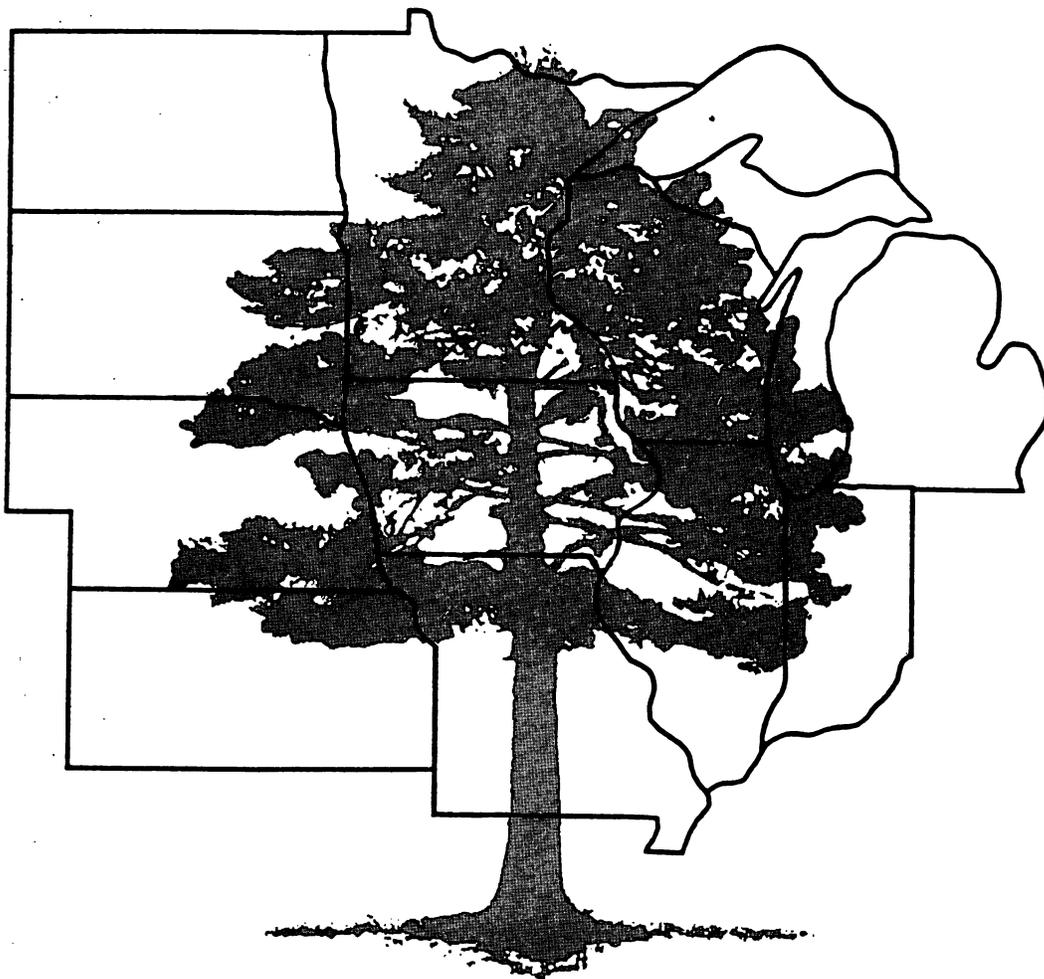


**NORTH CENTRAL REGION
FOREST INVENTORY AND ANALYSIS**

FIELD INSTRUCTIONS



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

NORTH CENTRAL
FOREST EXPERIMENT STATION
FOREST INVENTORY ANALYSIS
FIELD MANUAL

MISSOURI, 1986
MINNESOTA, 1986

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

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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.

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

Most instructions which apply to a new measurement plot will also hold true for a remeasurement plot. When additional information or explanation is needed, it will appear with instructions for that item but for a remeasurement plot.

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

FIELD EQUIPMENT LIST

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

- Pocket 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.) - 1 per crew or vehicle
- Wheeler Pentaprism - 1 per crew or vehicle
- Cruiser's Vest
- Tree Marking Scribe
- Tree Paint
- One Yellow Stake
- Ten Metal Pins
- Flagging
- Safety Pin
- Mini-Caliper
- Data Recorder or field plot sheet

FIELD PROCEDURES

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

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

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

An appropriate 4 digit code (Sequential Plot Number) will be recorded by a photo interpreter to identify consecutive plot numbers in each unit. All plots, both forest and questionable forest, permanent and temporary, office and field, will receive a number. Sequential Plot Numbers will be used to identify sample plots on aerial photographs and county road maps. A plot header sheet must be completed for all plots, forest and non-forest, that are sent to the field.

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

Information obtained on each sample location will be recorded on a data recorder and a plot header sheet. All measurement categories have an "X" for each digit that must be recorded for that entry. The criteria used to determine these measurements can be found in the appropriate sections of this manual. In addition, commonly used codes can be found on each crew member's clip board under the heading "Tatum Guides".

For Remeasurement Plots

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

A check should also be made to see that the plot center is correctly pinpricked on both photos. If the pinpricks are in different locations on the old and new photographs, field inspection will be necessary to ascertain which, if either, of the pinprick locations is correct. If the pinprick on the new photo is grossly incorrect, prick the photo in the correct place, and record the error in the "Notes" section on the plot sheet. Once all photo and plot sheets appear to be in order, the crew can begin location of the plot in the field.

The tallier and cruiser must work together to locate the original trees and then work together adding in new trees in the proper sequence. Each original tree should be checked to see that DBH was measured correctly.

Ownership, Item 1.

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

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

For a remeasurement plot, owner class and tenure will be recorded for any ground land use reclassification that involves removal of timber.... i.e., conversion to cropland, pasture, etc.

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

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

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

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

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

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

Owner tenure is needed only for plots established on commercial forest land. All publicly owned CFL lands will receive an automatic code of 99.

NOTE: Ownership accuracy will be noted on the plot sheet header but not entered in the data recorder for each of these ownership items:

(1) owner name and address (2) owner area class (3) owner tenure, using the following codes:

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

Sample Kind, Item 2.

A one digit code recorded by the photo interpreter.

<u>Code</u>	<u>Description</u>
1	Full New Plot (volume measurements taken)
2	Full Remeasurement Plot (volume measurements taken)
6	Partial Remeasurement Plot (old full measurement plot but new volume measurements not taken)
7	Partial New Plot (volume measurements not taken)
8	Partial Re-established Plot (established at the location of a remeasurement plot not permanently established last time, land use change and disturbance between surveys should be recorded.) In Minnesota these plots were permanently established last time.

On sample kind 6, 7 and 8, items 34-40, sawlog length through cull cubic feet will not be recorded except log grade. Record log grade (Item 37) for plot numbers ending in 3, 6, or 9. In Minnesota all sample kind 1, 2, and 6 plots will receive a log grade.

Sample Kinds - Office use only

5	Reserved Area Plot
9	Undisturbed remeasurement plot (modeled)

Plot Location, item 3.

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

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

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

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

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

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

For remeasurement plots the following procedure should be used:

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

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

In the event that the original S.P. cannot be relocated, or if the S.P. is not suitable, a new starting point should be established. Record the course to sample location, S.P. description, and S.P. DBH on the new plot sheet.

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

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

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

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

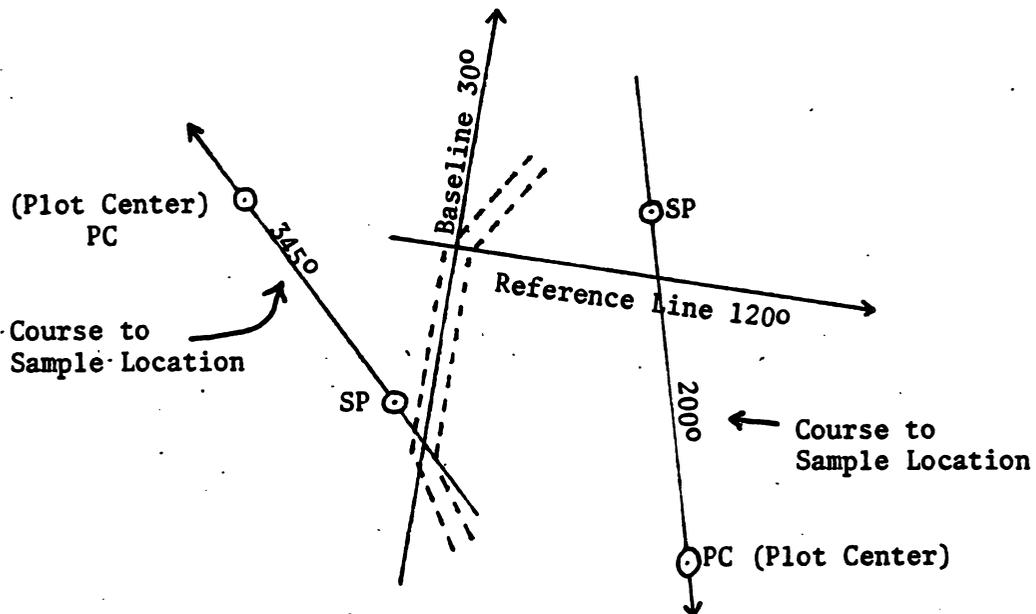
If the base line and the line to the sample location do not intersect on the photograph, draw a straight line that will intersect the base line and the course to sample location line. Indicate the directions of the sample location line and the base line by putting an arrow at the end of each line.

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

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

AZIMUTH CALCULATIONS

Figure 1



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

Chaining. Using compass and tape, run a course on the computed azimuth. Distance correction for slope will be necessary when slope exceeds ten percent. Using the Suunto clinometer the slope correction can be quickly determined and added by the tallier after the cruiser has run out the line. Making adjustments for differences in the height of crew partners the tallier can sight on the cruiser and directly read the percent scale on the clinometer, using the percent slope and the following table (table 1). The correct adjustment to whatever length line was run should be added at the same percent slope.

Slope Correction Table
Table 1

Distance is measured on slope.

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

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

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

Plot Location - Remeasurement: Once the S.P. has been re-established, the crew should chain the computed azimuth and distance along the approach line. Once chaining is completed, the cruiser should mark the location.

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

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

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

For remeasurement plots; if after a thorough search you are unable to locate the plot, bring it to the attention of the person in charge. After two crews have tried finding the plot (as long as there has been no disturbance), establish a new sample kind plot at the correct location. Change the sample kind on the plot sheet to a new full measurement if the old plot was a full remeasurement and to a new partial measurement if the old plot was a partial remeasurement and make a note of the sample kind change in the notes. Where there have been major disturbances and the old plots cannot be found (i.e., the area has been clearcut and bulldozed), a remeasurement should be established as close as possible to the old P.C. All new trees will receive a tree history reflecting ongrowth or ingrowth (31, 32, 61 or 62). Original tree data will be transferred to the data recorder and the current data collected to reflect whether the original trees were cut or dead. Tally items needed for these are listed under Missing Trees and Trees cut since Last Survey.

If a remeasurement plot is found to be put in the wrong location (i.e. not in the same location as the photo pinprick), re-establish the plot in the wrong location. If the error is significant (use the black circle as a guide), repinprick the new photo where the plot is actually located. In the notes section indicate that the plot was put in a different location and record the distance and azimuth (use photo scale) from the original pinprick on the new photo to the location where the plot is actually located. Turn in plots like these to the person in charge. It should be assumed that the plot is located in the correct location unless evidence of the plot is found in the wrong place (i.e., pins, paint or flagging).

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

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

Once an individual point center has been relocated, it should be remarked in the prescribed manner. The crew should then calculate the proper distance and azimuth to point #1, or plot center, and begin to search for plot center. When P.C. is found, it should be remarked in the prescribed manner. If the distance between P.C. and the end of the approach line exceeds 3% of the chaining distance, a turning point needs to be established. The distance and azimuth from the end of the approach line to P.C. should be recorded on the back of the new photo and on the new plot sheet under course to same location. Remove the blue flagging at the turning point location.

It is highly important that each individual point be located as accurately as possible. Finding each point is a challenge, because most of the flagging disintegrates, the wires rust and appear just like twigs or roots, or the point center was never permanently marked. Therefore, the best method is to run out 70 feet from the last point at the proper azimuth, mark the spot, and search by running your hands through the area. If several trees identifiable from the paint are available, use the triangulation method to relocate the point. If this is not possible, due to lack of trees or other extenuating circumstances, locate several adjacent points, and use these to triangulate to the missing point. The general location of the missing point can then be found, thus reducing the area to be searched. Each point after P.C. should be marked in the prescribed manner.

Ground Land Use, item 4.

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

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

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

Use one of the following two digit codes:

Code

20 Commercial forest land: Forest land that is capable of producing in excess of 20 cubic feet per acre per year of roundwood products, excluding fuelwood, and is not withdrawn from timber utilization by statute, administrative designation, or exclusive use for Christmas tree production. (If land is used for grazing, see codes 21 and 59).

- 21 Pastured commercial forest land: Forest land for which the primary use is wood-production, but is used for grazing. (If land is less than 25 percent stocked in growing stock trees, see code 59).
- 22 Plantations: An artificially reforested area sufficiently productive to qualify as commercial forest land, established by planting or by direct seeding. Planted species is not necessarily predominant. For a plantation plot the forest type, stand age, and stand size class should be of the trees planted. If the plantation has failed, give the plot a ground land use of 20. (If land is used for Christmas Tree production, see code 59.)
- 40 Unproductive forest land: Forest land incapable of producing 20 cubic feet per acre per year of roundwood products, excluding fuelwood, because of adverse site conditions. Based on site index under 15 for northern white cedar, under 20 for black spruce and tamarack, under 25 for eastern red cedar and under 35 for all other species. All commercial species must be unproductive.
- 41 Reserved forest land-unproductive: Forest land withdrawn from timber utilization by a public agency or by law but that is incapable of producing 20 cubic feet per acre per year of roundwood products.
- 45 Reserved forest land-productive: Forest land withdrawn from timber utilization by a public agency or by law and sufficiently productive to produce 20 cubic feet per acre per year of roundwood products.
- 46 Christmas Tree Plantations: Forest land sufficiently productive to qualify as commercial forest land but 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.

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

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

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

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

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

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

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

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

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

Nonforest with trees (Tree species present in plot area) has at least one or more 5.0 inch trees occurring on plot area.

Code

51 Cropland with trees

- 52 Improved pasture and rangeland with trees: Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush (less than 16.7 percent stocked with all trees). The 16.7 percent stocking is only a guide, and stocking can be greater when the primary land use is grazing and the pasture is maintained at regular intervals. Examples of pasture maintenance are: (1) bush hogged periodically, (2) maximum height of seedlings 3 to 4 feet and basal scars present on trees as evidence of being bush hogged, (3) 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.
- 55 Marsh with trees: Land that has less than 16.7 percent stocking with live trees; and which characteristically supports low, generally herbaceous or shrubby vegetation and which is intermittently covered with water.
- 56 Narrow windbreaks: A group of trees less than 120 wide feet used for the protection of buildings in use.
- *57 Wide windbreaks: A group of trees greater than 120 feet wide and one acre in size used for the protection of buildings in use. Area would qualify as commercial forest land except that the primary land use is protection of buildings.
- 58 Shelterbelt: A group of trees less than 120 feet wide and used for the protection of soil and cropfields.
- *59 Wooded pasture: Pasture land with more than 16.7 percent stocking in all trees, but less than 25 percent stocking in growing stock (20 class) trees and would qualify as pastured commercial forest land except that the primary land use is grazing. Area is currently improved for grazing by cultivation, seeding, irrigation, ponds, or clearing of trees or brush. Other evidence may be severe compaction of the soil from grazing and heavy browsing of the herbaceous and woody understory. The above should indicate that the primary use of the land is something other than wood production or the protection of buildings. The 25 percent stocking rule will be used to help determine primary land use in fairly homogeneous areas. The 25% rule should be used as a guide in non-homogeneous areas only (i.e. clumps and openings).
- 71 Urban forest land - locationally reserved: Land that would otherwise meet the criteria for commercial forest land, but is in an urban-suburban area surrounded by commercial, industrial, or residential development.

*A plot will be established for plots with land use 57 and 59, and a plot sheet completed.

72 Urban and other with trees: Areas with trees that are developed for residential, industrial, recreational, or other urban uses. For example city parks, cemeteries, or golf courses.

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

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

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

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

Code

- 61 Cropland without trees
- 62 Improved pasture and rangeland without trees
- 64 Idle farmland without trees: Farmland that has not been tended within the last two years and has no trees.
- 65 Marsh without trees
- 66 Other farmland: Including farmsteads and farm buildings.
- 67 Urban and other areas without trees: Areas without trees that are developed for residential, industrial, recreational, or other use than those covered in other land use codes.
- 68 Rights-of-way: Transportation, utility, and communication rights-of-way. These include railroads, powerlines, pipelines, and maintained roads.
- 69 Nonforest without trees (reserved)
- 80 Noncensus Water: A body of water more than 120 feet wide, and one acre in size, but less than 10 chains wide and 40 acres in size (normal water level).
- 90 Census Water: A body of water greater than 10 chains wide and greater than 40 acres (normal water level).

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

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

The following information is for remeasurement plots with ground land use changes and guidelines for collecting tree data and assigning tree histories to these land use change plots.

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

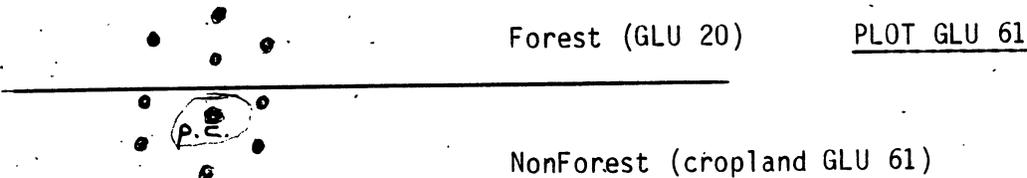
If there has been a land use change from noncommercial or nonforest back to commercial forest, a remeasurement plot will be established and all trees will receive a tree history reflecting ongrowth or ingrowth (31, 32, 61 or 62). For definitions of both ongrowth and ingrowth, see Item 23.

If there has been a land use change from commercial forest land to noncommercial forest or nonforest land, except for wide windbreaks, 57 and wooded pasture, 59, the plot will not be established. For remeasurement sample kinds all trees, tallied at the time of the last survey, will be recorded on the data recorder or plot sheet and be assigned a tree history according to the following guidelines:

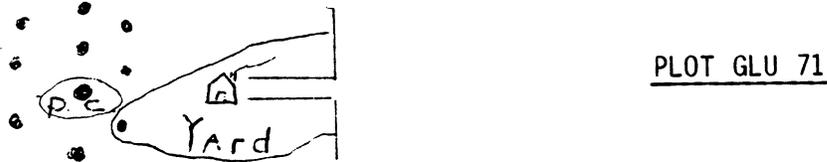
1. For Reserved Areas with the trees still standing (GLU 40, 41, 45) trees will be assigned a tree history of 10 or 20. The information to be recorded for each tree is Item 16, 21, 22, 23 and old tree number. A point that was cover classed will be recorded, Item 16 and 28. For each point, also transfer the original B.A. count, Item 20. Ignore previously dead trees.

2. For Nonforest Areas that are a result of clearing (GLU 61-69, 80, 90) trees will be assigned 18, 19, 28, 29, 48, 49 or 59 depending on whether the cleared trees were utilized or not. Field crews will make their best estimate from owner contact, field examination, etc. in areas where it isn't clear as to utilization. Example - owner says he utilized all the larger oaks and pushed the other trees over to the side of the field. All larger oaks would received a tree history of cut and utilized and other trees would receive a not utilized tree history.

