FOREST INVENTORY AND ANALYSIS
NATIONAL CORE FIELD GUIDE
Modified for
North Central FIA Unit

VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

Version 1.4
FIAFIELD Version 2.5 (Data recorder program)

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Version 1.4

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INTRODUCTION

This document describes the standards, codes, methods, and definitions for Forest Inventory and Analysis (FIA) field data items. The objective is to describe CORE FIA field procedures that will be consistent and uniform across all FIA units. **This CORE serves as the framework for regional FIA programs; individual programs may add variables, but may not change the CORE requirements.** Unless otherwise noted, the items in this manual are considered CORE, that is, the information will be collected by all FIA Units as specified. Items or codes specified as CORE OPTIONAL are not required by individual units; however, if the item is collected or coded, it will be done so as specified in this manual. It is expected that all items in Volume I can be measured by a two-person field crew in less than a single day, on average, including time spent travelling to and from the plot.

The FIA program is in transition, changing in response to legislation and new customer demands. One of these demands is for increased consistency, which this manual begins to address. Another change is the merger of the FIA program with the field plot component of the Forest Health Monitoring (FHM) program. This will be accomplished by a joint sampling approach where FHM plots become a subset of the larger sample of FIA plots. In this model, plots formerly known as FIA plots will now be called Phase 2 plots; plots formerly known as FHM plots will be called Phase 3 plots.

The focus of Volume I is on data that are collected in the field on all Phase 2 plots in the FIA sample and on mensuration add-ons collected on Phase 3 plots. Volume II of the series will describe an additional expanded suite of data collected on the Phase 3 subsample. Volume II will consist of the FHM field manual, minus data elements already collected on the FIA sample. Volume III of the series (in preparation) will document the office procedures including data elements measured in the office, data from other sources that are merged into the FIA database, and CORE compilation and analysis algorithms. When complete, the three-volume set will describe all field data measured consistently across the country, comprising the CORE FIA program.

FIELD GUIDE LAYOUT

Each section of the field guide corresponds to one of the following sections:

0 General Description
1 Plot
2 Condition
3 Boundary

4 Subplot
5 Tree Measurements
6 Seedling
7 Site Tree
8 Nonforest/Denied Access/Hazardous Plots

Each section begins with some general overview of the data elements collected at that level, along with whatever technical background is necessary to prepare the field crews for data collection. Descriptions of data elements follow, in the following format:

DATA ELEMENT NAME -- <brief variable description>

When collected: <when data element is recorded>
Field width: <X digits>
MQO: <measurement quality objective>
Values: <legal values for coded variables>

Data elements and descriptions of when to collect, field width, MQOs, and values, apply to both Phase 2 plots (formerly called FIA plots) and Phase 3 plots (formerly called FHM plots) unless specifically noted.

Field width designates the number of columns (or spaces) needed to properly record the data element. MQO describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance.

Tolerances may be stated in +/- terms or a number of classes for ordered categorical data elements (e.g., +/- 2 classes); in absolute terms for some continuous variables (e.g., +/- 0.2 inches); or in terms of percent of the value of the data element (e.g., +/- 10% of the value). For some data elements, no errors are tolerated (e.g., PLOT NUMBER).

Percentage of time within tolerance is generally expressed as "at least X percent of the time," meaning that crews are expected to be within tolerance at least X percent of the time.

UNITS OF MEASURE

The field guide will use ENGLISH units as the measurement system.

Plot Dimensions:

Annular plot - for sample intensification or sampling relatively rare events.

Radius = 58.9 ft
Area = 10,890 sq. ft or 0.25 ac or 1/4 ac

Subplot - for selecting trees with diameter $\geq$ 5.0 in

Radius = 24.0 ft
Area = 1,809.56 sq. ft or approximately 0.04 ac or approximately 1/24 ac

Microplot - for counting seedlings and selecting saplings

Radius = 6.8 ft
Area = 145.27 sq. ft or approximately 0.003 ac or approximately 1/300 ac

The distance between subplots is 120.0 ft horizontal.
The minimum area needed to qualify as accessible forest land is 1.0 ac.
The minimum width to qualify as accessible forest land is 120.0 ft

Tree Limiting Dimensions:

breast height	4.5 ft
stump height	1.0 ft
merchantable top	4.0 in
minimum conifer seedling length	6.0 in
minimum hardwood seedling length	12.0 in
seedling/sapling DBH/DRC break	1.0 in
sapling/tree DBH/DRC break	5.0 in

0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24 ac in size with a radius of 24.0 ft. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 ft horizontal at azimuths of 360, 120, and 240 degrees, respectively from the center of subplot 1. See Figure 1. Subplots are used to collect data on trees with a diameter (at breast height "DBH", or at root collar "DRC") of 5.0 in or greater. Throughout this manual, use of the word 'plot' refers to the entire set of four subplots. “Plot center” is defined as the center of subplot 1.

Each subplot contains a microplot of approximately 1/300 ac in size with a radius of 6.8 ft. The center of the microplot is offset 90 degrees and 12.0 ft horizontal from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH/DRC of 1.0 in to 4.9 in) and seedlings (DBH/DRC less than 1.0 inch in diameter and greater than 6 inches in length (conifers) or greater than 12 inches in length (hardwoods)).

As a **CORE OPTION**, the field plot may also include annular plots of 1/4 ac in size with radius of 58.9 ft with the annular plot center coinciding with each subplot center. Annular plots are numbered in the same way as subplots. Annular plots may be used to select and collect additional data for regional enhancements. For example, annular plots may be used to provide a better sample of rare population elements such as very large trees.

Data are collected on field plots at the following levels:

Plot	Data that describe the entire cluster of four subplots.
Subplot	Data that describe a single subplot of a cluster.
Condition Class	A discrete combination of landscape attributes that describe the environment on all or part of the plot. These attributes include CONDITION STATUS, RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY.
Boundary	An approximate description of the demarcation line between two condition classes that occur on a single subplot, microplot, or annular plot. There is no boundary recorded when the demarcation occurs beyond the fixed radius plots.
Tree	Data describing saplings with a diameter 1.0 in to 4.9 in, and trees with diameter $\geq$ 5.0 in

Seedling	Data describing trees with a diameter < 1.0 inch and ≥ 6.0 inches in length (conifers) or ≥ 12.0 inches in length (hardwoods).
Site Tree	Data describing site index trees.

0.1 PLOT SETUP

Plots will be established according to the regional guidelines of each FIA program. In cases where the plot center cannot be occupied due to safety hazards, lack of access, or when the plot center is out of the sample, but some of the subplots can be occupied and are in the sample, those subplots which can be established should be established and sampled according to normal procedures. In cases where a subplot or microplot center cannot be occupied, no data will be collected from that subplot or microplot; instead, the entire subplot or microplot should be classified according to the condition preventing occupancy.

The table provided below can assist in locating subplot 2-4 from a subplot other than subplot 1.

Subplot Numbers		Azimuth	Backsight	Distance
From	To	*degrees*		*feet*
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

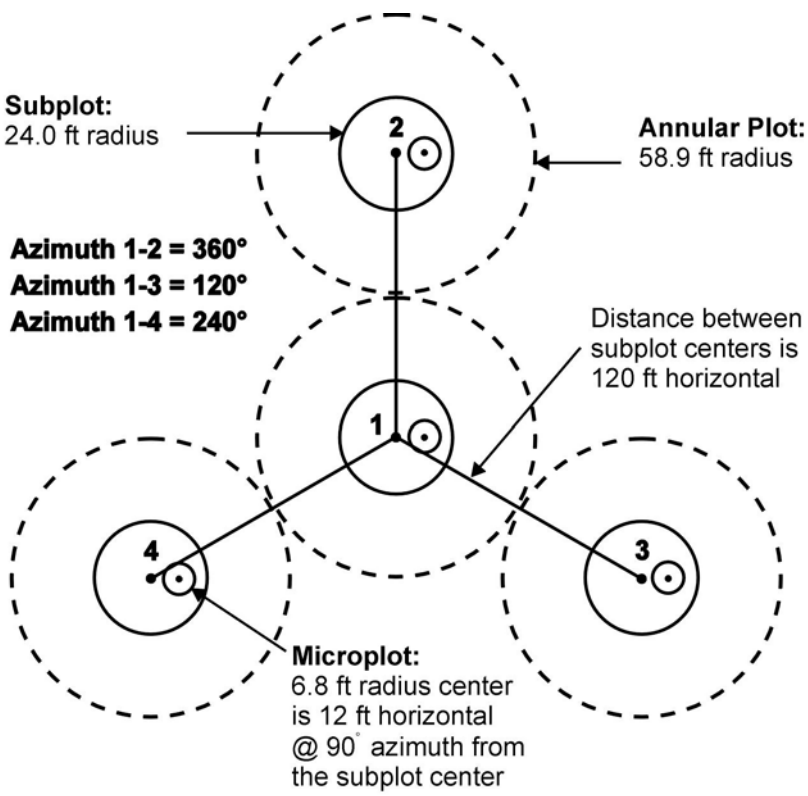


Figure 1. FIA plot diagram.

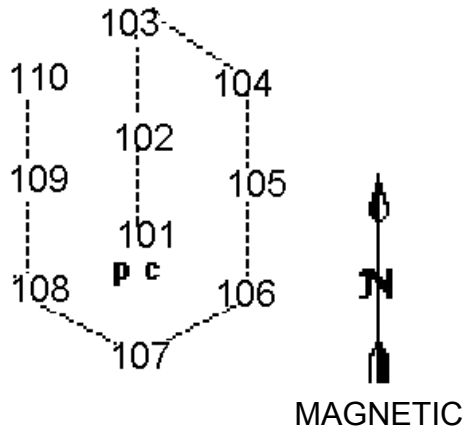
0.1.1NC OLD VARIABLE RADIUS PLOT

The old variable radius plot consists of 10 subplots. The layout of these subplots is shown in figure NC1. Plot center is the term applied to the point used to locate the plot. It is the ground location that corresponds to the pin prick on the photography. The centers of the subplots are referred to as subplot centers. Subplot center 101 is the same as plot center. Each subplot consists of a variable radius (37.5 BAF) plot to sample trees 5.0 inches and larger. A fixed radius micro plot (6.8 ft. radius) to sample trees less than 5.0 inches was measured at subplots 101, 102 and 103 in IL and IN and at all subplots in IA, KS, MI, MN, MO, NB, ND, SD, and WI. In Mo, MI, IA and prior to Cycle 6 in MN, when a subplot center was in a different land use than plot center, subplots were rotated so that all ten subplots fell in the same landuse as PC. If PC was nonforest subplots were not established. If PC was forest all subplots were rotated to be contained in forest. Figure NC1 does not apply for these plots. Instead refer to the plot sheets for subplot location.

The pattern of the old variable radius plot was designed to obtain a uniform distribution of subplots over approximately one acre of forest land. Distances between sequential subplot centers is 70 horizontal feet. (fig. NC1).

Figure NC1 Old variable radius plot layout.

From subplot center	70' to subplot center	Azimuth
101	102	0°
102	103	0°
103	104	120°
104	105	180°
105	106	180°
106	107	240°
107	108	300°
108	109	0°
109	110	0°



After subplot center 101 has been relocated, establish, locate, and mark 101-105 subplot centers with metal pins and flagging in the **same** location that they were last measured. All trees measured in the previous inventory will be re-measured (except saplings on subplots 104 & 105). Previously rotated subplots (101-105) will be re-measured in their rotated locations only when they were not un-rotated in a previous measure. For the location of any un-rotated subplots see the plot sheet.

0.1.1.1NC PLOT LOCATION PROCEDURE FOR RE-MEASUREMENT PLOTS

Using both the old and new photographs (or provided image), locate the starting point(SP). For the remainder of this manual photo will refer to any image format.

If the SP pinprick is missing from the old photo, refer to "starting point Description" on the old plot sheet and determine the SP location according to the azimuth and distance to plot center (PC). Pay close attention to any openings on the photo, such as clearings, roads, woods trails, lakes, and streams, where the SP might logically be located. Also check the sketch of the area on the back of the original plot sheet.

Once the SP tree is located, inspect to see that it is suitable. If the SP is suitable, the cruiser re-scribes (not in reserved areas), repaints (not in reserved areas), and re-measures DBH. The tallier checks the "Course to Sample Location" on the plot sheet to see if it seems reasonable. The tallier then transfers the original course to sample location, SP description, and the re-

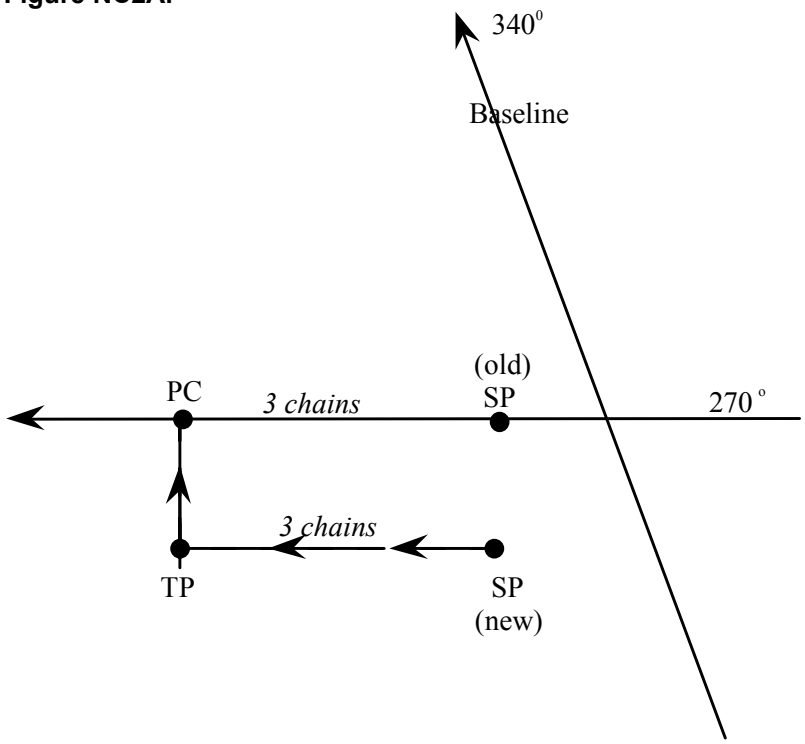
measured DBH to the new plot sheet. On the new photo, pinprick the SP and record the course to sample location on the back of the photo.

Establish a new starting point if the original SP is not suitable, cannot be found, or the plot location is visible. Record the course to sample location, SP description, and SP DBH on the new plot sheet. After re-establishing the SP, chain the computed azimuth and distance along the approach line and mark the location.
Search the area for evidence of the old plot. Items to look for are paint on the tree bases (vertical line) and at breast height (horizontal line). Look for 10-inch wire pins and bits of flagging at each subplot, and witness trees (painted with an "X").
After finding plot center, establish a turning point if the distance between plot center and the end of the approach line exceeds 3% of the chaining distance.
In the event that, after chaining the prescribed distance, no evidence of the old plot can be found, the following alternatives for locating PC are available.

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

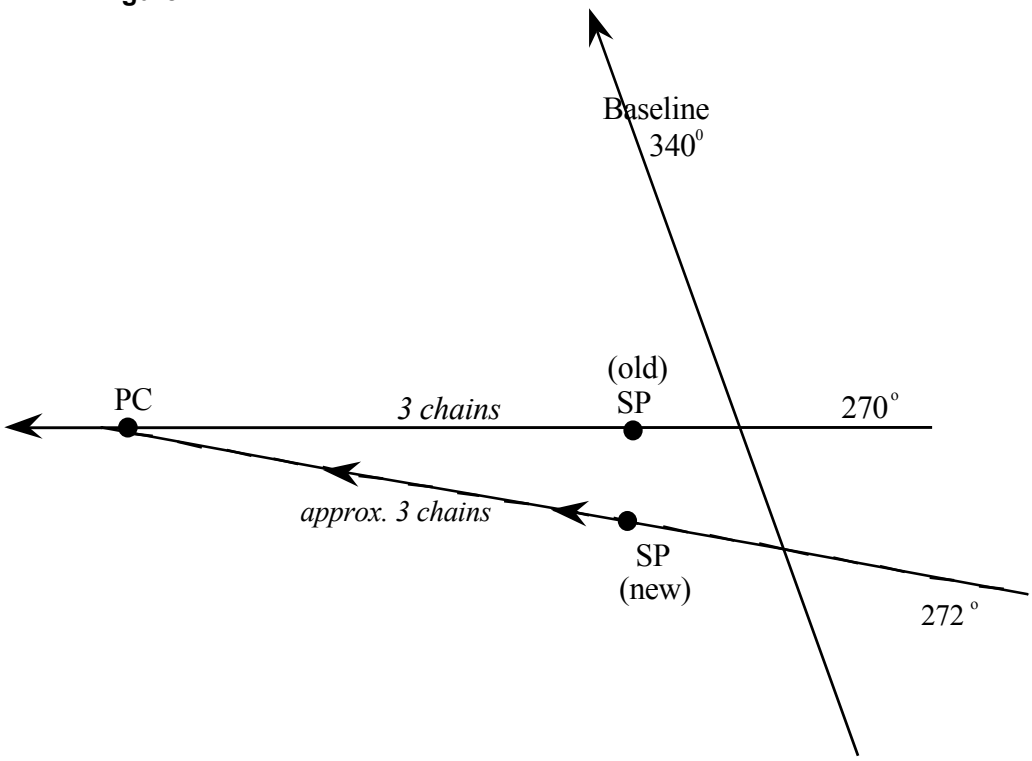
An easy way to establish a new SP, when needed, is to inspect the vicinity of the original SP for a suitable replacement. The following three options are available once you've found a replacement (fig. NC2A, NC2B, NC2C). Note that fig. NC4 shows the plot sketch—east-west azimuths would need to be reversed if drawn on the back of the photo.

Figure NC2A.



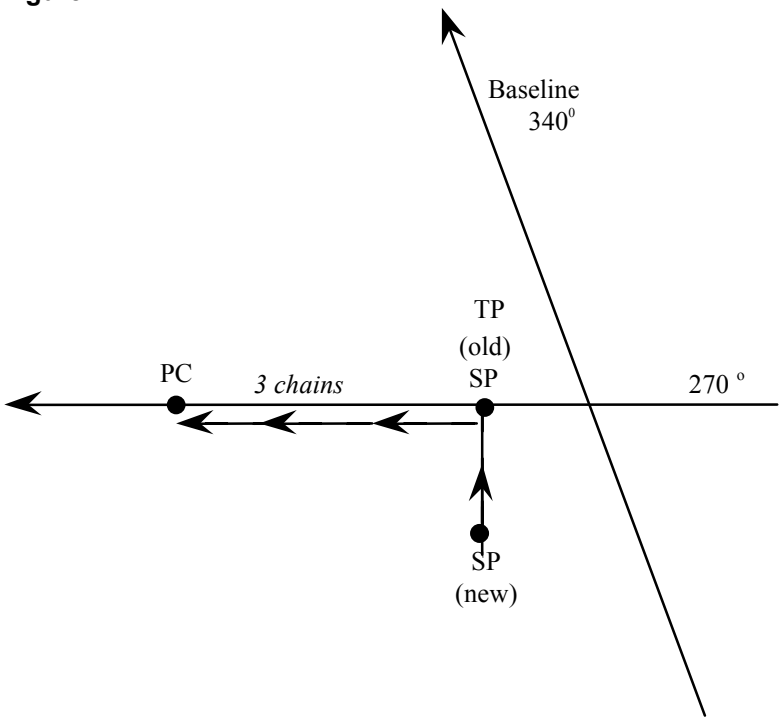
If the new SP is close by, pick the tree on the photo and use the original course to sample location. Leave a marker at your destination and look for plot center. It should be approximately the same distance and azimuth that the old SP is from the new SP. Once PC is found, make a turning point from your marker to PC.

Figure NC2B.



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

Figure NC2C.



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

0.1.1.2NC SUBPLOT LOCATION

After finding some evidence of the old plot, look for trees marked at the base and at DBH with paint. When several of these trees are found in close proximity, examine the original plot data and try to match these trees to trees on one of the original subplots.

Match by comparing current tree species, azimuths, distances, and DBH to the data for trees on the tree record sheet. Once it is determined to which subplot the trees belong, use triangulation to find the subplot center, marked with a piece of galvanized or aluminum wire--bent into a loop with a piece of blue flagging tied through it.

After finding the old pin, place a new pin next to it. If the old pin cannot be found, triangulate to accurately re-establish the point in the original location.

It is very important to locate each individual subplot as accurately as possible. Finding each subplot is a challenge—most of the flagging disintegrates, the wires rust and appear just like twigs or roots. The best method is to run out 70 feet from the last subplot 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 subplot. If this is not possible, due to lack of trees or other circumstances, locate several adjacent subplots and use these to triangulate to the missing subplot. You can then determine the general location of the missing subplot and reduce the area to search.

If there is a former Forest Health Monitoring (FHM/P3) plot installed on the location already and the location of the FHM/P3 subplot one does not mesh with subplot one of the FIA plot, use the location of the FIA plot to do all work on the old trees. Then install the new plot using the location of the FHM/P3 plot. Make a note on the plot sheet about where the FHM/P3 plot is

located in relation to the FIA plot. If there was a 4 point FIA plot installed at a different location than the FHM/P3 plot re-measure the FIA plot where the FHM plot was installed.

0.1.1.3NC IF UNABLE TO LOCATE A RE-MEASUREMENT PLOT

If the crew can not find a re-measurement plot, bring it to the attention of the person in charge. After the crew has thoroughly searched for the plot without success, establish the plot using one of the following guidelines.

1. When there has been a major disturbance (such as the area has been clearcut and bulldozed) and it is obvious that the plot can't be relocated establish the plot as near as possible to the old PC.

   No new trees will be measured on subplot numbers 101-105. All original trees should be accounted for using status of removed or dead. Any other current data that is possible should be collected, ie lean, utilization, DBH (same as original).

OR

2. When there has been no major disturbance to the area, two plots will be created. The first plot retains the old plot number, is given SK=0 and NCSK=0 this data file and the old plot sheet This is considered a Lost plot. The second plot is a new plot that is established to replace the old lost plot. Give the new plot a SK=1 and NCSK=33, complete the whole plot. Contact headquarters for a new plot number and retrieve a Husky download file.

What is a lost plot and how do I handle it?

A lost plot must meet the following criteria:

1. There has been no major disturbance to the plot area.
2. It may be any downloaded sample kind that refers to re-measurement. This excludes plots where SK=1 **and** NCSK=0.

IF YOU ARE IN THE FIELD AND ARE READY TO START THE PLOT HERE IS HOW TO HANDLE THE DOWNLOAD DATA FROM THE LOST PLOT AND THE NEW PLOT.

A. The lost plot is closed out as a condition status 7 "Not in sample" with:

1. Plot header filled out, change sample kind as directed in section 0.1.1.3NC in your field manual
2. Condition data needed = CON#, STAT

B. Start a new plot on the Husky using the Husky option from Data entry below:

>0000000.00 NEW PLOTEnter/Edit

1. Change the default values for State, Unit, County to the correct ones for the plot location. Leave the plot number as 9999 until you get to the office to get a new number from St. Paul. Collect all the data under this plot number of 9999 and return to the office. Once you get the new number from St. Paul, change the plot number to the number you are given before trying to upload the data. Sample kind for this new plot would follow manual directions in Section 0.1.1.3NC in the manual that you are working in.

2. When you save the new plot now with the correct new plot number you will still have the plot you called 9999 in the plot list and on the Husky. Now you must delete the plot number 9999 from the Husky, using the Delete a Plot Option.

C. Transfer/send both the lost plot file and the new plot file to St. Paul.

IF YOU ARE IN THE OFFICE BEFORE YOU NEED TO START THIS PLOT:

A. The lost plot is closed out as a condition status 7 “Not in sample” with:
1. Plot header filled out, change sample kind as directed in section 0.1.1.3NC in your field manual
2. Condition data needed = CON#, STAT

B. Call St. Paul for a new plot number. St. Paul will create a new plot file for you to download.

C. Get the new download file one of two ways.
1. When St. Paul gives you the new plot number filename use the JAVA program to retrieve the new download file.
2. Have St. Paul send you the new download file with the new plot number.

D. Go to the field and collect all the data for the plot on the new download file.

E. Transfer/send both the lost plot file and the new plot file to St. Paul.

0.1.1.4NC RE-MEASUREMENT PLOT IN THE WRONG LOCATION

If a re-measurement plot was established in the wrong location (i.e. not in the same location as the photo pinprick), re-establish the plot in that wrong location. If the error is more than 2 chains or if it needs clarification for next crew, re-pinprick the new photo where the plot is actually located.

NOTE: An example of needs clarification for the next crew is that the current pinprick is on the north side of the road only 1 chain away but the plot is on the south side of the road. In this case please re-pinprick the new photo.

In the "Notes" section of the plot sheet, indicate that the plot was put in a different location. Record the distance and azimuth (use photo scale) from the original pinprick on the new photo to where the plot is actually located. Bring such plots to the attention of the person in charge. It is assumed that the plot is located in the correct location, unless evidence of the plot is found in the wrong place (i.e., pins, paint or flagging).

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

0.1.2NC NC SUBPLOT NUMBERING

The new standard plot design consists of a series of fixed-area, circular subplots tied to a cluster of four points that are spaced 120 ft (36.6 m) apart (Figure 1). The sampling unit for most tree measurements (trees > 5.0" DBH) is the 1/24-acre (1/60 hectare) subplot. The radius of this plot is 24.0 ft (7.32 m). A tree is on the subplot if its center (at the base of the tree) is within 24.0 ft of subplot center. Each subplot also includes a 1/300-acre (1/750 hectare) micro-plot located 12 feet and 90^0 from the (6.8 ft (2.07 m) radius) subplot center. Seedlings and saplings are measured on the micro-plot. To distinguish subplots on the new standard plots from subplots on the old 10-point plot, the new standard subplots will be given subplot numbers 1-4 and the old 10-point subplots will be numbered 101-110.

0.1.3NC ESTABLISH BASELINE

The first step in locating the forest sample location is finding two features on the ground that are easily noticed on the photograph. The two features should be at least 10 chains apart for scale 1:20,000 and 20 chains apart for scale 1:40,000 to help minimize error. Select such features as straight road sections, drainage ditches, or two distinct trees. Avoid using railroads or power lines since they influence the compass reading.

Pinprick both features on the photograph and circle the pinpricks on the back of the photos. Draw the baseline on the back of the photograph with an arrow at one end of the line to indicate the azimuth direction. Measure the azimuth with a compass to the nearest half-degree and record it on the back of the photograph. Disregard magnetic declination.

0.1.4NC STARTING POINT

A starting point (SP) is established for the purpose of locating a sample plot. It should be as near as possible to the sample location, yet not on the same acre as the sample plot.

When selecting the starting point, make sure it is readily identifiable on the ground and on the photograph. Select a prominent tree located at the edge of a field or clearing, at a bend in a stream, or any landmark easy to find on the next survey.

Pinprick the starting point on the aerial photograph on which the sample location is pinpricked. Label and circle the pinprick "SP" on the back of the photograph. Record the latitude and longitude of the “SP” tree on the plot sheet, using the same method as “Collecting the Plot Center Coordinate” in Appendix 7.

0.1.4.1NC STARTING POINT TREE MONUMENTATION

In the field, mark the starting point with paint facing the direction of normal approach. Paint "SP" (in letters four-inches tall) just above where the diameter breast height (DBH) measurement was taken. Paint a three-inches tall "SP" near ground level. Use discretion in painting trees on private lands and in well-traveled areas. Note when painting deviates from normal procedures. In reserved areas do not use paint, unless the manager of reserved area* indicates otherwise. Instead, nail a tag marked with "SP" to the base of the tree. Please make a note on the plot sheet telling what was used to mark if reserved areas are not marked with a nail and tag at the base.

