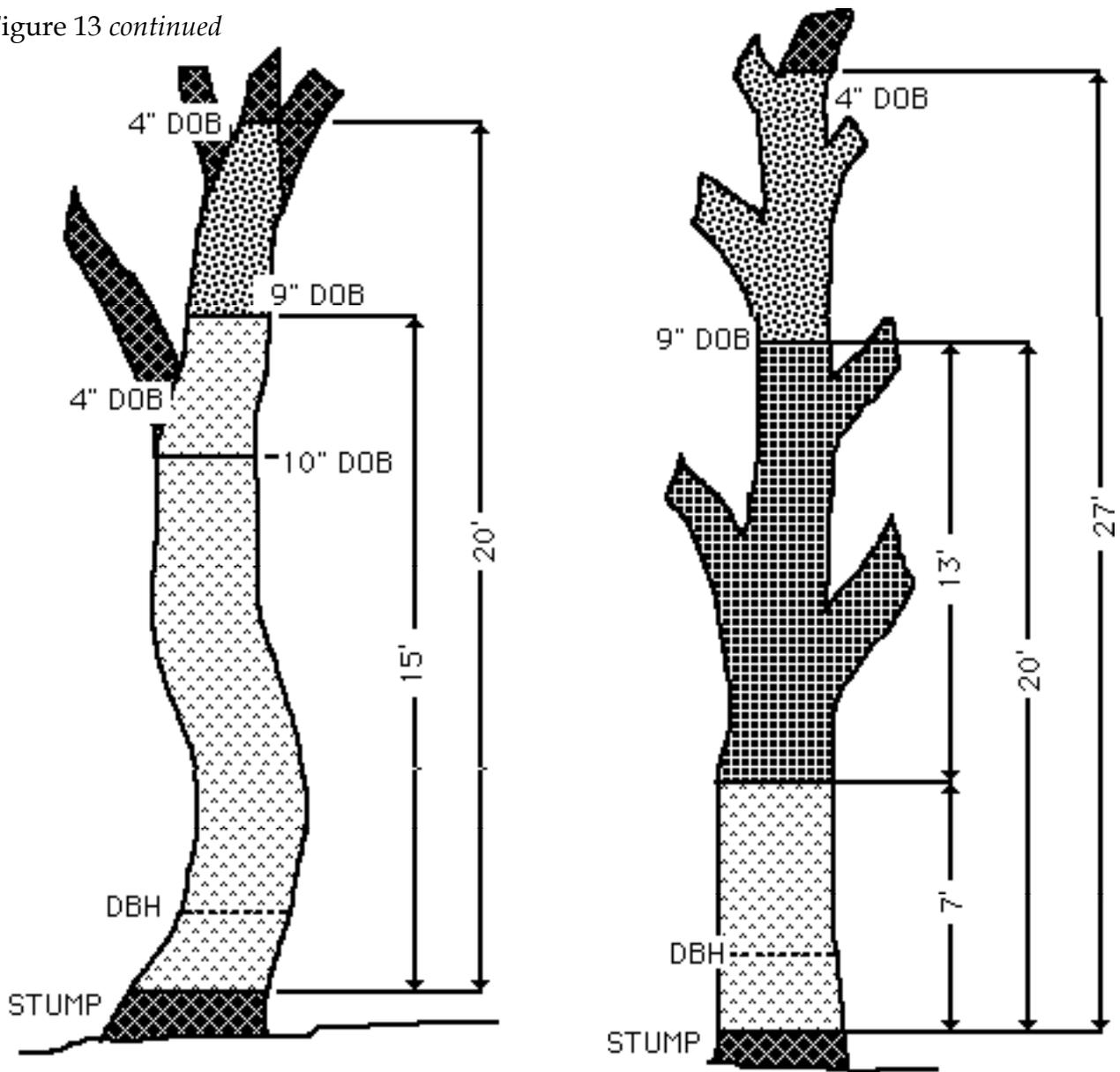


**5. TWO HARDWOOD SAWTIMBER TREES**

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 includes the total volume of the one-foot fork. When a tree forks above DBH, measurements are recorded on one fork only. Merchantable bole length is 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**

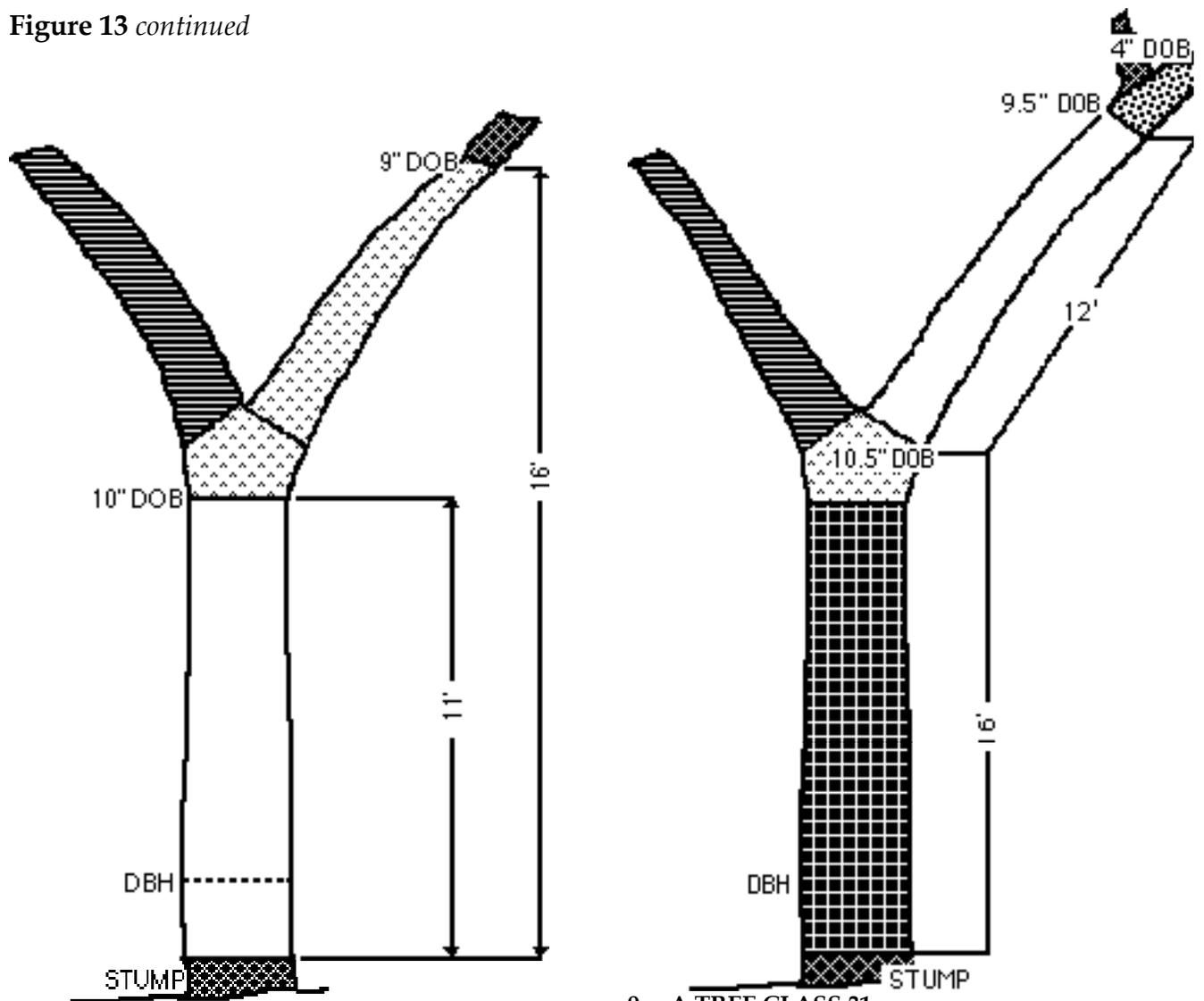
Sawlog portion is 15 feet long. There is no sawlog present that will meet minimum hardwood log grades 1-4. Minimum clear-panel length is not present for grade 3 and sweep plus a 1/3 diameter limb stopper prevents grade 4. Since more than half the board-foot volume is lost as sound cull, it is a rough 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; it will not meet log-grade specifications because of 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 represents 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