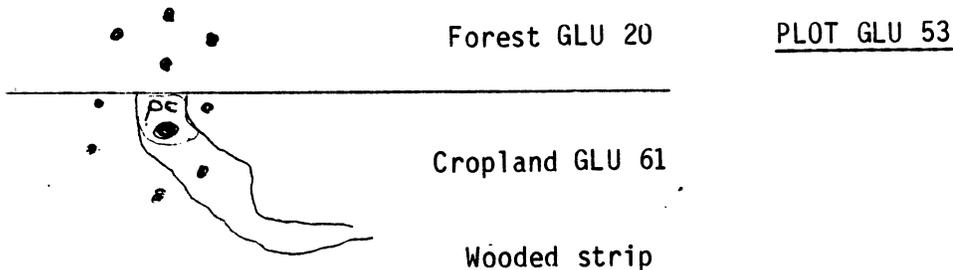
3. For Nonforest Areas that have been partially cleared (possible GLU's 46, 51-56, 58, 61-69, 80, 90) field crews are to ascertain the cause of land use change. St. Paul analysts are mainly interested in getting an estimate of the cut and utilized portion of the sample. Field crews will make an effort to determine the cut and utilized trees and assign them a cut and utilized tree history. See examples below:



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.



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.



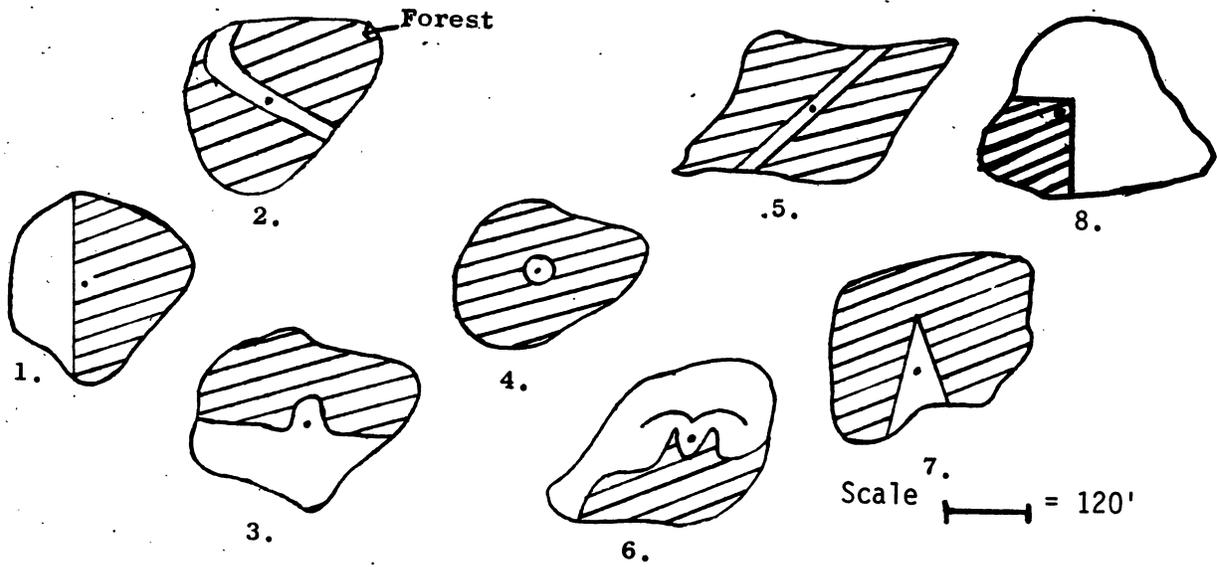
Assign trees on points 1, 2, 3, 4, 6, and 10 a no status tree history (10 or 20). Assign trees on points 5, 7, 8, and 9 a tree history of cut and utilized or cut and not utilized.

The information required for the header is the same for each type of remeasurement plot. Record current estimates of site index, B.A./Acre, Forest Type-Stand Size Class and Stand Age on a nonforest with trees plot. A nonforest without trees plot requires no current B.A./Acre, Forest Type-Stand Size Class or Stand Age.

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

Hatched areas represent forest lands.

Figure 2



Explanation of land use classifications found in figure 2.

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

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

Previous Land Use, Reason for use change, Item 5 (3 digits).

The first two digits are the previous inventory ground land use using current ground land use codes.

The following codes were those used at the previous inventory and are listed here only for explanation purposes.

<u>GLU code</u>	<u>Missouri (1972)</u>	<u>GLU code</u>	<u>Minnesota (1977)</u>
20	Commercial forest land	20	Commercial forest land
21	Pastured commercial forest land	21	Pastured commercial forest land
40	Unproductive forest land	40	Unproductive forest land
50	Productive reserved forest land	45	Productive reserved forest land
51	Christmas tree production land	46	Christmas tree production land
61	Cropland	51	Cropland with trees
62	Improved pasture	52	Improved pasture with trees
64	Idle farmland	53	Wooded strip
65	Marsh	54	Idle farmland with trees
66	Other farmland, including farmstead	58	Windbreak
67	Urban and other	59	Wooded pasture
69	Wooded pasture	61	Cropland without trees
91	Census water	62	Improved pasture without trees
92	Noncensus water	64	Idle farmland without trees
		65	Marsh
		66	Other farmland
		67	Urban and other
		80	Noncensus water
		90	Census water

Third digit - Indicate the process that cause the change with one of the following codes:

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

Aspect, Position, Slope, Slope Shape, and Slope Distance, Item 6

Record the appropriate codes in the header information.

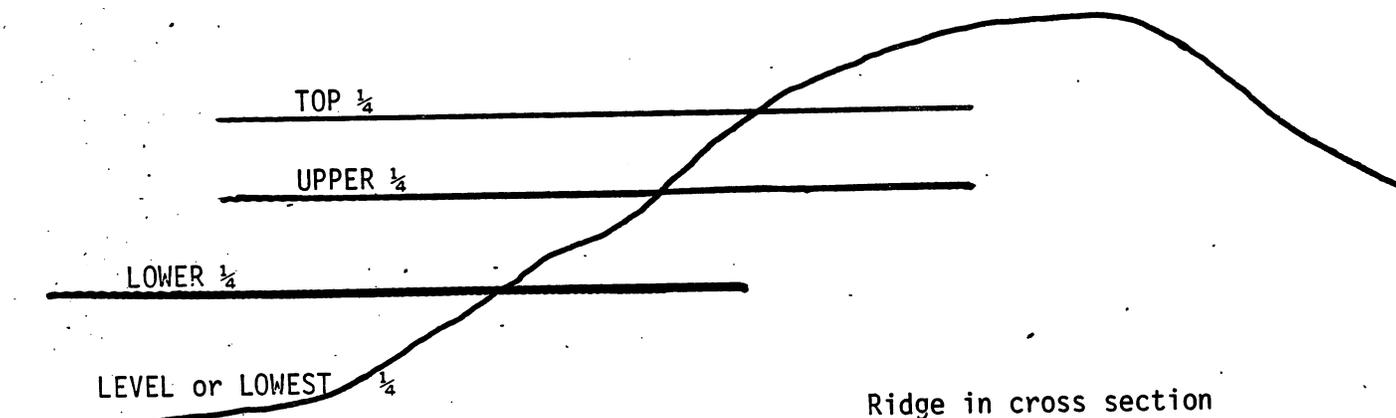
Aspect (3 digits)-represents the direction of drainage for the majority of the sample points, and is recorded as the azimuth of this direction. For instance, if the direction of drainage is 36° , the code is 036. Direction due North will be recorded as 001.

Position (1 digit)-represents the location of the majority of the points in reference to topography of the immediate area. (See exhibit 6.)

<u>Code</u>	<u>Position</u>
1	Top $\frac{1}{4}$
2	Upper $\frac{1}{4}$
3	Lower $\frac{1}{4}$
4	Level or lowest $\frac{1}{4}$

The following example has been included to aid in locating position of plot in reference to topography of the immediate area.

FIGURE 3

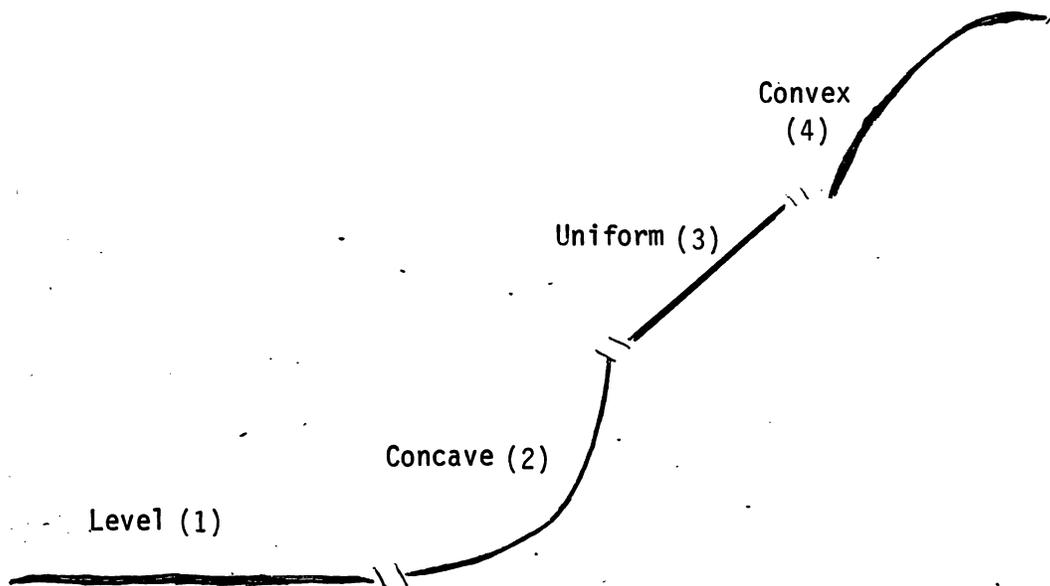


Slope (2 digits)-represents the average percentage of the deviation from horizontal over the entire 10 sample points. Recorded code will be a measure of this percentage. For instance, 35% slope is recorded as 35. All slope percentages 100+% will receive a code 99.

Slope shape (1 digit)-represents the location of Point 1 of the majority of the points in reference to slope shape. A convex shape is usually found on the upper part of a slope and indicates an area with potential erodibility and rapid runoff. A concave shape is found on the lower part of the slope profile and has good water holding capacity for a slope.

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

Figure 4
Slope Shape



Slope length (4 digits)

At plot center or on the slope where the majority of the points fall, look up and down the slope and estimate total slope length to the nearest 1/2 chain (from 0000 to 999.5 chains). Slope length is measured to record the distance from the point where water starts to flow down slope (upper slope - ridge top) to the point where runoff enters a well defined channel, or at the bottom of the slope where deposition beings. For flatland and bottomland, record slope length as 0000.

Physiographic Class, Item 7.

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

Code Physiographic Class

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

Stand Origin, Item 8.

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

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

Stand History, Item 9.

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

For remeasurement plots, this code should reflect any changes since the last inventory. Stand history cannot exceed the remeasurement period.

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

First digit (what happened)

Code

- 0 No Disturbance: No evidence to indicate any of the following:
- 1 Grazing: Significant disturbance has been caused by livestock grazing. Evidence of livestock grazing would include: the absence of an understory, exposed tree roots and mineral soil, dead standing timber, severe erosion and cow patties.
- 2 Timber Stand Improvement: There is evidence that some trees have been deadened or removed (or vines cut) through some type of precommercial thinning, pruning, or selective firewood harvest.
- 3 Commercial Clear Cut: All merchantable stems, or stems down to some minimum diameter have been removed. Some large diameter cull-trees may have been left, but in general all merchantable material has been removed.
- 4 Partial Harvest Cut: Less than 50% of merchantable stems have been removed. Usually only large diameter, old, or otherwise high value stems are removed in this type of cut.
- 5 Natural: Significant disturbance has been caused by fire, wind, insect or disease agents.
- 6 Man-Caused: Significant disturbance has resulted directly or indirectly as a result of human activities (e.g., alteration of natural drainage, chemical spraying, salt damage from oil wells, or acid water run off, etc.
- 7 Planting of Forest Land:
- 8 Planting of Non-Forestland: 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. This would include old field sites.

Second digit (how long ago)

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

Seed Source, Item 10.

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

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

Code Seed Source

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

Conifer Understory, Item 11 (4 digits).

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

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

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

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

Photo Age, Item 12.

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

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

Date of Survey, Item 13.

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

First two digits

Second two digits

<u>Code</u>	<u>Month</u>	<u>Code</u>	<u>Year</u>
01	January	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, 1987 would be coded 0687.

Recreational Opportunities, item 14

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

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

Code

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

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

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

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

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

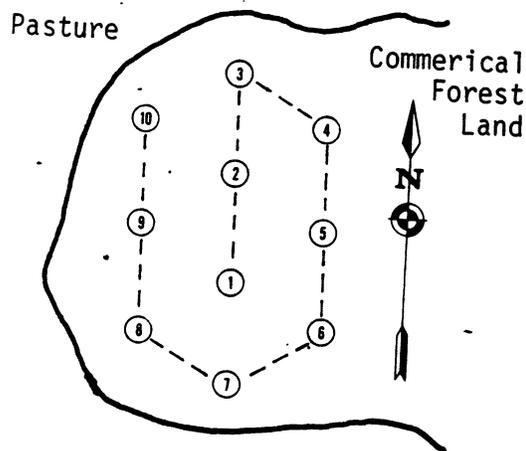
All denied access plots should have a posting code other than 0. Personal contact with the Landowner and his refusal to grant permission to go on his land is the only way a plot can be called a denied access plot.

Plot Design, Item 16.

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

Figure 5

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



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

Point Class Record, Point Type/Size. A point class record for each point 1 through 10 will be recorded. If the forest type and/or stand size class for the point is noticeably different than the general type/size for the plot, as evidenced by a noticeable type and/or size change while traversing the plot, record this in item 27, Damage/Death. The point forest type must meet minimum area classification requirements of 1-acre and 120 feet in width to qualify as a separate type. Looking at the plot location on the air photo can also help to determine if type and size are different on some of the points.

Record forest type in the first 2 digits and stand size in the 3rd. The point class record should also be used to record cover class if no live trees are recorded at the point using cover class codes found in Item 28 and for the basal area tree count, Item 20. If a different forest type does occur on the plot, sketch the location on the plot layout on the plot header sheet.

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

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

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

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

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

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

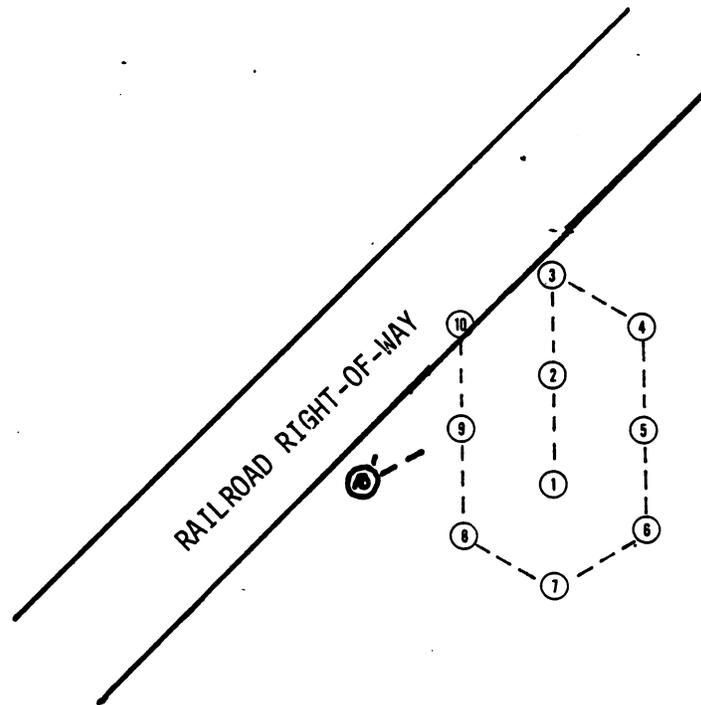
When a substitute point is used, show its location in the "Notes" section on the back of the plot sheet, and on the sketch.

For remeasurement plot points on the previous survey that were placed on commercial forest land that are presently nonforest or noncommercial forest land, all trees 1.0" DBH or larger that were tallied as live on the last survey must be accounted for. Assign these trees a tree history code of 10, 20, 40, 50, 17, 18, 19, 27, 28, 29, 48, or 59 according to the same guidelines as on page 7, item 4, and transfer the original information to the data recorder, item numbers 16, 21, 22, 23, and 25 originals. Then, the crew must rotate the point. This new substitute point is then measured according to remeasurement standards, and all trees tallied on the substitute point will receive a tree history reflecting ongrowth or ingrowth (code 31, 25, 32, 34, 61, 62, 64 or 65). Continue the tree numbers on the substitute point where they left off on the original point.

For points that were rotated out or nonforest or noncommercial forest which has since turned to commercial forest land, remeasure the substitute point.

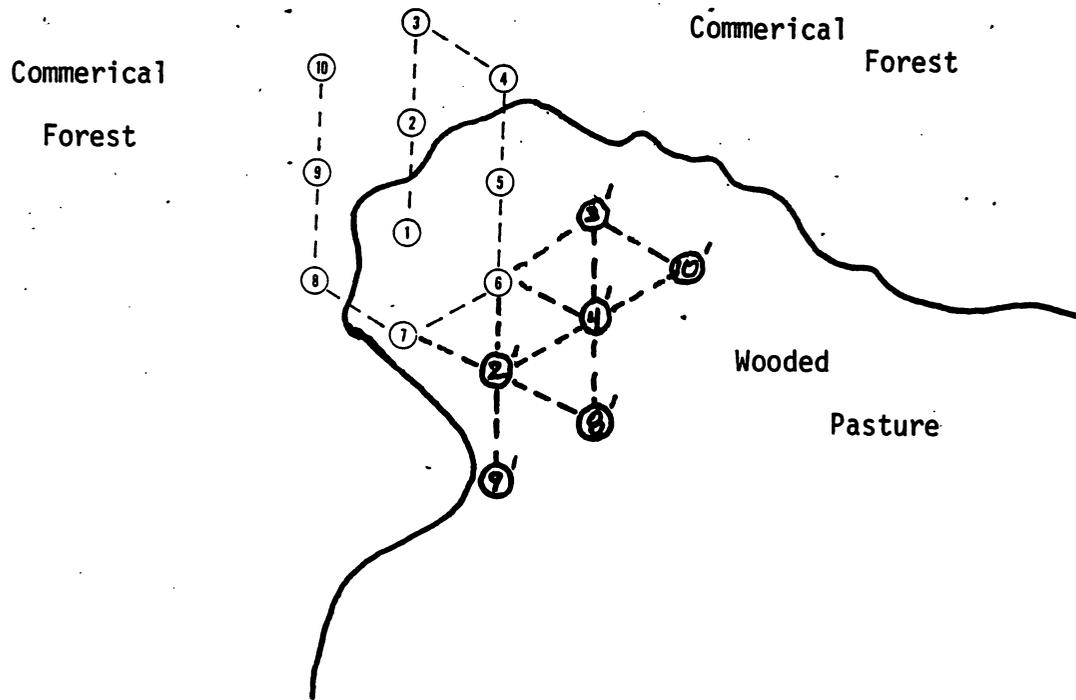
Following are examples of substitute points:

Figure 6



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

Figure 7



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

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

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

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

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

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

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

All established plots will be witnessed.

