

**FOREST INVENTORY AND ANALYSIS
NATIONAL CORE FIELD GUIDE**

VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

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NATIONAL CORE FIELD GUIDE
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This field guide is subject to revision.
Responsibility of keeping this field guide updated resides
with the user. To determine the latest version, go to
http://srsfia2.fs.fed.us/data_acquisition/manual.shtml

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Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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 are consistent and uniform across all FIA units. **This CORE is 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 field guide 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 as specified in this field guide. It is expected that on average all items in Volume I can be measured by a two-person field crew in less than one day, including travel time to and from the plot.

This document also describes additional regional standards, methods, and definitions for the southern FIA unit. This serves to enhance the National CORE, not change it. All regional items and clarifying text are shaded in the same manner as this paragraph.

Variables or codes not collected in the field by the Southern Research Station will appear as light gray text when printed (example text) .

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 field guide begins to address. Another change was the merger of the FIA program with the field plot component of the Forest Health Monitoring (FHM) program's Detection Monitoring. A systematic grid was established that includes some, but not all former FIA plots. This grid contains the Phase 2 plots, the annual survey plots that are designed for measurement on a rotation such that a portion of the plots are measured each year. The rotation length varies by region. The former FHM Detection Monitoring field plots are the Phase 3 plots, a subset of the Phase 2 plots. The same basic plot and sampling designs are used on all the plots.

The focus of Volume I is on data that are collected in the field on all Phase 2 plots in the FIA sample. The methods in Volume I are also used on Phase 3 plots except when specifically noted otherwise in the methods text. Volume II of the series describes an additional, expanded suite of data collected on the Phase 3 subset of plots. Volume II contains methods for the following indicators: ozone bioindicator plants; lichen communities; soils (physical and chemical characteristics); crown condition; vegetation diversity and structure; and down woody material. 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 the CORE FIA program field data, all of which are measured consistently across the country.

FIELD GUIDE LAYOUT

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

- 0 General Description
- 1 Plot
- 2 Condition
- 3 Subplot
- 4 Boundary
- 5 Tree Measurements
- 6 Seedling
- 7 Site Tree

Each section begins with a general overview of the data elements collected at that level and background necessary to prepare field crews for data collection. Descriptions of data elements follow in this format:

DATA ELEMENT NAME -- <brief variable description>

When collected: <when data element is recorded>

Field width: <X digits>

Tolerance: <range of measurement that is acceptable>

MQO: <measurement quality objective>

Values: <legal values for coded variables>

Data elements, descriptions of when to collect the data elements, field width, tolerances, MQO's, and values, apply to both Phase 2 plots (formerly called FIA plots) and Phase 3 plots (formerly called FHM Detection Monitoring plots) unless specifically noted. Field width designates the number of columns (or spaces) needed to properly record the data element.

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

MQO's state the percentage of time when the collected data are required to be within tolerance. 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.

PLOT NOTES will be available on every PDR screen for ease in recording notes.

UNITS OF MEASURE

The field guide will use **METRIC** units as the measurement system.

Plot Dimensions:

Macroplot:

Radius = 17.95 M
Area = 1012.5 square meters or approximately 0.10 hectare

Subplot:

Radius = 7.32 M
Area = 168.12 square meters or approximately 0.01 hectare

Microplot:

Radius = 2.07 M
Area = 13.5 square meters or approximately 0.001 hectare

Annular plot:

Radius = from 7.32 M to 17.95 M
Area = 844.11 square meters or approximately 0.84 hectare

The distance between subplot centers is 36.6 M horizontal.

The minimum area needed to qualify as accessible forest land is 0.4 hectare (1.0 acre).

The minimum width to qualify as accessible forest land is 36.6 M

Tree Limiting Dimensions:

breast height	1.37 M
stump height	30 cm
merchantable top	10 cm DOB
minimum conifer seedling length	15 cm
minimum hardwood seedling length	30 cm
seedling/sapling DBH/DRC break	25 mm DOB
sapling/tree DBH/DRC break	125 mm DOB

0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/60 hectare in size with a radius of 7.32 M. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 36.6 M horizontal (+/- 2.1 meters) at azimuths of 360, 120, and 240 degrees, respectively, from the center of subplot 1 (see Figure 1). Throughout this field guide, the use of the word 'plot' refers to the entire set of four subplots. 'Plot center' is defined as the center of subplot 1. As a CORE OPTION, the field plot may also include macroplots that are 1/10 hectare in size with a radius of 17.95 M; each macroplot center coincides with the subplot's center. Macroplots are numbered in the same way as subplots.

If the macroplots are not installed, the subplots are used to collect data on trees with a diameter (at breast height, DBH, or at root collar, DRC) of 125 mm or greater. If the macroplots are installed, then subplots are used to collect data on trees from a diameter 125 mm to the breakpoint diameter and the macroplot is used to collect data on trees with diameter greater than the breakpoint diameter.

Each subplot contains a microplot of approximately 1/759 hectare in size with a radius of 2.07M. The center of the microplot is offset 90 degrees and 3.66 M horizontal (+/- 30 cm) 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 25 mm through 124 mm) and seedlings [DBH/DRC less than 25 mm in diameter and greater than 15 cm in length (conifers) or greater than 30 cm in length (hardwoods)]. Longleaf pine must be at least 12 mm at the root collar. Planted seedlings must meet the same size requirements listed above.

As a CORE OPTION for a Phase 2 plot that is not part of the Phase 3 subset, data for one or more of the Phase 3 indicators may be collected on the plot. If a region exercises the option to collect one or more Phase 3 indicator(s) on a Phase 2 only plot, the entire suite of measurements for the particular indicator(s) described in the appropriate chapter must be collected for the data for that indicator to be core optional.