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 top 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.

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

**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.

**ITEM 29 CROWN RATIO (CRO, CRC)**

Crown ratio is the percentage of total tree height that supports full, live, green, healthy foliage effectively contributing to tree growth. Crown ratio is expressed as a percent of total tree height and is recorded as a one-digit code for all live trees  $\geq 1.0$ " DBH. For trees with uneven length crowns, ocularly transfer branches to fill holes in the upper portions, until an even crown is visualized. For example: A tree might have scattered green branches extending over 60 percent of its total height, by ocularly transferring branches to produce a full crown, the crown ratio might be 40 percent.

Transfer the original crown ratio from the plot sheet to the data recorder. If the original crown ratio is missing, record an estimate.

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 100 percent |

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

Record a one-digit code to show crown class of all live trees  $\geq 1.0$ " DBH. Crown class is determined by an 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. Transfer the original crown class from the plot sheet to the data recorder. If the original crown class is missing, record an estimate.

| <u>Code</u> | <u>Crown Class</u> |
|-------------|--------------------|
|-------------|--------------------|

- |   |                                                                                                                                                                                                                                                                                                                    |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <b>Open grown</b> Tree crown receiving full light from above and from all sides throughout all or most of the life of the tree, particularly during early development.                                                                                                                                             |
| 2 | <b>Dominant</b> Tree crown extending above the general level of the crown cover and receiving full light from above and partly from the sides. Tree is larger than the average tree in the stand, crown is well developed, but possibly somewhat crowded on the sides.                                             |
| 3 | <b>Codominant</b> Tree crown forming part of the general level of the crown cover and receiving full light from above, but comparatively little from the sides. Typically a medium-sized crown, more or less crowded on the sides. (In stagnated stands, includes a small-sized tree crown, crowded on the sides.) |
| 4 | <b>Intermediate</b> Tree shorter than those in the two preceding classes, crown is 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. Typically a small crown, considerably crowded on the sides.          |
| 5 | <b>Overtopped</b> Tree crown 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> Usually a mature or over-mature tree, crown at least 25 percent taller 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, the data recorder automatically computes and assigns stocking percents. If the tallier chooses to record stocking percent, it should be recorded for all 10 points using a two-digit code. Example: Four percent is recorded as 40; and 2.4 percent is recorded as 24.

Below 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. Following the order of point occupancy assigned to trees on a particular point, stocking percent is assigned to live trees according to DBH class.

A maximum of 16.7 percent stocking is allowed each point. The last tree to contribute to the 16.7 percent total usually receives just the amount needed to reach 16.7 percent, rather than the full stocking percent value possible for the DBH class. For example, a point has four trees,  $\geq 5.0$ " DBH, the tree given a point occupancy of four receives only 2.6 percent, bringing the total to the 16.7 percent stocking necessary for the 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                     |
| Seedling                                                      | 2.0                     |                                                      |                         |

### ITEM 32 POINT OCCUPANCY (POCC)

Show the order of occupancy by ranking trees tallied on a point that are making the most use of the site. Crown class, crown ratio and DBH can be used as a reference for determining point occupancy. Fully crowned trees of large diameter obviously dominating the point, but shorter than the surrounding trees, can receive a higher point occupancy code than a taller tree with small, weakened crowns.

**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. |

Record no code greater than 8.

**ITEM 33 TREE CAVITIES (TCAV)**

At each sample point, examine all live and dead trees,  $\geq 5.0$ " DBH, for cavities that could be used for nesting, resting or storage by birds or mammals. To qualify as a cavity, an entrance hole must be 1.0" or larger in the main stem, fork, or large limb. (A limb must be greater than 8.0" DOB.)

For the largest cavity record a two-digit code. The first digit indicates the size of the cavity. Cavity size is the diameter of the largest ball that could fit through the entrance hole. The second digit indicates the location of the cavity on the tree.

| <u>First Digit</u> |                                    | <u>Second Digit</u> |                                     |
|--------------------|------------------------------------|---------------------|-------------------------------------|
| <u>Code</u>        | <u>Size of opening</u><br>(inches) | <u>Code</u>         | <u>Location of cavity</u><br>(feet) |
| 1                  | 1                                  | 1                   | 0 - 1                               |
| 2                  | 2                                  | 2                   | 2 - 5                               |
| 3                  | 3                                  | 3                   | 6 - 9                               |
| 4                  | 4                                  | 4                   | 10 - 19                             |
| 5                  | 5                                  | 5                   | 20 - 29                             |
| 6                  | 6                                  | 6                   | 30 - 39                             |
| 7                  | 7                                  | 7                   | 40 - 49                             |
| 8                  | 8                                  | 8                   | 50 - 59                             |
| 9                  | 9+                                 | 9                   | 60+                                 |

### ITEM 34 SAWLOG LENGTH (SAWL)

Sawlog length on a live sawtimber-size tree is the distance from the top of the one-foot stump to a minimum top of 9.0" DOB for hardwoods or 7.0" DOB for softwoods or to the point on the bole above which no merchantable sawlog exists. Record sawlog length on live 20 and 31 class sawtimber-size trees. Record sawlog length to the last whole foot. Example: Sawlog length of 14.8' is 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 all softwoods and for grade 1, 2, and 3 hardwoods include: any limb (live or dead) having a diameter exceeding the stem DOB at that point; or any group of 2.0" diameter or larger limbs (live or dead), within a one-foot span, having a combined sum of diameters greater than the stem DOB of that section. 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 one-third the stem DOB of that section.

Minimize limb limitations by logical log making, aim at obtaining the longest sawlog length. For example, for a tree with two staggered limbs combining to form a stopper, bucking between the limbs may give a longer sawlog length.