** If the reserved area is a National Park we have a National agreement to use the nails so do not paint.*

Describe the starting point on the plot sheet under "Starting Point Description." Include the landmarks you used to locate SP. Specify details of the starting point such as:

- Species, DBH, and the face on which the tree is painted.
- Any nearby road, fence, pasture, etc. and the tree's location in relation to that feature.
- Any noticeable characteristic of the SP tree, such as a fork at 10 feet, multiple stems, deer stand, etc.
- Take a GPS reading at SP tree and record on the plot sheet. Follow the same directions as getting a GPS reading at plot center.(Appendix 7)

0.1.4.2NC AZIMUTH AND DISTANCE COMPUTATION

On the back of the photograph, connect the pinpricks for the starting point and plot center with a straight line. Extend this line to intersect the baseline. Lines should extend well beyond the intersection to allow reading the backsight off the 360-degree protractor to check the accuracy of the angle being measured.

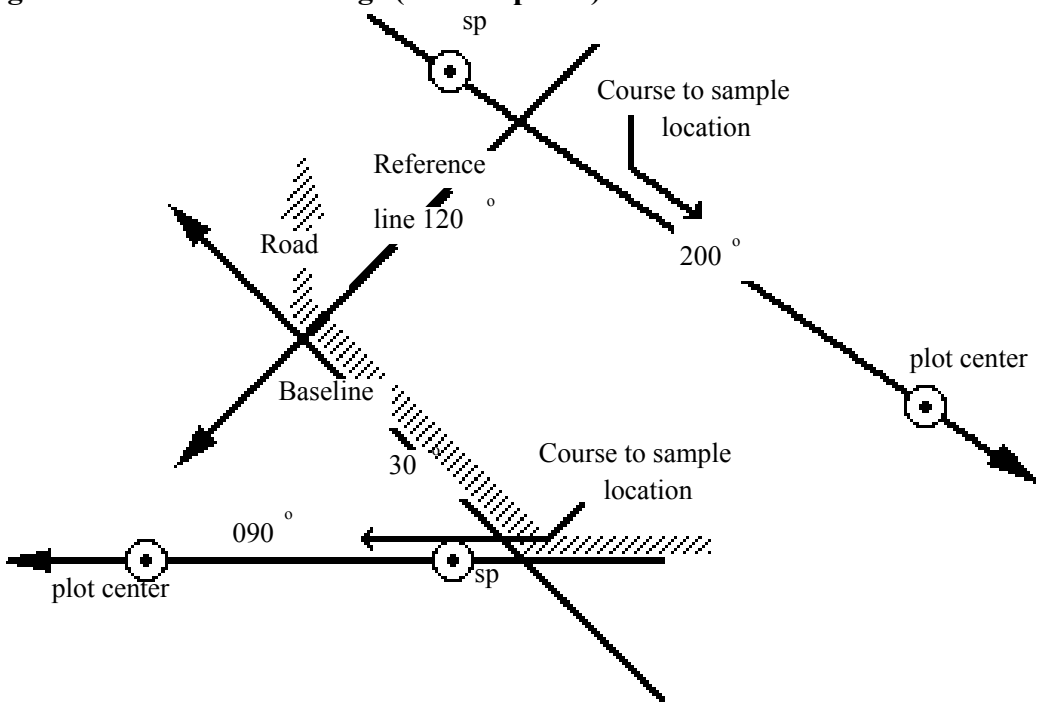
If the baseline and the line to the sample location do not intersect on the photograph, draw a straight line that will intersect the baseline and the course to sample location line. Indicate the directions of the

sample location line and the baseline by putting an arrow at the end of each line. Measure the angle between these lines, starting from the baseline.
Be sure to use an inverted 360^0 protractor or flip a standard 360^0 protractor over. Align the 360-degree protractor over the azimuth of the baseline to get the azimuth of the sample location line. The azimuth is read directly off the protractor once the azimuth of the baseline is correctly aligned on the inverted protractor. This is because east-west azimuths are reversed 180 degrees when working on the back of the photographs. Repeat this procedure if an additional line (reference line) is needed to intersect the course to sample location. To minimize error, check the backsights of both base and course to sample location lines. This is a check to see if the protractor is precisely aligned.

Important: East-west azimuths are reversed when working on back of photo with standard protractor. Inverted protectors are available.

Refer to Figure NC4. Measure on the photograph the distance from the starting point (SP) to the plot center (PC) to the nearest quarter chain using a transparent photo scale. (Photo scales, corresponding to the aerial photography, are supplied.) Hold the photo up to the light and carefully measure, from the center of one pinprick to the center of the other. (Sometimes it helps to use your stereoscope as a magnifier.) Record both distance and direction on the back of the photograph and on the plot sheet under "Course to Sample Location".

Figure NC4. Azimuth settings (back of photo)



0.1.4.3NC CHAINING

Using compass and tape, run a course on the computed azimuth. Distance correction for slope is necessary when slope exceeds 10 percent. Using the Suunto clinometer, slope correction can be quickly determined and added by the tallier after the cruiser has run out the line. Making adjustments for differences in the height of crew partners, the tallier can sight on the cruiser and directly read the percent scale on the clinometer. The appropriate slope correction can then be found in NC Table 1. The correct adjustment should be added at the same percent slope. For

example, to chain a horizontal distance of 66.0 feet on a 25 percent slope, chain 68.0 feet (66.0 + 2.0) on the slope.

NC Table 1. Slope Correction in feet
(Distance is measured on slope)

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

Once the computed course has been run, place a permanent stake at the end of the computed course. Important: Make sure that photograph location agrees with ground location.

0.1.4.4NC LOCATION CORRECTION

If the ground location is clearly not the point pinpricked on the photograph (more than 2 chains error), and the correct location can be determined on the site, place a second pin at the correct location. Note the azimuth and distance from the initial pin to the relocated pin and record these items under "Course to Sample Location" on the plot header sheet and remove the first pin. The initial pin is referred to as a turning point. The second pin becomes the location of the plot.

0.1.4.5NC CHAINING TO OTHER THAN PC

In chaining to plot center, you may encounter some condition that makes it impossible or impractical to physically reach plot center and put in a pin. Plot center may be in water, the center of a barn, or on a busy highway. Other subplots on the plot may be in a forest condition and the plot must be installed. In this case you can chain to any one of the subplots and establish it first. This can be done by using the data recorder program to compute the direct distance and azimuth to take from the starting point to any subplot center and chaining directly to a given subplot. This method is best when you can see you will have trouble reaching plot center before you start chaining.

Note: This program works only if you are farther than 140 ft. away from PC.

A turning point can also be used at any point when chaining to reach another subplot center. At any point while chaining, establish a turning point, chain the distance and azimuth from plot center to the subplot you wish to chain to, and then continue on your original course. For example, the course from the starting point to plot center is 200^0, 700 ft. After chaining 600 ft you can see that plot center will be in a river and it would be best to chain to subplot 103. At 600 ft, establish a turning point and go 0^0,

140 ft (the distance and azimuth from plot center to subplot 103). Establish another turning point and complete the original course (200^0, for the remaining 100 ft) to reach subplot 103.

0.2 PLOT INTEGRITY

Each FIA program is responsible for minimizing damage to current or prospective sample trees and for specifying how these trees are monumented for remeasurement. The following field procedures are permitted:

- Scribing and nailing tags on witness trees so that subplot centers can be relocated.
- Boring of trees for age on subplots and annular plots to determine tree age, site index, stand age, or for other reasons.
- Nailing and tagging of trees on microplots, subplots, and annular plots so that these trees can be identified and relocated efficiently and positively at times of remeasurement.
- Nailing, scribing, or painting microplot, subplot, and annular plot trees so that the point of diameter measurement can be accurately relocated and remeasured.

All other potentially damaging procedures that may erode plot integrity are prohibited.
The following practices are specifically prohibited:

- Boring and scribing of some specific tree species, such as quaking aspen, that are known to be negatively affected (i.e., the initiation of infection or callusing).
- Chopping vines from tally trees. When possible, vines should be pried off trunks to enable accurate measure. If this is not possible, alternative tools (calipers, biltmore sticks) should be used.

1.0 PLOT LEVEL DATA

In general, plot level data apply to the entire plot. They are recorded from the center of subplot 1. If subplot 1 is not established, record from the lowest numbered subplot which is established.

1.0.1NC SUBPLOT CENTER MONUMENTATION

Subplot centers are marked with wire, bent into a loop and wrapped with blue flagging. Leave about two inches of the wire projecting above the ground. In reserved areas do not attach flagging to the wire. All subplot centers are marked, 101 – 105 and 1-4.

1.0.2NC NC SUBPLOT REFERENCE TREES

On many plots, certain subplots within the plot lack information useful in determining their location on future surveys. Examples of this are subplots with part or all forested condition with out any trees within the subplot area.

All subplots on the plot without data that could be used to re-established location (i.e. no azimuth or distances to any tree) must be referenced. Monument reference trees above DBH and at the base with a scribe mark and paint on the side of the tree facing the subplot center. There is no set rule for painting a reference tree, but it is best to paint the tree with a number corresponding to the subplot being references. This method make it easier for field crews on the next survey to identify which subplot they have located. In reserved areas follow the same rules as on a subplot tree for monumentation.

Reference trees should have the following characteristics:

- Located within 70 feet of the subplot center
- Not likely to die or be cut before the next survey
- Species easily located in the stand
- At least 5.0 " DBH (or at least 2.0" DBH if no 5.0+ DBH is available)

In the "Reference Tree" grid of the plot sheet the subplot number, azimuth, slope distance to the center at the base (nearest tenth of a foot), and DBH.

1.1 STATE (ST)

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.

When collected: All plots
Field width: 2 digits
MQO: No errors, 100% of the time
Values: See Appendix 1

1.2NC NC UNIT (UNIT)

Unit is a one digit code which refers a division of a State that the plot and county are in (see the listed codes in the appendix 1)

When collected: All plots
Field width: 1 digits
MQO: No errors allowed, 100% of the time.
Values: See appendix 1 for complete list.

1.2 COUNTY (CNTY)
Record the unique FIPS (Federal Information Processing Standard) code identifying the county (or unit in AK) where the plot center is located.

When collected: All plots
Field width: 3 digits
MQO: No errors, 100% of the time
Values: See Appendix 1

1.3 PLOT NUMBER (PLT#)
Record the identification number for each plot, unique within a county (survey unit in AK).

When collected: All plots
Field width: 4 digits
MQO: No errors, 100% of the time
Values: 0001 to 9999

1.4 SAMPLE KIND (SK)
Record the code that describes the kind of plot being installed.

When collected: All plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1 **Initial plot establishment** - field-visited or remotely classified.

2 **Remeasurement** of a previously established National design plot - field visited or remotely classified.

3 **Replacement plot** - a previously established National design plot that was replaced with a new plot because the original plot could not be relocated or because plot data were lost.

0 **NC only code –** Do not install an new 4 point National design plot here.

1.4NC NC SAMPLE KIND (NCSK)
The NC sample kind indicates the information to be collected on plot types that are unique to North Central Research Station FIA.

When collected: All plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0 **Lost plot** – Ground evidence of old plot could not be found and there has been no major disturbance to the area, or new plot no old trees.

6 **Partial Re-measurement Relocate**. Measure all old trees on subplots 101-105.

8 **No Re-measurement Relocate**. Do not measure old plot just use old plot information to locate subplot center to begin installation of new plot design.

33 **Replacement plot**. No old subplots are measured here.

1.5 MANUAL VERSION

Record the version number of the National Core Field Guide that was used to collect the data on this plot. This will be used to match collected data to the proper version of the field manual.

When collected: All plots (done by St. Paul office not a field collected item for North Central)
Field width: 2 digits (x.y)
MQO: No errors, 100% of the time
Values: 1.1 (Maine 1999) and higher

1.6 CURRENT DATE

Record the year, month, and day that the current plot visit occurred as follows:

1.6.1 YEAR (YEAR)

Record the year that the plot visit occurred.

When collected: All plots
Field width: 4 digits
MQO: No errors, 100% of the time
Values: Beginning with 1998, constant for a given year

1.6.2 MONTH (MONT)

Record the month that the plot visit occurred.

When collected: All plots
Field width: 2 digits
MQO: No errors, 100% of the time
Values:

January	01	May	05	September	09
February	02	June	06	October	10
March	03	July	07	November	11
April	04	August	08	December	12

1.6.3 DAY (DAY)

Record the day of the month that the plot visit occurred.

When collected: All plots
Field width: 2 digits
MQO: No errors, 100% of the time
Values: 01 to 31

1.7 DECLINATION (CORE OPTIONAL)

NC Note: Not recorded in North Central Region.

1.8 TRAILS OR ROADS (RTYP)

Record the nearest trail or road to the plot. Use the plot photo, maps, or reasonable observations made while traveling to the plot to determine nearest trail or road (within 1 mile straight-line distance of the plot center). If two or more trails or roads are estimated to be equally distant, code the higher quality trail or road (lower code number). Base the coding decision on the condition of the road at the time of the visit.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit

MQO: No errors, at least 90% of the time
Values:

0	None within 1 mile
1	Paved road or highway
2	Improved gravel road (has gravel, ditching, and/or other improvements)
3	Improved dirt road (has ditching, culverts, signs, reflectors, or other improvements)
4	Unimproved dirt road/four-wheel drive road (has no signs of any improvements)
5	Human access trail- clearly noticeable and primarily for recreational use

1.9 HORIZONTAL DISTANCE TO IMPROVED ROAD (RDIS)

Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road (TRAILS OR ROADS = 1, 2, or 3) is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements.

NC Note: A private drive is considered a road if it meets the qualifications above.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values:

1	100 ft or less
2	101 to 300 ft
3	301 to 500 ft
4	501 to 1000 ft
5	1001 ft to 1/2 mile
6	1/2 to 1 mile
7	1 to 3 miles
8	3 to 5 miles
9	Greater than 5 miles

1.10 ROAD ACCESS (RACC)

Record the first road access restrictions encountered while traveling to the plot. These restrictions limit car and truck access to the starting point for the walk to the plot, and may occur on ownerships encountered before reaching the plot area.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values:

0	None – no road access restrictions
1	Road blocked by locked gate or cable across road
2	Road blocked by a human-made obstruction across road (ditch, mound, etc.)
3	Road blocked by natural occurrences (trees blown over onto road, road or bridge washed out)
4	Posted no motorized vehicle signs; road present, but restricted area such as Wilderness or National Park where vehicles are not allowed
9	Other – specify in plot-level notes

1.11 PUBLIC USE RESTRICTIONS (REST)

Record, if any, the restriction posted near or on the plot area that limits public use of the plot area; if more than one restriction occurs for the plot area, record the lowest number restriction present (1-3, 9).

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values:

0	None – no public use restrictions
1	Keep out / no trespassing
2	No hunting or fishing
3	No dumping
9	Other - specify in plot-level notes

1.12 RECREATION USE 1 (RECU)

Record up to 3 signs of recreation use encountered within the accessible forest land portion of any of the four subplots, based on evidence such as campfire rings, compacted areas (from tents), hiking trails, bullet or shotgun casings, tree stands, etc. Record the recreation use that has had the most significant impact on the plot area first, then the second and third use. For example, in general numerous four-wheel drive or ATV trails would be coded before camping, and camping before hiking, and hiking before fishing. Use the coding system provided as a hierarchy. Do not repeat codes, except codes 0 and 9. Physical recreation evidence must be present to code 1-9. Also, disregard dumping where no evidence of recreation is present. Examine the plot area for clues before spending an exorbitant amount of time trying to find evidence that normally would not be found in the area; look for the obvious signs first.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values:

0	No evidence of recreation use
1	Motor vehicle (four wheel drive, ATV, motorcycle, snowmobile)
2	Horse riding, dog team trails, ski trails
3	Camping
4	Hiking
5	Hunting/shooting
6	Fishing
7	Boating – physical evidence such as launch sites or docks
9	Other – recreation use where evidence is present, such as human litter, but purpose is not clear or does not fit into above categories.

1.13 RECREATION USE 2

Record the second most significant recreation use impact. See RECREATION USE 1 for coding instructions.
NC Note: this is the second digit of RECREATION USE 1 (RECU)

1.14 RECREATION USE 3

Record the third most significant recreation use impact. See RECREATION USE 1 for coding instructions.
NC Note: this is the third digit of RECREATION USE 1 (RECU)

1.15 WATER ON PLOT (WTYP)

Record the water source that has the greatest impact on the area within the accessible forest land portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water. This variable may be used for recreation, wildlife, hydrology, and timber availability studies.

When collected: All plots with at least one accessible forest land condition class
Field width: 1 digit
MQO: No errors, at least 90% of the time
Values:

0 None – no water sources
1 Permanent streams or ponds too small to qualify as noncensus water
2 Permanent water (too small to qualify as Census or noncensus water) in the form of deep swamps, bogs, marshes without standing trees present or with standing trees and less than 1.0 ac in size
3 Ditch/canal – human-made channels used as a means of moving water, such as irrigation or drainage which are too small to qualify as noncensus water
4 Temporary streams
5 Flood zones – evidence of flooding when bodies of water exceed their natural banks

9 Other temporary water – specify in plot notes

1.16 QA STATUS (QAST)

Record the code to indicate the type of plot data collected, using the following codes:

When collected: P2 – All plots
P3 - All plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1 Standard production plot
2 QA field plot (cold check)
3 Reference plot (off grid)
4 Training/practice plot (off grid)
5 Botched plot file (disregard during data processing)
6 Blind QA Plot
7 Production Plot Hot Check

1.17 CREW TYPE (CRTY)

Record the code to specify what type of crew is measuring the plot.

When collected: P2 – All plots
P3 - All plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1 Standard field crew
2 QA crew

1.18 GPS COORDINATES

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field visited plot locations.

1.18.1 GPS UNIT SETTINGS, DATUM, and COORDINATE SYSTEM

Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured.

Each FIA unit will determine the Datum to be used in that region. Most will use the NAD 27 Datum (also known as NAS-C or NA 27 CONUS/CLK66), but coordinates collected using any appropriate datum can be converted back to a national standard for reporting purposes.

Each FIA unit will also determine which coordinate system to use. Regions using a Geographic system will collect coordinates in Degrees, Minutes, and Seconds of Latitude and Longitude; those using the UTM coordinate system will collect UTM Easting, Northing, and Zone.

1.18.2 COLLECTING READINGS

Collect at least 180 GPS readings at the plot center which will then be averaged by the GPS unit. Each individual reading should have an error of less than 70 ft if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable readings (180 readings at error $\leq$ 70 ft) can not be obtained, try again before leaving the plot center.

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 ft of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. If a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in Sections 1.18.12 and 1.18.13.

Coordinates may be collected further than 200 ft away from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Again, if a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance in Sections 1.18.12 and 1.18.13.

In all cases try to obtain at least 180 readings before recording the coordinates.

1.18.3 GPS UNIT (UNIT)

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

When collected: All field visited plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

- 0 GPS coordinates not collected
- 1 Rockwell Precision Lightweight GPS Receiver (PLGR)
- 2 Other brand

1.18.4 GPS SERIAL NUMBER (GPS#)
Record the last six digits of the serial number on the GPS unit used.

When collected: When GPS UNIT > 0
Field width: 6 digits
MQO: No errors, 100% of the time
Values: 000001 to 999999

1.18.5 COORDINATE SYSTEM
Record a code indicating the type of coordinate system used to obtain readings.

NC Note: In the North Central Research Station region this will always be 1.

When collected: When GPS UNIT > 0
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1 Geographic coordinate system
2 UTM coordinate system

1.18.6 LATITUDE (N:)
Record the latitude of the plot center to the nearest hundredth second, as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 8 digits (DDMMSSSS)
MQO: No errors, 100% of the time
Values:

1.18.7 LONGITUDE (W:)
Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS.

When collected: When COORDINATE SYSTEM = 1
Field width: 9 digits: (DDDMMSSSS)
MQO: No errors, 100% of the time
Values:

NC Note: As NC will always be recording Latitude and Longitude items 1.18.8, 1.18.9, 1.18.10 will not be collected in the field.

1.18.8 UTM ZONE
1.18.9 EASTING (X) UTM
1.18.10 NORTHING (Y) UTM

1.18.11 CORRECTION FOR "OFFSET" LOCATION
As described in Section 1.18.2, coordinates may be collected at a location other than the plot center (an “offset” location). If a PLGR unit is used all offset coordinates will be "corrected" back using the Rng/Calc function. If a GPS unit other than a PLGR is used, then record items 1.18.12 and 1.18.13.

1.18.12 AZIMUTH TO PLOT CENTER (AZM)

Record the azimuth from the location where coordinates were collected to actual plot center. If coordinates are collected at plot center, record 000.

When collected: When GPS UNIT = 2
Field width: 3 digits
MQO: +/- 3 degrees, 100% of the time
Values: 000 when coordinates **are** collected at plot center
001 to 360 when coordinates **are not** collected at plot center

1.18.13 DISTANCE TO PLOT CENTER (DIST)

Record the horizontal distance in feet from the location where coordinates were collected to the actual plot center. If coordinates are collected at plot center, record 000. As described in Section 1.18.2, if a Laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 ft from the plot center. If a range finder is not used, the offset location must be within 200 ft.

When collected: When GPS UNIT = 2
Field width: 3 digits
MQO: +/- 6 ft, 100% of the time
Values: 000 when coordinates **are** collected at plot center
001 to 200 when a Laser range finder **is not** used to determine distance
001 to 999 when a Laser range finder **is** used to determine distance

1.18.14 GPS ELEVATION (ELEV)

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

When collected: When GPS UNIT > 0
Field width: 6 digits
MQO: No errors, 100% of the time
Values: -00100 to 20000

1.18.15 GPS ERROR (ERRS)

Record the error as shown on the GPS unit to the nearest foot. As described in Section 1.18.2, make every effort to collect readings only when the error $\leq$ 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record reading with an error of up to 999 ft.

When collected: When GPS UNIT > 0
Field width: 3 digits
MQO: No errors, 100% of the time
Values: 0 to 70 if possible
71 to 999 if an error of less than 70 cannot be obtained

1.18.16 NUMBER OF READINGS (READ)

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT > 0
Field width: 3 digits
MQO: No errors, 100% of the time
Values: 1 to 999

1.19 PLOT-LEVEL NOTES

Use these fields to record notes pertaining to the entire plot. If the notes apply only to a specific subplot or other specific aspect of the plot, then make that clear in the notes.

When collected: All plots
Field width: Unlimited alphanumeric character field
MQO: N/A
Values: English language words, phrases and numbers

1.20 P3 HEXAGON NUMBER

Record the unique code assigned to each Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 7 digits
MQO: No errors, 100% of the time
Values:

1.21 P3 PLOT NUMBER

Record the P3 PLOT NUMBERS that are used to identify individual plots within the same Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

1.1NC NC ADDRESS

The name, address and phone number of the landowner of the plot will be collected in the courthouse or with other available records. Collect this information only once per plot and record the owner of the first forested condition that you assign. This data is collected in the data recorder (Husky) from the main plot menu option F2.

1.1.1NC NC OWNER FIRST NAME (FIRST NAME)

Enter the First name of the owner of the first forested condition defined on a plot.

When collected: All forested plots on first forested condition
Field width: 40 characters
MQO: Entered
Values:

1.1.2NC NC OWNER LAST NAME (LAST NAME)

Enter the last name of the owner of the first forested condition defined on a plot.

When collected: All forested plots on first forested condition
Field width: 40 characters
MQO: Entered
Values:

1.1.3NC NC OWNER STREET (STREET)

Record street address of the plot land owner. If the land owner is a government agency or private industry, owner groups less than 40, this item is not needed.

When Collected: First forested condition where owner group = 40.
Field width: 40 characters
MQO:
Values:

1.1.4NC NC OWNER CITY (CITY)

Record city name for the street address of the plot land owner. If the land owner is a government agency or private industry, owner groups less than 40, this item is not needed.

When Collected: First forested condition where owner group = 40.
Field width: 40 characters
MQO:
Values:

1.1.5NC NC OWNER STATE (STATE)

Record two digit State name for the street address of the plot land owner. If the land owner is a government agency or private industry, owner groups less than 40, this item is not needed.

When Collected: First forested condition where owner group = 40.
Field width: 2 digits
MQO:
Values: all two character state codes

1.1.6NC NC OWNER ZIP (ZIP)

Record city zipcode for the street address of the plot land owner. If the land owner is a government agency or private industry, owner groups less than 40, this item is not needed.

When Collected: First forested condition where owner group = 40.
Field width: 15 characters
MQO:
Values:

1.1.7NC NC PHONE (PHONE)

Record phone number of the plot land owner. Record the area code and phone number with dashes between area code and the next 3 digits(exchange) and between the exchange and the number (nnn-nnn-nnnn). If the land owner is a government agency or private industry, owner groups less than 40, this item is not needed.

When Collected: First forested condition where owner group = 40.
Field width: 10 digits
MQO:
Values: nnn-nnn-nnnn

2.0 CONDITION CLASS

The Forest Inventory and Analysis (FIA) plot is cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1). Delineation and mapping of condition classes is a major departure from past inventory practices, and is intended to allow flexible post stratification of data for a variety of purposes.

NC Note: All conditions will be assigned as new this visit and will not represent what may or may not have been mapped in the last visit. Indiana and Illinois where the 4-point plot is being re-measured, there are some special cases which are explained with examples in Appendix 10.

2.1 DETERMINATION OF CONDITION CLASS

2.1.1 Step 1: Delineate the plot area by CONDITION STATUS

The first attribute considered when defining a condition class is CONDITION STATUS. The area sampled by a plot is assigned into condition classes based upon the following differences in CONDITION STATUS:

1. Accessible forest land
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit
7. Area that is not in the sample, e.g., in Canada or Mexico.

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted.

2.1.2 Step 2: Further subdivide Accessible Forest Land by 6 mapping variables

Any condition class sampled as accessible forest land may be further subdivided, in order of listed priority, into smaller condition classes if distinct, contrasting condition classes are present because of variation within the sampled area in any of the following attributes:

1. Reserved Status
2. Owner Group
3. Forest Type
4. Stand Size Class
5. Regeneration Status
6. Tree Density

At time of re-inventory, two additional attributes, PAST NONFOREST/INACCESSIBLE LAND USE and PRESENT NONFOREST LAND USE are mapped to delineate new condition classes if the sampled area on a plot has changed to or from accessible forest land. This allows tracking of land use changes without requiring mapping of all nonforest condition classes on all plots.

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for mapping purposes (see Sections 2.4.7 to 2.4.23).

2.2 CONDITION CLASS ATTRIBUTES

A CONDITION CLASS NUMBER and a classification for CONDITION STATUS is required for every condition class sampled on a plot. For each condition class classified as accessible forest land, a classification is required for each of the following attributes:

2.4.1	Reserved Status	=	Attributes where a change causes a separate condition class
2.4.2	Owner Group	=	
2.4.3	Forest Type	=	
2.4.4	Stand Size	=	
2.4.5	Regeneration Status	=	
2.4.6	Tree Density	=	
2.4.7	Owner Class	=	Ancillary - changes do not delineate a new condition class
2.4.8	Private Owner Industrial Status	=	
2.4.9	Artificial Regeneration Species	=	
2.4.10	Stand age	=	
2.4.11	Disturbance (up to 3 coded)	=	
2.4.12	Disturbance Year (1 per disturbance)	=	
2.4.17	Treatment (up to 3 coded)	=	
2.4.18	Treatment Year (1 per treatment)	=	
2.4.23	Physiographic Class	=	

Three additional attributes require classification in specific situations:

2.4.24 Past Nonforest/ Inaccessible Land Use (for area afforested since last inventory).

2.4.25 Present Nonforest Land Use (for area converted from accessible forest land condition class to nonforest land since last inventory).