Each unit may choose which Phase 3 indicators to collect as core optional on a Phase 2 plot that is not a Phase 3 plot. They may choose no indicators, all indicators or a subset. If they choose to collect data for a Phase 3 indicator, all the procedures for the indicator must be followed for that indicator to be considered core optional (data in National NIMS). If a subset of measurements for an indicator are collected, that is considered a regional enhancement and the data will be in the regional database.

Macroplots may be used to provide a better sample of rare population elements, such as very large trees.

The annular plot may be used for destructive sampling; for example soil samples. Also the term annular plot will be used for instructions in the field guide, for example, instructions on numbering trees when the macroplots are installed.

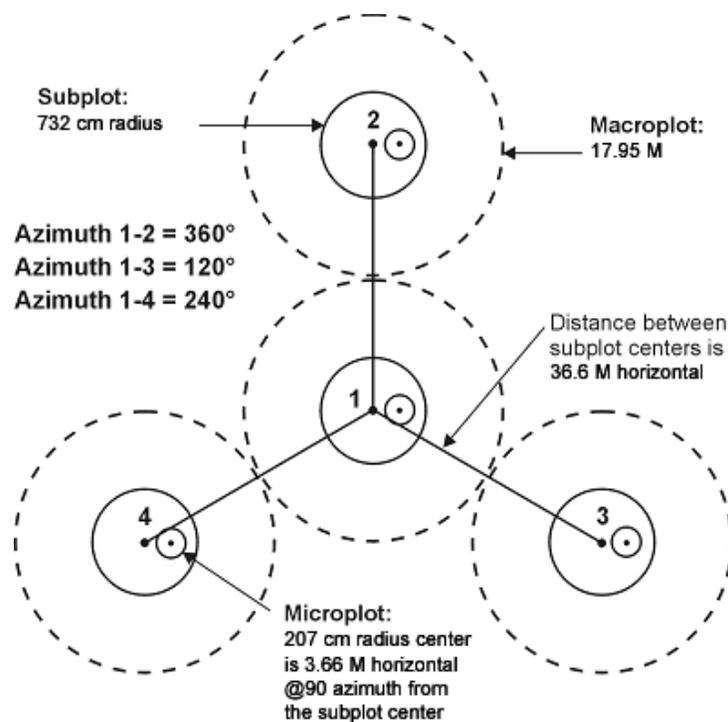


Figure 1. FIA Phase 2 plot diagram. See individual Phase 3 chapters for Phase 3 plot figures.

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 CLASS 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 macroplot. There is no boundary recorded when the demarcation occurs beyond the fixed radius plots.
Tree	Data describing saplings with a diameter 25 mm through 124 mm, and trees with diameter greater than or equal to 125 mm
Seedling	Data describing trees with a diameter less than 125 mm and greater than or equal to 15 cm in length (conifers) or greater than or equal to 30 cm in length (hardwoods). Longleaf pine must be at least 0.5 in at the root collar. Planted seedlings must meet the same size requirements as listed above.
Site Tree	Data describing site index trees.

0.1 PLOT SETUP

Plots will be established according to the regional guidelines of each FIA unit. Mark each subplot and microplot center with a wire pin. Bend the subplot center pin in a “horseshoe” shape. Bend the microplot pin in a “pigtail” shape. Place pins at all subplot and microplot centers that contain an accessible forest condition, even if there is no tally on the subplot or microplot. When the crew cannot occupy the plot center because safety hazards exist, or the plot center is inaccessible or out of the sample, the crew should check the other subplots. If any subplot centers can be occupied and are in the sample, the subplots that can be occupied should be established and sampled following normal procedures. **When a subplot center 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 (i.e. census water, denied access, hazardous, etc.).**

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

Subplot From	Subplot Numbers To	Azimuth <i>degrees</i>	Backsight	Distance <i>meters</i>
2	3	150	330	63.3
2	4	210	030	63.3
3	4	270	090	63.3

If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location and contact the field supervisor. In cases where individual subplots are lost (cannot be relocated), use the following procedures:

- assign the appropriate present CONDITION CLASS STATUS Code(s) to the new subplot (usually CONDITION CLASS STATUS = 1 or 2)
- assign TREE STATUS = 0 to all downloaded trees (i.e., incorrectly tallied at the previous survey)
- assign RECONCILE codes 3 or 4 (i.e., missed live or missed dead) to all trees on the new subplot.
- assign the next TREE RECORD NUMBER.

0.2 PLOT INTEGRITY

Each FIA unit 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 trees for age on subplots and macroplots to determine tree age, site index, stand age, or for other reasons.

- Nailing and tagging trees on microplots, subplots, and macroplots so that these trees can be identified and relocated efficiently and positively at times of remeasurement.
- Nailing, scribing, or painting microplot, subplot, and macroplot trees so that the point of diameter measurement can be accurately relocated and remeasured.

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

- Boring and scribing some specific tree species 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 measurement. If this is not possible, alternative tools (calipers, biltmore sticks) should be used.

0.3 OWNERSHIP INFORMATION

Ownership information is recorded on all accessible forest land conditions when available. Prior to actual fieldwork in a county, ownership data is collected from county courthouse records. It is important to gather as much information as possible on the initial visit to the courthouse to avoid a return visit while the fieldwork is occurring.

NOTE: If the ownership has changed either from or to National Forest, the state coordinator or field supervisor must be notified.

SURVEY SYSTEMS

There are two primary boundary surveys: metes-and-bounds and Public Land Survey (PLS). The metes-and-bounds method uses map and parcel whereas the PLS uses section, township, and range to describe boundaries. Field crews should become familiar with the method used in the state.