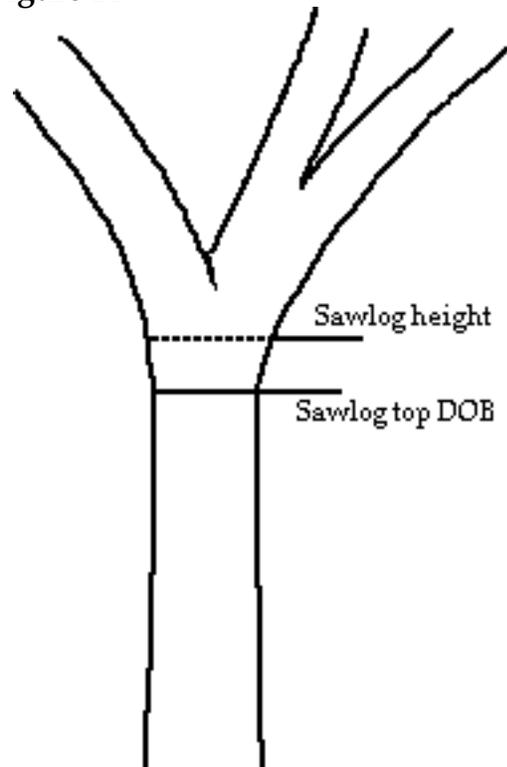
In situations where limbs are a limiting factor in determining merchantable length, length is taken to the point where the limbs divide the diameter of the merchantable section (Figure 14).

As long as a merchantable log, 8 feet or longer, is present above an unmerchantable section, no sawlog length reduction is made because of an unmerchantable piece.

In the case of a tree forking above DBH, sawlog length is taken on the trunk yielding the greatest length.

Use a height pole for heights to 40 feet, over 40 feet use a clinometer.

Figure 14



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

For each sawtimber-sized tree, record sawlog top DOB to the last tenth-inch, using a three-digit code. For example, record 7.0" as 070. The minimum top DOB recorded for hardwoods is 9.0" and 7.0" for softwoods. If a tree's sawlog length terminates before reaching minimum top DOB, or if the sawlog length is affected by a fork or the flare from a limb, record the smallest diameter immediately below the swell. 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 a tree that cannot be recovered for use as lumber because of rot, sweep, crook, fork or other defects. The following are included in cull volumes.

- The entire volume 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 volume 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 of 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 and guides for determining the proportion of cull are found in the Tatum Guides in the appendix.

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 sawlog trees (20 and 31 class) that qualify on all full new measurement, full remeasurement, and partial new measurement plots (SK #1, SK #2, and SK #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 (DIB) 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 for 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<br>1 |    |    | Tree grade<br>2 |    | Tree grade<br>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 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. For softwoods, the second and third digits are always "00".

| <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 live trees  $\geq 5.0$ " DBH is determined between the top of a one-foot stump and 4.0" DOB, or to the point where the central stem or branch breaks into limbs and above which there is no 4.0" DOB. On a 20-class sawlog-size tree, 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 includes lengths of 23.0 feet up to, but not including, 24.0 feet and is coded as 023.

Note: Use a clinometer on heights over 40 feet.

## ITEM 39 BOLE LENGTH TOP DOB (BDOB)

Top DOB is 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 tenth-inch. 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, record the smallest diameter immediately below the swell.

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

For all live 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 table, "Cubic Foot Volumes of Short Logs," of the Tatum Guides. Using a four-digit code, estimate and record cull to the last one-tenth cubic foot (0.1 cubic foot is 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 is 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 HGHT
- Total age under TAGE
- The years added to age at DBH under ADYR

For remeasurement plots, a new site index is 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 currently 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 that 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 largest 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.

**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<br/>during the last 5 years</u> | <u>Site Index<br/>(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<br/>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**

Carefully measure tree height and age to get a good estimate of site index.

#### Tree Height

This measurement is taken to the nearest whole foot. For trees up to 30 feet in height, use the 30-foot height pole. Use a clinometer and tape for trees greater than 30 feet. Make a visual estimate of tree height before choosing the scale on the clinometer. Choose a place to stand that gives you a clear view of both the top and base of the tree. The distance from where you stand to the base of the tree should be approximately equal to the total tree height. 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. During the winter, it is best to remove your borer from the tree before taking time to count the core.

Ring porous hardwoods are generally easy to count. Growth rings of many softwoods and diffuse porous hardwoods 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 take 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 bored in determining site index.

## FIELD AND OFFICE PROCEDURES

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

Basal area per acre is usually calculated in the St. Paul office. However, field crews estimate BA/acre for sample plots located on noncommercial forest land (GLU codes 40, 41, 45, or 46). Use a three-digit code to record the basal area per acre for the plot.

BA/acre is estimated from the number of live trees,  $\geq 1.0$ " DBH, on all 10 points that occur within the limiting distance of the 37.5 basal area factor prism. Total number of trees to BA/acre conversion may be determined directly from Table 5 (below). For remeasurement plots, the original basal area per acre is recorded on the plot sheet.

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 all plots, record the appropriate two-digit code based on a visual estimate while in the plot area. If stocking is insufficient, use your best judgment. North Central analysts use your estimate as a check against the calculated forest type.

For remeasurement plots, the original forest type is recorded on the plot sheet in St. Paul and remains unchanged. See forest type codes in the appendix of this manual.

### **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 sheet in St. Paul and remains unchanged. A sample plot with less than 16.7 percent stocking in growing-stock trees, but greater than 16.7 percent in all trees is recorded as non-stocked.

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: A plot with less than 16.7 percent in growing-stock trees is recorded as nonstocked (code 4).

#### **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. For remeasurement plots, the original stand age is recorded on the plot sheet in St. Paul.

Stand age is recorded with a three-digit code to the nearest year. A stand 49 years old is recorded as 049.

#### **ITEM 46 STAND AREA (AREA)**

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

##### **Water**

Determine the permanent water source nearest to the sample plot location. A permanent water source is present year-round, as opposed to an intermittent stream.

A lake, swamp, pond, or reservoir must meet the minimum area requirements of 120 feet in width and one acre in size. There is no minimum-size requirement for a stream or flowage.

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

Use the following codes to record Water Type, Water Area, and Water Distance.

**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)**

Record the width (in feet) of streams and flowages (000 to 999 feet)  $\pm$  33 feet. For lakes, swamps and farm ponds, area is measured in acres (001 to 999 acres)  $\pm$  5 acres.

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

Measure the distance from PC to the nearest permanent water source. Record the distance to the nearest half chain (0000 to 999.5 chains).

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

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

This information is used primarily in re-establishing the plot on future remeasurements. However, plots may be visited by personnel outside the Forest Service for their own purposes. The sketch should contain information necessary to enable one to find the starting point of the course to the plot. Include a reference to a town, a numbered or named road, intersections, or easily identified landmarks. Describe any particular procedure or situation encountered on the plot. Explain in the "Notes" section so that remeasurement crews can take them into consideration.

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

#### **ITEM 51 STATE (ST)**

Record the appropriate two-digit state code (listed with the county codes, item 53, in the appendix).

#### **ITEM 52 UNIT (UNIT)**

Record the appropriate one-digit code for unit number (listed with the county codes, item 53, in the appendix).

### **ITEM 53 COUNTY (CTY)**

Record the appropriate two-digit county code listed in the appendix.

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

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

### **ITEM 58 POINT TYPE/ SIZE (TYSZ)**

A point data line for each Point 1 through 10 is 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 TYSZ column on the point data line.

The point forest type must meet the minimum-size requirement 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. If a different forest type occurs on the plot, sketch the location on the 10-Point Cluster Diagram of the plot header sheet.

Record the two-digit cover class code in the CCOU column of the point data line (see item 28, Cover Class).