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

For remeasurement plots, the witness trees established on the last survey must be located and inspected. Remeasure and rescribe at DBH and the base if they are still suitable witness trees. If the witness trees are missing or in poor shape (not expected to live until the next survey), select new witness trees.

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

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

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

Record the Point Number and Azimuth, distance and d.b.h. to the reference in the reference tree section on the plot header sheet.

TALLY ITEMS

Biomass Study (Shrubs), Item 17.

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

Point Number 1, 2, or 3

Tree number starting at 51 and increasing for each point. Each species diameter class will have a tree number.

Species. (See list).

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

Diameter (use the following codes in the DBH column)

Tree History 80

Tree History 81

<u>Code</u>	<u>Diameter measured along stem 6" from ground</u>	<u>Code</u>	<u>% ground cover</u>
001*	0.0- .19"	001	solitary plant, 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 6" tall.

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

Note: Only seedlings may be recorded twice, once on the Biomass Study (with a number of 51+) and also on the 6.8 foot fixed radius plot if there are no trees 5.0" DBH on the point. Any tree 1.0" DBH or larger on the point will not be recorded in the Biomass Study.

Missouri Biomass List (Shrubs), Item 17.

(Includes all commercial and noncommercial tree species and appropriate codes (see Item 22.)

<u>Code</u>	<u>Tree History</u>	<u>Common Name</u>	<u>Scientific Name</u>
355	81	Cane	Arundinaria gigantea
463	80	Dwarf hackberry	Celtis tenuifolia
*490	80	Dogwood	Cornus spp.
591	80	American Holly	Ilex opaca
592	80	Winterberry, Black-alder	Ilex verticillata
594	80	Possumhaw	Ilex decidua
595	80	Hydrangea	Hydrangea arborescens
603	80	Spicebush	Lindera benzoin
712	81	Virginia creeper	Parthenocissus spp.
748	81	Meadowsweet, Spiraea	Spiraea spp.
768	80	Devil's walking stick	Aralia spinosa
*853	80	Witch-hazel	Hamamelis virginiana
854	80	Ninebark	Physocarpus opulifolius
855	80	Serviceberry, Juneberry	Amelanchier spp.
*856	80	Hazelnut	Corylus spp.
857	80	Prickly ash	Xanthoxylum americanum
859	80	Buckthorn	Rhamnus spp.
*862	80	Viburnum, Nannyberry	Viburnum spp.
863	80	Elderberry	Sambucus spp.

* indicates species of particular interest to wildlifera

Missouri Biomass List (continued)

<u>Code</u>	<u>Tree History</u>	<u>Common Name</u>	<u>Scientific Name</u>
*864	80	Sumac	Rhus spp.
865	81	Gooseberry, Black currant	Ribes spp.
*867	81	Blackberry, Dewberry, Raspberry	Rubus spp.
*868	81	Rose	Rosa spp.
869	80	Shrubby trefoil	Ptelea trifoliata
870	80	American bladdernut	Staphylea trifolia
873	81	Black Huckleberry	Gaylussacia Baccata
874	81	Blueberry, Farkleberry	Vaccinium spp.
*876	81	Honeysuckle	Lonicera spp.
*877	81	Snowberry, Buckbrush, Coralberry	Symphoricarpos spp.
*881	81	Multiflora rose	Rosa multiflora
902	81	Poison ivy	Rhus radicans
907	80	New Jersey tea	Ceanothus americanus
912	80	Buttonbush	Cephalanthus occidentalis
917	80	Wahoo	Euonymus spp.
920	80	Willow	Salix spp.
*932	81	Greenbrier	Smilax spp.
934	80	Kudzu-vine	Pueraria lobata
*982	81	Grape	Vitis spp.
997	80	Other species	(Tall, woody perennials)
998	81	Other species	(Other perennials)

*Indicates species of particular interest to wildlifere.

Minnesota Biomass List (Shrubs), Item 17.

(Includes all commercial and noncommercial tree species and appropriate codes (see Item 22.) Record shrub data on remeasurement plots only.

<u>Code</u>	<u>Tree History</u>	<u>Common Name</u>	<u>Scientific Name</u>
230	81	Yew	Taxus canadensis
356	80	Alder species	Alnus spp.
380	80	Bog birch	Betula pumila
492	80	Red osier dogwood	Cornus stolonifera
493	80	Alternate-leafed dogwood	Cornus alternifolia
494	81	Bunchberry	Cornus canadensis
500	80	Hawthorn	Crataegus spp.
712	81	Virginia creeper	Parthenocissus spp.
749	81	Labrador tea	Ledum groenlandicum
750	81	Leatherleaf	Chamaedaphne calyculata
751	81	Bog laurel	Kalmia polifolia
849	81	Sweetfern	Comptonia peregrina
853	80	Witch hazel	Hamamelis virginiana
854	80	Common ninebark	Physocarpus opulifolius
855	80	Juneberry	Amelanchier spp.
856	80	Beaked hazel	Corylus cornuta
857	80	Prickly ash	Xanthoxylum americanum
858	80	American hazel	Corylus americana
859	80	Buckthorn species	Rhamnus spp.
861	80	Leatherwood	Dirca palustris
862	80	Viburnum, Nannyberry	Viburnum spp.
863	80	Elderberry	Sambucus spp.

Minnesota Biomass List (continued)

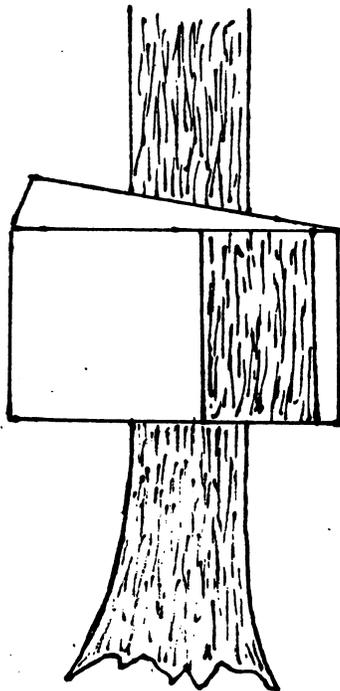
<u>Code</u>	<u>Tree History</u>	<u>Common Name</u>	<u>Scientific Name</u>
864	80	Sumac	Rhus spp.
865	81	Gooseberry-currant	Ribes spp.
867	81	Raspberry-Blackberry	Rubus spp.
868	81	Rose	Rosa spp.
870	80	American bladdernut	Staphylea trifolia
874	81	Blueberry, Bilberry	Vaccinium spp.
875	81	Bush honeysuckle	Diervilla lonicera
876	81	Honeysuckle	Lonicera spp.
880	80	Buffaloberry	Shepherdia spp.
902	81	Poison ivy	Rhus radicans
907	80	New Jersey tea	Ceanothus americanus
913	80	Russian or Autumn olive	Eleagnus spp.
932	81	Greenbrier	Smilax spp.
978	81	Bog rosemary	Andromeda glaucophylla
979	80	Willow species (clumped)	Salix spp.
980	80	Willow species (single stemmed)	Salix spp.
982	81	Grape	Vitis spp.
984	81	Strawberry	Fragaria spp.
997	80	Other species	(Tall, woody perennials)
998	81	Other species	(Other perennials)

Variable Radius Plot, Item 18.

All trees 5.0" DBH and larger (except dead trees not qualifying as mortality or salvable-mortality) will be tallied if the tree is within the limiting distance of the 37.5 basal area factor prism. Example 18 illustrates trees that are within the variable plot, outside the variable plot, and those that are questionable. Questionable trees will be checked for their limiting distance. The limiting distance is the horizontal distance from the pin to the center of the tree at DBH. For example, a tree with a DBH of 14.6", is 20.7 feet, using a basal area factor of 37.5. Table 2 shows the limiting distances for the 37.5 basal area factor prism.

Figure 8

Within the variable plot



Outside the variable plot

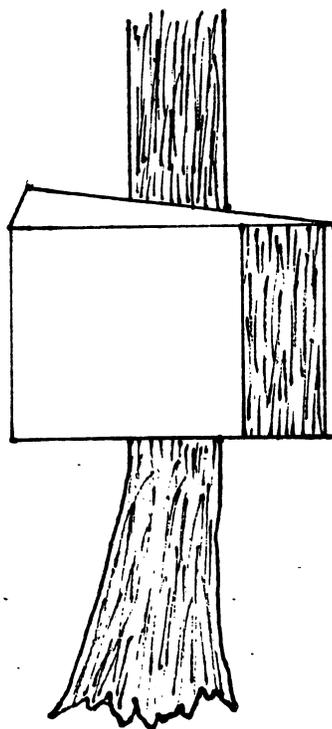


Figure 8 continued

Questionable tree

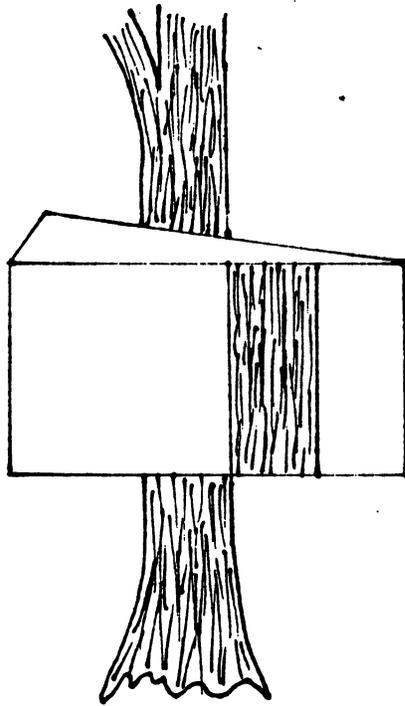


TABLE 2

Limiting distances for B.A.F. 37.5 prism

(1.421 feet per inch DBH)

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

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

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

Saplings - Points 1-10. Tally all live saplings (trees ≥ 1.0 " DBH, but < 5.0 " DBH) within the fixed radius plot.

Seedlings - Points 1-10. If not enough saplings are present to reach 16% stocking, record live seedling (trees < 1.0 " DBH) data until 16% stocking is reached on that point.

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

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

- 1) 20 class commercial tree species
- 2) non-commercial tree species
- 3) poorly formed or diseased commercial tree species

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

- 1) The center of the stump is within 16.6' horizontal distance of the point center.
- 2) The stump is from a tree that was cut within 3 years of the date of the fieldwork.
- 3) The stump is from a tree that has a stump diameter greater than or equal to 3.0 inches 1' off the ground.

Stump height and diameters will be taken at the same point on the stump. Make sure the point selected has minimal natural or mechanical distortion. Record stump diameter in the diameter breast high (DBH) column. Record stump height to the last .1' in the bole length column. Beaver cut trees are recorded as mortality and/or salvable mortality (if applicable), not as stumps. Record cause of death for salvable dead trees (codes 07, 17, 27).

For remeasurement plots:

- 1) Only stumps of trees recorded last time will be measured.
- 2) For remeasurement plot stumps, record tree history (code 7, 8, or 9) and old (previous inventory) d.b.h.

3) It is not necessary to record stump height or stump diameter for remeasurement plot stumps.

Basal Area Count, Item 20.

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

Tree Number, Item 21.

Record a 2-digit code for all line entries including trees and stumps, point number with or without a cover class, and all biomass entries. Site trees for the plot will also be given tree numbers.

For each point:

Numbers from 01-39 will be assigned consecutively for trees and stumps.

Number 40 will be assigned to the point class record with or without a cover class.

Numbers 51-99 will be assigned consecutively for all biomass entries.

For the plot

Numbers 41-49 will be assigned to the plot site trees.

For remeasurement plots

Number previously measured trees using old tree number. Stumps, dead trees and seedlings on the old tally sheet will be disregarded and their old tree numbers not used. New trees (ongrowth and ingrowth) will be numbered consecutively proceeding clockwise from 0 azimuth starting with the next available tree number.

Following are additional instructions (A-J) for remeasurements in reference to tallying trees and tree history codes.

A. 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 DBH and old tree number. These items should be zeroed out. All seedlings will receive an ingrowth tree history (31 or 32).

B. Original Tally Trees Still Alive (Tree History Codes 10, 11, 12, 20, 21 and 22): All live trees tallied as live at the last survey must be accounted for, old tree number and old DBH transferred to the data recorder from the plot sheet, and all new items completed to survey standards. Use the proper tree history code to reflect both the original and current tree conditions. All entries except no status trees will be filled in according to guidelines set for sawtimber, pole timber and sapling sized trees.

C. Missing Trees (Tree History Codes 14, 15, 17, 18, 19, 25, 27, 28 and 29):
Live trees tallied on the last survey, but now missing, must be accounted for and classified as dead or cut. See Section D. and E. for required tally items.

D. Trees Alive at the Last Survey, Now Dead (Tree History Codes 14, 15 and 25):
All trees tallied as live on the last survey that have since died qualify as mortality trees. Standards for salvable-mortality trees remain the same as for a regular plot. Trees qualifying as mortality or salvable-mortality will require the following entries on the data recorder:

Pole-sized trees--enter Items 16, 21, 22, Old Tree Number (from cribsheet), 23, 25 (original and current), 27, 28 (current), 33, (38, 39 and 40 on sample kind #2 only).

Sawtimber-sized trees--enter Items 16, 21, 22, Old Tree Number (from cribsheet), 23, 25 (original and current), 27, 28 (current), 33, (34, 35, 36, 38, 39, 40 on sample kind #2 only).

For trees under 5.0" DBH--enter Items 16, 21, 22, Old Tree Number, 23, 25 (original and current), 27, 28 (original), zero out Items 33 through 40.

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

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

E. Trees Cut Since Last Survey (Tree History Codes 17, 18, 19, 27 and 29): For trees that were tallied as live on the last survey and have been cut since that time, record the following items on the data recorder: 16, 21, 22, Old Tree Number, 23, 25 (original). Stumps of live trees tallied on the last survey need to be tallied on remeasurement plots. There is no 16.6 foot fixed radius plot for stumps. For salvaged dead trees (17 and 27), record cause of death. If there is no way to determine cause of death, record unknown (code 70) but make an effort, especially in recently dead trees.

F. Stumps and Seedlings Tallied at Time of Last Survey: Stumps and seedlings from previous inventory will be disregarded and their entry not transferred to the remeasurement plot sheet.

G. Trees Tallied or Omitted from the Last Survey By Error: We will assume that the work completed on the last survey was done as accurately as possible and was correct.

Record trees and tree history codes as they are even if you are suspicious or positive that an error was made on the last survey.

Three situations will arise:

1. (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.

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

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

H. 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 such things as 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 on the last survey and displaced off of the plot will be considered no status trees. They will receive a tree history of 10 or 20. Record Item #'s 16, 21, 22, 23, (25 original, old tree number) on the data recorder. No current information needs to be recorded. Be sure to adequately explain the exact circumstances in the "Notes" section of the plot sheet. Trees tallied live on the last survey, now dead and displaced off of the plot, will be tallied as dead trees.

I. Dead Trees (Tree History Codes 44, 45, 54, 55, 48, 49, 59): Trees $\geq 5''$ and dead on the original survey will be accounted for if they are still standing or if they have been cut. Salvability standards remain the same. Items required are the same as for (D) trees alive last survey, now dead. Cause of death, Item 27, should be transferred from old plot sheet. Dead trees last survey, now on the ground or missing (rotted away) can be disregarded.

J. Ongoingrowth or Ingrowth Dead trees Codes 64, 65, 34, 35): Trees $\geq 5''$, and too small at time of last survey, and have grown onto the plot and are dead, will be recorded. Use of code 34 or 35 is possible but not very likely; the only case being a tree in the 6.8 plot that attained 5.0", died, and was displaced off stick.

Tree Species, Item 22

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

The tree species for remeasured trees should be inspected and corrected if necessary. Assign tree species codes as needed for new trees. Those trees identified as noncommercial species on the prior survey (species-code 999) which are now considered as shrubs can be dropped from the sample, and need not be accounted for. Code 999 cannot be used. Tree species coded 999 last time must be given their proper species code on the current survey. If the tree is missing, the tallier should use his best judgment in assigning a species.

Missouri Tree Species List

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
068	Eastern redcedar	Juniperus virginiana
110	Shortleaf pine	Pinus echinata
221	Baldcypress	Taxodium distichum
313	Boxelder	Acer negundo
314	Black maple	Acer nigrum
316	Red maple	Acer rubrum
317	Silver maple	Acer saccharinum
318	Sugar maple	Acer saccharum
331	Ohio buckeye	Aesculus glabra
373	River birch	Betula nigra
391	*American hornbeam	Carpinus caroliniana
401	Water hickory	Carya aquatica
402	Bitternut hickory	Carya cordiformis
403	Pignut hickory	Carya glabra
404	Pecan	Carya illinoensis
405	Shellbark hickory	Carya laciniosa
407	Shagbark hickory	Carya ovata
408	Black hickory	Carya texana
409	Mockernut hickory	Carya tomentosa

* Noncommercial tree species

Tree species, Item 22

Missouri Tree Species List

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
423	Ozark Chinkapin	Castanea ozarkensis
452	Northern catalpa	Catalpa speciosa
462	Hackberry, Sugarberry	Celtis spp.
471	*Eastern redbud	Cercis canadensis
491	Flowering dogwood	Cornus florida
500	*Hawthorn	Crataegus spp.
521	Common Persimmon	Diospyros virginiana
531	American beech	Fagus grandifolia
541	White ash	Fraxinus americana
544	Green ash	Fraxinus pennsylvanica
546	Blue ash	Fraxinus quadrangulata
552	Honeylocust	Gleditsia triacanthos
571	Kentucky coffeetree	Gymnocladus dioicus
601	Butternut	Juglans cinerea
602	Black walnut	Juglans nigra
611	Sweetgum	Liquidambar styraciflua
621	Yellow-poplar	Liriodendron tulipifera
641	*Osage orange	Maclura pomifera
651	Cucumbertree	Magnolia acuminata
660	*Apple, crabapple	Malus spp.
681	White mulberry	Morus alba
682	Red mulberry	Morus rubra

* Noncommercial tree species

Tree species, Item 22

Missouri Tree Species List

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
691	Water tupelo	<i>Nyssa aquatica</i>
693	Black tupelo	<i>Nyssa sylvatica</i>
694	Swamp tupelo, blackgum	<i>Nyssa sylvatica</i> , var. <i>biflora</i>
701	*Eastern hophornbeam	<i>Ostrya virginiana</i>
731	American sycamore	<i>Platanus occidentalis</i>
742	Eastern cottonwood	<i>Populus deltoides</i>
762	Black cherry	<i>Prunus serotina</i>
766	*Wild plum	<i>Prunus americana</i>
767	*Paw paw	<i>Asimina triloba</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, jack oak	<i>Quercus ellipsoidalis</i>
812	Southern red oak	<i>Quercus falcata</i>
813	Cherrybark oak	<i>Quercus falcata</i> var. <i>pagodifolia</i>
817	Shingle oak	<i>Quercus imbricaria</i>
822	Overcup oak	<i>Quercus lyrata</i>
823	Bur oak	<i>Quercus macrocarpa</i>
824	Blackjack oak	<i>Quercus marilandica</i>
825	Swamp chestnut oak	<i>Quercus michauxii</i>
826	Chinkapin oak	<i>Quercus muehlenbergii</i>