INITIAL COUNTY OVERVIEW

Review the county materials to determine which plots were forested on the previous survey. Also, determine if any of the plots were recorded as idle farmland, which may have reverted since the last inventory. In addition, examine the aerial photographs/imagery to determine other plot locations that may have reverted and/or partially sample forest land. Be sure to collect ownership information on these plots. Owner data is not required on nonforest plots.

COUNTY RECORDS

Record keeping systems varies both between and within states. Some counties are highly computerized, while some rely totally on paper. Some counties have up-to-date information, while others are outdated. It is always advisable to ask for help from courthouse employees. They are there to help the public and are generally eager to assist people. They can also be invaluable sources of information for local forest industries.

GENERAL OWNERSHIP PROCEDURES:

1. Determine if the plot location samples forest land. Keep in mind the plot layout. One or more of the subplots may sample forest land. This is where preliminary work is beneficial.
2. Locate the plot location on county courthouse tax maps using the aerial photograph. When available, rely primarily on the old photograph to locate the plot on the county tax maps. Also use the plot sketch from the previous survey. It may show distinguishing physical characteristics that may help delineate the ownership boundaries. If there is more than one parcel in the vicinity of the plot, record information for each possible parcel. The adjacent tract may be in another owner category or may help you gain access to the plot.

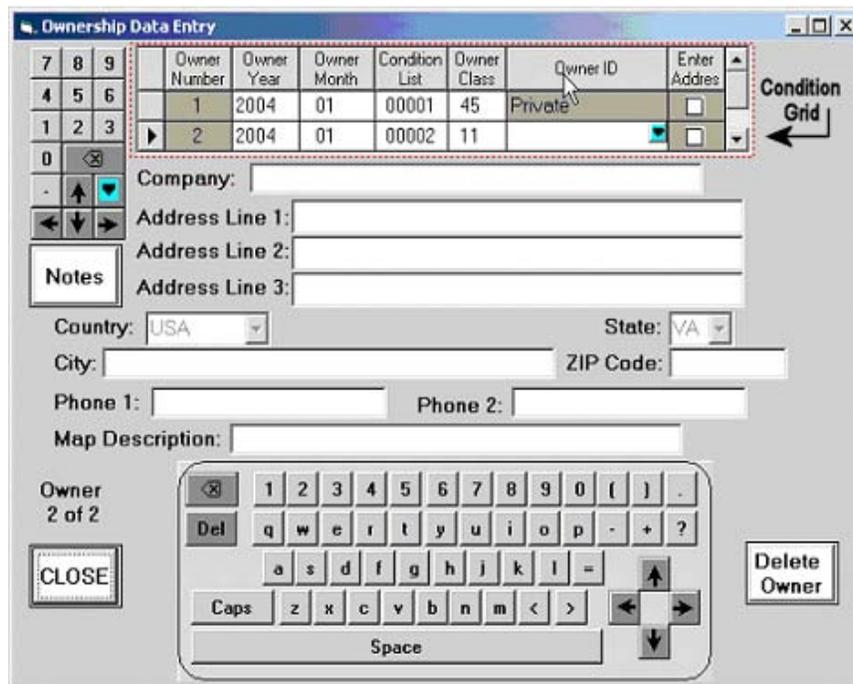
3. Record the name, address, and owner class for the owner of each parcel. Cross check the owner with the past survey to verify an actual ownership change or if either the current or previous assignment was in error.
4. Determine the total acreage of each parcel and the number of forest acres, if required. Woodland acres are broken out of the total acreage in some states and can be used to determine percent forest. In other states, however, pine plantations are included in the agriculture category. In these cases, use the aerial photograph/imagery and the field visit to estimate the percent forest of the tract. Field check the percent forest information when the plot appears to have been planted, naturally reverted, or land cleared.
5. Record all pertinent ownership information on the "Forest Land Ownership Classification" sheets and the "Sample Location Reference Page." In addition, the ownership information must also be recorded in the data recorder program. The following provides instruction on entering the ownership data in the National Tally Program (NaTally).

0.3.1 OWNERSHIP DATA ENTRY

The ownership data entry function of the National Tally Program (NaTally) will be used to enter ownership information for all forested conditions on a plot. That data collected is no different than what cruisers have previously collected in the County Courthouse. Cruisers are still expected to collect the ownership information on paper at the courthouse. This required data will then be entered via NaTally and transmitted with the plot information. The plot will not pass the final edit unless the ownership data entry function is completed.

0.3.2 UNDERSTANDING THE OWNERSHIP DATA ENTRY WINDOW

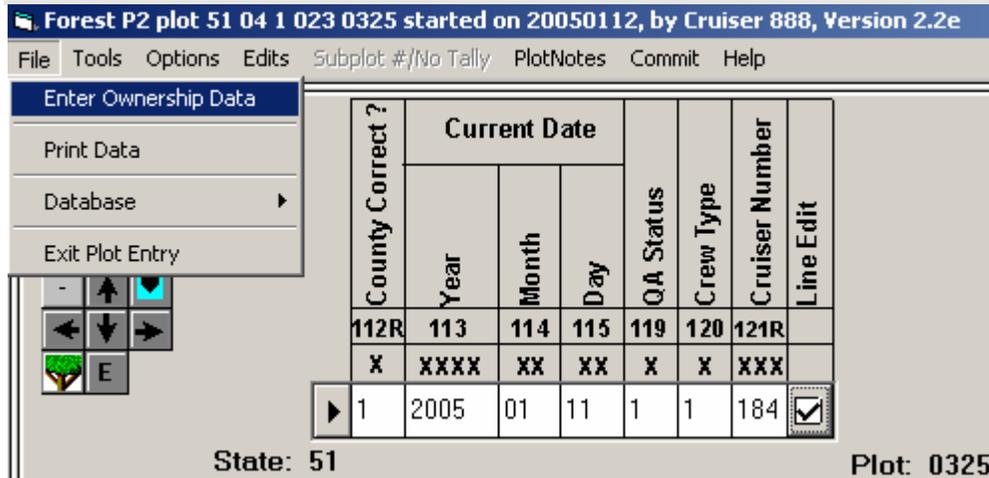
The Ownership Data Entry window is comprised of four major sections. The first two are the keyboard and numeric keypad. Both are the same as in the NaTally plot entry program. The two new sections are the Condition Grid at the top of the window and the Address Information Grid located in the middle of the window.