2.4.26 Nonforest Year (estimate year that accessible forest land condition class was converted to nonforest).

When classifying condition status, owner group, reserved status, and previous and present nonforest use, base the classification on what is present within the area defined by the fixed radius plot (annular, subplot, or microplot). When classifying all other condition class variables, base the classification on the annular plot.

Specific instructions for the classification of each attribute follow.

2.2.1 CONDITION CLASS NUMBER (CON#)

On a plot, assign and record a unique identifying number for each condition class. At the time of the plot establishment, the condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated. On a plot, each sampled condition class must have a unique number that can change at remeasurement to reflect new conditions on the plot.

When collected: All condition classes
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

CONDITION CLASS DEFINING (MAPPING) VARIABLES:

2.2.2 CONDITION STATUS (STAT)
Record the code that describes the status of the condition. Record for all condition classes sampled on a plot. The instructions in Section 2.2 and 2.3 apply when delineating condition classes that differ by CONDITION STATUS.

When collected: All condition classes
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1. Accessible forest land
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit
7. Area that is not in the sample, e.g., in Canada or Mexico.

2.3 DETERMINING CONDITION CLASSES DIFFERING IN CONDITION STATUS:

The first step in delineating condition classes is to recognize differences in CONDITION STATUS. The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 1.0 ac in size, and each is at least 120.0 ft in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 ac in size and less than 120.0 ft in width are considered forest land and are not delineated and classified as a separate nonforest condition class.

Within a nonforest land condition class, forested areas or linear strips of trees less than 1.0 ac in size and less than 120.0 ft in width are considered part of the nonforest condition class.

Five exceptions to these size and width requirements apply:

1. Developed nonforest conditions: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 ac in size and 120.0 ft in width and are surrounded by forest land. All extensions from developed nonforest conditions are nonforest condition classes regardless of length or width. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements.

    a) Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. Unimproved traces and roads created for skidding logs are not considered improved roads

    b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs.

    c) Developments: structures and the maintained area next to a structure, all less than 1.0 ac in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds.

2. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is less than 1.0 ac in size and less than 120.0 ft in width. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement.

   For many small intermingled strips, determine the total area that the alternating strips occupy, and classify according to the CONDITION STATUS (forest land or nonforest land) that occupies the greater area. If the area of alternating strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.

   For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 2. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.

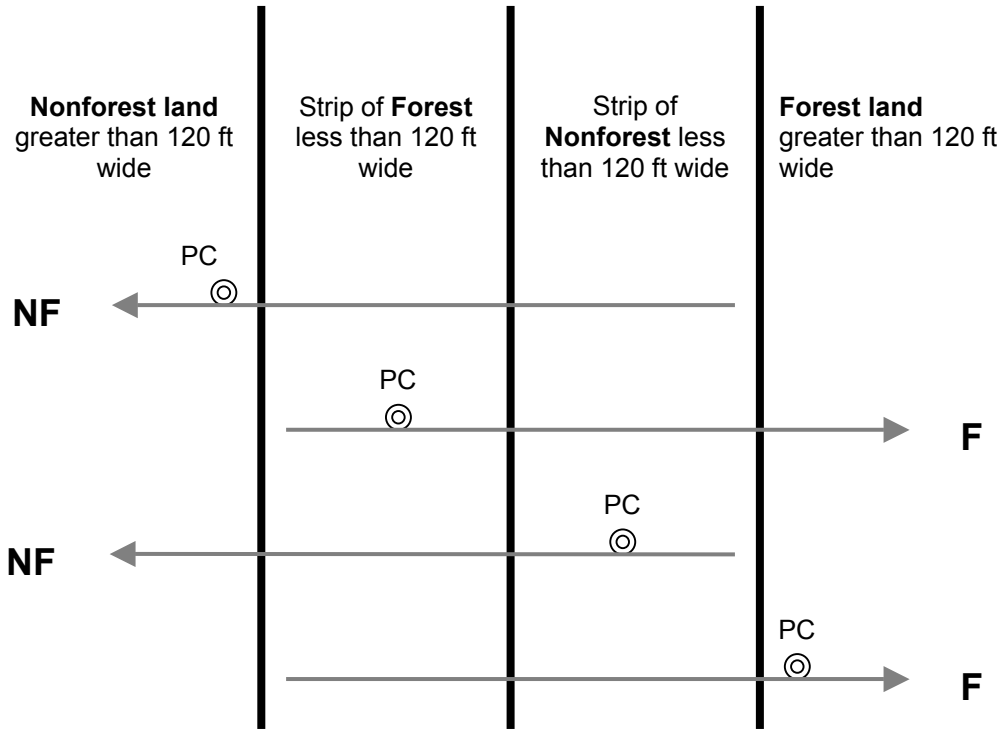


Figure 2. Example of alternating strips of forested and nonforested conditions.

3. The 120 foot minimum width for mapping does not apply when a corner angle is 90 degrees or greater (Figure 3).

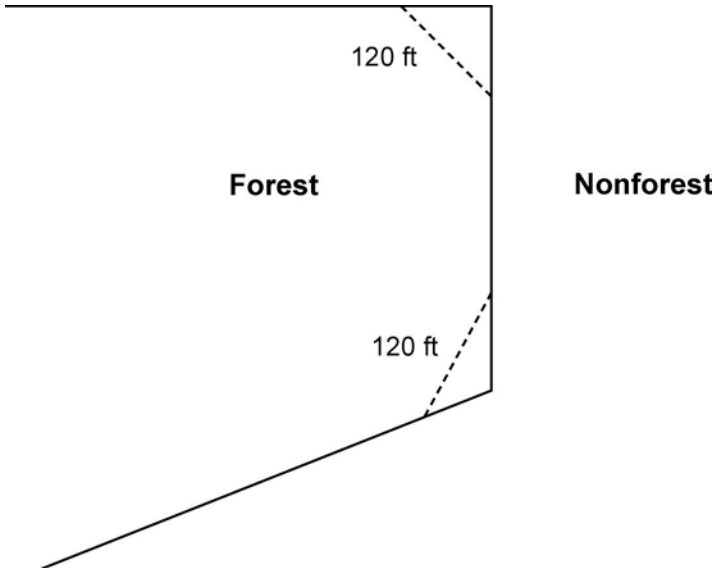


Figure 3. Illustration of the 90 degree corner rule.
The dotted lines do not create nonforest conditions.

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 ft wide and cover at least 1.0 ac. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features which do not meet the definition for Census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 ac requirement; use professional judgment and common sense on any linear water feature.

5. Riparian forest area: A riparian forest area is defined as a forest area between 30.0 and 120.0 ft wide, and 1.0 ac or more in size, cumulative, but not necessarily present on both sides of and adjacent to a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated “within forest” and contain at least one distinct and obvious change in a condition class mapping attribute from its adjacent accessible forest land condition class.

CONDITION STATUS DEFINITIONS:

2.3.1 ACCESIBLE FOREST LAND

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets at least one of the two following criteria:

(a) the condition is at least 10-percent stocked by trees of any size (Appendix 4) or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities;

(b) in several western woodland types **NC Note:** not used.

To qualify as forest land, the prospective condition must be at least 1.0 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

Transition zones and forest/nonforest encroachment. When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10% minimum forest land stocking, and where it clearly is less than required stocking; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 4).

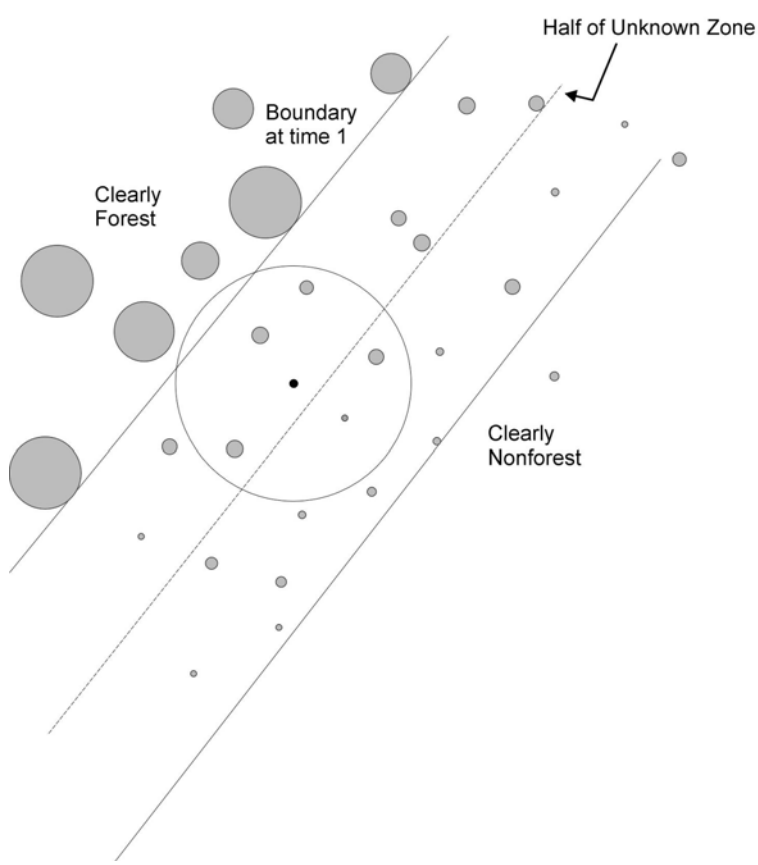


Figure 4. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment is clearly stocked where it meets the nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone is not clearly stocked where it meets the nonforest, determine where it is clearly stocked (forest) and where it is clearly not stocked (nonforest); divide this zone in half, and classify the entire subplot based on which side of the line the subplot center falls.

Treated strips – Occasionally, crews will come across plantations of trees, in which rows of trees alternate with strips of vegetation that have been bulldozed, mowed, tilled, treated with herbicide, or crushed. Because these strip treatments are conducted to optimize growth or to release the stand, the areas are considered forest land, and the treatment is considered a timber stand improvement operation. Do not confuse these practices with similar treatments on nonforest lands such as yards or rights-of-way. Contact with the land owner may help determine the intent of a treatment.

Indistinct boundary due to the condition minimum-width definition: Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 ft) definition. Although the point where the definition changes from forest to nonforest creates an invisible "line" between conditions, **this definitional boundary is not distinct and obvious**. See Figures 5 and 6. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.

The rules in Figure 5 & 6 apply equally, but in reverse manner, if the forest and nonforest land is reversed.

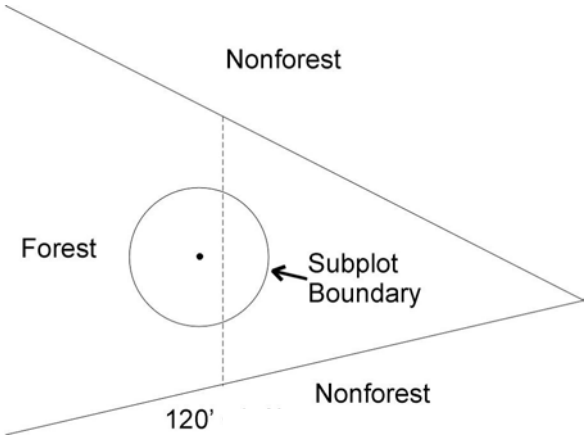


Figure 5. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120 ft wide. In this example, the entire subplot is classified as forest.

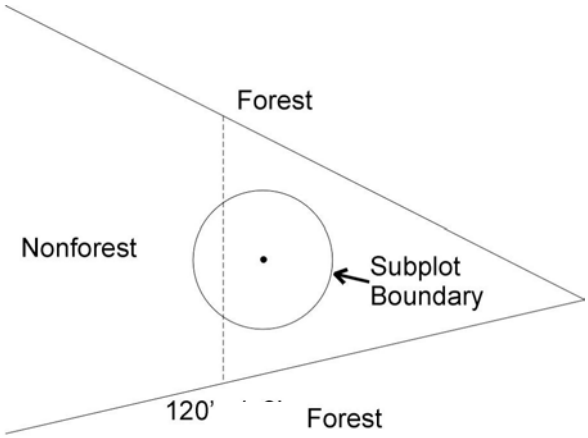


Figure 6. Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120 ft wide. In this example, the entire subplot is classified as forest.

2.3.2 NONFOREST LAND
Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the CONDITION STATUS values defined in Sections 2.3.3 through 2.3.7. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, with 5 exceptions discussed previously at the beginning of section 2.3. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next occasion to see if it has become forest land.

2.3.3 NONCENSUS WATER
Lakes, reservoirs, ponds, and similar bodies of water 1.0 ac to 4.5 ac in size. Rivers, streams, canals, etc., 30.0 ft to 200 ft wide.

2.3.4 CENSUS WATER
Lakes, reservoirs, ponds, and similar bodies of water 4.5 ac in size and larger; and rivers, streams, canals, etc., more than 200 ft wide (1990 U.S. Census definition).

2.3.5 DENIED ACCESS
Any area within the sampled area on a plot on which access is denied by the legal owner of the land the plot falls on, or by an owner of the only reasonable route to the plot. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.

2.3.6 HAZARDOUS
Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal plantations, temporary high

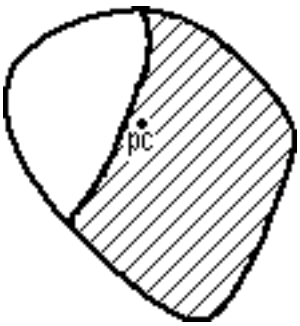
water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.

2.3.7 NOT IN THE SAMPLE

Any area within the sampled area on a plot that is not within the boundaries of the sample population of interest. Examples of areas out of the sample would be plots or portions of plots falling in Mexico, Canada, and areas which are not currently participating in FIA such as National Forest land in California, Oregon, Washington, or BLM land in western Washington. A condition outside the sample area remains in the potential population of interest and is re-examined at the next occasion to determine if it becomes part of the population of interest. There are no minimum size or width requirements for a condition class delineated as out of the sample.

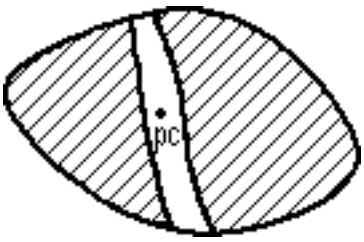
Figure NC5. The following examples have been included to aid in assigning Condition Status to subplot centers. Shaded areas represent forest.

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



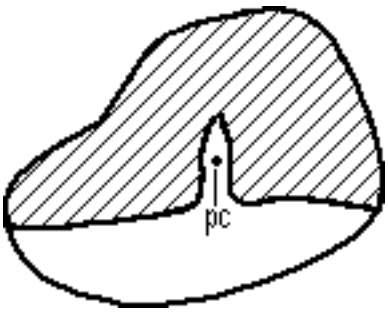
1.

Forest (STAT=1)
Subplot Center falls on forest land larger than one acre in size.



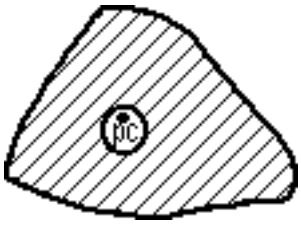
2.

Forest (STAT=1)
Subplot Center falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least two sides. Note exceptions.



3.

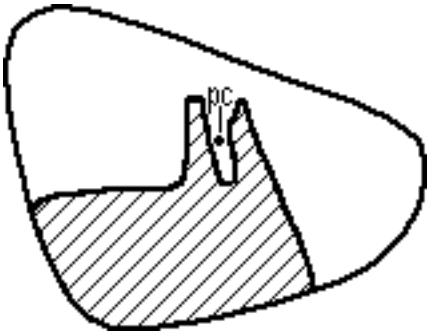
Forest (STAT=1)
Subplot Center falls on strip of nonforest land (less than 120 feet in width) that is bounded by forest land on at least two sides.



4.

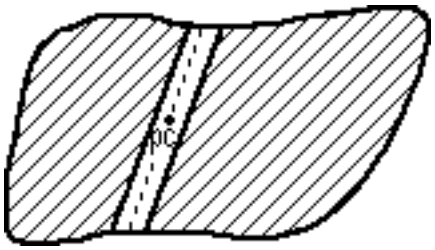
Forest (STAT=1)
Subplot Center falls on nonforest land (less than one acre in size) that is surrounded by forest land. Note exceptions.

Figure NC5 *CONTINUED*



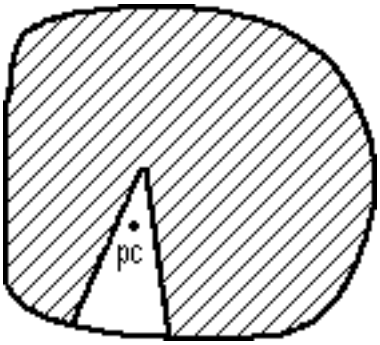
5.

Forest (STAT=1)
Subplot Center falls in area of more than two adjacent strips of clearly defined forest and nonforest land (each strip less than 120 feet in width). As the band of strips in the acre is comprised of more forest than nonforest, the classification is forest.



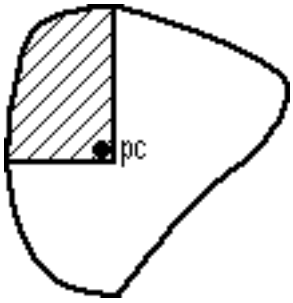
6.

Nonforest (STAT=2)
Subplot Center falls in improved road less than 120 feet wide. Improved roads and power line clearings of any width are nonforest.



7.

Forest (STAT=1)
Subplot Center falls on nonforest land (less than 120 feet in width). If point had fallen in area 120+ feet wide, the classification would be nonforest. In this case do not subdivide the subplot into two conditions. The entire subplot is classified by where the center is.



8.

Forest (STAT=1)
Subplot Center falls in a forest land area less than 120 feet in width, but it is classified as forest. This is a special case to handle corners (in the vicinity of 90°) of forest land that have man-created boundaries adjoining them to nonforest lands. An example would be a farm woodlot, over 120 feet in width and one acre in size, that was bordered by a field.

2.3.8NC NC LAND USE (NCLU)
All conditions defined will also receive an NC Land Use. This list is the same one used by NC in the past but it no longer determines which data items are collected.

Code	Description
20	**Timberland** Forest land that is capable of producing in excess of 20 cubic feet per acre per year of roundwood products, excluding fuelwood, and is not withdrawn from timber utilization by statute, administrative designation, or exclusive use for Christmas tree production. (If land is used for grazing, see codes 21 and 59.)
21	**Pastured Timberland** Forest land used for wood production and grazing. (If land has a stocking value of less than 10 in trees over 1.0" DBH or less than 25 in growing-stock trees of any size, see codes 52 and 59.)
22	**Plantations** An artificially reforested area, sufficiently productive to qualify as commercial forest land, established by planting or by direct seeding. Planted species is not necessarily predominant. The forest type, stand age, and stand size class should reflect the planted species. If the plantation has failed, give the plot a GLU code 20. (If land is used for Christmas tree production, see code 46.) Unless the land is used primarily for grazing, code 22 is preferred over codes 21 and 59. **Note**: All species found within the portion of the plot where the condition extends should be considered and determined unproductive (code 40) before classifying the condition as unproductive forest land. Do not include species that are only growing in small inclusions in the condition such as a small high or low spot in the topography. The tallier judges whether the unproductive area is over one acre in size; if it is, the condition is classified as unproductive. Refer to Site Index, items 51-59, for more information.
40	**Unproductive forest land** Forest land incapable of producing 20 cubic feet per acre per year of roundwood products, excluding fuelwood, because of adverse site conditions. Adverse conditions include sterile soils, dry climate, poor drainage, high elevation, steepness, and rockiness. Vegetation, if present, is widely spaced and scrubby, or tree growth cannot be established. Based on site index under 15 for northern white-cedar, under 20 for tamarack & black spruce, under 25 for eastern redcedar, and under 35 for all other species. All commercial species must be unproductive. In cases where compaction or other negative impact by grazing is the cause for the low productivity use code 52 or 59.
41	**Reserved forest land - unproductive** Forest land that is withdrawn from timber utilization, by a public agency or by law, and is incapable of producing 20 cubic feet per acre per year of roundwood products .
45	**Reserved forest land - productive** Forest land withdrawn from timber utilization by a public agency or by law and is sufficiently productive to produce at least 20 cubic feet per acre per year of roundwood products.
57	**Wide windbreaks** A group of trees, greater than 120 feet wide and one acre in size, protecting buildings in use. Area would qualify as commercial forest land except that the primary land use is protection of buildings. As a guideline, consider using code 22 if there are more than 12 rows of trees or the area is larger than 5 acres.
59	**Wooded pasture** Grazed land with a stocking value of more than 10.0 in all live trees 1" DBH or larger, but less than 25.0 in growing stock (20 class) trees of any size. Two situations are possible. The first is that the land could qualify as pastured timberland except that the low stocking in growing stock trees indicates that the land is not being used for wood production. The second is that the land is unproductive for timber, due to livestock or intrinsic site factors, and is being used for forage. If evidence indicates that the primary use is wood production or the protection of buildings see code 21 and 57. The stocking value 25.0 rule applies when determining primary land use in fairly homogeneous areas. In clumps, openings, and other inclusions, use your best judgment.
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 for Christmas trees.
50	**Reserved, nonforest with trees** Nonforest land with trees that is withdrawn from timber utilization, by a public agency or by law.

51 **Cropland with trees** Cropland with scattered inclusions of single trees or small groups of trees. Orchards are also included in this class.

52 **Pasture and rangeland with trees** Land used for grazing with a stocking value of less than 10.0 in all live trees 1" DBH or larger. Examples of grazing evidence include:

- cattle trails
- cow pies
- water tanks
- bush hogged periodically
- evidence of being bush hogged (maximum height of seedlings three to four feet and basal scars present on trees)
- area periodically treated with herbicides.

53 **Wooded strip** An acre or more of continuous forest land that meets the definition of forest land (code 20, 21, 22, 40, 41, 45) 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 has a stocking value of less than 10.0 in all live trees. **Caution:** Do not confuse this with non-stocked forest land which is GLU 20 and should have a stand-size class code 4.

55 **Marsh with trees** Land that has a stocking value of less than 10.0 in all live trees; characteristically supports low, generally herbaceous or shrubby vegetation and is intermittently covered with water.

56 **Narrow windbreaks** A group of trees, less than 120 feet wide, used for the protection of buildings in use.

58 **Shelterbelt** A group of trees, less than 120 feet wide, used for the protection of soil and crop fields. Do not confuse this land use with an old fence line between two fields that contains a few trees.

71 **Urban forest land** Locationally reserved land that normally would meet the criteria for commercial forest land, but is in an urban-suburban area surrounded by commercial, industrial, or residential development. It is extremely unlikely that such land is used for timber products on a continuing basis. Example: wooded creek bottom surrounded by houses. Includes forested areas on military bases, depots, or proving grounds where access and use are restricted because of certain activities.

72 **Urban and other with trees** Area with trees that is developed for residential, industrial, recreational, or other urban use. For example city park, cemetery, golf course, maintained backyard, farmsteads with trees. The 120 feet/one acre rule does not apply in the case of a maintained yard.

79 **In another country.**

61 **Cropland without trees** Presently cropped or fallow up to two years.

62 **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. Do not confuse with non-stocked forest land.

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. The 120 feet/one acre rule does not apply in the case of a maintained yard.

68 **Rights-of-way** Transportation, utility, and communication rights-of-way. This includes railroads, power lines, pipelines, and maintained roads. A right-of-way <u>of any width</u> qualifies as non-forest land--this is an exception to the one acre, 120 feet rule.

69 **Nonforest without trees** (reserved)

80 **Noncensus Water** A body of water 30 feet wide but less than 200 feet, and one acre in size but less than 4.5 acres in size (normal water level)

89 **Noncensus Water** (reserved)

90 **Census Water** A body of water greater than 200 feet wide and greater than 4.5 acres (normal water level).

96 **Inaccessible plot** When any portion of a forest plot cannot be reached or measured because permanent physical conditions prohibit **safe** access (e.g. steep slopes) no field measurements are required. Explain in notes why the plot is inaccessible.

97 **Dropped plot** Determined in office by field supervisor or crew leader.

98 Lost (not relocated) plot Will only be assigned in St. Paul after data collection.
99 Denied access plot

NC Table 2
Chart of valid NC Land Use Codes with Condition Status Codes

	Condition Status						
NC Land Use	1	2	3	4	5	6	7
20	X						
21	X						
22	X						
40	X						
41	X						
45	X						
57	X						
59	X						
71	X						
46		X					
50		X					
51		X					
52		X					
53		X					
54		X					
55		X					
56		X					
58		X					
72		X					
79							X
61		X					
62		X					
64		X					
65		X					
66		X					
67		X					
68		X					
69		X					
80			X				
90				X			
96						X	
97							X
98	This plot will not have a new 4-point plot.						
99					X		

2.4 DETERMINING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND:

Accessible forest land is subdivided into condition classes that are based on differences in RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY. Section 2.1 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in subsections within 2.4.1 to 2.4.6. “Stands” are defined by plurality of stocking for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 ac in size and at least 120.0 ft in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained.

No other attribute shall be the basis for recognizing contrasting condition classes. For each condition class recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for mapping purposes (see Sections 2.4.7 to 2.4.23).

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within an annular plot (if applicable), subplot, or microplot: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 3.0.

2. Indistinct boundary within a subplot: Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

   Example: The 4 subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large diameter trees. Subplot 2 falls in the middle of a stand size transition zone. In the zone, the large diameter stand phases into a sapling stand.
   Subplot 2 must not be divided into two mapped condition classes on the basis of stand size. Instead, it is treated entirely as part of the large diameter condition class or is assigned entirely to a new condition class that is classified as a seedling-sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedling-saplings than a stand of large diameter trees; then the boundary between the large and small diameter stands is assumed to occur between and not on the subplots.

3. A boundary or transition zone between fixed radii plots that sample distinctly different condition classes: Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed radius plots, but a distinct boundary or indistinct transition zone exists outside the sampled (fixed-radius) area of the subplots. In such cases, a boundary, if present, is not referenced.

   Example: The northernmost subplot (2) samples entirely accessible forest land. The other three subplots, 1, 3, and 4, fall clearly in a nonforest meadow. Between subplot 1 and 2 is a transition zone; the number of trees present goes from none to what clearly represents at least 10-percent tree stocking. Two condition classes are sampled: accessible forest land sampled on subplot 2, and nonforest land sampled on the other subplots.

2.4.1 RESERVED STATUS (RESV)

Record the code that identifies the reserved designation for the condition. Reserved land is withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood harvesting methods). Such authority is vested in a public agency or department, and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but rather is permanent in nature. The phrase "withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products.

When collected: All accessible forestland condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors, 100% of the time

Values:

0	Not reserved
1	Reserved

2.4.2 OWNER GROUP (OWNG)

Record the OWNER GROUP code identifying the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will be mapped based on changes in OWNER GROUP only; separate conditions due to changes in OWNER GROUP are recognized only where differences can be clearly identified on the ground when visiting the plot.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 2 digit
MQO: No errors, 100% of the time
Values:

10	Forest Service
20	Other Federal
30	State and Local Government
40	Private

2.4.3 FOREST TYPE (FTYP)

Record the code corresponding to the FOREST TYPE (from Appendix 2) that best describes the species with the plurality of stocking for all live trees in the condition class that are not overtopped.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 3 digits
MQO: No errors in group, 100% of the time; No errors in type, at least 95% of the time
Values: See Appendix 2

The instructions in section 2.1 and 2.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST TYPE.