* Noncommercial tree species

Tree species, Item 22

Missouri Tree Species List

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
830	Pin oak	Quercus palustris
831	Willow oak	Quercus phellos
833	Northern red oak	Quercus rubra
834	Shumard oak	Quercus shumardii
835	Post oak	Quercus stellata
837	Black oak	Quercus velutina
901	Black locust	Robinia pseudoacacia
921	*Peachleaf willow	Salix amygdaloides
922	Black willow	Salix nigra
926	*Gumbumelia	Bumelia lanuginosa
931	Sassafras	Sassafras albidum
951	American basswood	Tilia americana
971	Winged elm	Ulmus alata
972	American elm	Ulmus americana
974	Siberian elm	Ulmus pumila
975	Slippery elm	Ulmus rubra
977	Rock elm	Ulmus thomasii

* Noncommercial tree species

Minnesota Tree Species List, Item 22

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
012	Balsam fir	Abies balsamea
068	Eastern redcedar	Larix laricina
071	Tamarack	Juniperus virginiana
094	White spruce	Picea glauca
095	Black spruce	Picea mariana
105	Jack pine	Pinus banksiana
125	Red pine	Pinus resinosa
129	White pine	Pinus strobus
130	Scotch pine	Pinus sylvestris
241	Northern white-cedar	Thuja occidentalis
313	Boxelder	Acer negundo
314	Black maple	Acer nigrum
315	*Striped maple	Acer pennsylvanicum
316	Red maple	Acer rubrum
317	Silver maple	Acer saccharinum
318	Sugar maple	Acer saccharum
319	*Mountain maple	Acer spicatum
341	*Ailanthus, tree-of-heaven	Ailanthus altissima
371	Yellow birch	Betula alleghaniensis
373	River birch	Betula nigra
375	Paper birch	Betula papyrifera
391	*American hornbeam	Carpinus caroliniana

* Noncommercial tree species

Minnesota Tree Species List - continued

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
402	Bitternut hickory	<i>Carya cordiformis</i>
407	Shagbark hickory	<i>Carya ovata</i>
462	Hackberry	<i>Celtis occidentalis</i>
500	*Hawthorn	<i>Crataegus</i> spp.
541	White ash	<i>Fraxinus americana</i>
543	Black ash	<i>Fraxinus nigra</i>
544	Green ash	<i>Fraxinus pennsylvanica</i>
571	Kentucky coffeetree	<i>Gymnocladus dioica</i>
601	Butternut	<i>Juglans cinerea</i>
602	Black walnut	<i>Juglans nigra</i>
660	*Apple	<i>Malus</i> spp.
701	*Eastern hophornbeam	<i>Ostrya virginiana</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 pennsylvanica</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>
809	Northern pin oak	<i>Quercus ellipsoidalis</i>

* Noncommercial tree species

Minnesota Tree Species List - continued

<u>Code</u>	<u>Common Name</u>	<u>Scientific Name</u>
823	Bur oak	Quercus macrocarpa
833	Northern red oak	Quercus rubra
837	Black oak	Quercus velutina
851	*Mountain ash	Sorbus
921	*Peachleaf willow	Salix amygdaloides
922	Black willow	Salix nigra
951	American basswood	Tilia americana
972	American elm	Ulmus americana
975	Slippery elm	Ulmus rubra
977	Rock elm	Ulmus thomasii

* Noncommercial tree species

Tree History, Item 23.

Record a 2-digit code for tree history.

Remeasurement Plots-First digit describes previous tree history, second digit describes current tree history. Ingrowth and ongrowth are explained below.

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

All ingrowth trees must be tallied on points 1-10. Seedlings need only be tallied on points with no trees >5.0 " DBH. Assign ingrowth tree history (31, 32, 34 or 35) according to present tree class.

B. Ongrowth: Ongrowth trees are defined as those trees that were too small to be included on the variable radius plot on the prior survey, but are now large enough to qualify for prism count. All ongrowth trees must be tallied on points 1-10. Trees >1.0 " DBH tallied as live on the last survey cannot receive a tree history of ongrowth. Assign ongrowth tree history (61, 62, 64 or 65) according to present tree class.

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

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

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

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

0 - is only valid as the first digit of tree history on nonremeasurement plots and the second digit on remeasurement plots that have points or plots no longer commercial forest land, (i.e. "01" is a live growing stock tree on a non-remeasurement plot, "20" is a cull tree at the time of the previous survey which is currently on non-commercial forest land). On remeasurement plots or points that have been cleared and are no longer CFL, record the appropriate code for cut and utilized or not utilized in the second digit of each tree.

Tree Distance, Item 24.

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

Diameter Breast High (DBH), Item 25.

Record a 3-digit code for each tree tallied. DBH is recorded to the last 0.0". The 6.1" diameter class coded as 061, for example, should include trees 6.10" in diameter up to, but not including, trees 6.20" in diameter. Record code 000 for trees with a DBH less than 1.0"

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

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

On the side of the tree facing point center paint a 2" horizontal scribed mark just above the upper tape at the point where DBH is measured. Within the 1' stump facing point center, paint a 2" vertical scribed mark to facilitate remeasurement plotwork, in the event the tree is cut. Do not scribe small, thin-barked trees.

Figures 9 and 10 illustrate the proper methods for obtaining DBH.

Cruisers should use their judgement to determine if trees that appear to have forked above DBH originated from a fork below DBH (use obvious separations and cracks as a guide).

DBH for remeasurement plots

A. Original: Transfer any original DBH that appears to have been correct as it appears on the original plot sheet. For obvious errors both in placement and measurement of the original DBH, correct the entry using the method outlined below.

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

If the previous measurement was taken on a deformity, or cannot be located, or another error was made, move the current DBH to the correct place on the bole, and record the new measurement. Keep in mind that the original DBH has to be correct as well when an error was made on the last survey. The original DBH can be corrected by measuring the current DBH at the correct spot, boring the tree, and subtracting the appropriate diameter growth according to the number of years elapsed since the last survey. In all cases, the new and old DBH's should be closely compared to see if they are reasonable. Watch for both excessive growth and too little growth in case the DBH was recorded incorrectly. Use alternative method if possible, because boring plot trees is not a good idea.

An alternative method for correcting mistaken original DBH's is to measure the place where the original DBH was taken. Then, measure the correct DBH location. Subtract the original, incorrect DBH from the current incorrect DBH to obtain a "correction factor". By subtracting this "correction factor" from the current correct DBH, a more accurate original DBH is obtained. This method should not be used when there is not uniform taper of the tree bole. The boring method described above should be used in these cases. Record the height where DBH is taken for all trees not taken at 4 $\frac{1}{2}$ feet above Mother Earth.

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

Figure 9

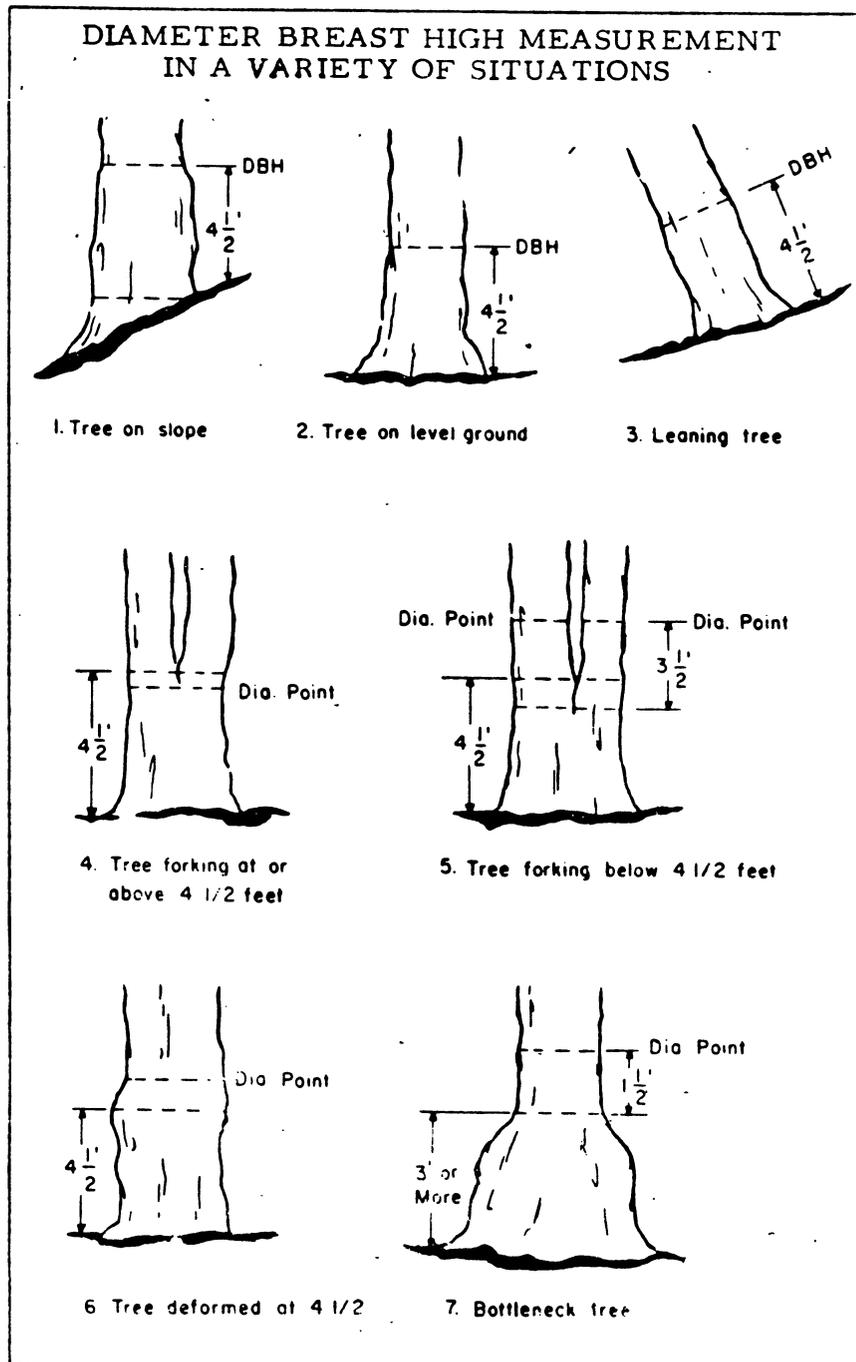
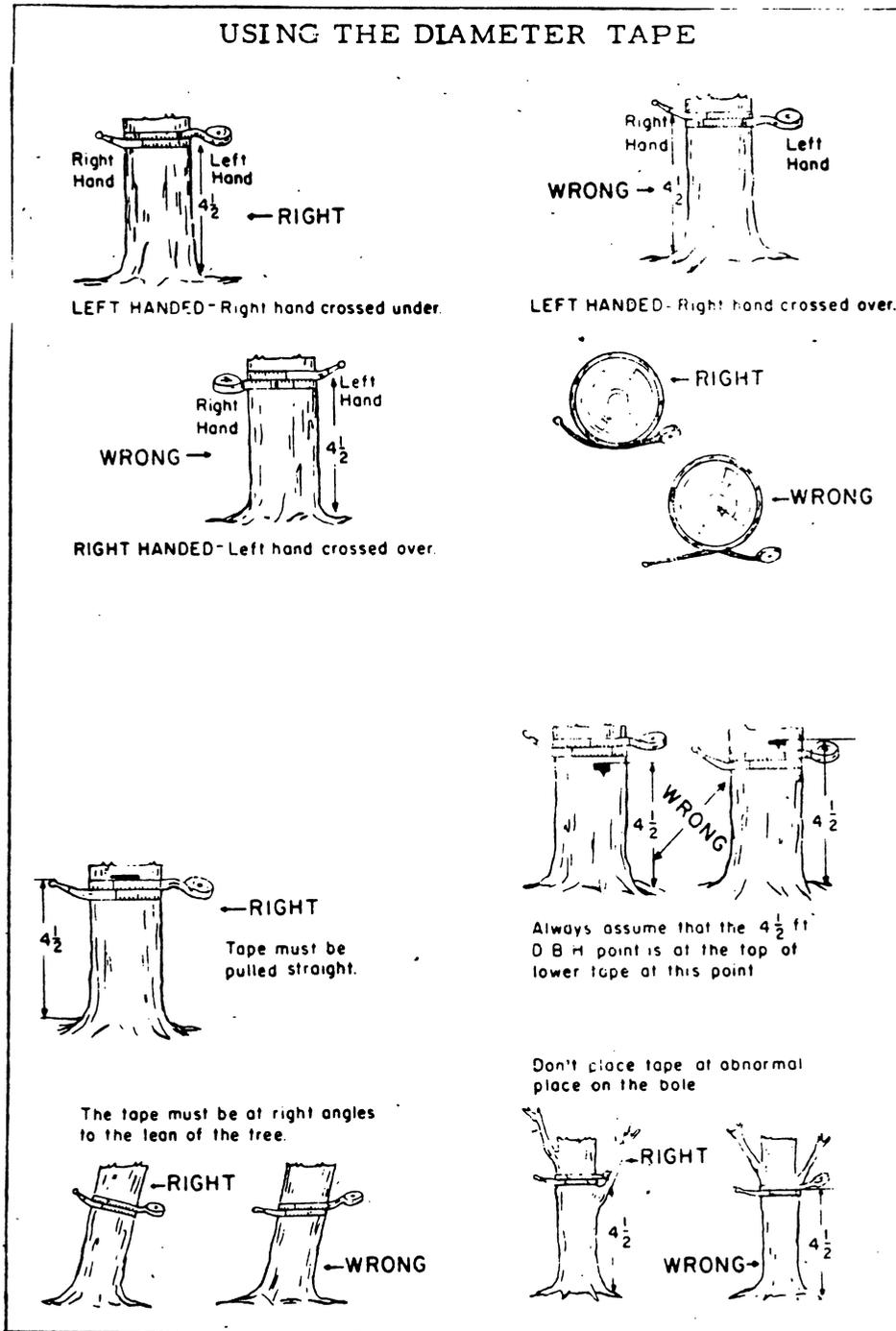


Figure 10



Tree Azimuth, Item 26.

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

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

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

For remeasurement plots, record azimuths at the time of remeasurement.

Damage or Cause of Death, Item 27.

Damage. For live trees record presence of damage or pathogen activity if serious enough to reduce the quality or vigor of the tree. Identifying the presence of any of these diseases will be sufficient reason to record them as a damage. Extensive damage by insects should be noted in the "Notes" section of the plot sheet. Also record extensive disease occurrence in the notes section. Cull trees (except noncommercial species) must have a damage code other than 000. When a tree is damaged by more than one agent, code the most severe damage. Seedlings and saplings, unless a specific damage is observed, should be considered growing-stock trees. Excessive sweep and crook will not be considered a specific damage code on seedlings and small saplings (3.0 inches or smaller). A damage code will not be recorded to indicate the reason for not qualifying as a better quality log grade.

Record presence of pathogens or damage using the following 3-digit code:

<u>Code</u>	<u>Disease or damage</u>	<u>Susceptible species</u>
100	Insects- General - Other Known List in Remarks	All
101	Unknown - Insect	"
110	Wood borers	"
120	Root collar borers	Conifers
130	Bark beetles	All
140	Terminal and shoot insects	Conifers
141	Spittlebugs - Saratoga	"
142	White pine weevil	"
143	White pine weevil & WPBR	WP
150	Defoliators	All
151	Sawflies	"
152	Budworm	Conifers
153	Pine tussock moth	"
154	Forest tent caterpillars	Hdwds.
155	Gypsy moth	"
156	Fall defoliator complex	"
200	Disease - General - Other Known List in Remarks	All

201	Unknown - Disease	All
202	Heart rot	"
203	Needlerusts & needlecasts	Conifers
204	Wilts	Oak, elm
210	<u>Phellinus</u> trunk rot	Aspen
211	<u>Phellinus</u> predominant, some <u>Hypoxyton</u>	"
220	<u>Hypoxyton</u> canker	"
221	<u>Hypoxyton</u> predominant, some <u>Phellinus</u>	"
230	Other cankers	All
231	Stem rusts	Conifers
240	White pine blister rust	WP
241	WPBR & white pine weevil	WP
250	Dwarf mistletoe	Conifers.
260	Pine tip blight	"
261	<u>Scleroderris</u>	"
262	<u>Sirococcus</u>	"
263	<u>Diplodia</u>	"
270	Root rots	All
271	Annosus	White, shortleaf, loblolly pine
272	<u>Armillaria</u> (shoestring)	All
280	<u>Nectria</u>	All hardwoods
290	<u>Eutypella</u>	Maple
300	Fire damage	All
400	Animal - General Other Known	All
410	Beaver damage	"
420	Cattle damage	"
430	Deer or moose damage	"
440	Porcupine damage	"
450	Sapsucker	"
460	Rabbit	"
470	Mouse	"
500	Weather Damage - General - Other Known	"
510	Lightning	"
520	Flooding	"
530	Wind	"
540	Frost cracks	"
550	Hail	"
560	Drought	"
570	Ice breakage	"
580	Winter injury	"
600	Suppression	"
700	Unknown	"
710	Missing or dead top	"
720	Poor form	"
730	Declines	Oak, birch, maple, ash, butternut beech

740	Ice gouging	All
750	Oil and salt damage	"
760	Vine damage	"
770	Barbed wire, nails, metal	"
780	Other Known - List in Remarks (Do not include insect & disease)	"
800	Logging & related mechanical	"
810	Logging	"
820	Timber stand improvement	"
840	Land clearing	"
850	Land use conversion	"
860	Chemical (herbicide)	"
000	No serious damage	"

Cause of Death, Item 27. Record cause of death for dead trees tallied, using the following 3-digit codes. All damage codes can be used for cause of death.

<u>Code</u>	<u>Cause of Death</u>
100	Insects
200	Disease
300	Fire
400	Animals
410	Beaver
420	Cattle
430	Deer or moose
440	Porcupine
450	Sapsucker
460	Rabbit
470	Mice
500	Weather damage
510	Lightning
520	Flooding
600	Suppression
700	Unknown and other
810	Logging
820	Timber stand improvement
840	Land clearing
850	Land use conversion

When there are multiple causes of mortality, code for the predominant cause of death. Thus, a tree killed by windthrow, but showing evidence of root rot, would be coded 500, since windthrow actually caused the death of the tree. A tree killed by disease only would be coded 200.

Tree Class, Item 28 (2 digits)
or cover class

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

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

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

If an illegal tree class code is found, bring it to the attention of the person in charge of remeasurement.

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

Acceptable tree (Code 20)

Live trees of commercial species that are:

- 1) Sawtimber size and have at least one merchantable 12-foot sawlog or two merchantable 8-foot sawlogs, meet minimum log grade requirements, and contain 33 percent or more of their gross board foot volume in sound material.
- 2) Poletimber size trees that have the potential to meet the above specifications (see 1 above). The assumption shall be made that pole size trees will eventually attain sawlog size at DBH. In evaluating the potential sawlog portion of pole size trees, only rot, large limbs, forks, and excessive sweep and crook may be used to disqualify the tree as a growing stock tree. When estimating the potential sawlog height for poletimber trees, the two-inch rule can be applied as a guide. The two-inch rule assumes that a tree's diameter will increase uniformly along its bole. For example, a hardwood poletimber tree with a DBH of 8.0 inches needs three inches of diameter growth to become sawtimber size. If diameter growth is uniform then the DBH minus 2 inches, 8-2 or 6 inches, identifies the potential sawlog top. This system works for both hardwoods and softwoods.

3) Seedlings and saplings will be considered growing stock trees unless a specific damage is observed. Seedlings and small saplings (less than 3.0 inches) may not be culled on the basis of excessive sweep or crook. It will be assumed that seedlings and saplings will eventually attain sawlog size at DBH.

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

Rough Tree (Code 30)

1) All trees of noncommercial species.