0.3.2 ENTERING OWNERSHIP INFORMATION

To begin entering ownership information, open the plot in NaTally.

Select “Enter Ownership Data” from the ‘File’ dropdown menu. This will open the Ownership Data entry form.

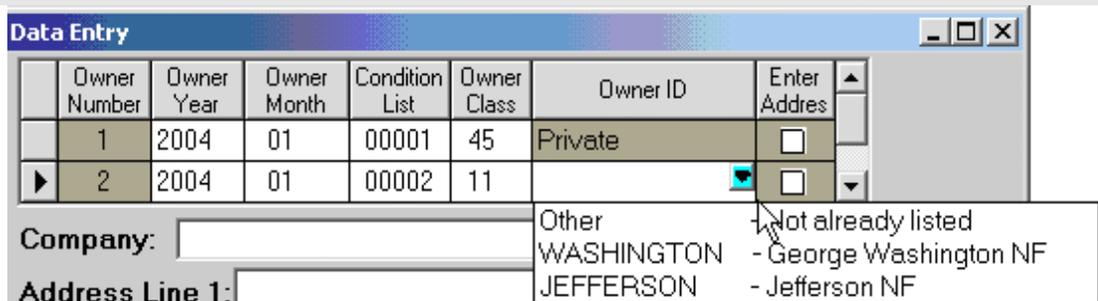


Enter the condition information one Owner Class at a time into the Condition Grid.

Required Fields:

- Owner Year: The year in which the ownership information was collected.
- Owner Month: The month in which the ownership information was collected.
- Condition List: List of conditions owned by owner X.
- Owner Class: Variable that classifies land into fine categories of ownership.
- Owner ID: Delineation of owner class code.

Note: When Owner Class 45 (individual) is entered, the Owner ID is filled Private. When Owner Class other than 45 is entered a selection must be made from the dropdown menu for Owner ID.



Select the ‘Enter Address’ check box to access the Address Information Grid for that condition.

Enter data into the Address Information Grid

Once the ‘Enter Address’ check box is selected, the cursor will jump to the Company or Name box depending on which owner class is selected.

To move around the Address Information Grid:

- Use the Up and Down arrows to tab between cells
- Use the Left and Right arrow to move within cells

With Owner Class 45 selected:

First Name: The owner's first name. This line should include all information about the owner's name except the last name of the last ownership record listed and any suffixes attached to the last name of the last ownership record.

Last Name: The owner's last name. This field should contain the last name of the last person listed as the ownership of record and any additional suffixes that are included with that person's name.

If an Owner Class selected is other than 45 the Company will need to be filled in.

Company: Company or agency. The company, government, government agency, or other organization that is the ownership of record (i.e., is recorded in the tax office).

Regardless of Owner Class, the following information will need to be recorded:

Address Line 1: The first line of the owner's address. This line can contain a person's name if the address is "in care of" (c/o), "attention to" (attn:) or a similar situation.

Note: If a company name is entered and there is contact information for an individual within a company, then enter that person's name into Address Line 1.

Address Line 2: The second line of the owner's address.

Address Line 3: The third line of the owner's address.

If no information exists for Address Lines 2 or 3, skip these sections and move to Country and State.

Country: The country of the owner's address. USA is the default country; other countries can be selected from the dropdown menu if appropriate. Province and Country are required only for owners who reside outside of the United States.

State: The state of the owner's address. The state the plot was collected in is automatically selected. If the owner is from another state, select it from the dropdown menu.

City: The city of the owner's address.

Zip Code: The zip code of the owner's address.

Phone 1: The primary phone number that should be used to contact the owner.

Phone 2: The secondary phone number that can be used to contact the owner.

Note: If no contact information exists, Phone 1 and Phone 2 can be left blank.

Notes can be added for each Owner Number. To do so, select the owner and select the NOTES button below the numeric keypad. This will bring up the NOTES form where additional information can be added. Be sure that the owner number at the top of the notes form matches the owner number from the condition grid.

The final piece of information required in the Address Information Grid is the Map Description. Depending on the state either map and parcel data or township and range data will be entered. This field cannot be left blank or an error will be generated at the final plot edit.

The map description can be recorded in one of two formats depending on the state and county. The Township & Range format should be recorded in the following format:

Tx Rx Sx (Where x = recorded value T = Township R = Range S = Section)

The Map & Parcel format should be recorded in the following format:

Mx Px (Where x = recorded value M = Map # P = Parcel #)

If the information provided at the county courthouse does not follow one of these two formats, record the data in a logical format and comment in the notes how it was recorded.

Once the information is complete for the particular owner, go back to the Condition Grid and select the check box for the next condition. Complete the Address Information Grid for each forested condition. When completed select the CLOSE button in the lower left of the form.

Once back at the plot form, run a final plot edit. Correct errors if necessary. If there are no errors, the plot is ready for transmittal.

0.3.3 DELETING AN OWNER RECORD

If an owner is entered by mistake and needs to be removed, the owner record should be deleted. To do this, select the row selector arrow in the Condition Grid and the Delete Owner button in the lower right of the form. A message box will appear, select 'YES'.