2.4.4 STAND SIZE CLASS (STSZ)

Record the code that best describes the predominant size class of all live trees in the condition class that are not overtopped.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0 <u>Nonstocked</u>:
Meeting the definition of accessible forest land, and one of the following applies:

(a) less than 10 percent stocked by trees of any size, and not classified as chaparral, or

(b) for forest types where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.

1 <u>1.0 – 4.9 in (seedlings / saplings)</u>

At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees less than 5.0 in DBH/DRC.

2 5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH, and/or western woodland trees 5.0 – 8.9 in DRC.

3 9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH, and for western woodland trees 9.0 – 19.9 in DRC.

4 20.0 – 39.9 in
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.

5 40.0 + in
At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in trees $\geq$ 40.0 in DBH.

6 Chaparral:
Less than 10 percent stocking by trees of any size, and greater than 5 percent **crown cover** of species that comprise chaparral communities.

The instructions in Sections 2.1 and 2.3 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

Within the sampled area on microplot, subplot, or annular plot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. Use tree stocking of all live trees that are not overtopped to differentiate between stand-size classes; for most western woodland forest types (e.g., pinyon, juniper, gambel oak) where stocking values are not readily available, use percent tree cover to represent stocking.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5% of the crown cover in STAND SIZE CLASSES of 1,2,3,4, and 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is either 0 or 6 depending on the characteristics of the stand. If at least 1/3 of crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), the accessible forested condition will be classified in one of these STAND SIZE CLASSES based on which of these STAND SIZE CLASSES has the most crown cover. If less than 1/3 of the crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), classify the accessible forested condition as a STAND SIZE CLASS = 1, if adequate cover is present.

If no other condition class defining variables are different between accessible forest conditions, map on differences in STAND SIZE CLASS only for the following combinations:

Between Nonstocked (STAND SIZE CLASS = 0) or Chaparral (STAND SIZE CLASS = 6) and any stocked forest land (STAND SIZE CLASS = 1, 2, 3, 4, or 5);
Between STAND SIZE CLASS = 1 and STAND SIZE CLASS = 3, 4, and 5;
Between STAND SIZE CLASS = 2 and STAND SIZE CLASS = 4 and 5; or
Between STAND SIZE CLASS = 3 and STAND SIZE CLASS = 5.

2.4.5 REGENERATION STATUS (SORI)

Record the code that best describes the degree of evidence of artificial regeneration which occurred in the condition.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0	Natural	Present stand shows no clear evidence of artificial regeneration. Includes unplanted, recently cut lands.
1	Artificial	Present stand shows clear evidence of artificial regeneration.

The instructions in section 2.1 and 2.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

For a forest land condition to be delineated and/or classified as artificially regenerated, the condition must show distinct evidence of planting or seeding. If it is difficult to determine whether or not a stand has been planted or seeded, then use code 0. If no distinct boundary exists within the sampled (fixed-radius) area on any subplot, then do not recognize separate conditions. In many regions of the West, trees are not planted in rows, and planted stands do not differ in physical appearance from natural conditions. In these cases, there is no need to differentiate conditions based on stand origin.

2.4.6 TREE DENSITY (DENS)

Record a code to indicate the relative tree density classification. Base the classification on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in section 2.1 and 2.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate mapped condition classes are homogenous, i.e. when a change in density is the ONLY difference within what would otherwise be treated only as one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy but not total tree mortality due to a ground fire. Mapping on density should only be done when the less-dense condition is 50% or less as dense as the denser condition.

Do not distinguish between low stocked stands or stands of sparse and patchy forest.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 1 digit

MQO: No errors, 100% of the time
Values:

1 Initial density class
2 Density class 2 - density different than 1
3 Density class 3 - density different than 1 and 2

In order to qualify as a separate condition based on density, there MUST be a distinct, easily observed change in the density of an area's tree cover or basal area.

Examples of valid contrasting conditions defined by differences in tree density are forest land conditions with the same type, origin, stand size, ownership, and reserved status, but:

- the eastern half of an otherwise homogeneous, 20 ac stand has many trees killed by a bark beetle outbreak,

or

- one portion of a stand is partially cut over (with 40 sq. ft basal area per ac) while the other portion is undisturbed (with 100 sq. ft basal area per ac).

ANCILLARY (NON-MAPPING) VARIABLES

2.4.7 OWNER CLASS (OWNC)

Record the OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will **NOT** be mapped based on changes in owner class. If multiple owner classes within a group occur on a single condition class, record the owner class closest to the plot center.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 2 digits
MQO: No errors, 100% of the time
Values:

Owner Classes within Forest Service Lands (Owner Group 10):

11 National Forest
12 National Grassland
13 Other Forest Service

Owner Classes within Other Federal Lands (Owner Group 20)

21 National Park Service
22 Bureau of Land Management
23 Fish and Wildlife Service
24 Departments of Defense/Energy
25 Other Federal

Owner Classes within State and Local Government lands (Owner Group 30)

31 State
32 Local (County, Municipality, etc.)
33 Other Non Federal Public

Owner Classes within Private lands (Owner Group 40)

41 Corporate
42 Non Governmental Conservation / Natural Resources Organization

- examples: Nature Conservancy, National Trust for Private Lands, Pacific Forest Trust, Boy Scouts of America, etc.

43 Unincorporated Partnerships / Associations / Clubs – examples: Hunting Clubs that **own, not lease** property, recreation associations, 4H, etc.

44 Native American (Indian)

45 Individual

2.5.8NC NC PRIVATE ACRES (NCPA)

For Ownership Group code 40, record the acres owned using the code that indicates ownership size (Condition Status=1) in the United States.

When collected: Only when owner group=40
Field width: 1 digit
MQO: +/- 1 code
Values:

Code	Acres forest land
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+

2.4.8 PRIVATE OWNER INDUSTRIAL STATUS (INDU)

Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, “mom & pop” home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner’s industrial status due to name, commercial plant size, type plant, etc., choose code 0 below.

NOTE: Unit or State headquarters may have to maintain a list of recognized industrial owners within a State for crews to use when making these determinations.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1) when the owner group is private (OWNER GROUP 40)
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0 Land **<u>is not</u>** owned by industrial owner with a wood processing plant

1 Land **<u>is</u>** owned by industrial owner with wood processing plant

2.4.9 ARITFICIAL REGENERATION SPECIES (SOSP)

Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand. This attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)
Field width: 3 digits
MQO: No errors, 100% of the time
Values: See Appendix 4

2.4.10 STAND AGE (SAGE)

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for non-stocked stands.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for Site tree age, estimates of stand age should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

To estimate STAND AGE, select two or three dominant or codominant trees from the overstory. If the overstory covers a wide range of tree sizes and species, try to select the trees accordingly, but it is not necessary to core additional trees in such stands. The variance associated with mean stand age increases with stand heterogeneity, and additional cores are not likely to improve the estimate. Core each tree at the point of diameter measurement and count the rings between the outside edge and the core to the pith. Add in the number of years that passed from germination until the tree reached the point of core extraction to determine the total age of the tree. Unless more specific information is provided at training or by the unit, add 5 years to all eastern species, 5 years to western hardwoods, and 10 years to western softwoods. Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

(34 x 0.25) + (62 x 0.60) + (59 x 0.15) = 55 years.

In some cases, it may be possible to avoid coring trees to determine age. If a stand has not been seriously disturbed since the previous survey, simply add the number of years since the previous inventory to the previous STAND AGE. In other situations, cores collected from site trees can be used to estimate STAND AGE.

If a condition class is nonstocked, assign a STAND AGE of 000.

If all of the trees in a condition class are of a species which, by regional standards, can not be bored for age (e.g., mountain mahogany, tupelo) record **998**. This code should be used in these cases only.

If tree cores are not counted in the field, but are collected and sent to the office for the counting of rings, record **999**.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)

Field width: 3 digits
MQO: +/- 10%, at least 95% of the time
Values: 000 to 997, 998, 999

2.4.11 DISTURBANCE 1 (DIS1)

Record the code corresponding to the presence of the following disturbances. Disturbance can connote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 ac in size. Record up to three different disturbances per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the disturbance must be within the last 5 years. For remeasured plots recognize only those disturbances that have occurred since the previous inventory.

The disturbance codes below require "significant threshold" damage, which implies mortality and/or damage to 25 percent of individual trees in the condition class.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 2 digits
MQO: No errors, 100% of the time
Values:

Code	Definition
00	None - no observable disturbance
10	Insects
20	Disease
30	Weather other than the following:
31	ice
32	wind (includes hurricane, tornado)
33	flooding (weather-induced)
34	drought
40	Fire (from crown and ground fire, either prescribed or natural)
41	ground fire
42	crown fire
50	Domestic animal/livestock (includes grazing)
60	Wild animal other than the following:
61	beaver (includes flooding caused by beaver)
62	porcupine
63	deer/ungulate
70	Human - Any significant threshold human-caused damage not described in the DISTURBANCE codes listed above or the TREATMENT codes listed below.
80	Other natural - Any significant threshold natural damage, not described in the DISTURBANCE codes listed above.

2.4.12 DISTURBANCE YEAR 1 (DYR1)

Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: When DISTURBANCE 1 > 00
Field width: 4 digits
MQO: No errors, 100% of the time

Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

2.4.13 DISTURBANCE 2 (DIS2)
If a stand has experienced more than one disturbance, record the second disturbance here. See DISTURBANCE 1 for coding instructions.

2.4.14 DISTURBANCE YEAR 2 (DYR2)
Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

2.4.15 DISTURBANCE 3 (DIS3)
If a stand has experienced more than two disturbances, record the third disturbance here. See DISTURBANCE 1 for coding instructions.

2.4.16 DISTURBANCE YEAR 3 (DYR3)
Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

2.4.17 TREATMENT 1 (TRE1)
Record the code corresponding to the presence of one of the following treatments since the last inventory cycle or within the past 5 years. The area affected by any treatment must be at least 1.0 ac in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial forest plot establishment (initial grid activation or newly forested plots), the treatment must be within the last 5 years. For remeasured plots recognize only those treatments that have occurred since the previous inventory.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 2 digits
MQO: No errors, 100% of the time
Values:

Code	Definition
00	None - No observable treatment.
10	Cutting - The removal of one or more trees from a stand.
20	Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	Artificial regeneration - Planting or direct seeding has resulted in a stand at least 50% stocked with live trees of any size.
40	Natural regeneration - Growth of existing trees and/or natural seeding has resulted in a stand at least 50% stocked with live trees of any size.

50 Other silvicultural treatment - The use of fertilizers, herbicides, girdling, pruning or other activities (not already listed above) designed to improve the commercial value of the residual stand.

2.4.18 TREATMENT YEAR 1 (TYR1)
Record the year in which TREATMENT 1 occurred.

When collected: When TREATMENT 1 > 00
Field width: 4 digits
MQO: No errors, 100% of the time
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

2.4.19 TREATMENT 2 (TRE2)
If a stand has experienced more than one treatment, record the second treatment here. See TREATMENT 1 for coding instructions, code 00 if none.

2.4.20 TREATMENT YEAR 2 (TYR2)
Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.

2.4.21 TREATMENT 3 (TRE3)
If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions, code 00 if none.

2.4.22 TREATMENT YEAR 3 (TYR3)
Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.

2.4.23 PHYSIOGRAPHIC CLASS (PHYS)
Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition; land form, topographic position, and soil generally determine physiographic class. As a rule of thumb, look over the annular plot area to determine physiographic class, but always use your best judgment when assessing any condition level variables.

When collected: All accessible forest land condition classes (CONDITION STATUS = 1)
Field width: 2 digits
MQO: No errors, at least 80% of the time
Values:

Xeric Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.

11 Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.

12 Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.

13 Deep Sands - Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams, and many deserts.

19 Other Xeric - All dry physiographic sites not described above.

Mesic Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.

21 Flatwoods - Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.

22 Rolling Uplands - Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated flood plains.

23 Moist Slopes and Coves - Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.

24 Narrow Flood plains/Bottomlands - Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs.

25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1 mile limit. Excludes swamps, sloughs, and bogs with year-round water problems within the 1 mile limit.

29 Other Mesic - All moderately moist physiographic sites not described above.

Hydric Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where excess water seriously limits both growth and species occurrence.

31 Swamps / Bogs - Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.

32 Small Drains - Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.

33 Bays and wet pocosins - Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include sites in the Lake States with lowland swamp conifers or the Carolina bays in the southeast US.

34 Beaver ponds

35 Cypress ponds

39 Other hydric - All other hydric physiographic sites.

3.0 BOUNDARY REFERENCES

Boundary reference data are used to remeasure plots and to compute the area for the condition classes sampled on a plot. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and microplots (and optionally annular plots). Boundaries outside sampled (fixed-radius) areas are not referenced.

In addition to the recording procedures described herein, sketch maps of condition class boundaries onto the pre-printed plot diagrams on field tally sheets.

NC Note: No mapping of condition boundaries will be done on the old NC variable radius plot (subplots 101-105.)
NC Note: In Indiana and Illinois the 4-point plot will be remeasued so there are some specific examples on how to handle these in Appendix 10.

3.1 REFERENCE PROCEDURE

Reference, within the sampled area on each microplot, subplot, and annular plot, the approximate boundary of each condition class that differs from the condition class at a subplot center. Trees selected on these fixed-radius plots are assigned to the actual condition in which they lie regardless of the recorded approximate boundary.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points (Figures 7 and 8). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference, and one "corner" point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

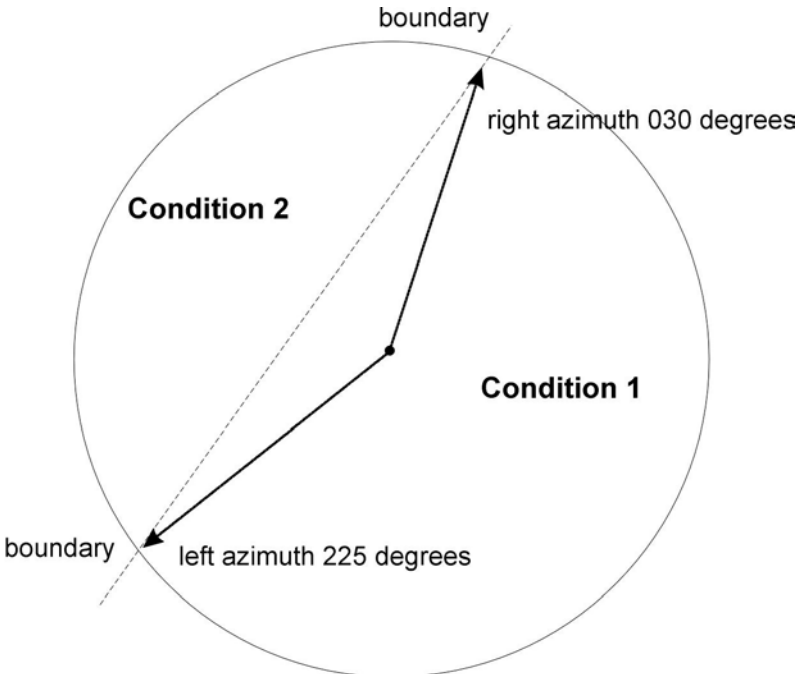


Figure 7. How to measure a straight boundary on a microplot, subplot, or annular plot.

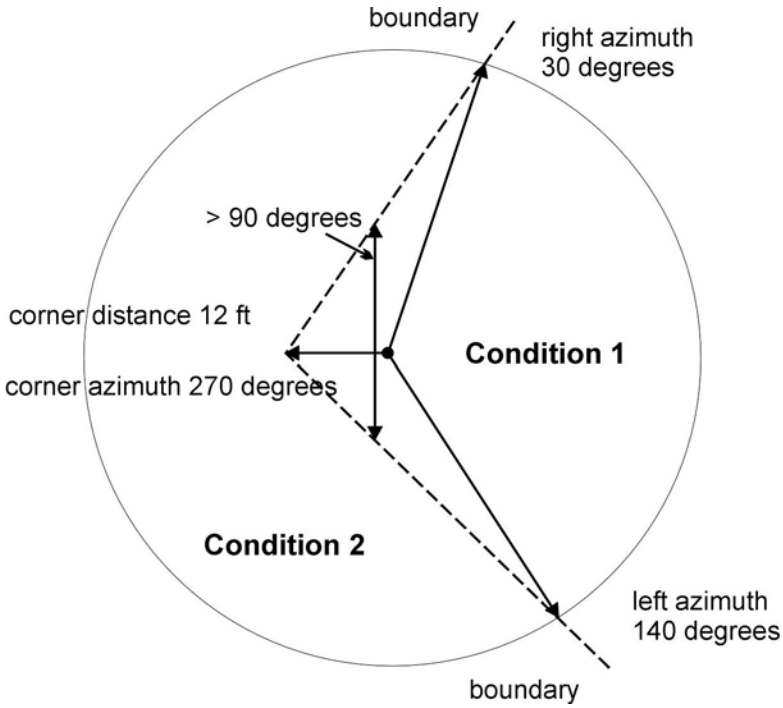


Figure 8. How to measure a boundary with a corner on a subplot or annular plot.

Microplot boundaries are referenced to the microplot center, and annular plot boundaries are referenced to the subplot center in the same manner described for subplots. Note that the larger the plot, the greater likelihood of a need for a boundary corner to record boundaries that are not straight lines.

Refer to Sections 2.1 and 2.3 for general mapping guidelines. The following additional rules apply when referencing a boundary within a subplot, microplot, or annular plot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water's edge along a stream course, ditch, or canal.

2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge.

3. When a boundary between two contrasting forest land condition classes is not clearly marked, map along the stems of the contrasting condition. When the boundary between two contrasting forest land condition classes is separated by a narrow linear inclusion (creek, fire line, narrow meadow, unimproved road), establish the boundary at the far edge, relative to subplot center, of the inclusion.

4. When a plot is remeasured, the crew will examine the boundaries referenced at last inventory. If no change has occurred, the current crew will retain the boundary data that were recorded at last inventory. If a boundary has changed, or a new boundary is present, or the previous crew made an obvious error, record new or updated boundary data. Delete boundaries that are no longer distinct.

5. Although individual MQOs are specified for the azimuths and distances, in practice a crew will be considered 'correct' when the difference in areas as mapped by the original crew and by the QA crew is less than 10% of the subplot or microplot area. This allows for slight variations in azimuths or distances due to the approximate nature of our mapping procedures.

3.2 BOUNDARY DATA

Record the appropriate values for each boundary mapped on the subplot, microplot, or annular plot as follows:

NC Note: No data is recorded for this menu if there is only one condition on the subplot. No mapping will be done on old subplots.

3.2.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: All boundaries
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

3.2.2 PLOT TYPE (TYPE)

Record the code to specify whether the boundary data are for a subplot, microplot, or annular plot.

When collected: All boundaries
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1	Subplot boundary
2	Microplot boundary
3	Annular plot boundary (coded only when annular plots are taken)

3.2.3 BOUNDARY CHANGE

Remeasurement (SAMPLE KIND = 2) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

When collected: SAMPLE KIND = 2, All boundaries
NC Note: Not collected in North Central Region.

3.2.4 CONTRASTING CONDITION (CCON)

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot or annular plot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line.

When collected: All boundaries
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

3.2.5 LEFT AZIMUTH (LAZM)

Record the azimuth from the subplot, microplot, or annular plot center to the farthest left point (facing the contrasting condition class) where the boundary intersects the subplot, microplot, or annular plot circumference.

When collected: All boundaries
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of the time
Values: 001 to 360

3.2.6 CORNER AZIMUTH (CAZM)

Record the azimuth from the subplot, microplot, or annular plot center to a corner or curve in a boundary. If a boundary is best described by a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

When collected: All boundaries
NC Note: Only record as non-zero if there is a corner.

Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of the time
Values: 000 to 360

3.2.7 CORNER DISTANCE (CDIS)

Record the horizontal distance, to the nearest 1 ft, from the subplot, microplot, or annular plot center to a boundary corner point.

When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 2 digits
MQO: +/- 1 ft, at least 90% of the time
Values:

microplot	1 to 7 ft
subplot	1 to 24 ft
annular plot	1 to 59 ft

3.2.8 RIGHT AZIMUTH (RAZM)

Record the azimuth from subplot, microplot, or annular plot center to the farthest right point (facing the contrasting condition) where the boundary intersects the subplot, microplot, or annular plot circumference.

When collected: All boundaries
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of the time
Values: 001 to 360

4.0 SUBPLOT INFORMATION

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the microplot, since the microplot is contained within the subplot perimeter. If the subplot center cannot be accessed, do not collect and record data on the subplot.

NC Note: Subplot data will not be collected on old subplots (subplot# ≥ 101).

4.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

4.2 SUBPLOT CENTER CONDITION (SCEN)

Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

When collected: All subplots
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

4.3 MICROPLOT CENTER CONDITION (MCEN)

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

When collected: All microplots where subplot center is CONDITION STATUS = 1, 2, 3, 7
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

4.4 SUBPLOT SLOPE (SLOP)

Record the angle of slope across the subplot to the nearest 1 percent. SUBPLOT SLOPE is determined by sighting the clinometer along a line parallel to the average incline (or decline) of each subplot. This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure SUBPLOT SLOPE, Observer 1 should stand at the uphill edge of the subplot and sight Observer 2, who stands at the downhill edge of the subplot. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

If slope changes gradually across the subplot, record an average slope. If slope changes across the subplot but the slope is predominately of one direction, code the predominate slope percentage rather than the average. If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the slope as follows:

- If the subplot falls directly between two side hills, code the average slope of the side hill(s).

- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 3 digits
MQO: +/- 10%, at least 90% of the time
Values: 000 to 155

4.5 SUBPLOT ASPECT (ASP)

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope. If aspect changes gradually across the subplot, record an average aspect. If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.

If the subplot falls on or straddles a canyon bottom or narrow ridge top, code aspect as follows:

- Code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of the time
Values:

000	no aspect, slope < 5 percent
001	1 degree
002	2 degrees
.	.
.	.
360	360 degrees, due north

4.6 SNOW/WATER DEPTH (SWD)

Record to the nearest 0.1 ft the average approximate depth of water or snow covering the subplot at the time of data collection. This variable is used to indicate subplots where some variables (e.g., seedling count, total heights) may be measured with less certainty due to conditions at the time of measurement.

When collected: All subplots with an accessible forest land condition class (CONDITION STATUS = 1)
Field width: 2 digits (x.y)
MQO: +/- 0.5 ft at the time of measurement (no MQO after initial date of visit)
Values: 0.0 to 9.9

4.7 SUBPLOT/ANNULAR PLOT STATUS (P3 Only)

Indicate whether or not this subplot currently has at least one accessible forested condition class. In regions measuring the CORE OPTIONAL annular plot, indicate whether or not this annular plot currently has at least one forested condition class.

NC Note: Not collected on Phase 2 plots.

When collected: All forested Phase 3 plots
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0 No accessible forest land condition class
1 At least one accessible forest land condition class

4.8 SUBPLOT/ANNULAR PLOT CONDITION LIST (CORE OPTIONAL)

This is a listing of all condition classes located within the 24.0-ft radius around the subplot center. In regions measuring the CORE OPTIONAL annular plot, this is a listing of all condition classes located within the 58.9-ft radius around the annular plot center. A maximum of four conditions is permitted at any individual subplot / annular plot. If a condition class has already been defined at a previously completed subplot / annular plot, use the same condition class number whenever that condition is encountered. Define new condition classes as they are encountered. If more than one condition class is listed here, boundary data are required. If only one condition class is listed, this condition is automatically assigned to the subplot center and microplot center. If less than four condition classes occur on this subplot, complete the remainder of this field with zeros. For example, if condition 1 is the only condition class on a subplot, record 1000.

NC Note: Not collected on Phase 2 plots.

When collected: All forested Phase 3 plots
Field width: 4 digits
MQO: No errors, 100% of the time
Values: 1000 to 9876

5.0 TREE AND SAPLING DATA

Trees at least 5.0 inches in diameter are sampled within the subplot. 'Tally trees' are defined as all live and standing dead trees in accessible forest land condition classes encountered on the subplot the first time a subplot is established, and all trees that grow into a subplot thereafter. These data yield information on tree growth, mortality, removals; coarse woody debris; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Trees with a diameter at least 1.0 in but less than 5.0 in, termed saplings, are sampled within the microplot. 'Tally saplings' are defined as all live saplings in accessible forest land condition classes encountered the first time a microplot is established, and all saplings that grow into each microplot thereafter are included until they grow to 5.0 in or larger, at which time they are tallied on the 24.0 ft subplot and referenced (new azimuth and distance taken) to the subplot center.

Trees are alive if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement, either diameter at breast height (DBH) or diameter at root collar (DRC). Trees that have been temporarily defoliated are still alive.

Once tallied, dead trees over 5.0 in diameter are tracked until they fall down. **Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be noted as such and left alone.**

To qualify as a standing dead tally tree, dead trees must be standing (LEAN ANGLE = 0 or 1) with no part of the bole touching the ground, at least 4.5 ft tall and be at least 5.0 inches in diameter. Broken portions of trees that are completely separated from their base are not treated as separate trees. For western woodland species (Appendix 4) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume.

Whether live or dead, standing trees do not have to be self-supported. They may be supported by other trees.

High stumps (trees that have been cut) do not qualify as standing dead trees.

Begin tallying trees at an azimuth of 001 degrees from subplot center and continue clockwise around the subplot. Repeat this sequence for trees on the microplot and again on the annular plot.

NC Note: All reference to DRC or woodland species does not apply in the North Central FIA region.

5.01NC NC RE-MEASUREMENT TREES

Re-measure all trees listed on the plot tree sheet that are listed “for re-measurement.” All old trees measured on the plot will be located on the tree sheet of the plot sheet packet for use to determine subplot center location.

SK=1 and NCSK=6:
Tally all old trees on the download data (sheets or data recorder file). Trees 5.0” and greater on subplots 101-105 and trees less than 5.0” on microplots 101-103.
Install and measure new subplots (1-4)

SK=0 and NCSK=6:
Old trees ≥ 5.0” will be remeasured on subplots 101 – 105 and trees < 5.0” weill be remeasured on microplots 101-103. Re-measure the trees listed on the download data file or sheet labeled “for re-measurement.”
No new subplots (1-4).