2) All trees of commercial species that are:

a) Sawtimber size and do not have any merchantable sawlog, where over one-half of the volume in the sawlog portion does not meet minimum log grade specifications because of roughness, excessive sweep or crook, splits, cracks, limb stoppers, or forks. The sawlog portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.

b) Pole size trees which do not have the potential to meet the specifications for growing stock trees because of forks, limb stoppers, or excessive sweep or crook. The assumption shall be made that all live trees not presently sawlog size will eventually attain sawlog size at DBH. Predicted death, tree vigor, or plot site index are not considerations in determining tree class.

Short sawtimber-sized tree (code 31)

1) Any live sawtimber-sized tree of commercial species which has at least one eight-foot log, but less than a twelve-foot log, that meets minimum log grade specifications.

2) Any live sawtimber-sized tree of commercial species which has less than one-third of the volume of the sawlog portion in merchantable logs, but has at least one eight-foot or longer sawlog that meets minimum log grade specifications. Short sawlog must be 50% sound at any point. The sawlog portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.

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

Rotten tree (Code 40)

All live trees of commercial species that are:

1) Sawtimber size and do not have any merchantable sawlog, where over one-half of the volume in the saw log portion does not meet minimum log grade specifications primarily because of rot or missing sections. The saw log portion is the length between the one-foot stump and the 9.0" top D.O.B. for hardwoods and the 7.0" top D.O.B. for softwoods.

2) Pole size trees which do not have the potential to meet the log grade specifications for growing stock trees because of rot. The assumption shall be made that all live trees not presently sawlog will eventually attain sawlog size at DBH. Predicted death, tree vigor, or plot site index are not considerations in determining tree class.

SUMMARY:

If any of the sawlog section requirements for a growing stock tree (20) is not met, the tree is considered cull. If a short sawlog is present, the tree class is 31 and sawlog information recorded. If no sawlog is present tree class is 30 or 40. If a pole timber tree does not have the potential to meet sawlog standards, its tree class is 30 or 40.

Following are the required tally items for each tree class.

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

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

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

For tree class 40 record bole length to a 4.0" top D.O.B. On cubic foot cull, cull out for rot or missing wood. Dash out saw log length, saw log top D.O.B., board foot cull, and log grade. Crown ratio and crown class will be accurately recorded. Damage code must not be "00" and must reflect rot or disease (codes "20-29"). Cubic foot cull should seldom exceed 90% of total cubic volume.

Cover Class. If no live trees are recorded at a point, examine the fixed radius plot for cover class and record, using the codes given below and record in the point class record entry line and record a tree number of 40.

Code Cover Class

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

51-grass, 52-shrubs, 53-vines, 54-other.

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

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

81-83 Nonstockable. Not capable of supporting trees of commercial species, because of the presence of rocks, water, etc. Use the following codes: 81-rocks, 82-water, 83-other.

For remeasurement plots

1) If a point was cover classed on the prior survey, two situations may be encountered. If the point is still cover classed on the current survey, determine and record what the current cover class should be. Reference cover classed points. If live trees or seedlings are now present on the point, record them as ongrowth or ingrowth. There is no need to record the original cover class in this instance.

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

DEAD TREES-Dead trees, 5.0" DBH or larger, will be tallied if they have died within the last 3 years. A tree history code of 04 or 05 will be assigned.

Code 04- Salvable-mortality- contains at least one four foot section that is at least 50% sound.

Code 05- Mortality- has no merchantable volume at least 50% sound.

The following tally items are required for dead trees: tree number, species, tree history, DBH, cause of death, tree class, tree cavities, sawlog length, sawlog top DOB, board foot cull, bole length, bole length top DOB, cubic foot cull. Unless specified, all tally items will be recorded using rules from the appropriate sections on live trees in the Forest Survey Field Manual.

How to Do a Dead Tree

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

Mortality trees- All required information will be projected back to the time of death except tree cavities, which will be recorded as they exist now. Many mortality trees won't look very good, but will be given a tree class of 20 because that's what they were at time of death.

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

Summary- Dead trees are EASY! 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 the Forest Survey Field Manual. Refer to remeasurement manual for dead trees on remeasurement plots. See example 10 to get confused.

Following is an explanation of tree class for selected examples. Hardwood trees are pictured in the examples, but softwoods can also be applied using a minimum 7.0" sawlog top D.O.B. (See Figure 11 - examples 1-10).

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

2. A hardwood grades 1, 2, and 3 or softwood sawtimber tree. Sawlog portion is terminated by limbs creating a full diameter stopper. Each limb is over 2 inches in diameter and their sum exceeds the diameter of the stem at that point (10 inches D.O.B.). The sawlog contains no cull and meets minimum grade specifications. Sawlog length is 14 feet. The upper stem portion contains no cull and terminates at 4.0" D.O.B. 5 feet above the sawlog portion. Bole length is 19 feet. Cull cubic is zero for the tree.

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

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

5. Two hardwood sawtimber trees. Since the lowest fork is below DBH, each fork is appraised and recorded as a separate tree. The lower 14 feet of the left-hand fork (or left-hand tree) meets log grade specifications. The bole length is 22 feet and the sawlog length 14 feet. Cull board feet is zero and cubic foot cull is zero.

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

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

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

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

9. A tree class 31. The sawlog portion is 16 feet to the 9.0" DBH. 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 or longer it is a tree class 31. Sawlog length is recorded as 011, sawlog top D.O.B. 100, and board foot cull 0000. Bole length and cubic foot cull are handled the same as on other trees, culling out for rot and missing wood only.

10. A dead tree

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

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

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

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

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

Cause of death and tree class are reflected back to the time of death for mortality trees. For salvable-mortality trees, cause of death and tree class are looked at in their present condition.

The tree in the example was a 20 class tree at the time of death according to survey standards. Even if the tree is now considered a 30 class tree, a tree class of 20 is still recorded because that item must be projected back to the time of death (for a mortality tree only).

Figure 11

HOW TO HANDLE TREE MEASUREMENTS
FOR ALL TREE CLASSES

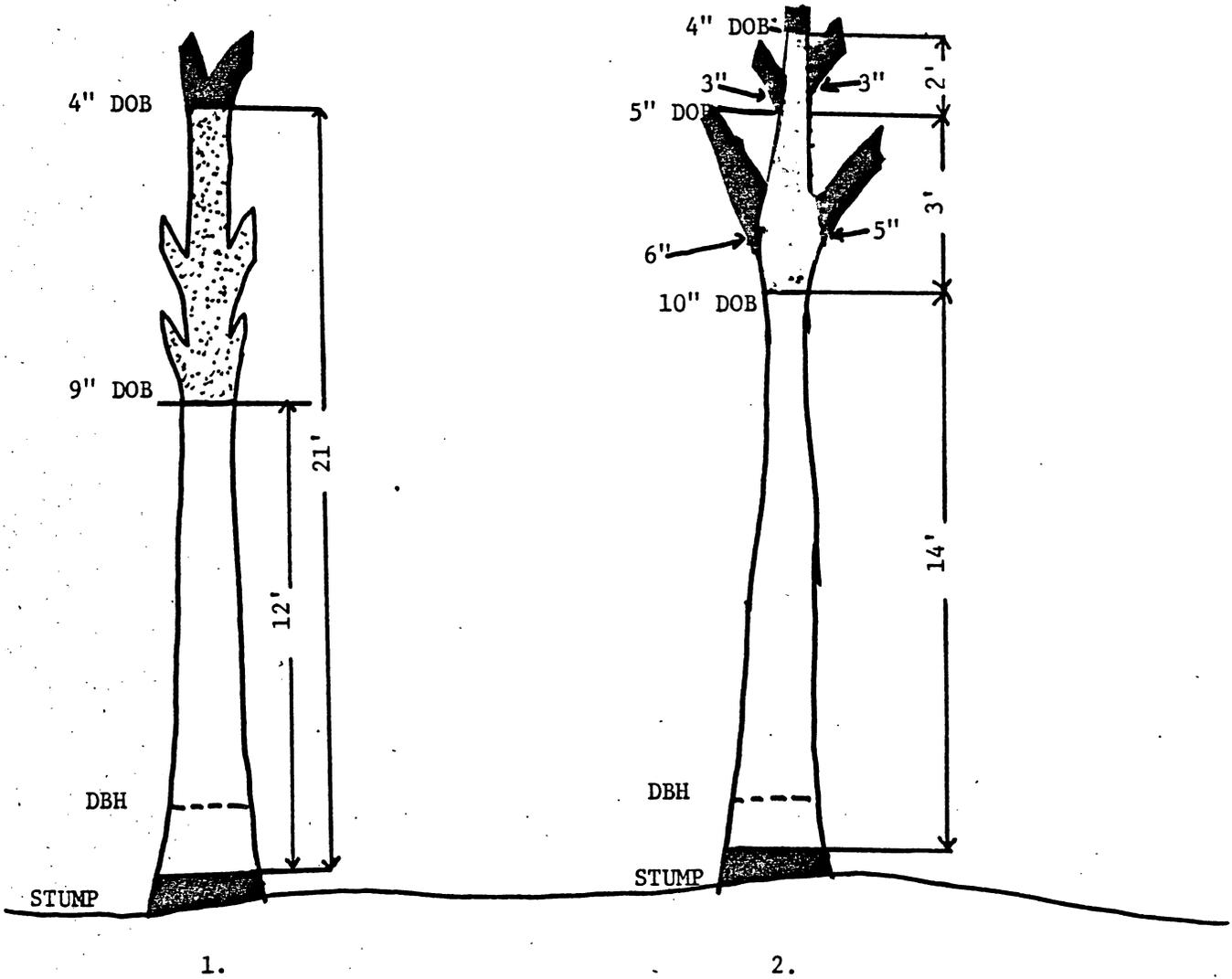
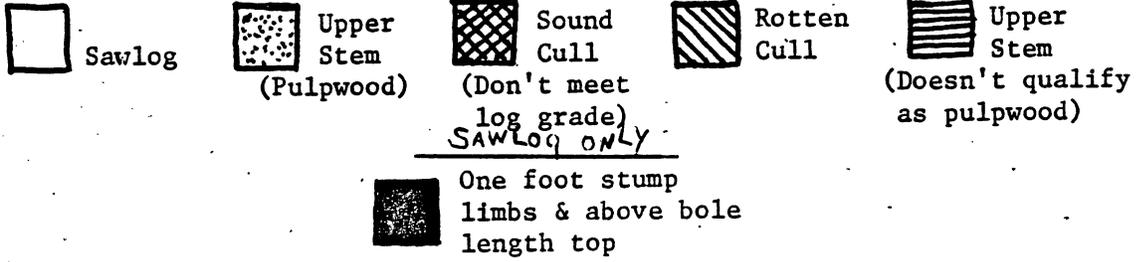


Figure 11 continued

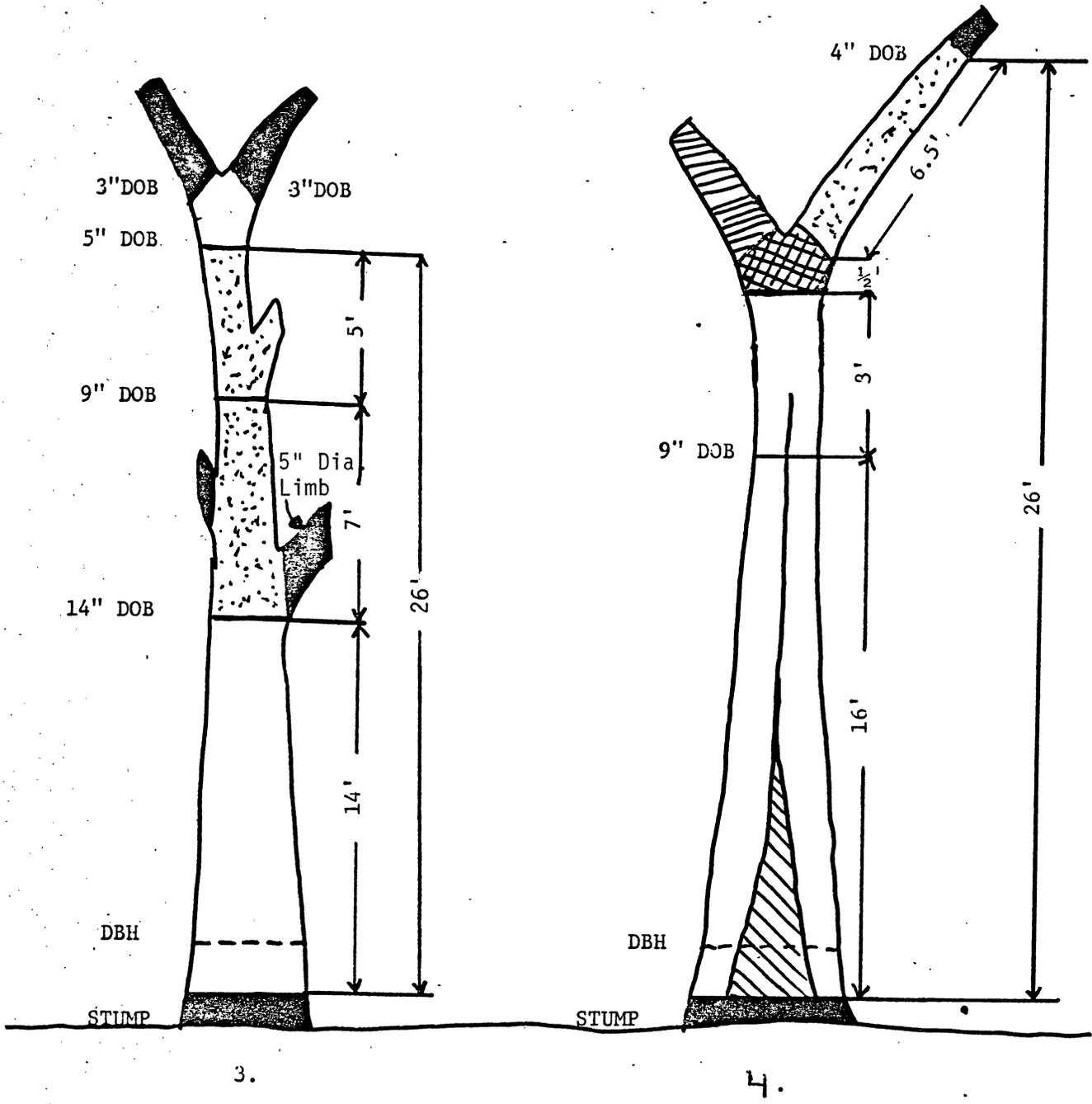
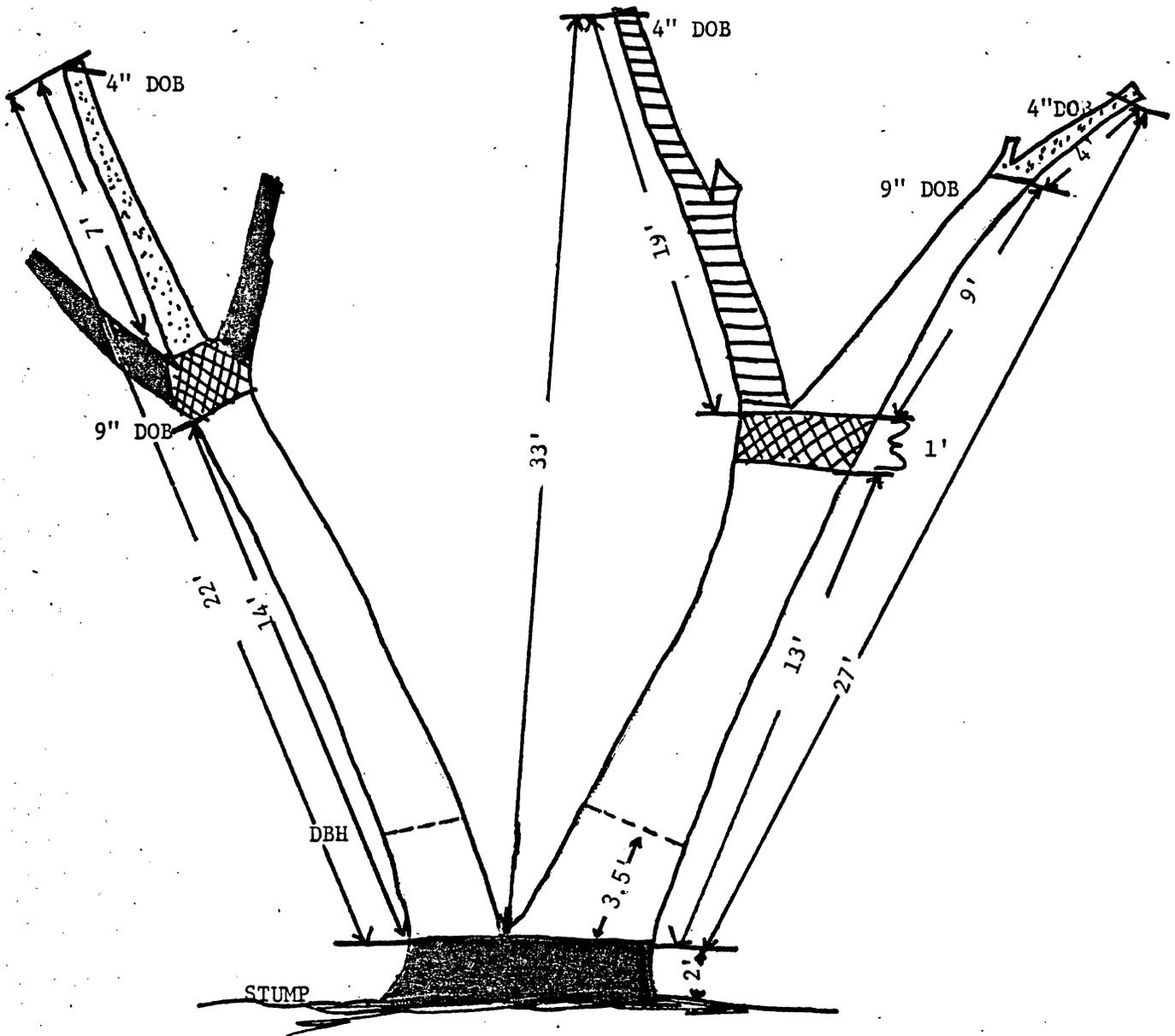


Figure 11 continued



5.