	Owner Number	Owner Year	Owner Month	Condition List	Owner Class	Owner ID	Enter Address
	1	2004	01	00001	45	Private	<input type="checkbox"/>
▶	2	2004	01	00002	31		<input type="checkbox"/>

0.3.4 PRINTING OWNERSHIP INFORMATION

To print the ownership information, select print from the file menu in NaTally. Deselect "All Data" and select "Ownership". Click Print button.

Example Printout:

Forest P2 plot 51 04 1 023 0325 started on 20050112, by Cruiser 888, Version 2.2e

Date Printed: 20050119

Printed by: 034

Edited?: No

Transmitted?: No

OWNERSHIP

Owner #:1 Owner Year:2004 Owner Month:01 Condition List:1 Owner Class:45 Owner ID:Private

Company:

First Name: Johnny

Last Name: Walker

Address Line 1: 1234 FIA ST.

Address Line 2:

Address Line 3:

Country: USA Province:

City: Knoxville State: TN ZIP Code: 37919

Phone 1: 865 862 2000 Phone 2:

Map description: M34 P6.01

Owner #:2 Owner Year:2004 Owner Month:01 Condition List:2 Owner Class:11 Owner ID:WASHINGTON

Company: George Washington NF

First Name:

Last Name:

Address Line 1: 1720 Peachtree St

Address Line 2: Suite 760S

Address Line 3:

Country: USA Province:

City: Atlanta State: GA ZIP Code: 30309

Phone 1: Phone 2:

Map description: T3 R5 S21

0.3.6 EDIT CONSTRAINTS

Every condition in the Condition Grid must be forested.

Every forested condition must appear in the Condition Grid.

A condition can only appear once in the Condition Grid. There can not be 2 owners for 1 condition.

A warning will be generated is there is an owner with a different tract size or percent forest.

0.4 LOCATING SAMPLE PLOTS

Each crew should always consider weather forecasts, water levels, plot access, and state and corporate cooperation when working a county. Each county should be worked in the most efficient manner possible. Always contact National Forest System (NFS) district and county forest offices, and county sheriff, as soon as you enter the county. Contact the landowner and always let local people know who you are and what you are doing when leaving an official vehicle near a residential area.

STOP AT HOUSES, KNOCK ON DOORS, ETC. DO NOT DRIVE ACROSS CROPLAND, WILDLIFE CLEARINGS, YARDS, ETC. UNLESS YOU HAVE PERMISSION FROM THE LANDOWNER. PARK THE VEHICLE AND WALK. "POPPING" A LOCK OR USING A MASTER KEY WILL NOT BE TOLERATED. IF A ROAD HAS WATER-BARS OR A CABLE WITH A LOCK DO NOT DRIVE ON IT.

Fill out a sample location sheet (draw sheet) for all forested plots and non-forest plots whenever a non-forest plot has adjacent forestland close to the plot. This will insure that all 4 subplots are completely and totally within the non-forest condition. This will aid cruisers in the next survey to identify those plots that may have started to revert, but did not meet the required minimum stocking. In addition, this will allow check cruisers to know exactly where PC was located in relation to the adjacent forestland. A sample location sheet is not required for intensification plots, although data from intensification plots are recorded in the data recorder or on hardcopy.

Each crew will be furnished with both new and old photos (when available), plot sheets, ownership and field classification sheets, county maps, and National Forest ownership maps. All non-forest plots and possible reversions (a sample location or a portion of a sample location that was non-forest in the previous inventory but now forest) must be chained in using the old photo pinprick. Correct the pinprick on the new photo/imagery after the field visit if needed. For intensification plots, only use the new photos/imagery. Do not make any corrections to the new photo/imagery for an intensification plot.

ACCESS TO STARTING POINT (SP)

In the Sample Location Reference page section "SP Location Sketch Map" sketch the route used to access the SP. Include location of the landowners' house, road names and numbers, obvious landmarks, and other prominent features that will aid the next field crew to locate the SP.

Starting Point

Select a permanent landmark or physical feature as the SP for locating the sample location. Intersections or sharp bends in roads, streams, or drainage ditches, field corners, prominent trees, and other features which can be readily identified both on the ground and on the photo make good starting points. The ideal starting point tree is a healthy, unique species, with unusual form, in a prominent location. At remeasurement relocations, the starting point on the old location sheet can often be used again. Scribe the SP tree with an "X" well above DBH (or well below depending on topography) and tag the tree at ground level, facing plot center.

Complete a new location sheet with the prior starting point information on land clearings, possible reversions that are chained into that do not meet minimum stocking levels, and on non-forest plots that are close to being partial plots. Copy the starting point information off the old sheets for any non-forest plots when the previous cruiser recorded the information. A starting point is not

necessary if the plot center was non-forest during the past survey and all four subplots are obviously non-forest at the present time.

Note: No mark is needed on an SP if the point is permanent and readily identifiable, such as the corner of a building or a road intersection. Reference a tree when possible. **Do not scribe an SP in peoples yards, on hiking trails or elsewhere where unsuitable. In these situations scribe the backside of the SP if possible and put a note stating that the SP was either placed on the backside of the tree or not scribed at all.**

PHOTO WORK/IMAGERY

A reference azimuth, angle of intersection, and azimuth to plot center are drawn on the photograph/imagery to aid in the establishment of an accurate course to sample location, verify placement of the pinprick, and ground check the office photo interpretation.

Imagery (Digital Ortho Photos or DOQ/DOQQ) is currently being printed on paper using a color laser printer. When recording the reference azimuth, angle of intersection and azimuth to plot center a ball point pen should be used. Felt tip-type pens (such as Sharpies) may dissolve the ink on the DOQ and should be avoided.