SK=1 and NCS=8
The old ten point PC(subplot 101) will be the location of subplot 1. Follow the old SP map and directions to the plot center. If plot center is not found, place a pin where the starting point directions took you and start installing the new subplots (1-4). **OLD TREES WILL NOT BE MEASURED.** Old tree information may be provided only for your use to locate plot center.
Install and measure new subplots (1-4)

SK=1 and NCSK=0:
No old trees will be remeasured.
Install and measure new subplots (1-4)

NC Table 3

Data needed by Subplot number, DBH and Tree status on P2 plots

Subplot numbers	1-4	1-4		Indiana & Illinois only See Appendix 10	101-103			101-105						
	DBH < 5.0”	DBH ≥ 5.0”			DBH < 5.0”			DBH≥ 5.0”						
Tree Status Codes	1	1	2		1	2	3	1	2	3	4	5	6	7
Sub#	X	X	X	OLD SUBPLOTS 1-4* dbh < 5.0” OLD SUPLOTS 1-4* dbh ≥ 5.0”	X	X	X	X	X	X	Not Valid Tree Status Codes for these subplots			X
Tree#	X	X	X		X	X	X	X	X	X				X
TYPE	X	X	X		X	X	X	X	X	X				
DIST	X	X	X		X	X	Z	Z*	Z*	Z				Z
DBH	X	X	X		X	X	Z	X	X	Z				Z
DIAH	X	X	X											
DCHE	X	X	X											
SPP	X	X	X		X	X	X	X	X	X				Z
LEAN		X	X		X	X		X	X					
TCC/DEC	X	X	X		X	X		X	X					
STAT	X	X	X		X	X	X	X	X	X				X
UTIL							X			X				
DECA			X											
CCR	X	X						X						
CCC	X	X						X						
AZM	X	X	X		X	X	Z	Z*	Z*	Z				Z
CON#	X	X	X		X	X	X	X	X	X				X
THGT		X	X											
ACTU		X	X											
METH		X	X											
TRGD		X												
ROTT		X												
CAUS						X			X					
MOYR														
LOC12		X												
DAM12		X												
SEV12		X												
NCD12		X												

*Change for subplot 101 to correct according to current manual.
** Tree status codes of 4,5 and 6 are not used on any of the old 10 point subplots.
X = record this data for tree status and subplot listed
Z = leave old data in this field, (except DBH on status 3 trees that you are able to measure).

See P3 table for P3 plots.

The following elements are recorded for all tally trees and tally saplings:

5.1 SUBPLOT NUMBER

Record the subplot number where the tree occurs.

When Collected: All live and dead tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

5.2.1NC NCPLOT TYPE (TYPE)

Record whether the tree is on the subplot (≥ 5.0"dbh) or microplot (< 5.0" dbh).

When Collected: All live and dead tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors 100% of time
Values:

CODE	PLOT TYPE
1	subplot tree
2	microplot tree

5.2 TREE RECORD NUMBER (TR#)

Record a code to uniquely and permanently identify each tree on a given subplot. The TREE RECORD NUMBERS must be unique within a subplot – being unique is more important than being sequential. In general, work clockwise from azimuth 001 to 360, and work outwards from subplot center to subplot edge. On remeasured plots, use the tree number assigned at the previous visit. Saplings tallied on microplots will retain their initially assigned tree number if they grow to tree size. Missed trees will be assigned the next available tree number. DO NOT renumber all plot trees in order to assign a more "correct" tree number to a missed tree. Numbers assigned to trees that are subsequently found to be extra will be dropped and not reused.

NC Note: On all subplots 1 – 4 use next available tree number to assign new tree numbers to any trees not in the download data file. The next available tree number is on the printed plot sheets and an option on the data recorder. If this is a Phase 3 plot the tree numbers in the download data file and on the printed plot sheet reflect their old FHM tree number.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits
MQO: No errors, 100% of the time
Values: 000, 001 to 999

5.3 CONDITION CLASS (CON#)

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 9).

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, 100% of the time
Values: 1 to 9

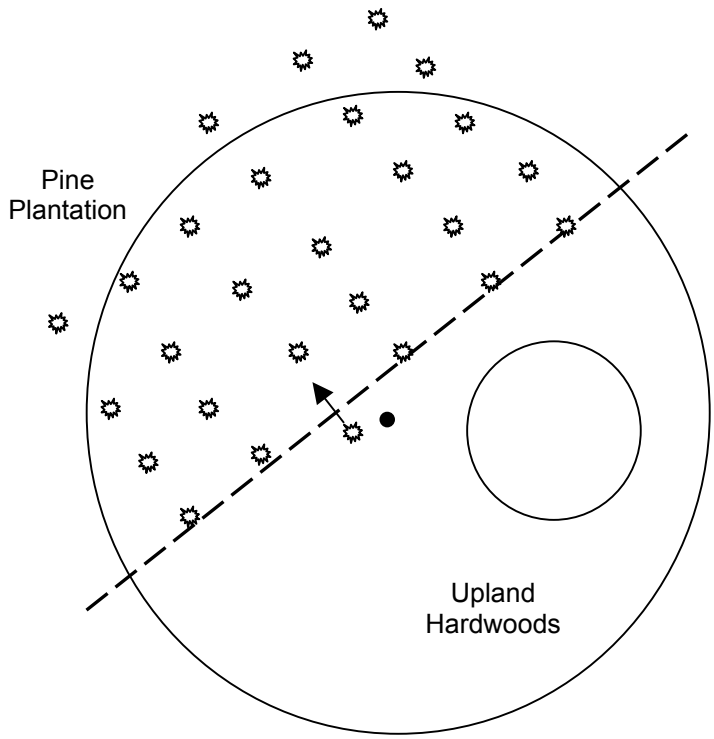


Figure 9. Ragged CONDITION CLASS boundary and tree condition class designation.

5.4 AZIMUTH (AZM)

Record the AZIMUTH from the subplot center (for trees ≥ 5.0 in DBH/DRC) or the microplot center (for trees ≥ 1.0 in and < 5.0 in DBH/DRC), sight the center of the base of each tree with a compass. Sight to the geographic center for multi-stemmed western woodland species. The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

NC Note: Do not repeat azimuths on a subplot, if needed separate by one degree.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of the time
Values: 001 to 360

5.5 HORIZONTAL DISTANCE (DIST)

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 ft, from the subplot center (for trees ≥ 5.0 in DBH/DRC) or microplot center (for trees ≥ 1.0 in and < 5.0 in DBH/DRC) to the pith of the tree at the base. For all multi-stemmed western woodland trees (woodland species indicated in Appendix 4), the HORIZONTAL DISTANCE is measured from subplot or microplot center to the "geographic center" of the tree. The geographic center is a point of equal distance between all tallied stems for a given woodland tree.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits (xx.y)
MQO: Microplot: +/- 0.2 ft, at least 90% of the time
Subplot: +/- 1.0 ft, at least 90% of the time
Values: Microplot: 00.1 to 6.8
Subplot: 00.1 to 24.0

5.6 TREE STATUS (STAT)

Record a current TREE STATUS for each tallied tree; this code is used to track the status of sample trees over time: as they first appear, as ingrowth, as they survive, and when they die or are removed. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All live and dead tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

The following codes (1-2) are used on new, replacement, and remeasured plots:

1 Live tree – any live tree (new, remeasured or ingrowth)

2 Dead tree – new plot – any standing dead tree (regardless of cause of death)
remeasured plot – a tree that died due to causes other than direct human activity related to harvesting, silviculture or nonforest land clearing

The following codes (3-7) are only used on remeasured (SAMPLE KIND = 2 or NCSK=6) plots:

3 Removal - a tree that has been cut or killed by direct human activity related to harvesting, silvicultural activity or land clearing. The tree may or may not have been utilized. Only code trees killed by fire as removals if it was a prescribed burn.

4 Missed live tree - live at time of previous inventory, live now.

5 Missed mortality tree - live at time of previous inventory, dead now.

6 Missed dead tree - dead at time of previous inventory, dead now.

7 No history - tree is not presently in the sample. Tree was incorrectly tallied at the previous survey, was physically moved off the plot (natural causes such as a landslide), or currently is not tallied due to definition or procedural change. NC Note: use this status trees for re-measurement that are now on a denied access condition.

Note: For microplot trees (saplings) which become trees, crews must collect new azimuth and distance information from the subplot center.

NC Note: For status codes that are valid for Trees on subplots 101-105 see NC Table 3, only codes 1 & 2 are valid for subplots 1-4.

5.7 LEAN ANGLE (LEAN)

Record the code that describes the lean angle from vertical of the tree. Trees supported by other trees or by their own branches are considered standing if equal to or less than 45 degrees.

When Collected: CORE: All live and standing dead tally trees ≥ 5.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0	Standing (less than or equal to 45 degrees of lean)
2	Down (more than 45 degrees of lean)

5.19NC NC TREE CLASS/DECAY CLASS CURRENT (TCC)

Tree class/decay class reflects tree suitability for timber products or the extent of decay in the butt section of down-dead trees. Tree class is basically a check for the straightness and soundness of the sawlog portion on a sawtimber tree or the potential sawlog portion on a poletimber tree or sapling. Not considered in determining tree class are: tree vigor, predicted death, and plot site index. The extent of decay in the **butt section** of down-dead trees determines the decay class. A metal pin is useful in assessing the amount of decay, but be sure to minimize damage to the tree. If the pin penetrates to the center of the log the tree is in decay class 44 or 45. Record decay class in the tree class field.
Use one of the following codes for tree/decay class of live standing, standing-dead, and down-dead trees.

When collected: All trees on all subplots will be given a NC Tree Class/Decay Class.
Field width: 2 digits
MQO: None
Values: 20,30,31,40,41,42,43,44,45

Code	Description
20	Growing Stock
30	Rough Cull, Salvable, and Salvable-down
31	Short-log Cull
40	Rotten Cull

Remeasurement trees only(see description)

41	Solid
42	Solid-punky
43	Punky
44	Disintegrating
45	Gone

20--Growing Stock

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

Any pole timber size tree that has the potential to meet the above specifications. Assume that pole-size trees will eventually attain saw-log size at DBH. In evaluating potential saw-log portion of pole-size trees, only rot/missing/dead wood, forks, excessive sweep/crook, & potential grade may disqualify the tree as a growing stock. Predict what grade the future log will have, this will determine the appropriate size limb stopper needed to stop the log length.
When estimating potential sawlog height for poletimber trees, apply the two-inch rule as a guide. The two-inch rule assumes that a tree's diameter increases uniformly along its bole. For example, a hardwood poletimber tree with an 8.0" DBH needs 3" of diameter growth to become sawtimber size. If diameter growth is uniform, then the DBH minus two inches (eight minus two), or six inches, identifies the potential sawlog top. This method works for both hardwoods and softwoods.
Consider a seedling or sapling as growing stock unless a specific damage is observed. A seedling or small sapling (< 3.0" DBH) may not be culled on the basis of excessive sweep or crook. Assume that seedlings and saplings will eventually attain sawlog size at DBH.

30--Rough Cull, Salvable, and Salvable-down

Any tree of noncommercial species is a rough cull
Any tree that is sawtimber size and has no merchantable sawlog. Over one-half of the volume in the sawlog portion does not meet minimum log-grade specifications because of roughness, excessive sweep or crook, splits, cracks, limb stoppers, or forks the tree is considered rough cull. The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods, or the 7.0" top DOB for softwoods.
Rough cull pole-size trees do not have the potential to meet the specifications for growing stock because of forks, limb stoppers, or excessive sweep or crook. Assume that all live trees not currently sawlog size will eventually attain sawlog size at DBH. Predicted death, tree vigor, and plot site index are not considered in determining tree class.
A standing-dead tree that contains at least one 8-foot section that is at least 50 percent sound has a tree/decay class of 30. A down-dead tree 5.0" DBH that meets these standards is given a tree/decay code of 30.

31--Short-log Cull

Any live sawtimber-size tree of commercial species that has at least one 8-foot sawlog, but less than a 12-foot sawlog, meeting minimum log-grade specifications.
Any live sawtimber-size tree of commercial species that has less than one-third of the volume of the sawlog portion in merchantable logs, but has at least one 8-foot or longer sawlog meeting minimum log-grade specifications. A short sawlog must be 50 percent sound at any point. (The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods and the 7.0" top DOB for softwoods.)

Note: Pole-size trees never receive a tree class code 31.

40--Rotten Cull

Any live tree of commercial species that is sawtimber size and has no merchantable sawlog. Over one-half of the volume in the sawlog portion does not meet minimum log-grade specifications primarily because of rot, missing sections, or deadwood. (The sawlog portion is the length between the one-foot stump and the 9.0" top DOB for hardwoods, or the 7.0" top DOB for softwoods.)
Classify any pole-size tree that does not have the potential to meet the specifications for growing stock because of rot as rotten cull. Assume that all live trees will eventually attain sawlog size at DBH. Predicted death, tree vigor, and plot site index are not considered in determining tree class.
A standing-dead tree without an 8-foot or longer section that is at least 50 percent sound has a tree class of 40. Any standing-dead sapling is also given a tree class of 40.
Summary: If any of the requirements for growing stock (tree class 20) are not met, the tree is considered cull. If a short sawlog is present, the tree class is 31. If no sawlog is present, the tree class is either 30 or 40. If a pole-size tree does not have the potential to meet sawlog standards, it is either tree class 30 or 40.

41--Solid
The butt section of a down-dead tree with this decay class has intact bark and is structurally sound enough that it cannot be penetrated with a pin. Any rotten portions are also intact. Use this class for trees ≥ 5" DBH that are not salvable due to breakage or form.

42--Solid-punky
Bark may or may not still be attached and the structural integrity of the butt section is sound to somewhat rotten. Branch stubs are still firmly attached. Any rotten portions are partly soft.

43—Punky
Decay has progressed substantially in the butt section. Although bark may still be attached, most is sloughing or detached and a pin easily penetrates the wood. Branch stubs pull out and rotten portions are soft and perhaps even squishy if moist.

44--Disintegrating
Little structural integrity remains. Bark is detached or absent (for some species it may still be intact). A pin penetrates to the center of the log and branch stubs have rotted. Rotten portions are "doughy" when wet and fluffy when dry.

45--Gone
Little to no evidence of the butt section remains.
The following table summarizes valid tree/decay class for the various tree histories.

The following table summarizes valid tree/decay class for the various tree histories.

Tree Status	**Tree lean**	**Tree/Decay Class**								
		20	30	31	40	41	42	43	44	45
1,4	0,1,2	Yes	Yes	Yes	Yes	NO	NO	NO	NO	NO
2,5,6	0,1	NO	Yes	NO	Yes*	NO	NO	NO	NO	NO
2	2	NO	Yes**	NO	NO	Yes	Yes	Yes	Yes	Yes

* Use this class for standing-dead trees <5.0" DBH
** Trees ≥ 5.0" DBH only

5.8 SPECIES (SPP)
Record the appropriate SPECIES code from the list in Appendix 4. If you encounter a species not listed in Appendix 4 and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use the generic SPECIES code only when you encounter a tree where you know tree species but the species is not on the species list.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 3 digits
MQO: No errors for genus 100% of the time, no errors for species at least 95% of the time
Values: See Appendix 4

5.9 DIAMETER

Record the actual diameter for each tallied tree to the last whole 0.1 in. Diameter is either diameter at breast height (DBH) or diameter at the root collar (DRC).

Each unit will apply methods that allow remeasurement of diameter (DBH or DRC) at the same point on the tree bole at successive visits. Valid methods include measuring distance from the ground to point of diameter, or marking the point of measurement with an aluminum nail, a scribe, crayon mark, or paint spot. If scribing is used, the mark should not penetrate the cambium. If a mark or nail is used, the diameter should not be taken until the mark or nail is in place. Do not scribe or nail trees less than 3.0 inches in diameter.

Do not nail or scribe tree species, such as aspen, that are highly susceptible to damaging agents introduced by these practices.

NC Note: Monumentation of subplots and microplots 101-105 are handled differently than subplots and microplots 1-4. For all trees and saplings on 1-4, scribe and paint a two-inch horizontal mark just below the lower tape at the point where DBH is measured. Do this on the side of the tree facing subplot center. Within the one-foot stump facing subplot center, scribe and paint a vertical mark to facilitate re-measurement in the event the tree is cut. Paint but do not scribe small, thin-barked trees and trees < 3.0" DBH. Scribe marks should not penetrate the cambium.

NC Note(continued): For subplots 101-105, re-mark only if necessary with scribe only at the point where DBH is measured. Scribe marks should not penetrate the cambium. If the old paint on the tree is still visible leave it on the tree and do not re-scribe.

NC Note(continued): In reserved areas monument each sample tree 5.0" DBH and larger with a nail at ground level either facing subplot center or on the uphill side of the tree if there is a slope. If only saplings are on the subplot, mark a couple of them with nails at ground level and note which are so marked. Measure DBH at exactly 4.5 feet above the nail. If DBH needs to be taken at a different location, record the location above the nail in feet and tenths of a foot in Height To Diameter (DIAH).

<u>Remeasurement trees</u>:

The diameter measurement must be taken at the same point on the tree as the previous measurement, if possible. The point of diameter measurement should not be moved unless the crew cannot physically remeasure that point (e.g., forks converge, tree buried by mudslide).

If there was an obvious recording error in the previous measurement (e.g., past crew measured 31.0 but recorded 13.0), crews should estimate and record the appropriate past diameter using local procedures.

For trees on the 24.0 ft radius subplot, measure single-stemmed trees 5.0 inches in diameter (DBH) or larger.

For trees on the 6.8 ft radius microplot, measure single-stemmed trees between 1.0 inch and 4.9 inches in diameter (DBH).

5.9.1 DIAMETER AT BREAST HEIGHT (DBH)

For trees requiring diameter at breast height, measure DBH at 4.5 ft above the ground unless one of the special DBH situations listed below is present. Figures 10-18 show the proper use of the diameter tape.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 4 digits (xxx.y)
MQO: +/- 0.1 in per 20.0 in of diameter on trees with a measured diameter, at least 95% of the time. For example: a tree with a diameter of 41.0 in would have a tolerance of plus or minus 0.3 in
Values: 0001 to 9999
Special DBH situations:

1. Tree with butt-swell or bottleneck: Measure these trees 1.5 ft above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 ft or more above the ground (Figure 10).

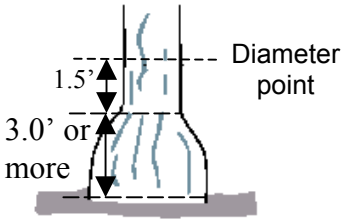


Figure 10. (1) Tree with swelled butt

2. Forked tree: If the point of pith separation is at or above 4.5 ft, consider the tree as one tree . Measure the diameter below the swell, as near as possible to 4.5 ft above the ground on the uphill side. If the point of pith separation is below 4.5 ft above the ground, but above 1.0 ft, consider each fork a separate tree. For diameter measurement, measure each fork at 3.5 ft above the point of pith separation, or as near as possible to this point (Figure 11).

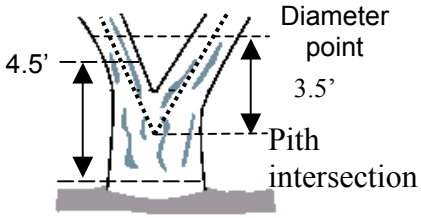


Figure 11. (2) Forked tree

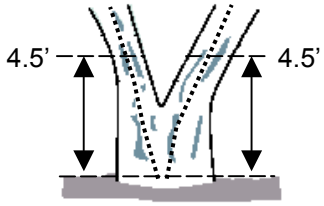


Figure 12. (2) Two trees

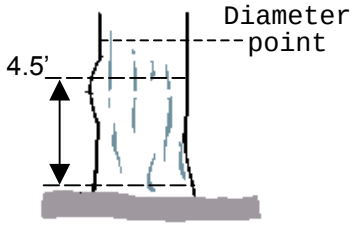


Figure 13. (3) Tree with swelling

3. Tree with irregularities at DBH: On trees with swellings (Figure 13), bumps, depressions, branches (Figure 14),

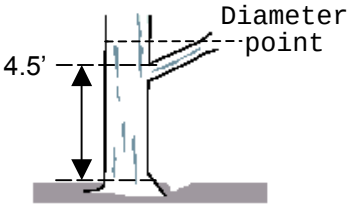


Figure 14. (3) Tree with branch

etc. at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

4. Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree (Figure 15).

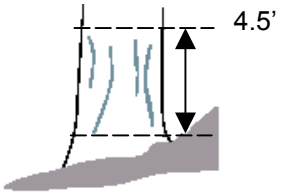


Figure 15. (4.) Tree on a slope

5. Leaning tree: Measure diameter at 4.5 ft from the ground along the bole. The 4.5 ft distance is measured along the underside face of the bole (Figure 16).

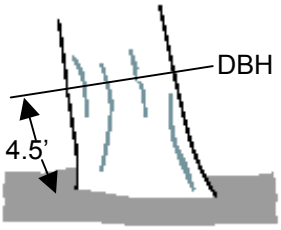


Figure 16. (5) Leaning tree

6. Turpentine tree: **NC Note: Not used in NC region.**

7. Independent trees that grow together: Continue to treat them as two trees.

8. Diameter on trees missing a portion of bark or bole at the point of diameter measurement is measured and recorded to the nearest 0.1 in as the tree actually exists (e.g., do not "reconstruct" the bole) (Figure 17).

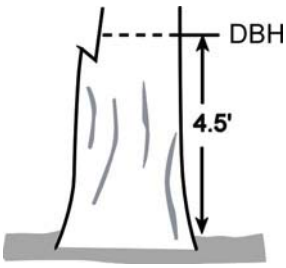


Figure 17. (8) Tree with broken stem

9. Live windthrown tree: Measure from the top of the root collar along the length to 4.5 ft (Figure 18).

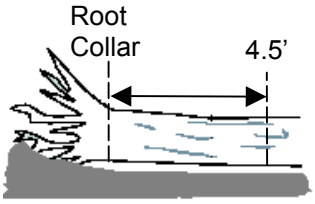
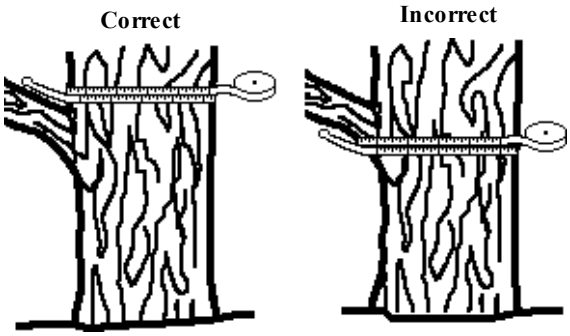


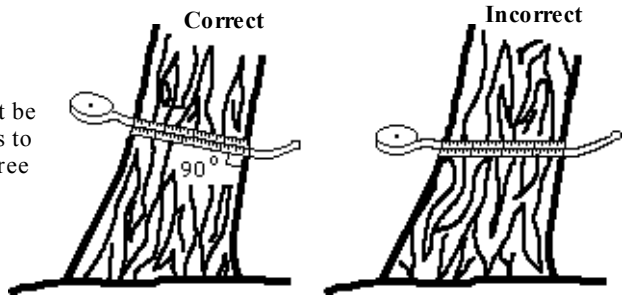
Figure 18. (9) Tree on the ground

Figure NC6 Using the diameter tape

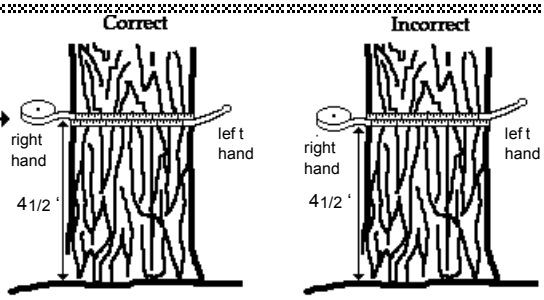


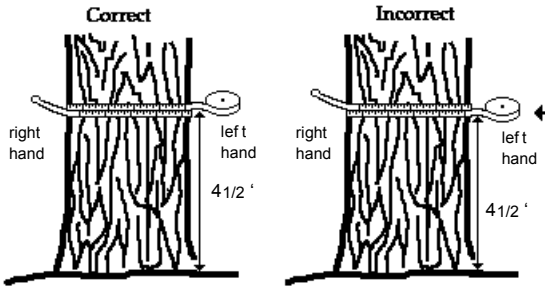
Don't position the tape at an abnormal place on the bole

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



Right handed--The right hand should cross over the left.

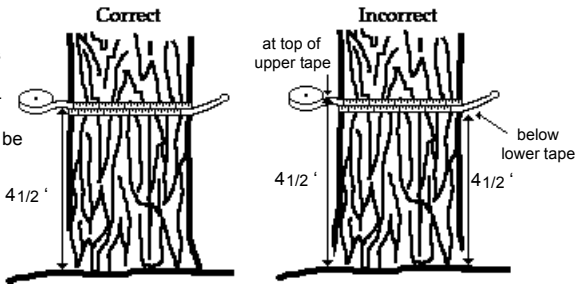




Left handed--The left hand should cross over the right.

The DBH point is always at the top of the lower tape.

The tape must be pulled straight.



5.23 LENGTH TO DIAMETER MEASUREMENT POINT (DIAH)

Record this item when tree diameter measurement locations are not monumented. For those trees measured directly at 4.5 ft above the ground, leave this item blank. If the diameter is not measured at 4.5 ft, record the actual height from the ground, to the nearest 0.1 in, at which the diameter was measured for each tally tree, 1.0 in DBH and larger. Leave this item blank for western woodland species measured for diameter at root collar.

When Collected: All live and dead tally trees (except western woodland species) ≥ 1.0 in DBH

NC Note: Record on all trees (subplots 1-4) if not equal to 4.5'.See Appendix 10 for process to calibrate you eye for estimating tree lengths.

Field width: 3 digits
MQO: +/- 0.3 ft, at least 90% of the time
Values: 0.1 – 15.0

5.10 DIAMETER CHECK (DCHE)

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

When Collected: All live and standing dead tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0	Diameter measured accurately
1	Diameter estimated
2	Diameter measured at different location than previous measurement (remeasurement trees only)

NC Note: Do not record on re-measurement trees (subplots 101-105).

5.11 PERCENT ROTTEN/MISSING CULL (ROTT)

Record the percent rotten or missing cubic-foot cull for all live tally trees ≥ 5.0 in DBH/DRC (CORE).

NC Note: Do not record on re-measurement trees (subplots 101-105).

When Collected: CORE: All live tally trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
MQO: +/- 10%, at least 90% of the time
Values: 0 to 99

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-ft stump to a 4-inch top. Do not include any cull estimate above actual length. For western woodland species, the merchantable portion is between the point of DRC measurement to a 1-inch DOB top.

Rotten and missing volume loss is often difficult to estimate. Refer to supplemental disease and insect pests field guides and local defect guidelines as an aid in identifying damaging agents and their impact on volume loss. Use your best judgment and be alert to such defect indicators as the following:

- Cankers or fruiting bodies.
- Swollen or punky knots.
- Dull, hollow sound of bole (use regional standards).
- Large dead limbs, especially those with frayed ends.

- Sawdust around the base of the tree.

5.20NC NC TREE GRADE (TRGD)

Grade qualifying sawlog trees (20 and 31 class) on all new subplots (1-4) in **all States**. See Appendix 10 for help using tree grade flow charts.

When collected: All live trees softwoods ≥ 9" DBH hardwoods ≥ 11" DBH with a tree class of 20 or 31
Field width: 3 digits
MQO: None
Values:

000	hardwoods/	softwoods
100	hardwoods/	softwoods
200		softwoods
210	hardwoods	
230	hardwoods	
240	hardwoods	
250	hardwoods	
270	hardwoods	
280	hardwoods	
300		softwoods
310	hardwoods	
330	hardwoods	
340	hardwoods	
350	hardwoods	
370	hardwoods	
380	hardwoods	
400		softwoods - White Pine only
430	hardwoods	
520	hardwoods	
560	hardwoods	
570	hardwoods	

First digit

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

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

For a hardwood sawtimber tree that does not qualify as tree grade 3, but has a 12-foot log within the butt 16-foot log and meets specifications for hardwood construction lumber logs (tie and timber) assign a grade 4. For a hardwood sawtimber tree that does not qualify as a tree grade 3 or log grade 4, but has a 12-foot log above the butt log or two 8-foot logs that meets log-grade requirements (therefore a 20 class tree), assign a log grade of 5.

A hardwood construction log grade table (grade 4) and a hardwood lumber log grade table (upper logs or grade 5) are included on the following pages.