Figure 11 continued

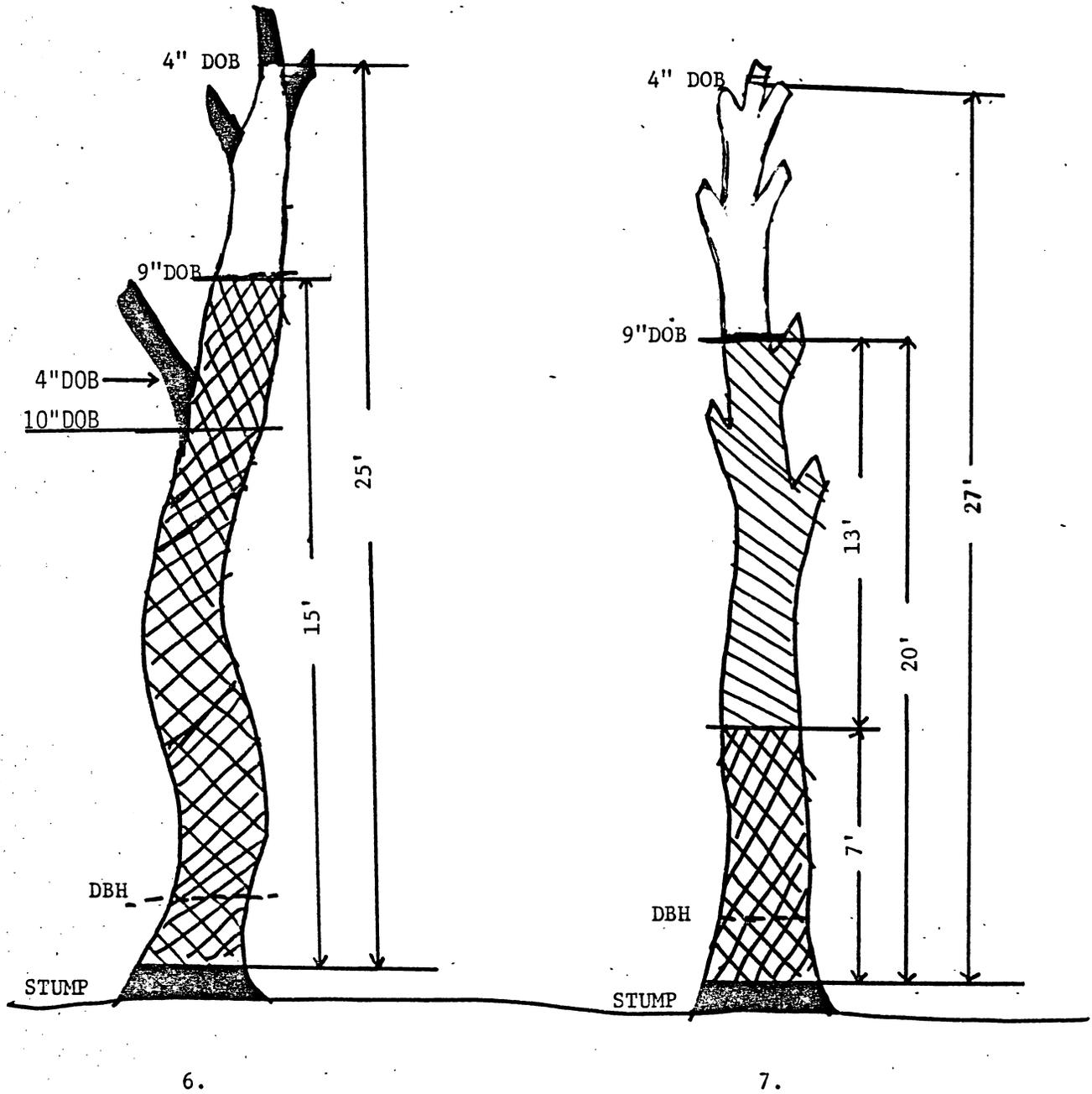


Figure 11 Continued

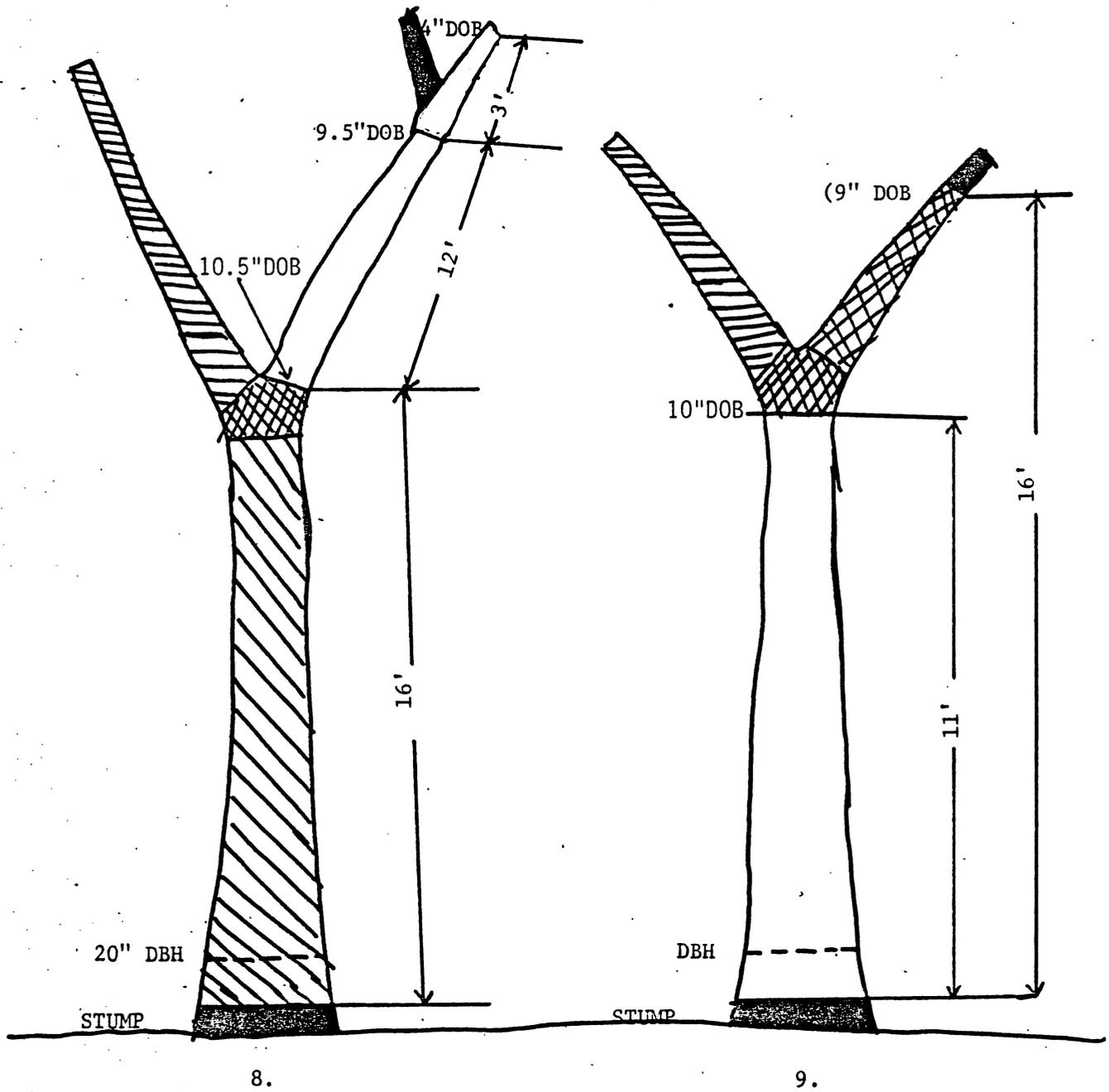
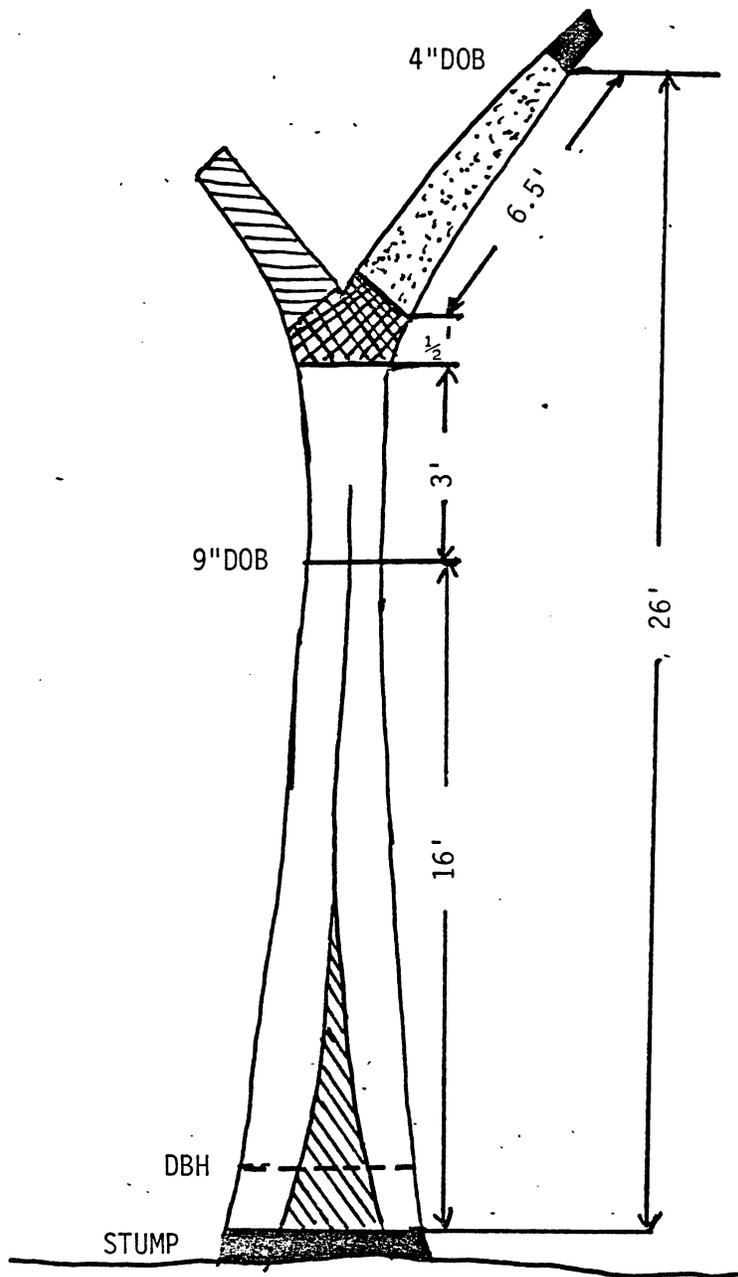


Figure 11 continued



10.

73

Crown Ratio, Item 29.

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

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

Record crown ratio using the following one-digit codes:

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

Crown Class, Item 30.

Record a one-digit code to show crown class of all live trees 1.0 inches DBH and larger. Crown class should be determined based on the individual tree's dominance in relation to adjacent trees in the stand, as indicated by crown development and amount of light received from above and the sides. If the original crown class on remeasurement plots is missing, record an estimate; otherwise, record the original crown class.

<u>Code</u>	<u>Crown Class</u>
1	<u>Open grown.</u> Trees with crowns which have received full light from above and from all sides throughout all or most of the life of the tree, particularly during its early developmental period.
2	<u>Dominant.</u> Trees with crowns extending above the general level of the crown cover and receiving full light from above and partly from the sides; larger than the average trees in the stand, and with crowns well developed, but possibly somewhat crowded on the sides.

- 3 Codominant. Trees with crowns forming part of the general level of the crown cover and receiving full light from above, but comparatively little from the sides--usually with medium-sized crowns more or less crowded on the sides. (In stagnated stands, includes trees with small-sized crowns crowded on the sides).
- 4 Intermediate. Trees shorter than those in the two preceding classes, but with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.
- 5 Overtopped. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.

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

Stocking Percent, Item 31.

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

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

One or more 5.0" or larger DBH live trees on the point

DBH	Stocking Percent
5.0"+	4.7
4.0 - 4.9	4.0
3.0 - 3.9	2.4
2.0 - 2.9	1.2
1.0 - 1.9	.4

No live trees 5.0" DBH or larger on the point

DBH	Stocking Percent
4.0-4.9	4.0
3.0-3.9	3.5
2.0-2.9	3.0
1.0-1.9	2.5
Seedling	2.0

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

Point Occupancy, Item 32.

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

Code Point Occupancy

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

Tree Cavities, Item 33.

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

To qualify as a cavity, the entrance hole must be 1.0" or larger in the main stem, fork, or larger limb. (A large limb must be greater than 8.0" in diameter o.b.) Cavity size is largest diameter circle that can be made from existing hole.

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

Sawlog Length, Item 34.

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

Record sawlog length on live or dead 20 and 31 class sawtimber size trees.

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

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

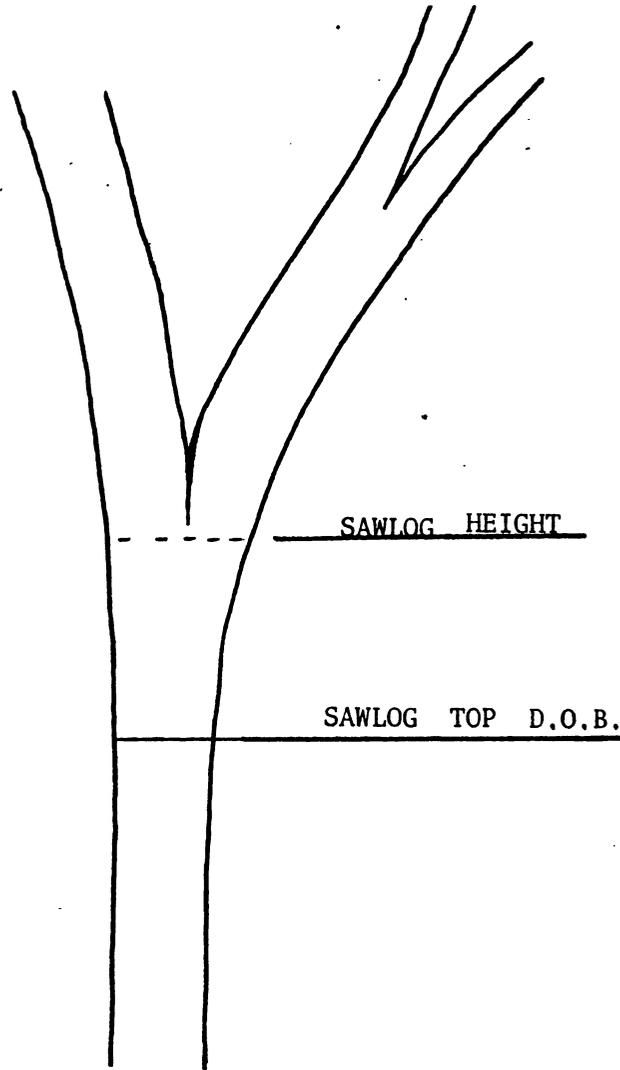
Minimize limb limitations by logical log making, aimed at obtaining the longest sawlog length. For example, bucking between staggered limbs within a one-foot span whose combined diameters exceed the D.O.B. at point of occurrence may give a longer sawlog length.

In situations where limbs are a limiting factor in determining merchantable length, length will be taken to the point where the limbs divide the diameter of the merchantable section. (See Figure 12).

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

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

Figure 12



Sawlog Top Diameter Outside Bark, Item 35.

For each sawtimber-sized tree record sawlog top DOB to the last 0.1", using a three-digit code. For example, record 7.0" as 070. The minimum top D.O.B. recorded for softwoods will be 7.0" and 9.0" for hardwoods. For trees with sawlog length terminating before reaching minimum top D.O.B., or if the sawlog length is affected by a fork or the flare from a limb, the smallest diameter immediately below the swell is recorded.

Board Foot Cull, Item 36.

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

Cull Volumes Include:

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

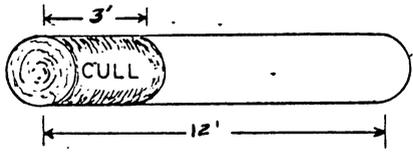
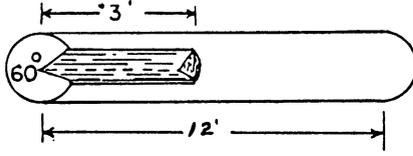
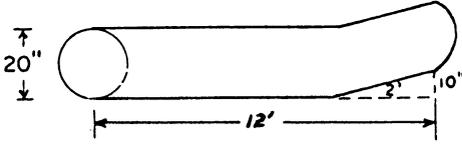
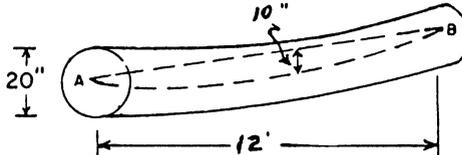
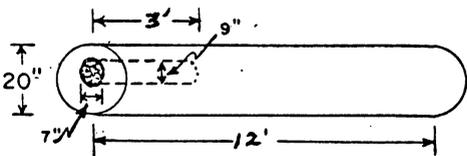
Board foot measure is computed from a squared off section within the circular form of a log. This is the only portion which contains lumber. Therefore, shallow defects that are expected to be cut in slabbing for lumber and rounding for veneer are ignored.

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

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

Figure 13

The following are suggestions for estimating cull in logs.

<p>If section of log is affected, deduct length of log length affected.</p> <p>Example: $\frac{3}{12} \times 100 = 25$ percent board foot cull.</p>	
<p>If sector is affected, multiply percent of circle times percent of length.</p> <p>Example: $\frac{60}{360} \times \frac{3}{12} \times 100 = 4$ percent board foot cull.</p>	
<p>For a crook, multiply proportion of diameter displaced times proportion of log length affected by crook.</p> <p>Example: $\frac{10}{20} \times \frac{2}{12} \times 100 = 8$ percent board foot cull.</p>	
<p>For sweep, determine sweep departure and subtract 2 inches. Divide this by minimum log diameter.</p> <p>Example: $\frac{10-2}{20} \times 100 = 40$ percent board foot cull.</p>	
<p>For interior defect, determine the defective material as percent of total volume of the log. Add 1 inch to width and thickness of defect, and divide by one less than average scaling diameter of the log.</p> <p>Example: $\frac{8 \times 10}{20-1} \times \frac{3}{12} \times 100 = 6$ percent board foot cull.</p>	

Log Grade, Item 37, 3 digits

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

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

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

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

For 31 class trees grade the log that is present.

In Missouri, for eastern redcedar a local use, log grade 5 will be recorded for trees that don't meet regular grade specifications but meet the log grade 5 rules.

Sawlog grade for all qualifying sawtimber trees on one-third of the plots in Minnesota and Missouri will be recorded. For Missouri this will include all sample kind 1 and 2 plots plus plot numbers ending in 3, 6 or 9 for all other plots. For Minnesota, all sample kind 1, 2 and 6 plots will receive a log grade.

2nd digit

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

<u>Code</u>	<u>Limiting Factor</u>
0.	Not applicable, already a grade 1
1	Diameter
2	Length
3	Clear cuttings
4	Sweep and crook
5	Cull
6	Position in tree
7	Multiple factors
8	Diameter and and clear cutting

3rd digit - Walnut and White Oaks only - (White, Swamp white, Bur, swamp chestnut, Chinkapin)

Indicate the presence of veneer with the following codes. For sawlog-sized 20, 30, and 31 class trees.

<u>Code</u>	
0	Not or never veneer or not walnut and white oak
1	Not veneer now but will be (diameter limiting factor)
2	6-7'
3	8-9'
4	10-11'
5	12-13'
6	14-15'
7	16-17'
8	18-19'
9	20' +

MINIMUM VENEER REQUIREMENTS

	<u>WALNUT</u>	<u>WHITE OAK</u>
LENGTHS	6' to 17'	7' 4" to 17'
DIAMETER	12" and up	14" and up
CONTENT (Doyle)	36 BF (6' & 14" 7' & 13")	50 BF (8' & 14" 7' 4 & 14.5")
ALLOWABLE DEFECT	90% clear (2 pcs.) Min. cutting 5'	14"-22" 90% clear (2 pcs.) 22" up 85% clear (4 pcs.) Min. cutting 6'

DEFECTS TO BE CONSIDERED IN STANDING TIMBER

1. Blind knots/catfaces
2. Worms/birdpeck - more than 2 birdpecks, removes log from veneer
3. Scars
4. Crook - no more than 1"/6'
5. Twisted grain - no more than 1"/6'
6. Grubs/pinworms
7. Rot/dote
8. Frost cracks
9. Abnormal swells
10. Metal
11. Ingrown bark
12. Pinknotes

Bole Length, Item 38.