## 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 Tree crown receiving full light from above and from all sides throughout all or most of the life of the tree, particularly during early development.

Dominant Trees Tree with well-developed crown extending above the general level of the crown cover and receiving full light from above and partly from the sides.

Codominant Trees Tree crown forming the general level of the crown cover and receiving full light from above, but comparatively little from the sides. Typically medium-sized crowns, more or less crowded on the sides.

*continued*

## ITEM 56 DEFINITION OF TERMS CONTINUED

### **Crown Class** *continued*

Intermediate Trees Tree crown 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. Typically a small crown, considerably crowded on the sides.

Overtopped Tree crown entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

Supra Canopy Usually a mature or over-mature tree, with crown at least 25 percent taller than the majority of dominant and codominant trees in the stand.

**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. 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. 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 16.7 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 16.7 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**

| <b>Code</b> | <b>Tree History</b> | <b>Common Name</b>                       | <b>Scientific Name</b>           |
|-------------|---------------------|------------------------------------------|----------------------------------|
| 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**

| <b>Code</b> | <b>Common Name</b>            | <b>Scientific Name</b>       |
|-------------|-------------------------------|------------------------------|
| 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 thomasii</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,<br>no volume/degrade loss                      |
| <b>100</b> | <b>Insect Defoliators</b>       | <b>All species</b>           | <b>&gt;20% foliage affected</b>                                     |
| 101        | Budworms                        | Conifers                     |                                                                     |
| 104        | Sawflies                        | Pines                        |                                                                     |
| 110        | Forest tent caterpillar         | Oaks, aspens<br>N. hardwoods |                                                                     |
| 112        | Large aspen tortrix             | Aspens                       |                                                                     |
| 113        | Gypsy moth                      | Hardwoods                    | Any occurrence                                                      |
| <b>130</b> | <b>Shoot and Branch Insects</b> | <b>All species</b>           | <b>Any occurrence on leader,<br/>&gt;20% shoots/branches affctd</b> |
| 131        | White pine weevil               | White pine                   |                                                                     |
| 133        | Saratoga spittlebug             | Pines                        |                                                                     |
| 134        | Scales                          | Hardwoods                    |                                                                     |
| <b>140</b> | <b>Branch Gall Insects</b>      | <b>All species</b>           | <b>&gt;20% branches affected</b>                                    |
| 143        | Saperda shoot borer             | poplars                      |                                                                     |
| <b>150</b> | <b>Bole Borers</b>              | <b>All species</b>           | <b>Any occurrence on bole</b>                                       |
| 151        | Two-lined chestnut borer        | Oaks                         |                                                                     |
| 154        | Sugar maple borer               | Sugar maple                  |                                                                     |
| 155        | Dioryctria borer                | Red pine                     |                                                                     |
| 159        | Pine bark adelgid               | White pine                   |                                                                     |
| <b>170</b> | <b>Bark Beetles</b>             | <b>Conifers</b>              | <b>&gt;20% crown dead/dying</b>                                     |
| 171        | Ips spp                         | Pines                        |                                                                     |
| <b>190</b> | <b>Root/Root Collar Insects</b> | <b>Conifers</b>              | <b>Entire crown off color;<br/>dead tree</b>                        |
| 191        | Root collar weevil              | Hard pines                   |                                                                     |
| <b>200</b> | <b>Foliage Diseases</b>         | <b>All species</b>           | <b>&gt;20% foliage affected</b>                                     |
| 201        | Needlecasts                     | Pines                        |                                                                     |
| 202        | Anthracnose                     | Hardwoods                    |                                                                     |
| <b>210</b> | <b>Shoot Blights</b>            | <b>All species</b>           | <b>Any occurrence on leader,<br/>&gt;20% shoots/branches affctd</b> |
| 212        | Scleroderris                    | Red, jack, scots<br>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  | <b>Bole Rusts</b>               | <b>Pines</b>                                  | Any occurrence on bole                                       |
| 241  | White pine blister rust         | White pine                                    |                                                              |
| 242  | Stem rusts of hardpines         | Pines                                         |                                                              |
| 250  | <b>Bole Cankers</b>             | <b>Hardwoods</b>                              | 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  | <b>Stem Decay</b>               | <b>All species</b>                            | Any occurrence on bole                                       |
| 261  | Phellinus pini                  | Conifers                                      |                                                              |
| 262  | Phellinus tremulae              | Aspens                                        |                                                              |
| 263  | Inonotus obliquus               | Birches                                       |                                                              |
| 271  | <b>Ash yellows</b>              | <b>Ashes</b>                                  | Any occurrence                                               |
| 273  | <b>Beech bark disease</b>       | <b>Beech</b>                                  | Any occurrence                                               |
| 281  | <b>Dutch elm disease</b>        | <b>Elms</b>                                   | Any occurrence                                               |
| 282  | <b>Oak wilt</b>                 | <b>Oaks</b>                                   | Any occurrence                                               |
| 291  | <b>Annosus root rot</b>         | <b>Conifers</b>                               | Any occurrence                                               |
| 292  | <b>Armillaria root rot</b>      | <b>All species</b>                            | >20% crown dieback                                           |
| 300  | <b>Weather</b>                  | All species                                   | >20% crown affected;<br>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*

| <b>Code</b> | <b>Damage or Death</b>                                                | <b>Hosts</b>       | <b>Severity</b>                                                         |
|-------------|-----------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------|
| <b>400</b>  | <b>Animal Damage</b>                                                  | <b>All species</b> | <b>Any damage to leader or bole cambium</b>                             |
| 401         | Browse                                                                |                    |                                                                         |
| 402         | Moose/Elk/Deer                                                        |                    |                                                                         |
| 403         | Rabbit                                                                |                    |                                                                         |
| 404         | Beaver                                                                |                    |                                                                         |
| 405         | Squirrel                                                              |                    |                                                                         |
| 406         | Porcupine                                                             |                    |                                                                         |
| 408         | Sapsucker                                                             |                    |                                                                         |
| 409         | Cattle/domestic animals                                               |                    |                                                                         |
| <b>500</b>  | <b>Fire</b>                                                           | <b>All species</b> | <b>&gt;20% crown affected;<br/>Any damage to leader or bole cambium</b> |
| 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                                                                 |
| 811         | Barbed wire, nails, etc.                                              | All species        | Any occurrence                                                          |
| 830         | Vehicle Damage                                                        | All species        | Any occurrence                                                          |
| <b>860</b>  | <b>Chemical</b>                                                       | <b>All species</b> | <b>&gt;20% crown affected</b>                                           |
| 861         | Pesticides                                                            | All species        |                                                                         |
| <b>900</b>  | <b>Unknown/Uncoded -<br/>Dead</b>                                     | <b>All species</b> | <b>Use on dead trees only</b>                                           |
| <b>901</b>  | <b>Unknown/Uncoded -<br/>Defoliation</b>                              | <b>All species</b> | <b>&gt;20% foliage affected</b>                                         |
| <b>902</b>  | <b>Unknown/Uncoded -<br/>Discoloration</b>                            | <b>All species</b> | <b>&gt;20% foliage affected</b>                                         |
| <b>903</b>  | <b>Unknown/Uncoded -<br/>Decline/Dieback</b>                          | <b>All species</b> | <b>&gt;20% crown affected</b>                                           |
| <b>904</b>  | <b>Unknown/Uncoded -<br/>Breakage</b>                                 | <b>All species</b> | <b>&gt;20% crown affected;<br/>any occurrence on bole</b>               |
| <b>905</b>  | <b>Unknown/Uncoded -<br/>Abnormal Growth or<br/>Form in the Crown</b> | <b>All species</b> | <b>&gt;20% crown affected</b>                                           |
| <b>906</b>  | <b>Unknown/Uncoded -<br/>Canker</b>                                   | <b>All species</b> | <b>Any occurrence on bole</b>                                           |
| <b>907</b>  | <b>Unknown/Uncoded -<br/>Crack</b>                                    | <b>All species</b> | <b>Any occurrence on bole</b>                                           |