All plots except intensification plots must be drawn up on the new photograph/imagery to verify correct plot location. Note any corrected pinpricks on the front and back of the new photo.

There may be one other instance when a plot does not need to be redrawn. To determine if the plot qualifies, the cruiser must compare the coordinates on the DOQ to the coordinates in NaTally. If the coordinates are the same and are verified (coordinates accurate to within 50' of the actual plot location on the ground), the plot does not need to be redrawn nor do new coordinates need to be collected. This is the only exception to these rules.

Reference Azimuth

For a reference azimuth, select a straight road section, drainage ditch, field edge, or draw a line between two well-spaced landmarks. Avoid standing near metal objects, e.g., railroads or power line towers, since they can influence the compass reading.

If no linear features exist on the photo/imagery, GPS coordinates of two point features can be used to obtain a reference azimuth. Prior to driving to the sample location, identify two distinct features on the photo/imagery within a reasonable distance (usually 1-2 miles) from the sample location. At each point feature, record 180 fixes in averaging mode on the GPS receiver (GPS can only be utilized when error falls below +/- 70 feet). The reference azimuth, based on magnetic north, is determined by using the distance feature in the WP menu of the PLGR.

Measure the reference azimuth with a compass to the nearest degree and record on the tally sheet under starting point notes, disregarding magnetic declination. If the reference azimuth line and the azimuth to plot center do not intersect on the photo/imagery, draw a line perpendicular to the reference azimuth line making it cross the azimuth to plot center. Use the perpendicular as the new reference azimuth line after adding or subtracting 90.

Angle of Intersection

With a protractor measure the interior angle between the reference azimuth and azimuth to plot center arrows to the nearest degree. The interior angle should be between 20 degrees and 90 degrees. Record on the tally sheet under starting point notes.

Photo/Imagery Notation

Note the following information on the **front** of the new photograph/imagery using a fine point marker (for imageries use a ball point pen) for all plots:

1. Reference azimuth line with an arrow indicating direction and azimuth noted.
2. Course to plot azimuth line with an arrow indicating direction and azimuth noted.

3. Starting Point circled and indicated as SP.
4. GPS Way Point circled and indicated as WP for completely non-forest plots only.
5. Interior angle noted with arrows drawn to the azimuth lines.
6. Note which plots have corrected pinpricks.

Note the following information on the **back** of new photographs/imagery when plot center is nonforest (e.g., partials and completely nonforest plots), if the plot is completely inaccessible, and intensification plots:

- a. Plot number, if not already noted.
- b. Land use code at plot center. If land use is a hayfield, record cropland land use (11) and write "hay" next to the code number. If the land use is Agricultural Land (10), developed (30-34) or Other Nonforest (40), then write a short description of the type of development, e.g., "back yard", "grocery store", "barn", etc. This will aid the next crew to ensure the same area is re-evaluated.
- c. Date (mm/dd/yyyy).
- d. Cruiser and assistant initials and codes.
- e. Circle and note the "correct" pinprick if a correction has been made (do not move intensification pinpricks).
- f. Recording GPS coordinates of non-forest plots on the back of the photo/imagery is optional.
- g. Note on the back of the new photograph/imagery if plot center is reverted or landcleared.

Also, if a plot is nonforest but a draw sheet is filled out due to the proximity of forest land to one or more subplots, then record 'See Nonforest Aid' on back of photo.

Course to plot

The course to sample location can be determined by measurements from the photo/imagery for new plot locations, reversions, partials, or land clearings and lost plots when the SP has been removed. The azimuth and distance can be determined using GPS or compass and chain. Pacing to most locations is possible unless underbrush, water, or rough topography make pacing impractical. Pacing between SP and PC can be used to verify a previously reported course to sample location, but not for establishing a plot.

When old starting points are used at remeasurement locations, use the same distance and azimuth recorded in the previous survey with corrections necessary to account for declination and errant distances recorded by the previous crew. Accurate measurement of azimuth and distance from SP to PC can be by GPS navigation or by traversing on the ground.

ESTABLISHMENT OF SAMPLE KIND 1 LOCATIONS USING PLGR GPS

To begin, manually enter the plot coordinates in the GPS unit. The following list will walk you through the buttons to push to enter the coordinates:

1. WP
2. Use the right/left arrows to highlight ENTER and press the down arrow.
3. Note the WP number in the upper left corner of the screen. This will be the waypoint the coordinates are stored as and to which you will be navigating, so it is an important number. It is a good idea to change the waypoint number to coincide with the number of the plot you are installing. To do this, right arrow until the number is blinking. Hit NUM LOCK and using the keypad, enter the plot number. Hit NUM LOCK again to turn it off. Right arrow to the next line.
4. Right arrow over N to 90. Hit NUM LOCK and enter the coordinates for North/latitude. Once these numbers have been entered, hit NUM LOCK and right arrow to the next line. **Down arrow to change the E to a W. This is critical!** The GPS default is East. If you do not change this designation, you will be putting in and navigating to coordinates in the eastern hemisphere and unless you can swim really fast and really well, you don't want to do that! Once you have changed the E to a W, right arrow to the 000 and hit NUM LOCK. Enter the West/longitudinal coordinates.

5. Once the coordinates have been entered, turn off NUM LOCK and right arrow to the P. Down arrow to store the waypoint. It will be saved as the waypoint you designated earlier.

Next, click on NAV. Make sure that you are using either the CUSTOM or 2D FAST navigating method. The other word should be DIRECT. Right arrow to WP and enter the waypoint you want to navigate to. Right arrow to P and down arrow. The next screen will tell you where you need to go. The variables may not be the same for everyone, but you need to at least have AZ and RNG to tell you where you need to go and how far it is.