Bole length of all trees 5.0" DBH and larger should be determined between the top of a one-foot stump and 4.0" diameter outside bark, or to the point where the central stem or branch breaks into limbs and above which there is no 4.0" D.O.B.

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

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

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

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

Top D.O.B. will be measured to the highest possible 4.0" D.O.B. or where the central stem or branch breaks into limbs and above which there is no 4.0" D.O.B. Use a 3 digit code to record bole top D.O.B. to the last 0.1". Bole length top D.O.B. is measured at the smallest point before the bole length terminates. If the bole length is taken to the bottom of a fork or the flare from a limb, the smallest diameter immediately below the swell is recorded.

Cubic-Foot Cull, Item 40.

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

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

Site Index, Item 42.

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

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

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

Site Tree Selection. On each site plot that site index entries are required, a minimum of three site index trees of one species will be measured. Site tree species selection will be based on availability of suitable site trees. 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.

An exception to this is eastern redcedar. To use redcedar as your site index tree, the plot forest type must be Eastern Redcedar (35) or Eastern Redcedar-Hardwood (42).

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

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

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

The location of the site trees from the nearest plot point will be noted on the sketch of the 10-point cluster layout on the header sheet.

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

For red pine:

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

Site Tree Data. For all trees measured for site index information record a tree history code of 99, site tree number starting with #41, species, DBH, total height under bole length, total age under bole length top DOB, and the years added to age at D.B.H. under cull cubic feet. All site index information collected should be coded on the front of the plot sheet, not in the notes.

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

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

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

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

Tree DBH. See DBH section of the survey manual.

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

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

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

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

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

FIELD AND OFFICE PROCEDURES

Basal Area Per Acre, Item 43.

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

Forest Type-Stand/Size Class, Item 44. New sample plots.

Forest type (first and second digit): Forest type is calculated in the St. Paul office based on plurality of stocking of all live trees. For new sample plots, field crews are to record the appropriate two digit code based on a visual estimate while in the plot area. Forest type is based on the flowchart on the state supplement sheet. If there is insufficient stocking, use your best judgment. St. Paul personnel will use your estimate as a check against your data, and as the forest type in cases of insufficient stocking. For remeasurement plots, the original forest type will be recorded on the plot header sheet in St. Paul and is not to be changed.

Stand Size Class (3rd Digit): Normally, this item is calculated in the St. Paul office. On new sample plots it is not necessary for field crews to exactly calculate stand size class in the field. A visual estimate will be 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(s) in the Notes section of the Plotsheet.

If ten or fewer trees are recorded, enter the estimated size class. This will be assumed to be correct by the St. Paul office. For remeasurement plots, the original stand size will be recorded on the plot header sheet in St. Paul and is not to be changed.

Below are the rules to determine stand size class:

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

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

Note: (new sample plots)

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

MISSOURI FOREST TYPES

<u>Code</u>	<u>Type-description</u>
(32)	Shortleaf Pine.--Forests in which pine comprises a plurality of the stocking with shortleaf the most common. This type occurs principally as plantations. In natural stands, common associated species are black oak, scarlet oak, post oak, blackjack oak, hickory and eastern redcedar.
(35)	Eastern redcedar.--Forests in which eastern redcedar comprises a plurality of the stocking. (Common associates include post oak, black oak, chinquapin oak, blackjack oak and hickory.)
(42)	Eastern redcedar-hardwood.--Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which eastern redcedar comprises 25 to 50 percent of the stocking. (Common associates include post oak, black oak, chinquapin oak, blackjack oak and hickory.)
(44)	Shortleaf pine-oak.--Forests in which upland oaks comprise a plurality of the stocking, but in which shortleaf pine comprises 25 to 50 percent of the stocking. (Common associates include black oak, scarlet oak, white oak, post oak, blackjack oak and hickory.)
(51)	Post-blackjack oak.--Forests in which post oak or blackjack oak, singly or in combination, comprise a plurality of the stocking. (Common associates include pignut and mockernut hickories, and black and scarlet oaks).
(53)	Black-Scarlet oak.--Forests in which black oak or scarlet oak, singly or in combination, comprise a plurality of the stocking. (Common associates include white, post, blackjack, northern red and chestnut oaks, and pignut and mockernut hickories.)

Missouri Forest Types - continued

- (54) White oak.--Forests in which white oak and other white oak species, singly or in combination, comprise a plurality of the stocking. (Common associates include northern red, black, scarlet, post, and bur oak, and mockernut, pignut, and bitternut hickories.)
- (60) Oak-Gum-Cypress.--Bottomland forests in which tupelo, sweetgum, oaks, or cypress, singly or in combination, comprise a plurality of the stocking except where pine comprise 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry and maple).
- (70) Elm-ash-maple.--Lowland forests in which elm, ash, or soft maple, singly or in combination, comprise a plurality of the stocking. (Common associates include boxelder, willow, sycamore, and beech).
- (73) Cottonwood.--Forests in which cottonwood comprises 50 percent or more of the stocking. (Associated species include willow, elm, soft maple, and ash).
- (80) Maple-beech.--Upland forests in which hard maple or beech, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, basswood, and soft maple).

MINNESOTA FOREST TYPES, Item 44

Code Type-description

- (01) Jack pine.--Forests in which jack pine comprises a plurality of the stocking. (Common associates include eastern white pine, red pine, aspen, birch, and maple.)
- (02) Red pine.--Forests in which red pine comprises a plurality of the stocking. (Common associates include eastern white pine, jack pine, aspen, birch, and maple.)
- (03) White pine.--Forests in which eastern white pine comprises a plurality of the stocking. (Common associates include red pine, jack pine, aspen, birch, and maple.)
- (12) Black spruce.--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.)

Minnesota Forest Types - continued

- (13) Balsam fir.--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).
- (14) Northern white-cedar.--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) Tamarack.--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) White spruce.--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) Oak.--Forests in which northern red oak, white oak, or bur oak, singly or in combination, comprise a plurality of the stocking. (Common associates include elm, maple, and aspen.)
- (70) Elm-ash-cottonwood.--Forests in which lowland elm, ash, cottonwood, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include basswood and balsam poplar.)
- (80) Maple-basswood.--Forests in which sugar maple, basswood, yellow birch, upland American elm, and red maple, singly or in combination, comprise a plurality of the stocking. (Common associates include white pine and elm.)
- (91) Aspen.--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) Paper birch.--Forests in which paper birch comprises a plurality of the stocking. (Common associates include maple, aspen, and balsam fir.)
- (94) Balsam poplar.--Forests in which balsam poplar comprises a plurality of the stocking. (Common associates include aspen, elm, and ash.)

Stand Age, Item 45 - Determine the age of the predominant stand size class from three or more borings of trees on or near the plot. If there is an insufficient number of acceptable trees to determine stand age, record an estimate. Stand age must reflect stand size class. If you have estimated stand size, record the stand age for other possible stand size classes in the notes section. Example:

Pole 050
Saw 078

Stand age will be recorded with a three digit code to the nearest year. A stand 49 years old will be recorded 049.

Nonstocked stands (stand size class code 4) receive an automatic stand age of 001.

For remeasurement plots the original stand age will be recorded on the plot header sheet in St. Paul.

Stand Area, Item 46

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

Distance to Water, Item 47.

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

Code Type of Water (one Digit):

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

AREA (Three Digits):

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

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

DISTANCE (Four Digits):

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

Distance to Road, Item 48.

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

Code Type of Road (One Digit):

TYPE (One Digit):

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

DISTANCE (Four Digits):

The distance to road will be measured in chains to the nearest 1/2 chain.
(0000 to 999.5 chains)

Distance to Agricultural Lands, Item 48a

Photo interpreters will record and field crews should check the straight line distance from plot center to the nearest agricultural lands for commercial forest land plots only.

Code Type of agricultural lands (one digit)

- 1 Cropland - row crops or cereal grains
- 2 Pasture, hay fields and idle farmland

Code Distance (four digits)

The distance to agricultural lands (measured in chains to the nearest 1/2 chain - 0000 to 99.5 chains).

Sketch and Notes, Item 49

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

State, Item 51.

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

State Code for Missouri is 29. State Code for Minnesota is 27.

Unit, Item 52.

Unit Codes, Missouri

- Unit 1 - East Ozark Unit
- Unit 2 - Southwest Ozark Unit
- Unit 3 - Northwest Ozark Unit
- Unit 4 - Prairie Unit
- Unit 5 - Riverborder Unit

Unit Codes, Minnesota

- Unit 1 - Aspen-Birch Unit
- Unit 2 - Northern Pine Unit
- Unit 3 - Central Hardwood Unit
- Unit 4 - Prairie Unit

County, Item 53.

Record the appropriate two-digit Missouri county code.

Unit 1 - East Ozark Unit

- 1 Bollinger
- 2 Butler
- 3 Carter
- 4 Crawford
- 5 Dent
- 6 Iron
- 7 Madison
- 8 Oregon
- 9 Reynolds
- 10 Ripley
- 11 St. Francois
- 12 Shannon
- 13 Washington
- 14 Wayne

Unit 2 - Southwest Ozark Unit

- 1 Barry
- 2 Christian
- 3 Douglas
- 4 Howell
- 5 McDonald
- 6 Newton
- 7 Ozark
- 8 Stone
- 9 Taney
- 10 Texas
- 11 Webster
- 12 Wright

Unit 3 - Northwest Ozark Unit

- 1 Benton
- 2 Camden
- 3 Cedar
- 4 Dallas
- 5 Hickory
- 6 Laclede
- 7 Maries
- 8 Miller
- 9 Morgan
- 10 Phelps
- 11 Polk
- 12 Pulaski
- 13 St. Clair

Unit 4 - Prairie Unit

- 1 Adair
- 2 Andrew
- 3 Atchison
- 4 Audrain
- 5 Barton
- 6 Bates
- 7 Buchanan
- 8 Caldwell
- 9 Carroll
- 10 Cass
- 11 Chariton
- 12 Clark
- 13 Clay
- 14 Clinton
- 15 Cooper
- 16 Dade
- 17 Daviess
- 18 De Kalb
- 19 Gentry
- 20 Greene
- 21 Grundy
- 22 Harrison
- 23 Henry
- 24 Holt
- 25 Jackson
- 26 Jasper
- 27 Johnson
- 28 Knox
- 29 Lafayette
- 30 Lawrence
- 31 Lewis
- 32 Lincoln
- 33 Linn
- 34 Livingston
- 35 Macon
- 36 Marion
- 37 Mercer
- 38 Monroe
- 39 Nodaway
- 40 Pettis
- 41 Pike
- 42 Platte
- 43 Putnam
- 44 Ralls
- 45 Randolph

Unit 4 Prairie Unit (continued)

- 46 Ray
- 47 Saline
- 48 Schuyler
- 49 Scotland
- 50 Shelby
- 51 Sullivan
- 52 Vernon
- 53 Worth

Unit 5 - Riverborder Unit

- 1 Boone
- 2 Callaway
- 3 Cape Girardeau
- 4 Cole
- 5 Dunklin
- 6 Franklin
- 7 Gasconade
- 8 Howard
- 9 Jefferson
- 10 Mississippi
- 11 Moniteau
- 12 Montgomery
- 13 New Madrid
- 14 Osage
- 15 Pemiscot
- 16 Perry
- 17 St. Charles
- 18 St. Louis
- 19 Ste. Genevieve
- 20 Scott
- 21 Stoddard
- 22 Warren

- 23 St. Louis City

Record the appropriate two-digit Minnesota county code.

Unit 1 - Aspen-Birch Unit

- 01 Carlton
- 02 Cook
- 03 Koochiching
- 04 Lake
- 05 St. Louis

Unit 2 - Northern Pine Unit

- 01 Aitkin
- 02 Becker
- 03 Beltrami
- 04 Cass
- 05 Clearwater
- 06 Crow Wing
- 07 Hubbard
- 08 Itasca
- 09 Lake of the Woods
- 10 Mahnomen
- 11 Roseau
- 12 Wadena

Unit 3 - Central Hardwood Unit

- 01 Anoka
- 02 Benton
- 03 Carver
- 04 Chisago
- 05 Dakota
- 06 Douglas
- 07 Fillmore
- 08 Goodhue
- 09 Hennepin
- 10 Houston
- 11 Isanti
- 12 Kanabec
- 13 Le Sueur
- 14 Mille Lacs
- 15 Morrison
- 16 Olmsted
- 17 Otter Tail
- 18 Pine
- 19 Ramsey
- 20 Rice
- 21 Scott
- 22 Sherburne
- 23 Stearns
- 24 Todd
- 25 Wabasha
- 26 Washington
- 27 Winona
- 28 Wright

Unit 4 - Prairie Unit

- 01 Big Stone
- 02 Blue Earth
- 03 Brown
- 04 Chippewa
- 05 Clay
- 06 Cottonwood
- 07 Dodge
- 08 Faribault
- 09 Freeborn
- 10 Grant
- 11 Jackson
- 12 Kandiyohi
- 13 Kittson.
- 14 Lac qui Parle
- 15 Lincoln
- 16 Lyon
- 17 McLeod
- 18 Marshall
- 19 Martin
- 20 Meeker
- 21 Mower
- 22 Murray
- 23 Nicollet
- 24 Nobles
- 25 Norman
- 26 Pennington
- 27 Pipestone
- 28 Polk
- 29 Pope
- 30 Red Lake
- 31 Redwood
- 32 Renville
- 33 Rock
- 34 Sibley
- 35 Steele
- 36 Stevens
- 37 Swift
- 38 Traverse
- 39 Waseca
- 40 Watonwan
- 41 Wilkin
- 42 Yellow Medicine

National Forest, Item 54.

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

National Forest Codes for Missouri

Mark Twain National Forest = 05

National Forest Ranger District, Item 55.

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

National Forest Ranger District Codes

Mark Twain Ranger Districts:

Fredericktown	02
Houston	03
Poplar Bluff	04
Potosi	05
Rolla	06
Salem	07
Cedar Creek	08
Ava	21
Cassville	22
Doniphan	23
Van Buren	24
Willow Springs	25
Winona	26

Zero out this item for sample locations on other lands.

National Forest Codes for Minnesota

09 = Superior National Forest

03 = Chippewa National Forest

Superior Ranger Districts:

Aurora	01
Gun Flint	02
Isabella	04
Kawishiwi	05
La Croix	06
Tofte	07
Two Harbors	08
Virginia	09

Chippewa Ranger Districts:

Blackduck	01
Cass Lake	02
Deer River	03
Marcell	04
Walker	05

Definition of Terms, Item 56.

Terms used in this handbook are defined below.

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

- d. Intermediate Trees. Trees with crowns either below or extending into the crown cover formed by codominant and dominant trees, receiving little direct light from above, and none from the sides; usually with small crowns considerably crowded on the sides.
 - e. Overtopped Trees. Trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.
8. Diameter Classes. A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). (Note: DBH is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches DBH inclusive).
 9. Face. A section of the tree surface one-fourth the circumference of the tree extending the full length of the log.
 10. Farm. Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals \$50 or more annually or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least \$250. Places having less than the \$50 or \$250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce products in sufficient quantity to meet the requirements of the definition.
 11. Farm Operator. A person who operates a farm, either doing the work himself or directly supervising the work.
 12. Farmer-Owned Land. Land owned by farm operators. (Note: This excludes land leased by farm operators from nonfarm owners, such as railroad companies and states.)
 13. Farmer-Owned Leased. Land owned by farm operators, but leased to forest industry.
 14. Forest Industry Land. Land owned by companies or individuals operating wood-using plants.
 15. Forest Land. Land not currently developed for nonforest use and having at least 16.7 percent stocking of all live forest trees of any size or formerly having 16.7 percent stocking. Roadside or streamside strips of land must have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails, streams or other bodies of water or clearings in forest areas will be classed as forest if less than 120 feet wide. The minimum area for classification of forest land is 1 acre and 120 feet in width.

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

16. Forest Trees. Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.
17. Forest Type. A classification of forest land based upon the species forming a plurality of live "tree stocking". (Note: Types shall be determined on the basis of species plurality of all live commercial trees that contribute to stocking; that is, up to maximum of 16 percent of each plot point.)
18. Growing-stock Trees. Live trees of commercial species qualifying as acceptable trees. (Note: Excludes rough, rotten, and dead trees.)
19. Growing-stock Volume. Net volume in cubic feet of growing stock trees 5.0 inches D.B.H. and over from a 1-foot stump to a minimum 4.0 inch top diameter outside bark of the central stem or to the point where the central stem no longer meets pulpwood specifications.
20. Hardwoods. Dicotyledonous trees, usually broad-leaved and deciduous.
21. Idle Farmland. Includes former croplands, orchards, improved pastures and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.
22. Improved Pasture. Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush.
23. Indian Land. Tribal lands held in fee by the Federal government but administered for Indian tribal groups and Indian trust allotments.
24. Land Area
 - a. Bureau of the Census. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than 1/8 of a statute mile in width; and lakes, reservoirs, and ponds less than 40 acres in area.
 - b. Forest Survey. The same as the Bureau of Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc. is 1 acre.
25. Limb. That part of the tree above the stump which does not meet the requirement for sawlogs and upper-stem portions, including all live, sound branches to a minimum of 4 inches D.O.B.

26. Log Grades. A classification of logs based on external characteristics as indicators of quality or value.
27. Logging Residues. The unused portions of trees cut or killed by logging.
28. Maintained Road. Any road, hard topped or other surfaces, that is plowed or graded at least once a year. Right of ways that are cut or treated to limit herbaceous growth are included in this area.
29. Merchantable. Refers to a pulpwood or sawlog section that meets pulpwood or sawlog specifications, respectively.
30. Miscellaneous Federal Lands. Federal lands other than National Forest, lands administered by the Bureau of Land Management, and Indian lands.
31. Miscellaneous Private Lands. Privately owned lands other than forest-industry and farmer-owned lands.
32. Mortality. Standing or down dead trees that have died within the last three years.
33. National Forest Land. Federal lands which have been legally designated as National Forest or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead Jones Title III lands.
34. Net Volume. Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.
35. Noncommercial Forest Land. (a) Unproductive forest land incapable of yielding crops of industrial wood, because of adverse site conditions and (b) productive-reserved forest land.
36. Noncommercial Species. Tree species of typically small size, poor form, or inferior quality which normally do not develop into trees suitable for industrial wood products.
37. Nonforest Land. Land that has never supported forests and lands formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1-to-40 acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide, and more than 1 acre in size, to qualify as nonforest land.)
38. Nonstockable. Areas of forest land not capable of supporting seedlings of commercial species, because of the presence of rock, water, etc.
39. Nonstocked Land. Commercial forest land less than 16.7 percent stocked with growing-stock trees, but greater than 16.7% in all trees.