|     |                                                             |             |                                         |
|-----|-------------------------------------------------------------|-------------|-----------------------------------------|
| 908 | Unknown/Uncoded -<br>Abnormal Growth or<br>Form on the Bole | All species | any occurrence causing<br>a volume loss |
|-----|-------------------------------------------------------------|-------------|-----------------------------------------|

## 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**

**Code    Ranger District**

- 2    Manistique
- 3    Munising
- 1    Rapid River
- 5    St. Ignace
- 4    Sault Ste. Marie

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

**Code    Ranger District**

- 1    Baldwin
- 2    Cadillac
- 7    Harrisville
- 3    Manistee
- 5    Mio
- 6    Tawas
- 4    White Cloud

**Ottawa National Forest - Code 07**

**Code    Ranger District**

- 1    Bergland
- 2    Bessemer
- 3    Iron River
- 4    Kenton
- 5    Ontonagon
- 6    Watersmeet

## Minnesota and Michigan States Shrub Species

| Code | Tree History | Common Name                              | Scientific Name                |
|------|--------------|------------------------------------------|--------------------------------|
| 230  | 81           | Yew                                      | <i>Taxus canadensis</i>        |
| 353  | 80           | Speckled alder                           | <i>Alnus rugosa</i>            |
| 356  | 80           | Alder species                            | <i>Alnus spp.</i>              |
| 380  | 80           | Bog birch                                | <i>Betula pumila</i>           |
| 490  | 80           | Dogwood (gray, alternate-leafed)         | <i>Cornaceae</i>               |
| 492  | 80           | Red osier dogwood                        | <i>Cornus stolonifera</i>      |
| 493  | 80           | Alternate-leafed dogwood                 | <i>Cornus alternifolia</i>     |
| 494  | 81           | Bunchberry                               | <i>Cornus canadensis</i>       |
| 500  | 80           | Hawthorn                                 | <i>Crataegus spp.</i>          |
| 592  | 80           | Black alder, mountain holly, winterberry | <i>Ilex verticillata</i>       |
| 712  | 81           | Virginia creeper                         | <i>Parthenocissus spp.</i>     |
| 749  | 81           | Labrador tea                             | <i>Ledum groenlandicum</i>     |
| 750  | 81           | Leatherleaf                              | <i>Chamaedaphne calyculata</i> |
| 751  | 81           | Bog laurel                               | <i>Kalmia polifolia</i>        |
| 764  | 80           | Sandcherry                               | <i>Prunus pumila</i>           |
| 849  | 81           | Sweetfern                                | <i>Comptonia peregrina</i>     |
| 853  | 80           | Witch hazel                              | <i>Hamamelis virginiana</i>    |
| 854  | 80           | Common ninebark                          | <i>Physocarpus opulifolius</i> |
| 855  | 80           | Juneberry                                | <i>Amelanchier spp.</i>        |
| 856  | 80           | Beaked hazel                             | <i>Corylus cornuta</i>         |
| 857  | 80           | Prickly ash                              | <i>Zanthoxylum americanum</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>              |
| 867  | 81           | Raspberry-Blackberry                     | <i>Rubus spp.</i>              |
| 868  | 81           | Rose                                     | <i>Rosa spp.</i>               |
| 870  | 80           | American bladdernut                      | <i>Staphylea trifolia</i>      |
| 873  | 81           | Black huckleberry                        | <i>Gaylussacia bassata</i>     |
| 874  | 81           | Blueberry, Bilberry                      | <i>Vaccinium spp.</i>          |
| 875  | 81           | Bush honeysuckle                         | <i>Dierovilla lonicera</i>     |
| 876  | 81           | Honeysuckle                              | <i>Lonicera spp.</i>           |
| 880  | 80           | Buffaloberry                             | <i>Shepherdia spp.</i>         |

**ITEM 24 BIOMASS STUDY "SHRUBS" (SPP) CONTINUED**

**Minnesota and Michigan Shrub Species, *continued***

| <b>Code</b> | <b>Tree History</b> | <b>Common Name</b>         | <b>Scientific Name</b>           |
|-------------|---------------------|----------------------------|----------------------------------|
| 902         | 81                  | Poison ivy                 | <i>Rhus radicans</i>             |
| 907         | 80                  | New Jersey tea             | <i>Ceanothus americanus</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>             |
| 932         | 81                  | Greenbrier                 | <i>Smilax spp.</i>               |
| 978         | 81                  | Bog rosemary               | <i>Andromeda glaucophylla</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>                |
| 984         | 81                  | Strawberry                 | <i>Fragaria spp.</i>             |
| 997         | 80                  | Other species              | <i>(Tall, woody perennials)</i>  |
| 998         | 81                  | Other species              | <i>(Other perennials)</i>        |