Using the GPS, navigate to within 30 – 45 M of the plot. If possible, locate a good SP. Set the GPS down and press and hold down the POS button until the screen says AVG and the unit begins taking hits. Again, you must collect at least 180 points for the coordinates to be accurate. Once the GPS has reached at least 180, store the current position as a waypoint. Next, hit WP. Right arrow to DIST and down arrow. This screen will allow you to calculate an azimuth and horizontal distance between two waypoints. As the first waypoint, put in the coordinates you collected at the SP. The second waypoint is the plot coordinates. Once both have been entered, the GPS calculates the RNG and AZ from the first WP to the second WP. At this point, chain the horizontal distance and azimuth to establish plot center. Once you are at PC, put the GPS down and press and hold the POS key to begin averaging. Again, take at least 180 hits. Record these coordinates as the new plot coordinates.

WITNESS TREES

Reference two witness trees to subplot 1 when at all possible. In the absence of trees, use distinct objects such as fence corners, boulders, etc. If another subplot is referenced, be sure to note which subplot is monumented with witness trees.

Witness trees should be:

- a. Close to the pin and spaced approximately at right angles from the pin,
- b. Not likely to die or be cut within 5-7 years, e.g., pine sawtimber,
- c. A species easily located in the stand,
- d. At least 125 mm DBH (At least 50 mm DBH if no 125 mm DBH trees are present).
- e. If there are no witness trees, use whatever is available near the subplot center and describe its' relationship to the pin (e.g., large down log that you can tag, a large rock, etc.) and describe these on the sample location reference page.

Witness tree data:

- a. Species
- b. DBH to the last millimeter
- c. Azimuth from pin to center of tree at ground level
- d. Horizontal distance to the nearest centimeter from pin to center of tree

Mark the base of each witness tree with a metal tag (8 to 11 cm long) facing plot center. Scribe an "X" well above DBH facing the pin and be careful not to penetrate the cambium. **Do not scribe or place a white tag on trees in peoples yards, picnic areas, etc. Note on the draw page if you did not scribe and/or tag the trees.**

Mark one of the witness trees with a designated tag (Venetian blind material) by nailing the tag at approximately 1.8 M facing the line of approach from the SP. Record the color of the tag on the sample location page.

0.5 COUNTY EDIT PROCEDURES

The field is the most critical place to edit data for errors. Correcting the data in the field is more precise and accurate than doing so after being submitted to the office. For this reason, a careful field edit is a vital part of data collection.

Count all county materials and complete the Office Summary Sheet. Ensure that all materials are accounted for before starting the county. If anything is missing when you receive the county materials (i.e., old maps, any photos/imagery, plots sheets, etc.) let your field coordinator know.

Make sure all items are filled in on the Sample Location record. Check for starting point notes, azimuth and slope distance to the sample location, and that the SP description and Sketch to Sample Location match. Check completeness of the plot layout diagram, Location Sketch Map, and Sketch to Sample Location. Make sure all plots have a North arrow and the Ownership is recorded. Check the witness tree information for completeness.

Check the photographs/imagery making sure that all the SP's are marked, the photographs/imagery are drawn-up, and all required information is recorded on the back of the photographs/imagery. Check math on course to plot azimuth, reference azimuth and angle of intersection.

Count all county materials and complete the Office Summary Sheet when finished. Ensure that all materials are accounted for before they are sent to the state coordinator or field supervisor for editing

1.0 PLOT LEVEL DATA

All variables listed in Section 1.0 are collected on plots with at least one accessible forested condition (PLOT STATUS = 1) and all NONFOREST/NONSAMPLED plots (PLOT STATUS = 2 or PLOT STATUS = 3). Some of the variables in Section 1.0 are collected on landcleared plots (PLOT STATUS = 4). In general, plot level data apply to the entire plot and they are recorded from the center of subplot 1. A plot is considered nonforest if no part of it is currently or previously located in forest land (CONDITION CLASS STATUS = 1). A plot is nonsampled if the entire plot is not sampled for one of the reasons listed in PLOT NONSAMPLED REASON.

If a forest plot has been converted to nonforest or becomes a nonsampled plot, 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 nonsampled plot, a new forest ground plot is installed. All nonforest and nonsampled plots are visited if there is any reasonable chance that they might include some forest land condition class.

Trees on previously forest land plots will be reconciled during data processing. There is a distinction between plots that have been clearcut, and plots that have been converted to another land use (landcleared). A clearcut plot is considered to be forest land until it is actively converted to another land use. Additional information concerning land use classifications is contained in Section 2.3.

Intensifications are additional ground checks of the photo interpretation completed in the office and are classified as PLOT STATUS = 5. Detailed plot, condition and tree data are not collected. These additional plots are used to strengthen the forest area adjustment and are numbered in the 4000 series.

The photo interpretation categories are forest, nonforest, census water and noncensus water. The land use codes recorded in the field are the same as the standard production plots (see Section 2.5). Do not move the pinprick on intensification plots or change the PI category on any plot. Photo work and GPS data are not required.

1.1 STATE

Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located. (FIPS codes are located in Appendix 1)

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1

1.2 COUNTY

Record the unique FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK) where the plot center is located. (FIPS codes are located in Appendix 1)

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1

- 1.3 PLOT NUMBER
Record the identification number, unique within a county, parish, or borough (survey unit in AK), for each plot.

Plot numbers in the South adhere to the following numbering system:

00001-00999 Standard field plots
04001-04999 Intensification plots
09000-09999 Temporary and supplemental plots
RXXX Certification plot
All other plot ranges are only used for training plots.