For a **softwood** sawtimber (tree class 20) tree, grade the portion of the log that gives the best grade. Use the grading rules in the Tatum Guides for determining log grade.
For a softwood 31-class tree, grade the log that is present.

Minimum sawlog length for tree grades is 12 feet and for log grades is 8 feet. Sawlog lengths should not extend above large forks, have excessive limbs or other defects, or have a section of the tree bole that does not meet minimum log grade specification. Limitations or "stoppers" for all softwoods and for hardwood grades 1, 2 and 3 include: any limb (live or dead) having a collar diameter exceeding the stem DOB at that point; or any group of 2.0" collar diameter or larger limbs (live or dead), within a 1 foot span, having a combined sum of diameters greater than the stem DOB of that section. Limitations for grade 4 hardwoods include: any limb or group of limbs, within a 1 foot span, with a collar diameter or sum of collar diameters greater than 1/3 of the stem DOB of that section.

1st digit Code	valid species
1	hardwoods & softwoods
2	hardwoods & softwoods
3	hardwoods & softwoods
4	hardwoods only
5	hardwoods only

Second and third digit

For **hardwoods** given a grade 2, 3, 4, or 5, record the limiting quality factor that is keeping the log from moving into a better quality grade. When a grade 5 is given to a hardwood log, the second digit is a 2 or 7 when an 8' log is present. If a 12' upper log is present, assign a second digit of 6.

For **softwoods**, the second and third digits are always "00".

Code 2nd & 3rd	Limiting Factor
00	Not applicable, already a grade 1, all softwoods
10	Diameter
20	Length
30	Clear cuttings
40	Sweep and crook
50	Cull
60	Position in tree
70	Multiple factors
80	Diameter and clear cutting

TABLE OF HARDWOOD TREE GRADES FOR FACTORY LUMBER

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

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

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

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

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

e Unlimited.

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

NOTE: The tree grading in this table is based on measuring DBH to the nearest inch, since FIA measures to the higher 10th of a inch use diameter classes, i.e. for grade 1, DBH can be 15.5" and for grade 2, DBH can be 12.5" for this table. Also FIA uses 11 inch as the minimum DBH to record tree grades so there only grade 1 and 2 are affected by diameter classes.

FOREST SERVICE STANDARD SPECIFICATIONS FOR HARDWOOD CONSTRUCTION (GRADE 4) LOGS

Position in tree		Butt & Upper.
Min. diameter, small end		8 inches +.
Min. length, without trim		8 feet +.
Clear cuttings		No requirements.
Sweep allowance, absolute		1/4 d.i.b. of small end for half logs, 1/2 d.i.b. for logs 16 feet long.
Sound surface defects permitted	Single knots	Any number, if no one knot has an average collar diameter over 1/3 of log diameter at point of occurrence.
	Whorled knots	Any number, if sum of collar diameters does not exceed 1/3 of the log diameter at point of occurrence.
	Holes	Any number provided none has a diameter over 1/3 of log diameter at point of occurrence and none extends over 3 inches into included timber.
Unsound defects permitted	Surface	Any number and size if they do not extend into included timber. If they do, they can't exceed size, number, and depth, or limits of sound knots.
	Interior	None allowed; log must be sound internally, but will permit 1 shake not to exceed 1/3 the scaling diameter and a longitudinal split not extending over 5 inches into the contained timber. No center rot.

FOREST SERVICE STANDARD GRADES FOR HARDWOOD FACTORY LUMBER LOGS [a]

Grading Factors*		Log grades							
		F1			F2				F3
Position in tree		Butts only	Butts & uppers		Butts & uppers				Butts & uppers
Scaling diameter, inches		13-15[b]	16-19	20+	11+[c]	12+			8+
Length without trim, feet		10+			10+	8-9	10-11	12+	8+
Required clear[d] cuttings of each of 3 best faces[e]	Min. length, feet	7	5	3	3	3	3	3	2
	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook allowance	For logs with less than 1/4 of end in sound defects	15%			30%				50%
	For logs with more than 1/4 of end in sound defects	10%			20%				35%
Maximum scaling deduction		40%[f]			50%[g]				50%

[a] From USDA Forest Service Research FPL. 63
[b] Ash and Basswood butts can be 12 inches if otherwise meeting the requirements for small No. 1's
[c] Ten-inch logs of all species can be #2 if they if otherwise meeting the requirements for small No. 1's
[d] A Clear cutting is a portion of a face free of defects, extending the width of the face. A face is one-fourth the surface of the log as divided lengthwise.
[e] A face is ¼ of the surface of the log as divided lengthwise
[f] Otherwise No. 1 logs with 41-60 percent cull can be No. 2.
[g] Otherwise No. 2 logs with 51-60 percent cull can be No. 3.

See Appendix 9 or Tatum guides for softwood grade tables.

5.12 TOTAL LENGTH (THGT)

Record the TOTAL LENGTH of the tree, to the nearest 1.0 ft from ground level to the tip of the apical meristem. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a broken or missing top, estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees.

NC Note: Do not record on re-measurement trees (subplots 101-105).

When Collected: P2 CORE - All live and standing dead tally trees ≥ 5.0 in DBH/DRC

P3 - All live tally trees ≥ 1.0 in DBH/DRC and all standing dead tally trees ≥ 5.0 in DBH/DRC

Field width: 3 digits
MQO: +/- 10% of true length, at least 90% of the time
Values: 005 to 400

5.13 ACTUAL LENGTH (ACTU)

For trees with broken or missing tops. Record the ACTUAL LENGTH of the tree to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. If the top is intact, this item may be omitted. Forked trees should be treated the same as unforked trees.

NC Note: Do not record on re-measurement trees (subplots 101-105).

When Collected: P2 CORE - All live and standing dead tally trees (with broken or missing tops) ≥ 5.0 in DBH/DRC

P3 - All live and standing dead tally trees (with broken or missing tops) 1.0 –4.9 in DBH/DRC
P3 - All live and standing dead tally trees (with broken or missing tops) ≥ 5.0 in DBH/DRC

Field width: 3 digits
MQO: +/- 10% of true length, at least 90% of the time
Values: 005 to 400

5.14 LENGTH METHOD (METH)

Record the code that indicates the method used to determine tree lengths.

When Collected: P2 CORE - All live and standing dead tally trees ≥ 5.0 in DBH/DRC

P3 - All live tally trees ≥ 1.0 in DBH/DRC and all standing dead tally trees ≥ 5.0 in DBH/DRC

Field width: 1 digit
MQO: No errors, 100% of the time
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape)

2 Total length is visually estimated, actual length is measured with an instrument

3 Total and actual lengths are visually estimated

5.15 CROWN CLASS (CCC)

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 20). Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree which is now dominant due to tree removal is classified as dominant.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
MQO: No errors, at least 85% of the time
Values:

1 Open Grown: Trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.

2 Dominant: Trees with crown extending above the general level of the crown cover and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides.

Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.

3 Co-dominant: Trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.

4 Intermediate: Trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediates usually have small crowns and are very crowded from the sides.

5 Overtopped: Trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

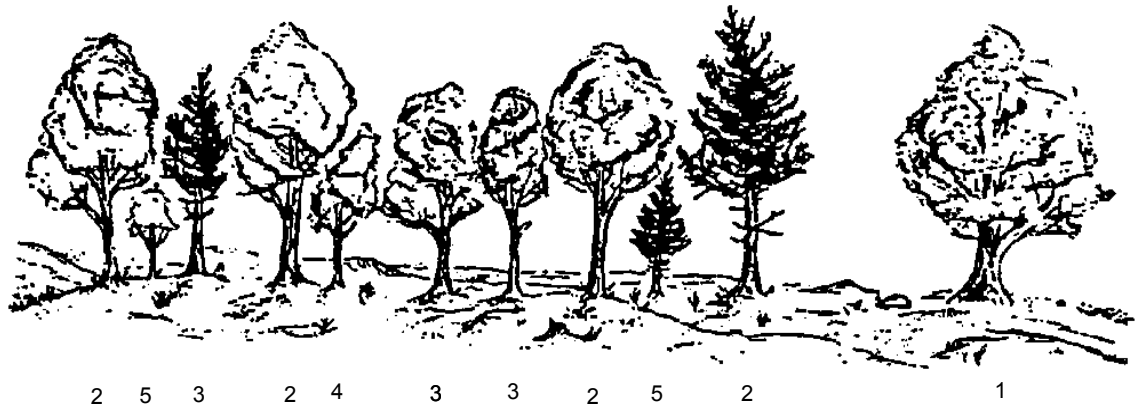


Figure 20. Examples of CROWN CLASS definitions.

5.16 UNCOMPACTED LIVE CROWN RATIO (P3 – CORE)
Refer to P3 field guide Section 12, Crown Condition Classification.

5.17 COMPACTED CROWN RATIO (CRC)
Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 in and larger. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage and is expressed as a percentage of the actual tree height. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC
Field width: 2 digits
MQO: +/- 10%, at least 80% of the time
Values: 00 to 99

5.18 TREE DAMAGE
Record up to two different damages per tree. Damage is characterized according to three attributes: location of damage, type of damage, and severity of damage. Damages must meet severity thresholds (defined in section 5.18.3, DAMAGE SEVERITY) in order to be recorded.

The tree is observed from all sides starting at the roots. Damage signs and symptoms are prioritized and recorded based on location in the following order: roots, roots and lower bole, lower bole, lower and upper bole, upper bole, crownstem, and branches recorded as location code 0 (for no damage), or DAMAGE LOCATION 1-9.

Within any given location, the hierarchy of damage follows the numeric order of DAMAGE TYPE possible for that location. The numeric order denotes decreasing significance as the code number goes up, i.e., DAMAGE TYPE 01 is more significant than DAMAGE TYPE 25. A maximum of two damages are recorded for each tree. If a tree has more than two damages that meet the threshold levels, the first two that are observed starting at the roots are recorded.

When multiple damages occur in the same place, the most damaging is recorded. For example, if a canker, DAMAGE TYPE 02, meets the threshold and has a conk growing in it, record only the canker. Another example: if an open wound meets threshold and also has resinosis, record only the open wound.

5.18.1 DAMAGE LOCATION 1 (LOC1)
Record the location on the tree where DAMAGE TYPE 1 is found (Figure 23). If the same damage continues into two or more locations, record the appropriate code listed below, or if the combination of locations does not exist (damage extends from crownstem to roots), record the lowest location that best describes the damage (see Figure 24). Multiple damages may occur in the same location, but record the higher priority damage (lower code number) first. If the damages are coincident (a conk within a canker), record only the higher priority damage.

The “base of the live crown” is defined as the horizontal line which would touch the lowest part of the foliage, excluding branches towards the base of the tree which are less than 1.0 inch or more than 5 ft from the rest of the crown. See Section 5.16 (UNCOMPACTED LIVE CROWN RATIO) for more details.

NC Note: See crown measurements P3 manual section, for help in determining “base of the live crown” used in accessing locations in the damage section.

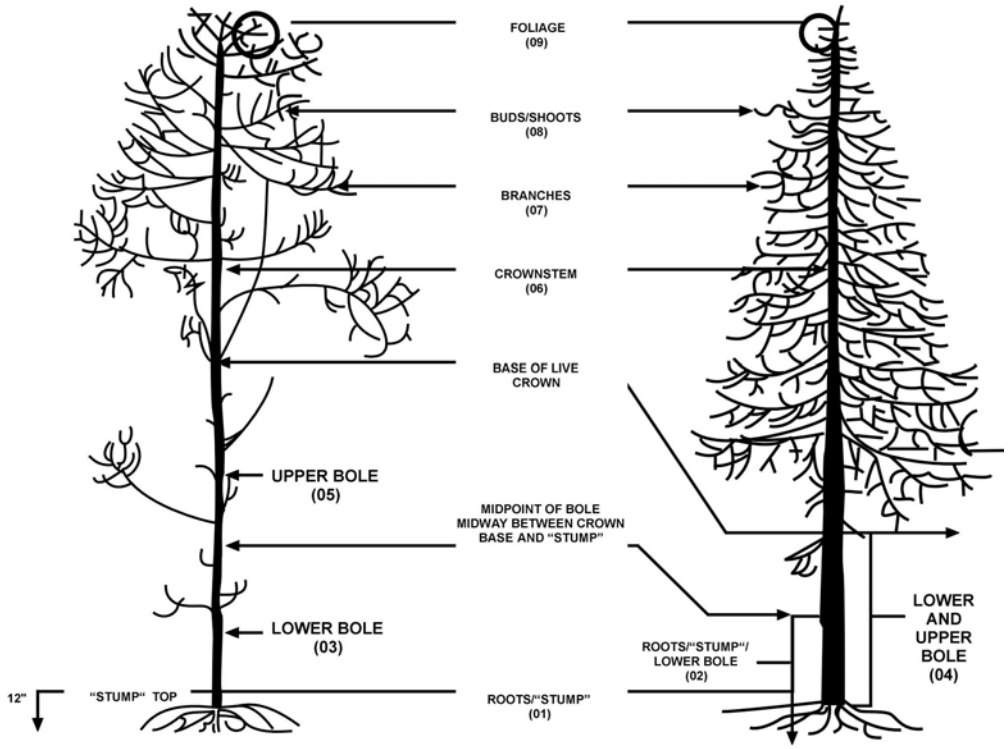


Figure 23. Location codes for damage.

When Collected: CORE: All live tally trees ≥ 5.0 in DBH/DRC

Field width: 1 digit
MQO: +/- 1 location class, at least 80% of the time
Values:

0 No damage

1 Roots (exposed) and stump (12 inches in height from ground level)

2 Roots, stump, and lower bole

3 Lower bole (lower half of the trunk between the stump and base of the live crown)

4 Lower and upper bole

5 Upper bole (upper half of the trunk between stump and base of the live crown)

6 Crownstem (main stem within the live crown area, above the base of the live crown)

7 Branches (>1 in at the point of attachment to the main crown stem within the live crown area)

8 Buds and shoots (the most recent year's growth)

9 Foliage

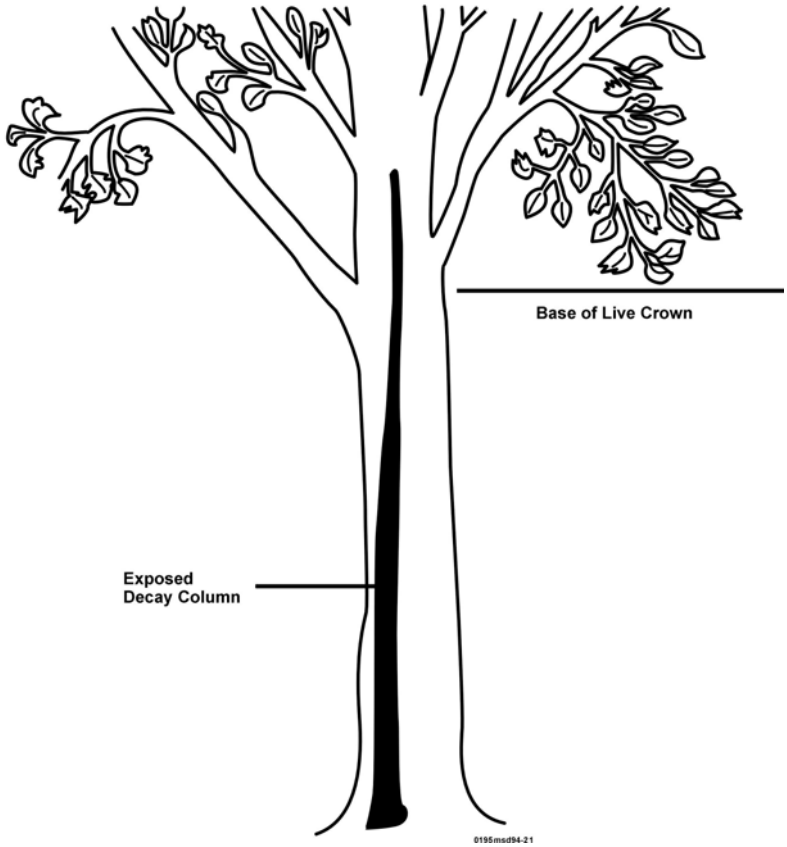


Figure 24. The damage runs from stump to crownstem. Code here should be 02 (roots and "stump" and lower bole) which represents the lowest locations of this multi-location damage.

5.18.2 DAMAGE TYPE 1 (DAM1)

Record the first damage type observed that meets the damage threshold definition in the lowest location. Damage categories are recorded based on the numeric order that denotes decreasing significance from damage 01 - 31.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
MQO: No errors, at least 80% of the time
Values:

1 Canker, gall: Cankers may be caused by various agents but are most often caused by fungi. The bark and cambium are killed, and this is followed by death of the underlying wood, although the causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider, or galling (including galls caused by rusts), on roots, bole, or branches. Due to the difficulty in distinguishing some abnormal swellings (e.g., burls) from classic galls and cankers, all are recorded as damage 01. A canker may be:

Annual (enlarges only once and does so within an interval briefer than the growth cycle of the tree, usually less than one year),

Diffuse (enlarges without characteristic shape or noticeable callus formation at margins), or

Perennial (enlarges during more than one year - often has a target appearance).

2 Conks, fruiting bodies, and signs of advanced decay: Fruiting bodies on the main bole, crownstem, and at the point of the branch attachment are signs of decay. "Punky wood" is a sign of decay and is evidenced by soft, often moist, and degraded tissue.

Cavities into the main bole that are oriented in such a way that they act as catchment basins for water are signs of decay. Bird cavities are signs of decay.

Rotten branches or branches with conks **are not indicators of decay unless** the threshold is met (>20% of branches are affected).

Rotting stumps associated with coppice regeneration (e.g., northern pin oak, maple) are excluded from coding.

3 Open wounds: An opening or series of openings where bark has been removed or the inner wood has been exposed and no signs of advanced decay are present. Improper pruning wounds that cut into the wood of the main stem are coded as open wounds, if they meet the threshold; those which leave the main stemwood intact are excluded.

4 Resinosis or gummosis: The origin of areas of resin or gum (sap) exudation on branches and trunks.

5 Cracks and seams: Cracks in trees are separations along the radial plane. When they break out to the surface they often are called frost cracks. These cracks are not caused by frost or freezing temperature, though frost can be a major factor in their continued development. Cracks are most often caused by basal wounds or sprout stubs, and expand when temperatures drop rapidly. Seams develop as the tree attempts to seal the crack, although trees have no mechanism to compartmentalize this injury.

Lightning strikes are recorded as cracks when they do not meet the threshold for open wounds.

11 Broken bole or roots (less than 3 ft from bole): Broken roots within 3 ft from bole either from excavation or rootsprung for any reason. For example, those which have been excavated in a road cut or by animals.

Stem broken in the bole area (below the base of the live crown) and tree is still alive.

12 Brooms on roots or bole: Clustering of foliage about a common point on the trunk. Examples include ash yellows witches' brooms on white and green ash and eastern and western conifers infected with dwarf mistletoes.

13 Broken or dead roots (beyond 3 ft): Roots beyond 3 ft from bole that are broken or dead.

20 Vines in the crown: Kudzu, grapevine, ivy, dodder, etc. smothers tree crowns. Vines are rated as a percentage of tree crown affected.

21 Loss of apical dominance, dead terminal: Mortality of the terminal of the crownstem caused by frost, insect, pathogen, or other causes.

22 Broken or dead: Branches that are broken or dead. Branches with no twigs are ignored and not coded as dead. Dead or broken branches attached to the bole or crownstem

outside the live crown area are not coded. 20% of the main, first order portion of a branch must be broken for a branch to be coded as such.

23 Excessive branching or brooms within the live crown area: Brooms are a dense clustering of twigs or branches arising from a common point that occur within the live crown area. Includes abnormal clustering of vegetative structures and organs. This includes witches' brooms caused by ash yellows on green and white ash and those caused by dwarf mistletoes.

24 Damaged buds, foliage or shoots: Insect feeding, shredded or distorted foliage, buds or shoots >50% affected, on at least 30% of foliage, buds or shoots. Also includes herbicide or frost-damaged foliage, buds or shoots.

25 Discoloration of foliage: At least 30% of the foliage is more than 50% affected. Affected foliage must be more of some color other than green. If the observer is unsure if the color is green, it is considered green and not discolored.

31 Other: Use when no other explanation is appropriate. Specify in comments section of PDR for "tree notes." Code 31 is used to maintain consistency with the Phase 3 crown damage protocols.

LEGAL COMBINATIONS OF DAMAGE TYPE BY DAMAGE LOCATION:

For each of the following location codes, possible damage codes and damage definitions are presented. Minimum damage thresholds are described in Section 5.17.3, DAMAGE SEVERITY.

	Damage Type (DAM1 & DAM2)														
LOC	**1**	**2**	**3**	**4**	**5**	**11**	**12**	**13**	**20**	**21**	**22**	**23**	**24**	**25**	**31**
1	2-9	2-9	2-9	2-9	2-9	0	0	2-9							0
2	2-9	0	2-9	2-9	0	0	0								0
3	2-9	0	2-9	2-9	0	0	0								0
4	2-9	0	2-9	2-9	0	0	0								0
5	2-9	0	2-9	2-9	0	0	0								0
6	2-9	0	2-9	2-9	0					0-9					0
7	2-9	2-9	2-9	2-9	2-9				2-9		2-9	2-9			0
8													3-9		0
9													3-9	3-9	0

NC Table 4 - Valid severity codes by damage type and location in the tree. Cells that have a diagonal line though them indicate that they are not a valid location and type combination.

Location 1: Roots and stump

01 Canker, gall -- exceeds 20% of circumference of stump
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds -- exceeds 20% of circumference of stump
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference of stump
05 Cracks and seams -- any occurrence
11 Broken bole or roots less than 3 ft from bole -- any occurrence
12 Brooms on roots or bole -- any occurrence.
13 Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead

31 Other

Location 2: Roots, stump, and lower bole

01 Canker, gall -- exceeds 20% of circumference of stump
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds – exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of the circumference of stump
04 Resinosis or gummosis -- origin of flow width exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of circumference of stump.
05 Cracks and seams - any occurrence
11 Broken bole or roots less than 3 ft from bole -- any occurrence
12 Brooms on roots or bole - -any occurrence.
13 Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead

31 Other

Location 3: Lower bole

01 Canker, gall -- exceeds 20% of circumference at the point of occurrence
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds -- exceeds 20% of circumference at the point of occurrence
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05 Cracks and seams -- any occurrence
11 Broken bole or roots less than 3 ft from bole -- any occurrence
12 Brooms on roots or bole -- any occurrence
31 Other

Location 4: Lower and upper bole -- same as lower bole.
Location 5: Upper bole - same as lower bole.
Location 6: Crownstem

01 Canker, gall -- exceeds 20% of circumference of crownstem at the point of occurrence
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds - exceeds 20% of circumference at the point of occurrence -- any occurrence
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05 Cracks and seams -- all woody locations -- any occurrence.
21 Loss of apical dominance, dead terminal -- any occurence

31 Other

Location 7: Branches >1 in at the point of attachment to the main or crown stem

01 Canker, gall -- exceeds 20% of circumference on at least 20% of branches
02 Conks, fruiting bodies and signs of advanced decay -- more than 20% of branches affected
03 Open wounds -- exceeds 20% of circumference at the point of occurrence on at least 20% of branches
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence on at least 20% of branches
05 Cracks and seams -- all occurrences, and on at least 20% of branches
20 Vines in the crown -- more than 20% of live crown affected
22 Broken or dead -- more than 20% of branches affected within the live crown area
23 Excessive branching or brooms -- more than 20% of branches affected
31 Other

Location 8: Buds and shoots

24 Damaged buds, shoots or foliage - more than 30% of buds and shoots damaged more than 50%.
31 Other.

Location 9: Foliage

24 Damaged buds, shoots or foliage - more than 30% of foliage damaged more than 50%.
25 Discoloration of foliage - more than 30% of foliage discolored more than 50%.
31 Other.

5.18.3 DAMAGE SEVERITY 1 (SEV1)

Record a code to indicate the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for TREE DAMAGE 1. Severity codes vary depending on the type of damage recorded.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
MQO: No errors, at least 80% of the time
Values: The codes and procedures for SEVERITY 1 values are defined for each DAMAGE TYPE 1.

DAMAGE TYPE Code 01 -- Canker, gall

Measure the affected area from the margins (outer edges) of the canker or gall within any 3-ft vertical section in which at least 20% of circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 25.

Severity classes for code 01 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

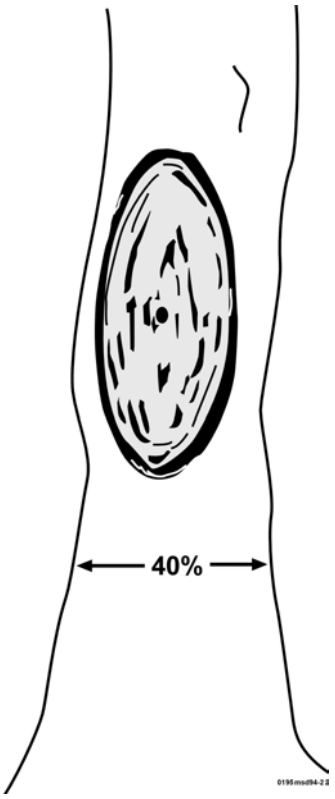


Figure 25. A canker which exceeds threshold. Since 40% of circumference is visible from any side, and since over half the visible side is taken up by the canker, it obviously exceeds the 20% minimum circumference threshold.

DAMAGE TYPE Code 02 -- Conks, fruiting bodies, and signs of advanced decay

Severity classes for code 02: **None**. Enter code 0 regardless of severity, except for roots > 3 ft from the bole, or number of branches affected - 20%

DAMAGE TYPE Code 03 -- Open wounds

The damaged area is measured at the widest point between the margins of the exposed wood within any 3-ft vertical section in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 26.

Severity Classes for code 03 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

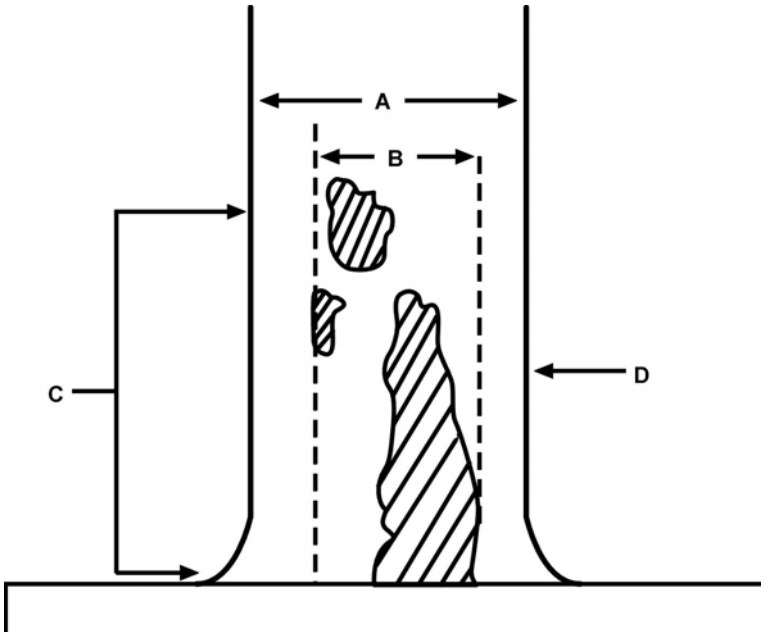


Figure 26. Multiple damage in "stump" and lower bole. A=approximately 40% of tree circumference; B=portion of tree circumference affected by damage; C=vertical distance within one meter; D=midpoint of occurence at which circumference is measured.