## Wisconsin Shrub Species

| Code | Tree History | Common Name                  | Scientific Name                    |
|------|--------------|------------------------------|------------------------------------|
| 230  | 81           | Yew                          | <i>Taxus canadensis</i>            |
| 356  | 80           | Alder                        | <i>Alnus spp.</i>                  |
| 490  | 80           | Dogwood                      | <i>Cornus spp.</i>                 |
| 500  | 80           | Hawthorn                     | <i>Crataegus spp.</i>              |
| 592  | 80           | Black Alder                  | <i>Ilex verticillata</i>           |
| 712  | 81           | Virginia Creeper             | <i>Parthenocissus quinquefolia</i> |
| 749  | 81           | Labrador Tea                 | <i>Ledum groenlandicum</i>         |
| 750  | 81           | Leatherleaf                  | <i>Chamaedaphne calyculata</i>     |
| 751  | 81           | Bog laurel                   | <i>Kalmia polifolia</i>            |
| 849  | 81           | Sweet fern                   | <i>Comptonia peregrina</i>         |
| 853  | 80           | Witch-hazel                  | <i>Hamamelis virginiana</i>        |
| 854  | 80           | Common ninebark              | <i>Physocarpus opulifolius</i>     |
| 855  | 80           | Juneberry                    | <i>Amelanchier spp.</i>            |
| 856  | 80           | Hazelnut                     | <i>Corylus spp.</i>                |
| 857  | 80           | Pricky Ash                   | <i>Zanthoxylum americanum</i>      |
| 859  | 80           | Buckthorn                    | <i>Rhamnus spp.</i>                |
| 861  | 80           | Leatherwood                  | <i>Dirca palustris</i>             |
| 862  | 80           | Viburnum                     | <i>Viburnum spp.</i>               |
| 863  | 80           | Elderberry                   | <i>Sambucus spp.</i>               |
| 864  | 80           | Sumac                        | <i>Rhus spp.</i>                   |
| 865  | 81           | Gooseberry-Current           | <i>Ribes spp.</i>                  |
| 867  | 81           | Raspberry-Blackberry         | <i>Rubus spp.</i>                  |
| 868  | 81           | Rose                         | <i>Rosa spp.</i>                   |
| 870  | 81           | American bladdernut          | <i>Staphylea trifolia</i>          |
| 874  | 81           | Blueberry                    | <i>Vaccinium spp.</i>              |
| 875  | 81           | Bush honeysuckle             | <i>Diervilla lonicera</i>          |
| 876  | 81           | Honeysuckle                  | <i>Lonicera spp.</i>               |
| 880  | 80           | Buffaloberry                 | <i>Shepherdia spp.</i>             |
| 902  | 81           | Poison ivy                   | <i>Rhus radicans</i>               |
| 907  | 80           | New Jersey Tea               | <i>Ceanothus americanus</i>        |
| 913  | 80           | Russian or Antunm olive      | <i>Elaeagnus angustifolia</i>      |
| 932  | 81           | Green briar                  | <i>Smilax spp.</i>                 |
| 978  | 81           | Bog rosemary                 | <i>Andromeda glaucophylla</i>      |
| 979  | 80           | Willow species (clumped)     | <i>Salix spp.</i>                  |
| 980  | 80           | Willow species (single stem) | <i>Salix spp.</i>                  |
| 982  | 81           | Grape                        | <i>Vitis spp.</i>                  |
| 984  | 81           | Strawberry                   | <i>Fragaria spp.</i>               |
| 997  | 80           | Other species                | Tall woody perennials              |
| 998  | 81           | Other species                | Other perennials                   |

## Kansas Shrub Species

| Code | Tree History | Common Name                 | Scientific Name                                |
|------|--------------|-----------------------------|------------------------------------------------|
| 463  | 80           | Dwarf hackberry             | <i>Celtis tenuifolia</i>                       |
| 490  | 80           | Dogwood                     | <i>Cornaceae drummondii</i>                    |
| 712  | 81           | Virginia Creeper            | <i>Parthenocissus spp.</i>                     |
| 764  | 80           | Sandcherry                  | <i>Prunus pumila</i>                           |
| 854  | 80           | Common ninebark             | <i>Physocarpus opulifolius</i>                 |
| 855  | 80           | Serviceberry                | <i>Amelanchier sp.</i>                         |
| 857  | 80           | Prickly ash                 | <i>Zanthoxylum americanum</i>                  |
| 858  | 80           | American hazel              | <i>Corylus americana</i>                       |
| 859  | 80           | Buckthorn                   | <i>Rhamnus lanceololta</i>                     |
| 862  | 80           | Viburnum                    | <i>Viburnum spp.</i>                           |
| 863  | 80           | Elderberry                  | <i>Sambucus canadensis</i>                     |
| 864  | 80           | Sumac                       | <i>Rhus spp.</i>                               |
| 865  | 81           | Gooseberry                  | <i>Ribes spp.</i>                              |
| 867  | 81           | Raspberry-blackberry        | <i>Rubus spp.</i>                              |
| 868  | 81           | Rose                        | <i>Rosa spp.</i>                               |
| 869  | 80           | Shrubby Trefoil             | <i>Ptelea trifoliata</i>                       |
| 870  | 81           | American Bladdernut         | <i>Staphylea trifolia</i>                      |
| 874  | 81           | Bilberry-Blueberry          | <i>Vaccinium spp.</i>                          |
| 876  | 81           | Honeysuckle                 | <i>Lonicera spp.</i>                           |
| 877  | 81           | Snowberry / Coralberry      | <i>Symphoricarpos occidentalis/orbiculatus</i> |
| 881  | 81           | Multiflora rose             | <i>Rosa multiflora</i>                         |
| 902  | 81           | Poison ivy                  | <i>Rhus radicans</i>                           |
| 907  | 80           | New Jersey tea/red root     | <i>Ceanothus americanus/herbaceous</i>         |
| 913  | 80           | Russian Olive               | <i>Elaeagnus angustifolia</i>                  |
| 915  | 80           | Wild crabapple              | <i>Pyrus ioensis</i>                           |
| 916  | 80           | Lead plant /false indigo    | <i>Amorpha canescens/fruiticosa</i>            |
| 917  | 80           | Wahoo                       | <i>Euonymus atropurpurea</i>                   |
| 918  | 81           | Bittersweet                 | <i>Celastrus scandens</i>                      |
| 919  | 80           | Soapberry                   | <i>Sapindus drummondii</i>                     |
| 924  | 81           | Raccoon grape               | <i>Ampelopsis cordata</i>                      |
| 925  | 80           | Tamarisk                    | <i>Tamarix ramosissima</i>                     |
| 927  | 80           | Rabbitbrush                 | <i>Chrysothamus pulchellus</i>                 |
| 929  | 81           | Sandhill sage               | <i>Artemisia filifolia</i>                     |
| 979  | 80           | Willow species (clumped)    | <i>Salix spp.</i>                              |
| 980  | 80           | Willow species (single st.) | <i>Salix spp.</i>                              |
| 982  | 81           | Grape                       | <i>Vitis spp.</i>                              |
| 997  | 80           | Other species               | <i>Tall, woody perennials</i>                  |
| 998  | 81           | Other species               | <i>Other perennials</i>                        |