40. Other Federal Lands. Federal lands other than National Forests, including lands administered by the Bureau of Land Management, Bureau of Indian Affairs, and other Federal Agencies.
41. Overgrown Knot. The scar left in the bark by a limb completely overgrown, but still outlined by the circular configuration in the bark.
42. Overstocked 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.)
43. Ownership. Property owned by one owner, regardless of the number of parcels in a specified area.
44. Poletimber Stands. (See stand-size class.)
45. Poletimber Trees. Growing-stock trees of commercial species at least 5.0 inches in DBH, but smaller than sawtimber size.
46. Productive-Reserved Forest Land. Forest land sufficiently productive to qualify as commercial forest land, but withdrawn from timber utilization through statute, administration, designation, or exclusive use for Christmas-tree production as indicated by annual shearing.
47. Prospectively. As used in this manual it refers to the moment a tree will reach sawtimber size at DBH.
48. Rangeland. Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.
49. Primitive Roads. Roads that are not maintained and are primarily used by vehicles not intended for highway use (i.e. old logging roads).
50. Rotten Trees. Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.
51. Rough Trees. (a) Live trees of commercial species that do not contain at least one 12-foot sawlog or two sawlogs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of non-commercial species.
52. Roundwood Products. Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes sawlogs, veneer logs and bolts; cooperage logs and bolts; pulpwood, fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

53. Salvable-mortality Trees. Standing or down dead trees that are considered merchantable by Regional standards and have died within the last 3-years.
54. Saplings. Live trees 1.0 inch to 4.9 inches in diameter at breast height.
55. Sapling-Seedling Stands. (See stand-size class.)
56. Sawlog. A log meeting minimum standards of diameter, length and and defect, including logs at least 8 feet long, sound and straight and with a minimum diameter outside bark for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.
57. Sawlog Portion. That part of the bole of sawtimber trees between the stump and the sawlog top, being a 9.0 DOB for hardwoods and a 7.0 DOB for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)
58. Sawlog Top. The point on the bole of sawtimber trees above which a sawlog cannot be produced. The minimum sawlog top is 7.0 inches DOB for softwoods and 9.0 inches DOB for hard woods.
59. Sawtimber Stands. (See stand-size class.)
60. Sawtimber Trees. Live trees of commercial species containing at least a 12-foot sawlog or two sawlogs 8 feet or longer, and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches in diameter breast height. Hardwoods must be at least 11.0 inches in diameter.
61. Sawtimber Volume. Net volume of the sawlog portion of live sawtimber in board feet International 1/4-inch rule.
62. Seedlings. Live trees less than 1.0 inch in diameter at breast height.
63. Site Class. A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.
64. Softwoods. Coniferous trees, usually evergreen having needles or scale-like leaves.
65. Sound Knot or Limb. Knots or limbs intergrown or encased with the surrounding wood and with no indication of decay. Bark may not be present on the limbs.
66. Stand-Size Class. A classification of forest land based on the size class of all live trees on the area; that is, sawtimber, poletimber or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point will be considered in determining stand-size class.)

- a. Sawtimber Stands. Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.
 - b. Poletimber Stands. Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.
 - c. Sapling-Seedling Stands. Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.
67. State, County, and Municipal Lands. Lands owned by states, counties, and local public agencies, or municipalities, or lands leased to these governmental units for 50 years or more.
68. Stocking. The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard. (Note: Also see stocking explanation in section 21.5 of Forest Survey Handbook.)
69. Timber Products. Roundwood products and plant byproducts. (Note: Timber products output includes roundwood products cut from growing stock on commercial forest land; from other sources, such as cull trees, salvable dead trees, limbs, and saplings; from trees on noncommercial and nonforest lands, and from plant byproducts.)
70. Tree Size Class. A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.
71. Unproductive Forest Land. Forest land incapable of producing 20 cubic feet per acre of industrial wood under natural conditions because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation steepness, and rockiness.)
72. Upper Stem Portion. That part of the bole of sawtimber trees above the sawlog top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.
73. 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.

74. 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.

75. Water

(a) 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.

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

FOREST SURVEY TATUM GUIDE, NCFES, PLOT TALLY

B7-WATER

- code-- 1 Stream & Flowage
- 2 Lake
- 3 Swamp
- 4 Farm Pond
- 5 Reservoir
- Area/Width--
- Type 1-3) feet
- Type 2-5) 3/4 acre
- Distance--
- To the nearest chain

- 1-ROADS
- code-- 1 Fenced & Jamp
- 2 Fenced 2 Jamp
- 3 Improved Gravel
- Distance--
- To the nearest 1/2 chain

- code-- 1 Cropland-row crop.
- 2 Pasture-Hay field
- 3 Idle farmland
- 80 Nonforest-reserved
- 90 Censur water

- OWNER CLASS
- 1-National Forest
- 12-B-L.P
- 13-Indian
- 14-Misc. Federal
- 15-State
- 16-County & Municipal
- 17-County
- 18-County & Municipal
- 19-County
- 20-County
- 21-Private Corporate
- 22-Private Individual
- 23-Misc. Private Individual
- *-Acres of Commercial Forest

- 1-1-A
- 2-1-B
- 3-1-C
- 4-1-D
- 5-1-E
- 6-1-F
- 7-1-G
- 8-1-H
- 9-1-I
- 9-5000-+

- 9-STAND HISTORY
- code (First digit (unit appended))
- 0 No disturbance
- 1 Timber stand improvement
- 2 Commercial clearcut
- 3 Partial harvest cut
- 4 Natural
- 5 Non-forested
- 6 Planting of forest land
- 7 Planting of non-forest land
- 8 Natural regeneration of non-forestland
- 9 Natural regeneration of non-forestland

- Second digit (how long ago)
- 0 No disturbance
- 1-10 years
- 11-1 years
- 12-1 years
- 13-1 years
- 14-1 years
- 15-1 years
- 16-20 years

A-GROUND LAID USE

- code FOREST LAND
- 20 Commercial
- 21 Pastured commercial
- 22 Plantation
- 23 Unproductive forest land
- 24 Reserved forest-Unproductive
- 25 Reserved forest-Productive
- 26 Christmas tree plantation
- 27 Nonforest with trees
- 28 Improved pasture w/ trees
- 29 Idle farmland with trees
- 30 Marsh with trees
- 31 Windbreak(greater than 120')
- 32 Windbreak(less than 120')
- 33 Shelterbelt
- 34 Urban forest
- 35 Urban & other w/ trees reserved
- 36 Nonforest without trees
- 37 Cropland
- 38 Improved pasture
- 39 Idle farmland
- 40 Other farmland
- 41 Urban & other
- 42 Rights-of-way
- 43 Nonforest-reserved
- 44 Noncensur water
- 45 Censur water

- ASPECT
- Record actual azimuth
- code
- 1 Top 1/2
- 2 Upper 1/4
- 3 Lower 1/4
- 4 Level or lower 1/4
- SLOPE
- Record actual percent slope
- SLOPE SHAPE
- code
- 1 Level
- 2 Conve
- 3 Uniform
- 4 Convex

- 6-ASPECT-POSITION-SLOPE
- code
- 1 Top 1/2
- 2 Upper 1/4
- 3 Lower 1/4
- 4 Level or lower 1/4
- Distance is measured on slope
- Percent 66%
- ZC 99%

- 7-PHYSIOGRAPHIC CLASS
- code
- 0 No change
- 1 Definition
- 2 Legislation
- 3 Natural
- 4 Herbicide
- 5 Clearing(land cleared--timber is utilized)
- 6 Clearcut(land cleared--timber is utilized)
- 7 Partial timber cut
- 8 Other man(include fencing to exclude livestock)
- 9

- 8-STAND ORIGIN
- code
- 1 Natural stand with no evidence of artificial manipulation
- 2 More than 40 percent of the sample location occupied by trees originating from artificial planting or seeding
- 3 Less than 40 percent of the sample location estimated to be occupied by trees originating from artificial planting or seeding
- 4 Explain, if other than 1
- 10-SEED SOURCE
- code
- 1 Adequate softwoods
- 2 Adequate hardwoods & hardwoods
- 3 Inadequate all species

- 11-RECREATIONAL OPPORTUNITIES
- Third Digit
- 0 None
- 1 Locked gate
- 2 No trespassing
- 3 No hunting
- 4 No fishing
- 5 No dumping
- 6 Other signs
- 7 Other contact
- 8 Other evidence
- 9

- 12-FOREST TYPE-SIZE CLASS
- MISSOURI FOREST TYPES
- code
- 32 Shortleaf pine
- 33 Eastern redcedar
- 34 Shortleaf pine - hardwood
- 35 Post - Blackjack oak
- 36 Black - Scarlet oak
- 37 White oak
- 38 Oak - Gum - Cypress
- 39 Gum - Ash - Maple
- 40 Elm - Sycamore
- 41 Maple - Beech

G-L-U, CAUSE FOR CHANGE

- code
- 0 No change
- 1 Definition
- 2 Legislation
- 3 Natural
- 4 Herbicide
- 5 Clearing(land cleared--timber is utilized)
- 6 Clearcut(land cleared--timber is utilized)
- 7 Partial timber cut
- 8 Other man(include fencing to exclude livestock)
- 9

- 10-SEED SOURCE
- code
- 1 Adequate softwoods
- 2 Adequate hardwoods & hardwoods
- 3 Inadequate all species

- 11-CONIFER UNDERSTORY
- Code (First digit)
- 0 None or inadequate
- 1 Planted-should succeed
- 2 Planted-should succeed
- 3 Natural-should succeed
- 4 Natural-should succeed
- 5 Natural-needs treatment

- CONVERSION TABLE
- CHAIN TO FEET
- 1/6ch = 11.0'
- 1/4ch = 16.5'
- 1/2ch = 22.0'
- 2/3ch = 27.0'
- 3/4ch = 32.5'
- 1 ch = 38.0'
- 1 1/4ch = 43.5'
- 1 1/2ch = 49.0'
- 1 3/4ch = 54.5'
- 2 ch = 60.0'
- 2 1/4ch = 65.5'
- 2 1/2ch = 71.0'
- 2 3/4ch = 76.5'
- 3 ch = 82.0'
- 3 1/4ch = 87.5'
- 3 1/2ch = 93.0'

DBH (inches)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
2	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
3	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
4	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
5	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
6	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
7	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
8	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
9	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
10	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
11	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
12	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
13	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
14	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
15	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
16	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
17	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
18	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
19	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7
20	1.4	1.6	1.7	1.9	2.0	2.1	2.2	2.4	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7

Tatum Guides, continued

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

GRADE 1 HARDWOOD LOGS

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

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

GRADE 2 HARDWOOD LOGS

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

^{1/} Any number in a combination may be increased but not decreased.

GRADE 3 HARDWOOD LOGS

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

^{1/} Any number in a combination may be increased but not decreased.

GRADE 4 HARDWOOD LOGS

Position in tree	Butt and upper
D.I.B., small end, inches	8"
Length without trim, feet	8"
Clear cuttings	No requirements, not graded on cutting basis.
Sweep allowance, maximum	1/4 d.i.b. of small end for half logs and 1/2 d.i.b. for logs 16' long.
Sound surface defects permitted:	
Single knots	Any number, none to have a knot collar diameter in excess of 1/3 of the log diameter at point of occurrence.
Whorled knots	Any number provided the sum of the collar diameter does not exceed 1/3 of the log diameter at point of occurrence.
Holes	Any number not exceeding knot specifications if they do not extend over 3" into contained tie or timber.
Unsound defects permitted:	
Surface	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie or timber they shall not exceed size, number, and depth or limits of sound knots.
Interior	None permitted except one shake not more than 1/3 the width of contained tie or timber and one split not over 5" long.

AD

LOG GRADES FOR SOFTWOOD LOGS

Grade 1

- Logs must be 16" or larger, 10' or longer, and with deduction for defect not over 30 percent of gross scale.
- Logs must be at least 75 percent clear on each of three faces.
- All knots outside clear cutting must be sound and not over 2 1/2" in size.

Grade 2

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

Grade 3

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

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

LOG GRADES FOR EASTERN WHITE PINE

GRADING FACTOR	TREE GRADE 1	TREE GRADE 2	TREE GRADE 3	TREE GRADE 4
(1) MINIMUM D.B.H. (inches)	10	10	10	10
(2) MAXIMUM WEEVIL INJURY IN BUTT 16-FT. SECTION (numbers)	None	None	2 injuries	No limit
(3) MINIMUM FACE REQUIREMENTS ON BUTT 16-FT. SECTION	Two full length or four 16" length good faces. (In addition, knots on balance of faces shall not exceed size limits same of Grade 2 sections.)	NO GOOD FACES REQUIRED Maximum diameter of knots on three best faces: SOUND RED KNOTS not to exceed 1/4 scaling diameter and 3 inch maximum. ¹ DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/12 scaling diameter and 1 1/2 inch maximum. ²	SOUND RED KNOTS not to exceed 1/3 scaling diameter and 1 inch maximum. ¹ DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/4 scaling diameter and 2 1/2 inch maximum. ²	Includes all trees not qualifying for Grade 3 or better and judged to have at least one-third of their gross volume in sound wood suitable for manufacture into standard lumber.
(4) MAXIMUM SWEEP OR CROOK IN BUTT 16-FT. SECTION (percent)	20	10	40	No limit
(5) MAXIMUM TOTAL SCALING DEDUCTION IN BUTT 16-FT. SECTION (percent)	10	10	10	No limit
After the tentative grade of the section is established from face examination, the section will be reduced in grade whenever the following defects are evident:				
(6) CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON SURFACE OF SECTION ³	Degrade one grade if present on one face. Degrade two grades if present on two faces. Degrade three grades if present on three or four faces.			
(7) If the final grade of the grading section is 1, 2, or 3, examine the tree for weevil injuries in the merchantable stem above 16 ft. If the total apparent weevil injuries exceed three, degrade the tree one grade below the tentative grade. ⁴ Otherwise the tree grade is the same as the final section grade.				

JACK PINE & RED PINE LOG GRADES

Grade 1 Logs with 3 or 4 clear faces.^{1/}

Grade 2 Logs with 1 or 2 clear faces.

Grade 3 Logs with no clear faces.

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

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

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

FOREST SURVEY TATUM GUIDE
NORTH CENTRAL FOREST EXPERIMENT
LOG GRADES

SOUTHERN PINE LOG GRADES				
Grade	(DIB) Diameter Limits	Number Clear Faces	Definitions	Exceptions
1	16"+	3, 4	A face is one-fourth of the circumference extending full length of the log	a. Lower one grade any log not grade 3 having 3 inches or more of sweep, if sweep is 1/3 or more of log diameter.
2	12" - 16"	1, 2	Clear faces are those free of: Knots measuring more than one-half inch in diameter, overgrown knots of any size, holes more than one-fourth inch in diameter	b. Lower one grade any log not grade 3 if heart-rot fruiting has occurred or is imminent, as indicated by conk or visible, massed, heart-rot hyphae.
3	6" - 12"	None		c. Logs with scaling deductions for sweep and rot exceeding 2/3 the gross scale of the log will be classified as cull.

EASTERN RED CEDAR - LOG GRADE 5 (MISSOURI SPECIAL USE)	
Position in tree	Butts and Uppers
DEH	6" +
DOB small end	5" +
Length without trim, feet	7' +
Clean cuttings	No requirements
Sweep Allowances	Reasonably straight
Sound surface defects permitted:	
single knots	Any number less than 1/2 diameter at point of occurrence
whorled knots	Any number provided the sum of the diameter of knots 2" or larger in a 1 ft. section does not exceed diameter at that point
Unsound defects permitted:	
	Any number provided defect is not greater than 1/2 volume at any one point of occurrence

PLOT NUMBER DOT STATE/UNIT/ SAMPLE STAND COUNTY
 NEW OLD NUMBER COUNTY(53) KIND(02) AREA(46) CRUISER TALLY NAME(53)
 29/ /

WATER(47) AGR. LAND(48a) ROAD(48) NATIONAL RANGER OWNER(O1)
 TYPE AREA DISTANCE TYPE DISTANCE TYPE DISTANCE FOREST DIST. CLASS TENURE

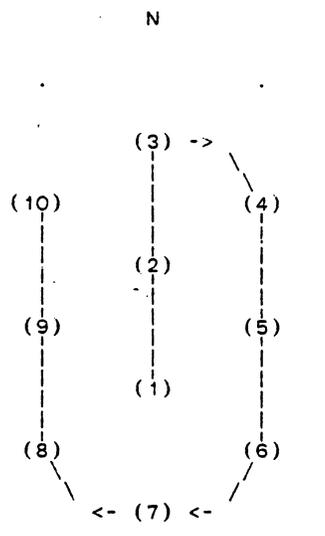
GROUND LAND USE(O4) POSI- SLOPE PHYSIO. STAND STAND SEED CONIFER
 ORIG. CURR. REASON ASPECT TION PERCENT SHAPE LENGTH CLASS ORIGIN HISTORY SOURCE UNDERSTORY
 (06) (06) (06) (06) (06) (07) (08) (09) (10) (11)

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

RECREATION(14) SUB- PHOTO FLIGHT PHOTO
 SETTING SIZE POSTING TOWNSHIP RANGE SECTION DIVISION AGE NO. PHOTO NO. SCALE

FIELD PHOTO 1: /

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



NOTES:(49)

WORKSHEET:

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

WITNESS TREES:(16) POINT NUMBER

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

REFERENCE TREES:(16)

PT.#	SPECIES	DIST.	AZIMUTH	MARK	DBH

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

STARTING POINT DESCRIPTION:(03)

COURSE TO SAMPLE LOCATION:(03)
 DIRECTION _____
 DISTANCE _____
 TO _____

SHRUB TOTALIZER(17)		
SPECIES	SIZE	NUMBER OR PERCENT

FIELD CREW:
 DATA RECORDER _____
 CRUISER _____
 TALLYER _____
 DATE _____

OWNERS NAME:(01) _____
 ADDRESS _____

PHOTO LOCATION _____

FIELD EDIT: _____ DATE: _____
 OFFICE EDIT: _____ DATE: _____

OWNER ACCURACY:

	UNKNOWN	POOR	GOOD
NAME & ADDRESS			
CLASS			
TENURE			

STARTING POINT MAP:

NEW PLOT# _____ OLD PLOT# _____ STATE/UNIT/COUNTY 29/_/_

CRUISER _____ TALLYER _____

B A C C O U N T	TREE IDENTIFICATION										TREE CLASSIFICATION							TREE MEASUREMENT							
	P O I N T #	T R E E #	S P E C I E S	T R E E H I S T	D I S T A N C E	D B H		A Z I M U T H	D A M / D E A T H	T R E E / C O V E R C L A S S	C R O W N R A T I O		C R O W N C L A S S		S T O C K I N G %	P O I N T O C C	T R E E C A V	L O G G R A D E	S A W L E N G T H	S A W T O P D O B	C U L L B D F T	B O L E L E N G T H	B O L E T O P D O B	C U L L C U T	
						O R I G I N A L	C U R R E N T				O R I G I N A L	C U R R E N T	O R I G I N A L	C U R R E N T											
20	16	21	22	23	24	25	25	26	27	28	28	29	29	30	30	31	32	33	37	34	35	36	38	39	40
XX	XX	XX	XXX	XX	XX	XXX	XXX	XXX	XXX	XX	XX	X	X	X	X	XX	X	XX	XXX	XXX	XXX	XXXX	XXX	XXX	XXXX

Growth Plot (used only in Minnesota)

TALLY INSTRUCTIONS

The growth plot is a 1/15 acre, 30.4' fixed radius plot. It is installed only at point 1 (plot center) of the 10 point cluster of plots with a sample kind of 1, 2, or 6. Tally all live trees 5.0" DBH or larger whose stump centers fall within a 30.4 radius of the pin marking the point center. If no trees meeting these parameters exist at point 1, mention the fact in the notes section of page 1 on the data sheets.

The data for the growth plot is recorded on a separate continuation data sheet. Record point number 11 in column 16 of the data sheet. Record tree data in columns 21-30 of the data sheet. Refer to the appropriate section of this manual for further information on these items.

Trees appearing on the growth plot will have their bark marked with a horizontal scribe at DBH and a vertical scribe at the base facing the point center. These scribe marks will be painted with blue paint. There is one exception. Often, a few trees will appear both on the variable radius (prism) plot and on the growth plot. These trees will have their scribe marks painted white.