DAMAGE TYPE Code 04 -- Resinosis or gummosis

Resinosis or gummosis is measured at the widest point of the origin of the flow width in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

Severity classes for code 04 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 05 -- Cracks and seams

Threshold: Crack or seam must be 5.0 feet long or longer.

Record "0" for the lowest location in which the crack occurs. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

DAMAGE TYPE Code 11 -- Broken bole or roots less than 3 ft from bole

Severity classes for code 11: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 12 -- Brooms on roots or bole

Severity classes for code 12: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 13 -- Broken or dead roots

At least 20% of roots beyond 3 ft from bole that are broken or dead.

Severity classes for code 13 (percent of roots affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 20 -- Vines in crown

Severity classes for code 20 (percent of live crown affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 21 -- Loss of apical dominance, dead terminal

Any occurrence (> 1%) is recorded in 10% classes as a percent of the crownstem affected. Use trees of the same species and general DBH/DRC class in the area or look for the detached portion of the crownstem on the ground to aid in estimating percent affected. If a lateral branch has assumed the leader and is above where the previous terminal was, then no damage is recorded.

Severity classes for code 21:

Classes	Code
01-09	0
10-19	1
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 22 -- Broken or dead branches (> 1in above the swelling at the point of attachment to the main or crown stem within the live crown area)

At least 20% of branches are broken or dead.

Severity classes for code 22 (percent of branches affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 23 -- Excessive branching or brooms

At least 20% of crownstem or branches affected with excessive branching or brooms.

Severity classes for code 23 (percent of area affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 24 - Damaged buds, shoots or foliage

At least 30% of the buds, shoots or foliage (i.e., chewed or distorted) are more than 50% affected.

Severity classes for code 24:

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 25 - Discoloration of Foliage

At least 30% of the foliage is more than 50% affected.

Severity classes for code 25 (percent affected):

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 31 -- Other

Severity classes for code 31:

None. Enter code 0 regardless of severity. Describe condition in tree notes.

Examples are shown in Figures 27-33.

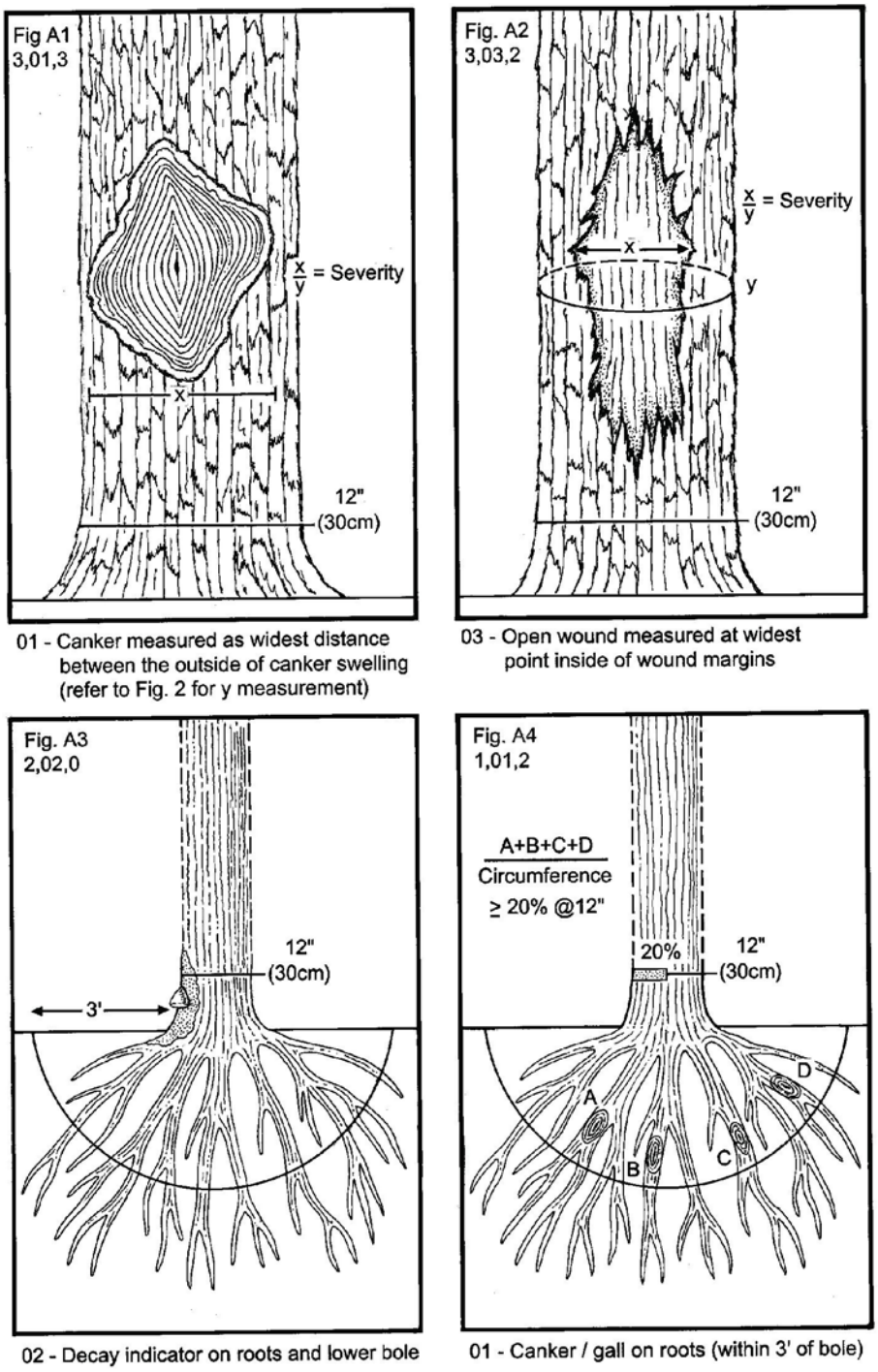
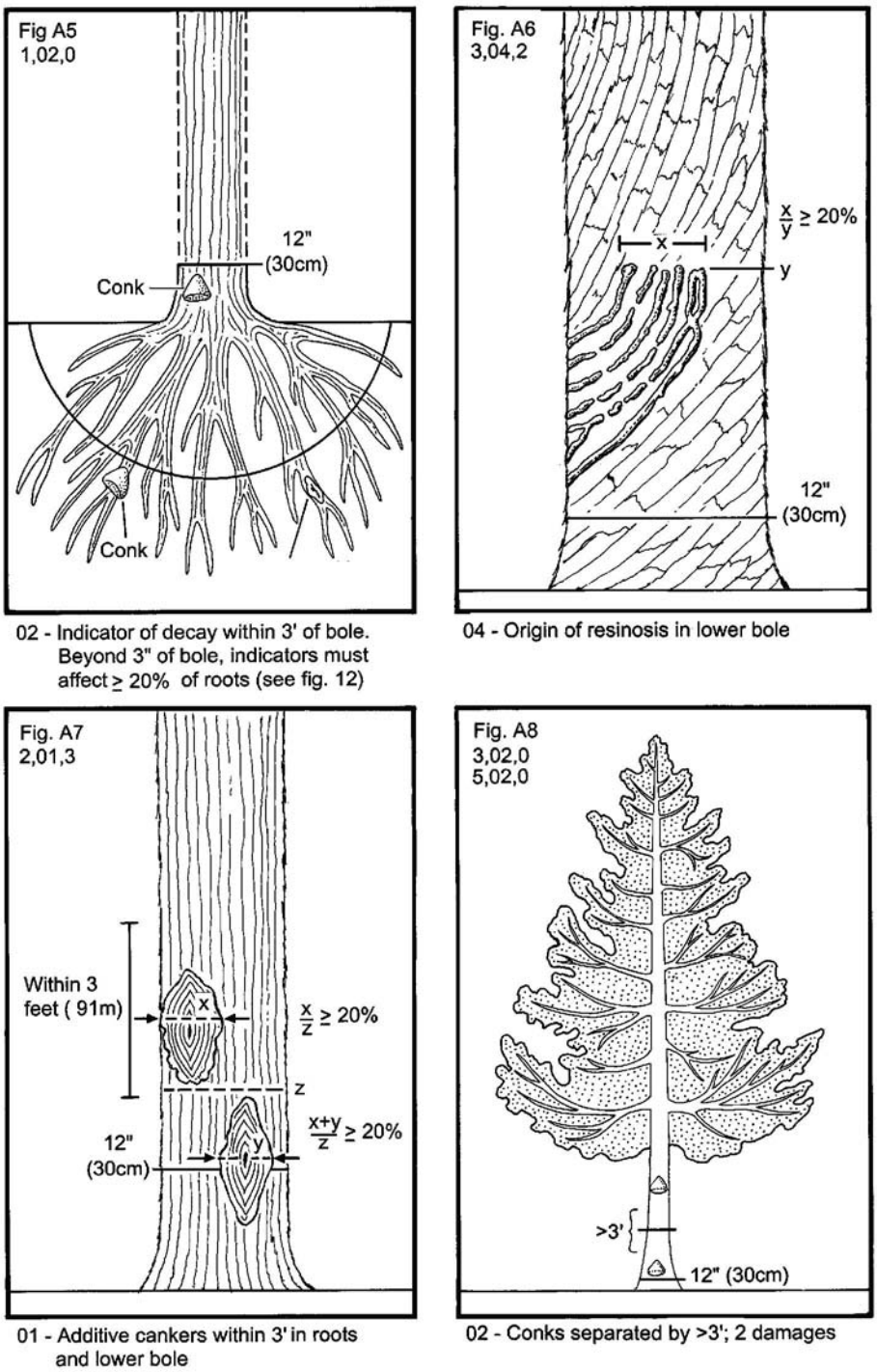


Figure 27. Examples of damage coding.



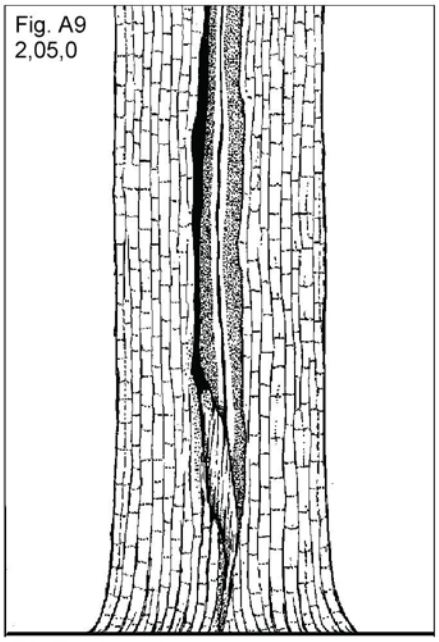
02 - Indicator of decay within 3' of bole. Beyond 3" of bole, indicators must affect ≥ 20% of roots (see fig. 12)

04 - Origin of resinosis in lower bole

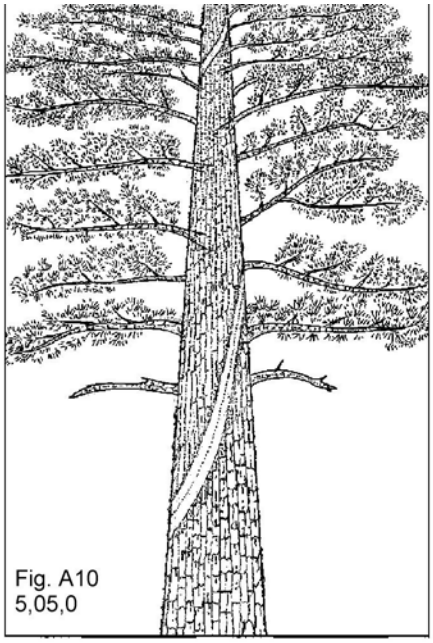
01 - Additive cankers within 3' in roots and lower bole

02 - Conks separated by >3'; 2 damages

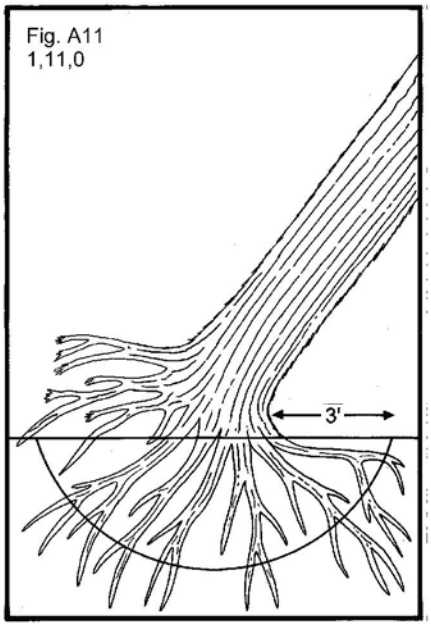
Figure 28. Examples of damage coding.



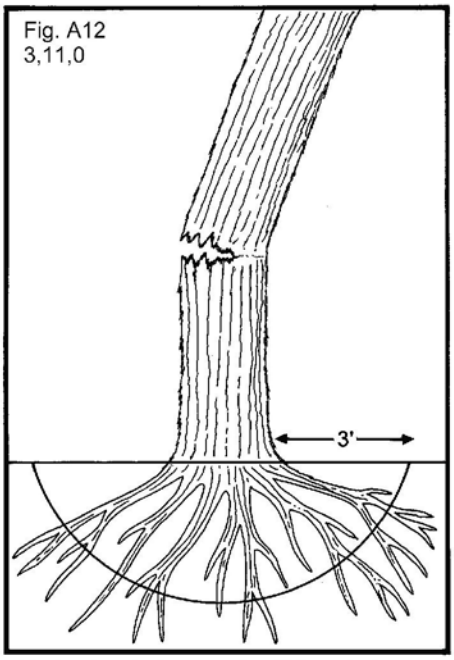
05- Cracks and seams



05 - Lightning strike

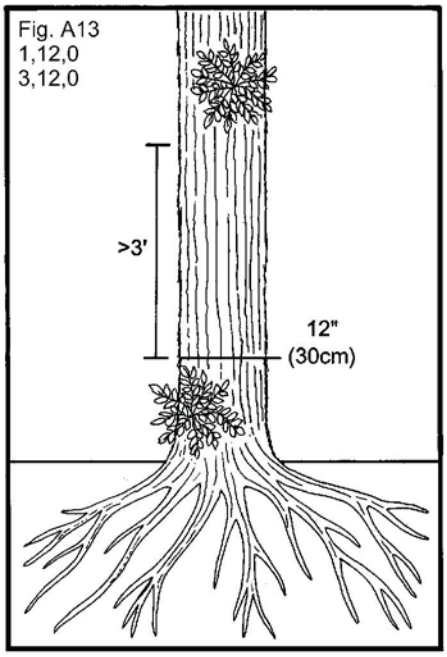


11 - Broken bole or roots <3' from bole, broken roots must be visible

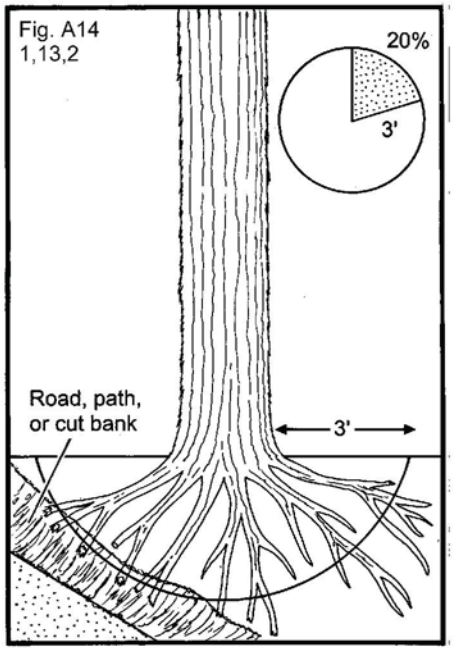


11 - Broken bole or roots <3' from bole

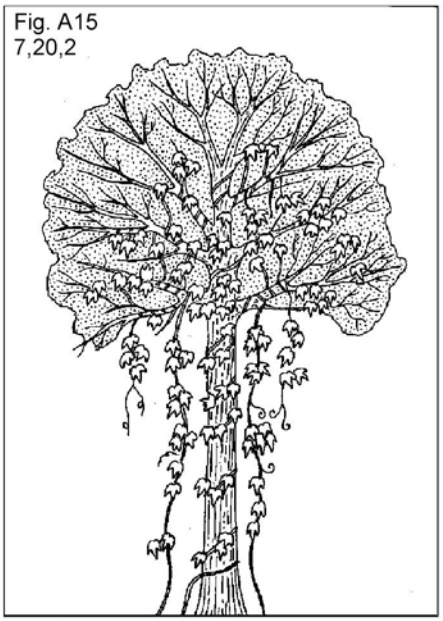
Figure 29. Examples of damage coding.



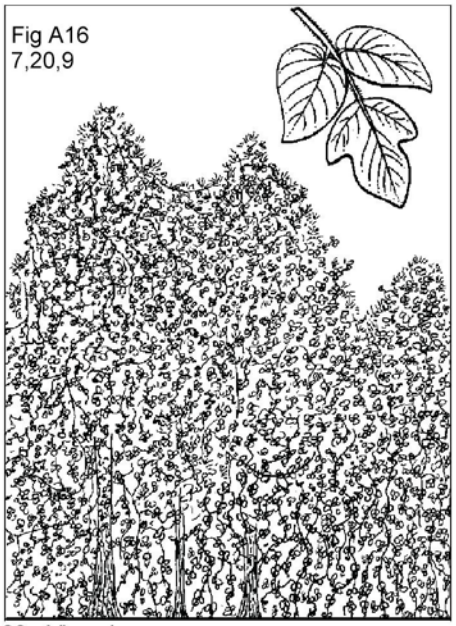
12 - Brooms on roots or bole



13 - Broken or dead roots >3' from bole



20 - Vines in crown



20 - Vines in crown

Figure 30. Examples of damage coding.

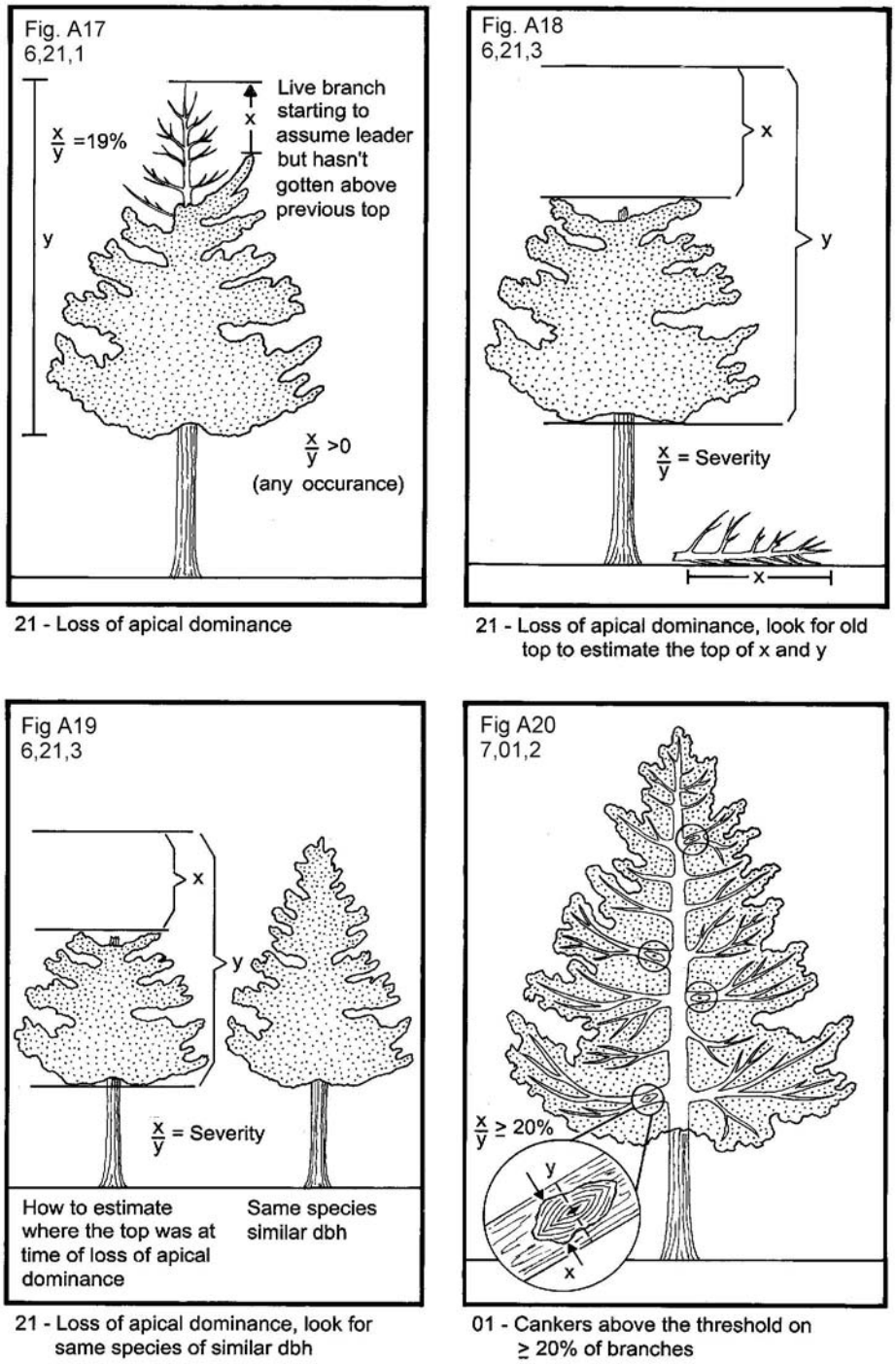
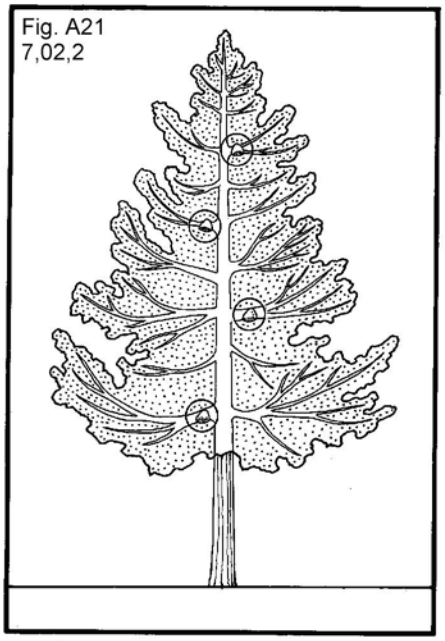
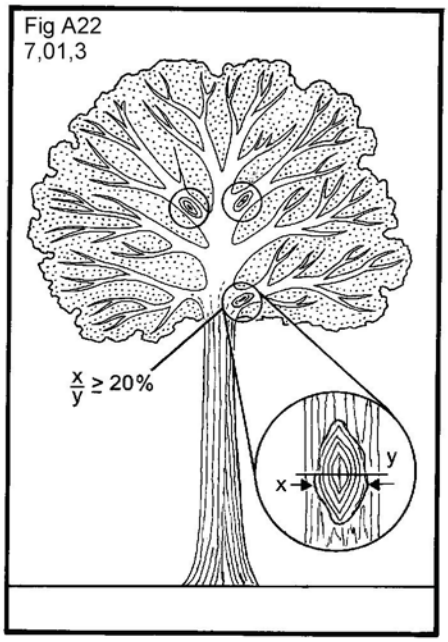


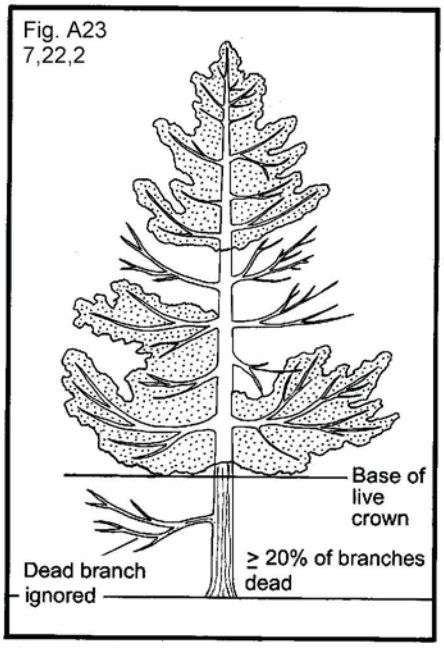
Figure 31. Examples of damage coding.



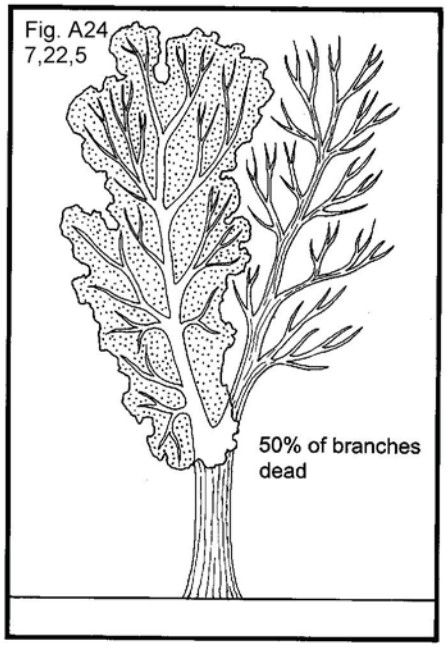
02 - Conks on ≥ 20% of branches



01 - Cankers above threshold on ≥ 20% of branches



22 - Dead branches within the live crown area. If branches cannot easily be counted, estimate % area of live crown affected



22 - Dead branches; only 2 branches present within live crown area, fines present and ≥20% of branch dead

Figure 32. Examples of damage coding.