**ITEM 24 BIOMASS STUDY "SHRUBS" (SPP) CONTINUED**

**Nebraska Shrub Species**

| Code | Tree History | Common Name                  | Scientific Name                                |
|------|--------------|------------------------------|------------------------------------------------|
| 059  | 81           | Creeping juniper             | <i>Junipeus horizontalis</i>                   |
| 069  | 81           | Common juniper               | <i>Juniperus communis</i>                      |
| 490  | 80           | Dogwood                      | <i>Cornaceae drummondii</i>                    |
| 492  | 80           | Redosier dogwood             | <i>Cornus sericea</i>                          |
| 493  | 80           | Alternate leafed dogwood     | <i>Cornus alternifolia</i>                     |
| 712  | 81           | Virginia creeper             | <i>Parthenocissus sp.</i>                      |
| 764  | 80           | Sandcherry                   | <i>Prunus pumila</i>                           |
| 854  | 80           | Common ninebark              | <i>Physocarpus opulifolius</i>                 |
| 855  | 80           | Serviceberry                 | <i>Amelanchier sp.</i>                         |
| 856  | 80           | Beaked hazelnut              | <i>Corylus cornuta</i>                         |
| 857  | 80           | Prickly ash                  | <i>Zanthoxylum americanum</i>                  |
| 859  | 80           | Buckthorn                    | <i>Rhamnus lanceolata</i>                      |
| 862  | 80           | Viburnum                     | <i>Viburnum sp.</i>                            |
| 863  | 80           | Elderberry                   | <i>Sambucus canadensis</i>                     |
| 864  | 80           | Sumac                        | <i>Rhus sp.</i>                                |
| 865  | 81           | Gooseberry                   | <i>Ribes sp</i>                                |
| 867  | 81           | Raspberry/Blackberry         | <i>Rubus sp.</i>                               |
| 868  | 81           | Rose                         | <i>Rosa sp.</i>                                |
| 870  | 81           | American bladdernut          | <i>Staphylea trifolia</i>                      |
| 876  | 81           | Honeysuckle                  | <i>Lonicera sp.</i>                            |
| 877  | 81           | Snowberry/coralberry         | <i>Symphoricarpos occidentalis/orbiculatus</i> |
| 880  | 80           | Buffaloberry                 | <i>Shepherdia canadensis</i>                   |
| 907  | 80           | New Jersey Tea/redroot       | <i>Ceanothus americanus/herbaceous</i>         |
| 912  | 80           | Buttonbush                   | <i>Cephalanthus occidentalis</i>               |
| 913  | 80           | Russian olive                | <i>Elaeagnus angusti</i>                       |
| 916  | 80           | Lead plant/false indigo      | <i>Amorpha canescens, fruticosa</i>            |
| 917  | 80           | Wahoo                        | <i>Euonymus atropurpurea</i>                   |
| 918  | 81           | Bittersweet                  | <i>Celastrus scandens</i>                      |
| 924  | 81           | Raccoon grape                | <i>Ampelopsis cordata</i>                      |
| 927  | 80           | Rabbitbrush                  | <i>Chrysothamnus pulchellus</i>                |
| 929  | 81           | Sandhill sage                | <i>Artemisia filifolia</i>                     |
| 932  | 81           | Greenbriar                   | <i>Smilax spp.</i>                             |
| 979  | 80           | Willow species (clumped)     | <i>Salix spp.</i>                              |
| 980  | 80           | Willow species (single stem) | <i>Salix spp.</i>                              |
| 982  | 81           | Grape                        | <i>Vitis spp.</i>                              |
| 997  | 81           | Other species                | <i>Tall, woody perennials</i>                  |
| 998  | 81           | Other species                | <i>Other perennials</i>                        |

## Minnesota and 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 pensylvanicum</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>        |
| 500* | Hawthorn                      | <i>Crataegus spp.</i>        |
| 531  | American beech                | <i>Fagus grandifolia</i>     |
| 541  | White ash                     | <i>Fraxinus americana</i>    |

\* Noncommercial tree species.

## Minnesota and Michigan tree species, continued

| Code | Common Name                    | Scientific Name                |
|------|--------------------------------|--------------------------------|
| 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.

## Wisconsin 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>           |
| 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  | Eastern white pine        | <i>Pinus strobus</i>         |
| 130  | Scotch pine               | <i>Pinus sylvestris</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 pensylvanicum</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>         |
| 341* | Ailanthus, Tree of heaven | <i>Ailanthus altissima</i>   |
| 371  | Yellow birch              | <i>Betula alleghaniensis</i> |
| 373  | River birch               | <i>Betula nigra</i>          |
| 375  | Paper birch               | <i>Betula papyrifera</i>     |
| 391* | American hornbeam         | <i>Carpinus caroliniana</i>  |
| 402  | Bitternut hickory         | <i>Carya cordiformis</i>     |
| 403  | Pignut hickory            | <i>Carya glabra</i>          |
| 407  | Shagbark hickory          | <i>Carya ovata</i>           |
| 452  | Northern Catalpa          | <i>Catalpa speciosa</i>      |
| 462  | Hackberry                 | <i>Celtis occidentalis</i>   |
| 500* | Hawthorn                  | <i>Crataegus sp.</i>         |
| 531  | Beech                     | <i>Fagus grandifolia</i>     |

\* Noncommercial tree species.

Wisconsin tree species, *continued*

| Code | Common Name         | Scientific Name               |
|------|---------------------|-------------------------------|
| 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>  |
| 601  | Butternut           | <i>Juglans cinerea</i>        |
| 602  | Black walnut        | <i>Juglans nigra</i>          |
| 660* | Apple               | <i>Malus sp.</i>              |
| 682  | Red mulberry        | <i>Morus rubra</i>            |
| 701* | Eastern hophornbeam | <i>Ostrya virginiana</i>      |
| 741  | Blasam 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>      |
| 765* | Canada plum         | <i>Prunus nigra</i>           |
| 766* | Wild plum           | <i>Prunus americana</i>       |
| 802  | White oak           | <i>Quercus alba</i>           |
| 804  | Swamp white oak     | <i>Quercus bicolor</i>        |
| 809  | Northern pin oak    | <i>Quercus ellipsoidalis</i>  |
| 823  | Bur oak             | <i>Quercus macrocarpa</i>     |
| 833  | Northern red oak    | <i>Quercus rubra</i>          |
| 837  | Black oak           | <i>Quercus velutina</i>       |
| 851* | Mountain ash        | <i>Sorbus spp.</i>            |
| 901  | Black locust        | <i>Robinia pseudoacacia</i>   |
| 921* | Peachleaf willow    | <i>Salix amygdaloides</i>     |
| 922  | Black willow        | <i>Salix nigra</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.

## Kansas tree species

| Code | Common Name               | Scientific Name                    |
|------|---------------------------|------------------------------------|
| 068  | Eastern redcedar          | <i>Juniperus virginiana</i>        |
| 313  | Boxelder                  | <i>Acer negundo</i>                |
| 314  | Black maple               | <i>Acer nigrum</i>                 |
| 317  | Silver maple              | <i>Acer saccharinum</i>            |
| 318  | Sugar maple               | <i>Acer saccharum</i>              |
| 333  | Texas buckeye             | <i>Aesculus glabra var. arguta</i> |
| 341* | Ailanthus, Tree of heaven | <i>Ailanthus altissima</i>         |
| 373  | River birch               | <i>Betula nigra</i>                |
| 926* | Chittamwood, gum bumelia  | <i>Bumelia lanuginosa</i>          |
| 402  | Bitternut hickory         | <i>Carya cordiformis</i>           |
| 404  | Pecan                     | <i>Carya illinoensis</i>           |
| 405  | Shellbark hickory         | <i>Carya laciniosa</i>             |
| 407  | Shagbark hickory          | <i>Carya ovata</i>                 |
| 408  | Black hickory             | <i>Carya texana</i>                |
| 409  | Mockernut hickory         | <i>Carya tomentosa</i>             |
| 452  | Northern catalpa          | <i>Catalpa speciosa</i>            |
| 461  | Sugarberry                | <i>Celtis laevigata</i>            |
| 462  | Hackberry                 | <i>Celtis occidentalis</i>         |
| 464  | Netleaf hackberry         | <i>Celtis reticulata</i>           |
| 471* | Eastern redbud            | <i>Cercis canadensis</i>           |
| 491  | Flowering dogwood         | <i>Cornus florida</i>              |
| 500* | Hawthorn                  | <i>Crataegus sp.</i>               |
| 521  | Common persimmon          | <i>Diospyros virginiana</i>        |
| 541  | White ash                 | <i>Fraxinus americana</i>          |
| 544  | Green ash                 | <i>Fraxinus pennsylvanica</i>      |
| 546  | Blue ash                  | <i>Fraxinus quadrangulata</i>      |
| 552  | Honey locust              | <i>Gleditsia triacanthos</i>       |
| 571  | Kentucky coffeetree       | <i>Gymnocladus dioicus</i>         |
| 602  | Black walnut              | <i>Juglans nigra</i>               |
| 603  | Texas walnut              | <i>Juglans microcarpa</i>          |
| 641* | Osage-orange              | <i>Maclura pomifera</i>            |

\* Noncommercial tree species.

Kansas tree species, *continued*

| Code | Common Name         | Scientific Name              |
|------|---------------------|------------------------------|
| 660* | Apple sp.           | <i>Malus sp.</i>             |
| 681  | White mulberry      | <i>Morus alba</i>            |
| 682  | Red mulberry        | <i>Morus rubra</i>           |
| 701* | Eastern hophornbeam | <i>Ostrya virginiana</i>     |
| 731  | Sycamore            | <i>Platanus occidentalis</i> |
| 742  | Eastern cottonwood  | <i>Populus deltoides</i>     |
| 752  | Silver poplar       | <i>Populus alba</i>          |
| 762  | Black cherry        | <i>Prunus serotina</i>       |
| 763* | Chokecherry         | <i>Prunus virginiana</i>     |
| 766* | Wild plum           | <i>Prunus americana</i>      |
| 802  | White oak           | <i>Quercus alba</i>          |
| 817  | Shingle oak         | <i>Quercus imbricaria</i>    |
| 823  | Bur oak             | <i>Quercus macrocarpa</i>    |
| 824  | Blackjack oak       | <i>Quercus marilandica</i>   |
| 826  | Chinkapin oak       | <i>Quercus muehlenbergii</i> |
| 830  | Pin oak             | <i>Quercus palustris</i>     |
| 833  | Northern red oak    | <i>Quercus rubra</i>         |
| 834  | Shumard oak         | <i>Quercus shumardii</i>     |
| 835  | Post oak            | <i>Quercus stellata</i>      |
| 837  | Black oak           | <i>Quercus velutina</i>      |
| 839* | Dwarf chinkapin oak | <i>Quercus prinoides</i>     |
| 901  | Black locust        | <i>Robinia pseudocacia</i>   |
| 921* | Peachleaf willow    | <i>Salix amygdaloides</i>    |
| 922  | Black willow        | <i>Salix nigra</i>           |
| 931  | Sassafras           | <i>Sassafras albidum</i>     |
| 951  | American basswood   | <i>Tilia americana</i>       |
| 971  | Winged elm          | <i>Ulmus alata</i>           |
| 972  | American elm        | <i>Ulmus americana</i>       |
| 974  | Siberian elm        | <i>Ulmus pumila</i>          |
| 975  | Slippery elm        | <i>Ulmus rubra</i>           |
| 977  | Rock elm            | <i>Ulmus thomasi</i>         |

\* Noncommercial tree species.

## Nebraska tree species

| Code | Common Name               | Scientific Name               |
|------|---------------------------|-------------------------------|
| 066* | Rocky mountain juniper    | <i>Juniperus scopulorum</i>   |
| 068  | Eastern red cedar         | <i>Juniperus virginiana</i>   |
| 096  | Blue spruce               | <i>Picea pungens</i>          |
| 105  | Jack pine                 | <i>Pinus banksiana</i>        |
| 122  | Ponderosa pine            | <i>Pinus ponderosa</i>        |
| 130  | Scotch pine               | <i>Pinus sylvestris</i>       |
| 133  | Austrian pine             | <i>Pinus nigra</i>            |
| 313  | Boxelder                  | <i>Acer negundo</i>           |
| 317  | Silver maple              | <i>Acer saccharinum</i>       |
| 321* | Rocky mountain maple      | <i>Acer glabrum</i>           |
| 331  | Ohio buckeye              | <i>Aesculus glabra</i>        |
| 341* | Ailanthus, Tree of heaven | <i>Ailanthus altissima</i>    |
| 375  | Paper birch               | <i>Betula papyrifera</i>      |
| 402  | Bitternut hickory         | <i>Carya cordiformis</i>      |
| 407  | Shagbark hickory          | <i>Carya ovata</i>            |
| 452  | Northern catalpa          | <i>Catalpa speciosa</i>       |
| 461  | Sugarberry                | <i>Celtis laevigata</i>       |
| 462  | Hackberry                 | <i>Celtis occidentalis</i>    |
| 471* | Eastern redbud            | <i>Cercis canadensis</i>      |
| 500* | Hawthorn                  | <i>Crataegus sp.</i>          |
| 541  | White ash                 | <i>Fraxinus americana</i>     |
| 544  | Green ash                 | <i>Fraxinus pennsylvanica</i> |
| 552  | Honeylocust               | <i>Gleditsia triacanthos</i>  |
| 571  | Kentucky coffeetree       | <i>Gymnocladus dioicus</i>    |
| 602  | Black walnut              | <i>Juglans nigra</i>          |
| 641* | Osage-orange              | <i>Maclura pomifera</i>       |
| 660* | Apple sp.                 | <i>Malus sp.</i>              |
| 681  | White mulberry            | <i>Morus alba</i>             |
| 682  | Red mulberry              | <i>Morus rubra</i>            |

\* Noncommercial tree species.

## Nebraska tree species, continued

| Code | Common Name           | Scientific Name              |
|------|-----------------------|------------------------------|
| 701* | Eastern hophornbeam   | <i>Ostrya virginiana</i>     |
| 731  | Sycamore              | <i>Platanus occidentalis</i> |
| 742  | Eastern cottonwood    | <i>Populus deltoides</i>     |
| 745  | Plains cottonwood     | <i>Populus sargentii</i>     |
| 746  | Quaking aspen         | <i>Populus tremuloides</i>   |
| 752  | Silver poplar         | <i>Populus alba</i>          |
| 753  | Narrowleaf cottonwood | <i>Populus angustifolia</i>  |
| 762  | Black cherry          | <i>Prunus serotina</i>       |
| 763* | Chokecherry           | <i>Prunus virginiana</i>     |
| 766* | Wild plum             | <i>Prunus americana</i>      |
| 804  | Swamp white oak       | <i>Quercus bicolor</i>       |
| 823  | Bur oak               | <i>Quercus macrocarpa</i>    |
| 824  | Blackjack oak         | <i>Quercus marilandica</i>   |
| 826  | Chinkapin oak         | <i>Quercus muehlenbergii</i> |
| 833  | Northern red oak      | <i>Quercus rubra</i>         |
| 835  | Post oak              | <i>Quercus stellata</i>      |
| 837  | Black oak             | <i>Quercus velutina</i>      |
| 839* | Dwarf chinkapin oak   | <i>Quercus prinoides</i>     |
| 901  | Black locust          | <i>Robinia psuedocacia</i>   |
| 921* | Peachleaf willow      | <i>Salix amygdaloides</i>    |
| 922  | Black willow          | <i>Salix nigra</i>           |
| 951  | American basswood     | <i>Tilia americana</i>       |
| 972  | American elm          | <i>Ulmus americana</i>       |
| 974  | Siberian elm          | <i>Ulmus pumila</i>          |
| 975  | Slippery elm          | <i>Ulmus rubra</i>           |
| 977  | Rock elm              | <i>Ulmus thomasi</i>         |

\* Noncommercial tree species.