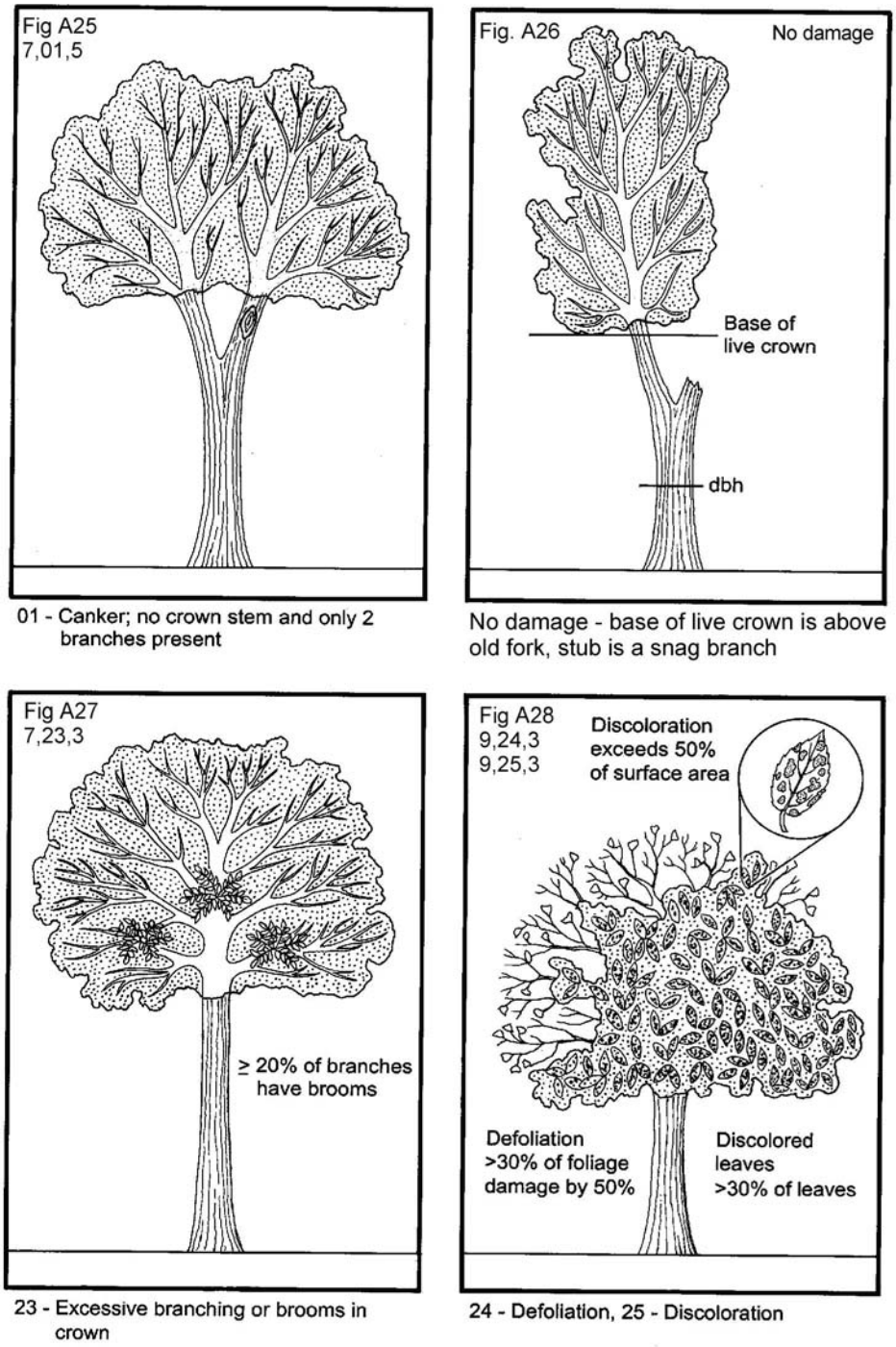


Figure 33. Examples of damage coding.

Procedures to Record Multiple Occurrences of the Same Damage

Damage codes 01 (canker), 03 (open wounds), and 04 (resinosis/gummosis) must meet a threshold of 20 percent of the circumference at the point of occurrence, within any 3-ft section. Multiple cankers or open wounds which are directly above one another pose no more threat to long term tree survival than would a single damage incidence of the same width. However, should multiple damages be located horizontally within any 3-ft section, the translocation of water and nutrients would be significantly affected. The widths of each individual damage are added and compared as a percent, to the total circumference at the midpoint of the 3-ft section (Figure 24).

Procedures to Measure Circumference Affected

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40% of the circumference of a face can be observed at any one time. The damage is measured horizontally between the margins. If the cumulative area affected within a 3-ft section exceeds 1/2 of any face, then the 20% minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10% classes. If in doubt, measure the damage and circumference at the widest point of occurrence on the bole with a linear tape, and determine the percent affected.

5.18.4 DAMAGE LOCATION 2 (LOC2)
Record the location on the tree where TREE DAMAGE 2 is found. Follow the same procedures as for DAMAGE LOCATION 1.

5.18.5 DAMAGE TYPE 2 (DAM2)
RECORD the second damage typeobserved that meets the damage threshold definition in the lowest location. Follow the same procedures as for DAMAGE TYPE 1.

5.18.6 DAMAGE SEVERITY 2 (SEV2)
Record the amount of affected area (above threshold) in DAMAGE LOCATION 2 recorded for DAMAGE TYPE 2. Follow the same procedures as for DAMAGE SEVERITY 1.

5.21NC NC DAMAGE AGENTS (NCD1,NCD2)

For each DAMAGE TYPE(DAM1,2) recorded, identify if available a causal agent from the Standard NC Damage Agent list. **Minnesota crews see codes in Appendix 9 & 10**.

When Collected: All live trees for each DAMAGE TYPE(DAM1,2) recorded
Field width: 3 digit
MQO: None
Values: 000-909

Standard NC Damage Agent codes (all states except Minnesota)

CODE	DAMAGE OR DEATH	HOSTS
000	**Healthy**	**All species**
100	**Insect defoliators**	**All species**
113	Gypsy Moth	Hardwoods
130	**Shoot and Branch Insects**	**All species**
140	**Branch Gall Insects**	**All species**
150	**Bole Borers**	**All species**
170	**Bark Beetles**	**Conifers**
190	**Root/Root Collar Insects**	**Conifers**
200	**Foliage Diseases**	**All species**
210	**Shoot Blights**	**All Species**
220	**Mistletoe**	**Black spruce, White spruce, Tamarack, Jack pine**
240	**Bole Rusts**	**Pines**
250	**Bole Cankers**	**Hardwoods**
251	*Eutypella* Canker	Maple
252	*Hypoxylon* Canker	Aspens
254	*Nectria* Canker	Hardwoods
257	Butternut Canker	Butternut
260	**Stem Decay (heartrot)**	**All species**
271	Ash Yellows	Ashes
281	Dutch Elm Disease	Elms
282	Oak Wilt	Oaks
290	**Root/Butt Rot**	**All species**
291	*Annosus* Root Rot	Conifers
292	*Armillaria* Root Rot	All species
300	**Weather**	**All species**
400	**Animal Damage**	**All species**
500	**Fire**	**All species**
800	**Logging/TSI/Other human**	**All species**
860	**Chemical**	**All species**

5.22NC NC SPECIAL DAMAGE CODING FOR MISSOURI (MOAG)

In Missouri because we have not completed an inventory using the old North Central method of damage coding, we will use the old method until all plots in this cycle are done. Only one of these will be recorded per tree.

When Collected: All live trees on subplots 1-4
Field width: 3 digit
MQO: None
Values: 000-909

CODE	DAMAGE OR DEATH	HOSTS	SEVERITY
000	**Healthy**	**All species**	**<20% crown affected. No volume/degrade loss**
100	**Insect defoliators**	**All species**	**>20% foliage affected**
102	Cankerworms/Loopers	Hardwoods	>20% foliage affected
103	Leaf Miners & Skeletonizers	Hardwoods	>20% foliage affected
104	Sawflies	Pines	>20% foliage affected
113	Gypsy Moth	Hardwoods	Any occurrence on foliage
114	Fall Webworm	Hardwoods	>20% foliage affected
115	Datana (Walnut) Caterpillar	Hardwoods	>20% foliage affected
120	Variable Oakleaf Caterpillar	Hardwoods	>20% foliage affected
121	Eastern Tent caterpillar	Hardwoods	>20% foliage affected
122	Walking Stick	Hardwoods	>20% foliage affected
123	Bagworm	Conifers	>20% foliage affected
130	Shoot and Branch Insects	All species	Any occurrence on leader , >20% shoots/branches affected
132	Tip Moths	Pines	>20% branches affected
135	Pine Needle Scale	Pines	>20% branches affected
136	Oyster Shell Scale	Hardwoods	>20% branches affected
138	Pine Shoot Beetle	Pines	Any occurrence on shoots/branches
140	Branch Gall Insects	All species	>20% branches affected
141	Ash Flower Gall Mite	Fraxinus	>20% branches affected
142	Gouty/Horned Oak Gall	Quercus	>20% branches affected
150	Bole Borers	All species	Any occurrence on bole
151	Two Lined Chestnut Bore	Quercus	>20% of crown dead/dying (flagging)
157	Ash Borer	Fraxinus	Any occurrence
158	Asian Long-horned Beetle	Hardwoods	Any occurrence
170	Bark Beetles	Conifers	>20% crown dead/dying
171	Ips spp.	Conifers	>20% crown dead/dying
173	Black Turpentine Beetle	Conifers	>20% crown dead/dying
190	Root/Root Collar Insects	Conifers	Entire crown off color, dead tree
200	**Foliage Diseases**	**All species**	**>20% foliage affected**
201	Needlecasts	Conifers	>20% foliage affected
202	Anthracnose	Hardwoods	>20% foliage affected
205	Dogwood Anthracnose	Dogwood	Any occurrence
206	Powdery Mildew	Dogwood	>20% foliage affected
208	Scirrhia Needlecasts	Pines	>20% foliage affected
209	Apple Scab	Rosaceae	>20% foliage affected
210	Shoot Blights	All Species	Any occurrence on leader, >20% shoots affected
213	Fire Blight	Rosaceae	Any occurrence on leader, >20% shoots affected
214	Diplodia Tip Blight	Pines	Any occurrence on leader, >20% shoots affected
215	Juniper Blights	Junipers	Any occurrence on leader, >20%

			shoots affected
CODE	**DAMAGE OR DEATH**	**HOSTS**	**SEVERITY**
220	Mistletoe	All Species	Any occurrence
230	Foliar Rusts	All Species	>20% foliage affected
233	Gall Rusts	All Species	>20% branches affected
235	Cedar/Apple Rust	Eastern Red Cedar	>20% foliage affected
236	Cedar/Quince Rust	Rosaceae	>20% branches affected
240	**Bole Rust**	**Pines**	**Any occurrence on bole**
250	**Bole Cankers**	**Hardwoods**	**Any occurrence on bole**
251	*Eutypella* Canker	Maple	Any occurrence on bole
252	*Hypoxylon* Canker	Oaks	20% circumference affected
254	*Nectria* Canker	Hardwoods	Any occurrence on bole
256	Strumella Canker	Oaks	Any occurrence on bole
257	Butternut Canker	Butternut	Any occurrence on tree
260	Stem Decay (heartrot)	All species	Any occurrence on bole
264	Pereniporia Fraxinophilia	Ashes	Any occurrence on bole
271	Ash Yellows	Ashes	Any occurrence
273	Beech Bark disease	Beech	Any occurrence
274	Oak decline	Oaks	>20% crown affected
276	Hickory decline	Hickories	>20% crown affected
277	White pine root decline	White Pine	Any occurrence
278	Ash decline	Ashes	>20% crown affected
281	Dutch Elm Disease	Elms	Any occurrence
282	Oak Wilt	Oaks	Any occurrence
283	Pine Wilt Nematode	Pines	Any occurrence
285	Verticillium Wilt	Hardwoods	Any occurrence
291	*Annosus* Root Rot	Conifers	Any occurrence
292	*Armillaria* Root Rot	All species	>20% crown dieback, *rhizomorphs/fan in root collar*
300	**Weather**	**All species**	**>20% crown affected; Any damage to leader; Any damage to bole cambium**
301	Hail	All species	>20% crown affected
302	Wind	All species	>20% crown affected; Any damage to bole cambium or leader
303	Lightning	All species	20% crown affected; Any damage to bole cambium or leader
304	Frost Cracks	All species	Any damage to bole cambium or leader
305	Frost Kill (foliage and shoots)	All species	>20% crown affected
306	Winter drying	conifers	20% crown affected
307	Flooding	All species	20% crown affected; Any damage to bole cambium or leader
308	Drought	All species	>20% crown affected
309	Ice/Snow	All species	>20% crown damage; Any damage to bole cambium or leader
400	**Animal Damage**	**All species**	**>20% crown affected; Any**

			damage to leader; Any damage to bole cambium
CODE	**DAMAGE OR DEATH**	**HOSTS**	SEVERITY
402	Moose/Elk/Deer	All species	>20% crown affected; Any damage to leader; Any damage to bole cambium
405	Squirrel	All species	>20% circumference of bole affected
408	Sapsucker	All species	>20% circumference of bole affected
409	Cattle/Domestic Livestock	All species	>20% circumference of bole affected
500	**Fire**	**All species**	**>20% crown affected; Any damage to leader; Any damage to bole cambium**
760	Vine damage	All species	>20% of crown covered
800	**Logging/TSI/Other human**	**All species**	**>20% crown affected; Any damage to leader; Any damage to bole cambium**
810	Mechanical Damage	All species	>20% crown affected; Any damage to leader; Any damage to bole cambium
811	Imbedded objects-wire, nails	All species	Any occurrence
830	Vehicle damage	All species	>20% crown affected
860	Chemical	All species	>20% crown affected
862	Air pollution	All species	>20% foliage affected
900	**Unknown/uncoded Dead**	**All species**	**Use on dead trees only**
901	Unknown/uncoded Defoliation	All species	>20% foliage affected
902	Unknown/uncoded Discoloration	All species	>20% foliage affected
903	Unknown/uncoded Decline/Dieback	All species	>20% crown affected
904	Unknown/uncoded Breakage	All species	>20% crown affected. Any occurrence on bole
905	Unknown/uncoded Abnormal Growth or Form in Crown	All species	>20% crown affected
906	Unknown/uncoded Canker	All species	Any occurrence on bole
907	Unknown/uncoded Crack	All species	Any open crack on bole
908	Unknown/uncoded Abnormal Growth or Form on the Bole	All species	Any occurrence on the butt log or any abnormal growth for that species causing a volume loss
909	Unknown/uncoded flagging/shoot damage	All species	>20% crown affected. Any occurrence on bole

5.19 CAUSE OF DEATH (CAUS)

Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

When Collected: All TREE STATUS = 1 at time 1 and TREE STATUS = 2 or 3 at time 2
Field width: 2 digits
MQO: No errors, at least 80% of the time
Values:

10	Insect damage
20	Disease damage
30	Fire damage
40	Animal damage
50	Weather damage
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other (include notes)
80	Human-caused damage (cultural, logging, accidental damage, etc.)
90	Physical (hit by falling tree)

NC Note: Cause of Death (CAUS) is not entered on status 3 trees when time one was a periodic inventory and time 2 is the first annual measurement of the plot.

5.20 MORTALITY YEAR

NC Note: Not collected until re-measure.

5.21 DECAY CLASS (DECA)

Record for each standing dead tally tree, 5.0 inches in diameter and larger, the code indicating the trees stage of decay.

NC Note: Do not record on re-measurement trees (subplots 101-105).

When Collected: All standing dead tally trees ≥ 5.0 in DBH/DRC
Field width: 1 digit
MQO: ±1 class, at least 90% of the time
Values: Use the following table for guidelines:

Decay stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition*	Heartwood condition*
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

* Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

5.22 UTILIZATION CLASS (UTIL)

Record the code to identify cut trees that have been removed from the site.

When Collected: All TREE STATUS = 3
Field width: 1 digit
MQO: No errors, 100% of the time
Values:

0	Not utilized - can still be found on the site
1	Utilized – some portion of the tree cannot be found on site, assumed to have been removed

5.25 MISTLETOE CLASS (CORE OPTIONAL)

NC Note: Not Collected.

5.26 TREE NOTES

Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All live and dead tally trees $\geq$ 1.0 in DBH/DRC
Field width: Alphanumeric character field
MQO: N/A
Values: English language words, phrases and numbers

6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting seedlings within the 6.8 ft radius microplot located 90 degrees and 12.0 ft from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 in at DBH/DRC in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 in at DBH/DRC in order to qualify for tallying. For western woodland species, each stem on a single tree must be less than 1.0 inch in DRC. Seedlings are counted in groups by species and condition class, up to 5 individuals per species. Counts beyond 5 are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. Only count seedlings occurring in accessible forest land condition classes.

6.1 SUBPLOT NUMBER
Use the procedures outlined in Section 4.1.

When Collected: All counts of seedlings
Field width: 1 digit
MQO: No errors, 100% of the time
Values: See section 4.1

6.2 SPECIES (SPP)
Use the procedures outlined in Section 5.8.

When Collected: All counts of seedlings
Field width: 3 digits
MQO: No errors for genus at least 90% of the time, no errors for species at least 85% of the time
Values: See Appendix 4

6.3 CONDITION CLASS (CON#)
Use the procedures outlined in Section 2.0.

When Collected: All counts of seedlings
Field width: 1 digit
MQO: No errors, 100% of the time
Values: See section 5.3

6.4 SEEDLING COUNT
NC Note: Replaced with NC seedling count in North Central Region.

6.5 NC SEEDLING COUNT (SED#)
Record the number of seedlings of each species, by condition class. Count up to 5 individuals by species; if there are more than 5 individuals of any given species in any given condition class estimate . Code species in order from most abundant to least abundant.

When Collected: All counts of seedlings
Field width: 2 digits
MQO: Code 1-5 No errors; Code 6-99 +/- 20%
Values:

CODE	SEEDLING COUNT
1 to 98	Exact count
99	More than 99 individuals by species by condition class.

7.0 SITE TREE INFORMATION

Site trees are a measure of site productivity expressed by the height to age relationship of dominant and co-dominant trees. If suitable site trees are available, site tree data are required for every accessible forest land condition class defined on a plot. An individual site tree may be used for more than one condition class where differences in condition classes are not the result of differences in site productivity. For example, when different condition classes are caused solely due to differences in reserved status, owner class, and/or disturbance-related differences in density (e.g., heavily thinned vs. un-thinned), a site tree may be used for more than one condition class. When in doubt, do not use a site tree for more than one condition class.

7.1 SITE TREE SELECTION

Select at least 1 site tree for each accessible forest land condition class; select tree from a species common to the condition class being sampled, based on regional or local tree species selection criteria (Appendix 5 lists preferred site tree species by region). Select trees off the subplot where possible. Use only trees that have remained in a dominant or co-dominant crown position through out their entire life span. If possible, trees should be 5.0 inches in diameter, or larger, and at least 20 years old. Trees that are visibly damaged, trees with ring patterns that exhibit signs of suppression, and trees with rotten cores should be rejected. **NC Note:** If there are no acceptable site trees, refer to section 7.2.9NC.

7.2 SITE TREE DATA VARIABLES

7.2.9NC NC SITE INDEX METHOD (NCSI)

Suitable site trees may not be available. When this occurs there is a still need to know something about the site. If suitable site trees are not available but a young or very old tree is available you should record them. If no tree is available you must make an estimate of site index for the site based on your best knowledge.

When code 2 or 3 is used the only data needed on the site record are NC site index method(NCSI), NC field site index (SITR), Condition Class List (CONL), species (SPP).

When Collected: All plots
Field width: 1 digit
MQO: None
Values: 1 site tree collected
2 Intercept method
3 Estimated Site index

<u>GROWTH INTERCEPT METHOD</u> 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 year old) of these species are available for site index indicators.

Growth Intercept
For red Pine:

Height growth during Last 5 years	Site Index (estimated)
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

7.2.10NC NC FIELD SITE INDEX (SITR)

Record the site index for a selected tree species. Using provided site index curves.

When Collected: Only when NC Site Index Method is 2 or 3.
Field width: 3 digits
MQO: None
Values: 000 to 999

7.2.1 CONDITION CLASS LIST (CONL)

List all CONDITION CLASSES that the site index data from this tree represent.

When Collected: All site trees (**NC Note:** All forested conditions)
Field width: 5 digits
MQO: No errors, 100% of the time
Values: 1 to 9 or 10000 to 98765

7.2.2 SPECIES (SPP)

Use the same procedures described in Section 5.8 (Appendix 5 lists preferred site tree species by region).
When Collected: All site trees (**NC Note:** All plots)
Field width: 3 digits
MQO: No errors for genus 100% of the time, no errors for species at least 95% of the time
Values: See Appendix 4

7.2.3 DIAMETER (DBH)

Use the same procedures described in Section 5.9.

When Collected: All site trees
Field width: 4 digits (xxx.y)
MQO: +/- 0.1 in per 20.0 in of diameter on trees with a measured diameter, at least 95% of the time. For example: a tree with a diameter of 41.0 in would have a tolerance of plus or minus 0.3 in
Values: 0001 to 9999

7.2.4 SITE TREE LENGTH (HGHT)

With a clinometer or other approved instrument, measure the total length of the site tree from the ground to the top of the tree. Record to the nearest 1.0 ft. SITE TREE LENGTH must be measured; no estimates are permitted on site trees.

When Collected: All site trees
Field width: 3 digits
MQO: +/- 10% of true length, at least 90% of the time
Values: 001 to 999

7.2.7NC NC SLOPE DISTANCE (DIST)

Record the measured slope distance, to the nearest 1 ft., from the subplot center to the pith at the base of the tree. Trees should be selected off the subplot, outside the 24.0 foot radius.

When Collected: All site trees
Field width: 3 digits (xxx)
MQO: +/- 5 ft. (0.3 m.) , at least 90% of time
Values: 25 - 500

7.2.8NC NC AZIMUTH (AZM)

From site tree to a subplot center (entered in 7.2.2), sight the center of the base of each tree with a compass; Record azimuth (to the nearest degree) as a 3-digit code ranging from 001 to 360. Use 360 for north.

When Collected: All site trees
Field width: 3 digits
MQO: +/- 10 degrees, at least 90% of time
Values: 001 to 360

7.2.5 TREE AGE AT DIAMETER (AGE)

Record the tree age as determined by an increment sample. Bore the tree at the point of diameter measurement (DBH/DRC) with an increment borer. Count the rings between the outside edge of the core and the pith. Do not add years to get total age.

When Collected: All site trees
Field width: 3 digits
MQO: +/- 5 years, at least 95% of the time
Values: 020 to 999

7.2.11NC SITE TREE NUMBER (TR#)

Record the corresponding record number of the site tree for the plot, beginning with 1 for the first site tree.

When Collected: All site trees
Field width: 1 digit
MQO: none
Values: 1-9

7.2.12NC SUBPLOT NUMBER (SUB#)

Record the number of the subplot that you referenced the site tree from.

When Collected: All site trees
Field width: 1 digit
MQO: none
Values: 1-4

7.2.6 SITE TREE NOTES

Record notes pertaining to an individual site tree.

When collected: All site trees as necessary
Field width: alphanumeric character field
MQO: N/A
Values: English language words, phrase and numbers

8.0 NONFOREST/DENIED ACCESS/HAZARDOUS PLOTS

8.1 OVERVIEW

This section describes field procedures for attempted, field-visited nonforest, denied access, and hazardous plots. These plots are of interest from the standpoint that they may once have been forest, or that they may revert to forest or become accessible in the future. Thus, they are monitored to account for lands that move into and out of the forest land base. Only basic plot identification data are recorded on these plots.

A plot is considered nonforest if no part of it is currently located in forest land (CURRENT PLOT STATUS = 1). A plot is inaccessible if access is prevented to the entire plot by the land owner or because of some hazardous situation.

No ground plots are established at nonforest or inaccessible sample locations. If a forest plot has been converted to nonforest or becomes inaccessible, the previous data are reconciled and an attempt is made to visit the plot during the next inventory. If a nonforest plot becomes forest or access is gained to a previously inaccessible plot, a new forest ground plot is installed. All nonforest and inaccessible plots are visited if there is any reasonable chance that they might include some forest land condition class.

8.2 PROCEDURE

Trees on previously forest land plots will be reconciled at data processing. There is a distinction between plots that have been clearcut, and plots that have been converted to another land use. A clearcut plot is considered to be forest land until it is actively converted to another land use. The procedures in this section do not apply to clearcuts unless and until the land is converted to a nonforest use. Additional information concerning land use classifications is contained in Section 2.3.

In cases where a plot is inaccessible, but obviously contains no forest land, assign the plot to the appropriate nonforest land use. Access-denied and hazardous land uses are utilized only if there is a possibility the plot contains forest.

It is not necessary to establish or maintain any starting points, witness trees, boundaries, etc., on nonforest or inaccessible plots.

8.3 DATA RECORDED

8.3.1 STATE (ST)

Use the same procedures described in Section 1.1.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.15NC NC UNIT (UNIT)

Unit is a one digit code which refers a division of a State that the plot and county are in (see the listed codes in the appendix 1)

Field width: 1 digits
MQO: No errors allowed, 100% of the time.
Values: See appendix 1 for complete list.

8.3.2 COUNTY (CNTY)

Use the same procedures described in Section 1.2.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.3 PLOT NUMBER (PLT#)
Use the same procedures described in Section 1.3.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.4 SAMPLE KIND (SK)
Use the same procedures described in Section 1.4.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.4NC NC SAMPLE KIND (NCSK)
The NC sample kind indicates the information to be collected on plot types that are unique to North Central Research Station FIA. All other plots will get a NCSK=0.

0 **Lost plot** – Ground evidence of old plot could not be found and there has been no major disturbance to the area, or new plot no old trees measured.

6 **Partial Re-measurement Relocate**. Measure all old trees on subplots 101-105.

9 **No Re-measurement Relocate**. Do not measure old plot just use old plot information to locate subplot center to begin installation of new plot design.

33 **Replacement plot**. No old subplots are measured here.

8.3.5 MANUAL VERSION
Use the same procedures described in Section 1.5

8.3.6 CURRENT DATE(MONT, DAY,YEAR)
Use the same procedures described in Section 1.6.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.7 QA STATUS (QAST)
Use the same procedures described in Section 1.16.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.8 CREW TYPE (CRTY)
Use the same procedures described in Section 1.17.

When Collected: All Nonforest/Denied Access/Hazardous plots.

8.3.7 GPS COORDINATES
Use the same procedures described in Section 1.18 to collect the following data items:

1.18.3 GPS UNIT (UNIT)
1.18.4 GPS SERIAL NUMBER (GPS#)
1.18.5 COORDINATE SYSTEM
1.18.6 LATITUDE (N:)
1.18.7 LONGITUDE (W:)
1.18.8 UTM ZONE
1.18.9 EASTING (X) UTM

1.18.10 NORTHING (Y) UTM
1.18.12 AZIMUTH TO PLOT CENTER (AZM)
1.18.13 DISTANCE TO PLOT CENTER (DIST)
1.18.14 GPS ELEVATION (ELEV)
1.18.15 GPS ERROR (ERRS)
1.18.16 NUMBER OF READINGS (READ)

8.3.8 CONDITION STATUS 1 (STAT)
Record the CONDITION STATUS at the center of Subplot 1. Use the same procedures described in Section 2.2.

When Collected: All Nonforest/Denied Access/Hazardous plots

8.3.9 CONDITION STATUS 2 (CORE OPTIONAL)
Record the CONDITION STATUS at the center of Subplot 2. Use the same procedure described in Section 2.2

When collected: Not in North Central Region

8.3.10 CONDITION STATUS 3 (CORE OPTIONAL)
Record the CONDITION STATUS at the center of Subplot 3. Use the same procedure described in Section 2.2

When collected: Not in North Central Region

8.3.11 CONDITION STATUS 4 (CORE OPTIONAL)
Record the CONDITION STATUS at the center of Subplot 4. Use the same procedure described in Section 2.2

When collected: Not in North Central Region

8.3.12 PLOT-LEVEL NOTES
Use the same procedures described in Section 1.19.

8.3.13 P3 HEXAGON NUMBER
Use the same procedures described in Section 1.20.

8.3.14 P3 PLOT NUMBER
Use the same procedures described in Section 1.21.

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LIST OF APPENDICES

1. FIPS Codes for all States and Counties

These are the standard federal 2- and 3-digit codes for States and Counties respectively.

2. Forest Type Codes

These are the codes that correspond to the National FIA Forest typing algorithm. North Central field crews will only use the list provided in this manual.

3. Invasive Plants/Noxious Weeds Checklist Species

List of species, in preparation.

4. Tree Species List

This list includes all species deemed to be tally trees in the North Central Region.

5. Site Tree Selection Criteria and Species by Region

6. Determination of Stocking Values for Land Use Classification

7. Glossary

8. Figures – Easy Reference Pages

9. North Central Tatum Guides

10. Specific State issues and instructions & NC specific examples

11. Rockwell GPS Unit directions

12. Husky Data Recorder Quick Reference

13. Tolerance limits on data items

This is the list of data items and their tolerance limits used for check cruising a plot.

14. North Central plot sheet example

15. North Central Site Index curves