When collected: SAMPLE KIND = 1, 2 and 3
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 00001 to 99999

- 1.4 PLOT STATUS
Record the code that describes the sampling status of the plot. In cases where a plot is inaccessible, but obviously contains no forest land, record PLOT STATUS = 2. In cases where a plot is access-denied or hazardous land use and has the possibility of forest, record PLOT STATUS = 3.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 1 Sampled – at least one accessible forest land condition present on plot
- 2 Sampled – no accessible forest land condition present on plot
- 3 Nonsampled
- 4 Landcleared – there was at least one accessible forest land condition at the last inventory, but the plot is now completely nonforest
- 5 Intensification

- 1.5 PLOT NONSAMPLED REASON
For entire plots that cannot be sampled, record one of the following reasons.

When collected: When PLOT STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 01 Outside U.S. boundary – Entire plot is outside of the U.S. border.
- 02 Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot. Because a denied-access plot 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.
- 03 Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc. Although most hazards will not change over time, a hazardous plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.
- 05 Lost data – Not field collected
- 06 Lost plot
- 07 Wrong location
- 08 Skipped
- 09 Dropped intensified
- 10 Other

1.6 SUBPLOTS EXAMINED (Variable not collected in field)

1.7 SAMPLE KIND

Record the code that describes the kind of plot being installed.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Initial plot establishment - the initial establishment and sampling of a national design plot (FIA Field Guide versions 1.1 and higher). SAMPLE KIND 1 is assigned under the following circumstances:
 - Initial activation of a panel or subpanel
 - Reactivation of a panel or subpanel that was previously dropped
 - Resampling of established plots that were not sampled at the previous visit
- 2 Remeasurement – remeasurement of a national design plot that was sampled at the previous inventory. The previous microplot was at the offset location (previous FIELD GUIDE version = 1.x or 2.x).
- 3 Replacement plot - a replacement plot for a previously established plot. Assign SAMPLE KIND = 3 if a plot is re-installed at a location other than the original location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the replaced plot. Replaced plots are assigned SAMPLE KIND = 2, PLOT STATUS = 3, and the appropriate NONSAMPLED REASON code. The plot number for the new (replacement) plot is assigned by NIMS.

1.8 PREVIOUS PLOT NUMBER

1.9 FIELD GUIDE VERSION

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

When collected: All plots

Field width: 2 digits (x.y)

Tolerance: No errors

MQO: At least 99% of the time

Values: 3.0

1.10 CURRENT DATE

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

1.10.1 YEAR

Record the year that the plot was completed.

When collected: All plots

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: ≥ 2005

1.10.2 MONTH

Record the month that the plot was completed.

When collected: All plots

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% 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

1.10.3 DAY

Record the day of the month that the plot was completed.

When collected: All plots

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 01 to 31

1.11 DECLINATION (CORE OPTIONAL)

1.12 HORIZONTAL DISTANCE TO IMPROVED ROAD

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

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

1	30 M or less (100 ft or less)
2	31 to 90 M (101 to 300 ft)
3	91 to 150 M (301 to 500 ft)
4	151 to 300 M (501 to 1000 ft)
5	301 to 792 M (1001 ft to 1/2 mile)
6	>792 to 1584 M (1/2 to 1 mile)
7	>1584 to 4752 M (1 to 3 miles)
8	>4758 to 7920 M (3 to 5 miles)
9	Greater than 7920 M (Greater than 5 miles)

1.13 WATER ON PLOT

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 can be used for recreation, wildlife, hydrology, and timber availability studies.

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 0 None – no water sources within the accessible forest land CONDITON CLASS
- 1 Permanent streams or ponds too small to qualify as noncensus water
- 2 Permanent water in the form of deep swamps, bogs, marshes without standing trees present and less than 1.0 ac in size, or with standing trees
- 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

1.14 QA STATUS

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

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Standard production plot
- 2 Cold check (QA reviews collected data while checking plot; may be done with or without standard field crew)
- 3 Reference plot (off grid – SRS QA certification plot answer key)
- 4 Training/practice plot (off grid – SRS field crew certification plot)
- 5 Botched plot file (disregard during data processing)
- 6 Blind check (QA crew remeasures the plot without reviewing the standard field crew's data; standard field crew is not present)
- 7 Hot check (production plot; QA members observing standard field crew)

1.15 CREW TYPE

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

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Standard field crew
- 2 QA crew (any QA crew member present collecting data)

1.16 GPS Coordinates

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

1.16.1 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 (NAD 83) 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; the regions using the UTM coordinate system will collect UTM Easting, Northing, and Zone.

1.16.2 Collecting Readings

Collect at least 180 GPS readings at the plot center. These may be collected in a file for post-processing or may be averaged by the GPS unit. Each individual position should have an error of less than 70 feet 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 positions (180 readings at error less than or equal to 21 M [70 feet]) cannot 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 60 M (200 feet) 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 as described in Sections 1.15.12 and 1.15.13.

Coordinates may be collected further away than 61 meters 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 as described in Sections 1.16.12 and 1.16.13.

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

1.16.3 GPS 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 when PLOT STATUS = 1 - 4

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 GPS coordinates not collected
- 1 Rockwell Precision Lightweight GPS Receiver (PLGR)
- 2 Other brand capable of field-averaging
- 3 Other brands capable of producing files that can be post-processed
- 4 Other brands not capable of field-averaging or post-processing
- 8 Previously field-collected coordinates accurate; not collected again

1.16.4 GPS SERIAL NUMBER

Record the last six digits of the serial number on the GPS unit used.

When collected: When GPS UNIT not 0 or 8

Field width: 6 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000001 to 999999

1.16.5 GPS DATUM

1.16.6 COORDINATE SYSTEM

1.16.7 Latitude

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS. If the coordinates cannot be corrected and an offset point is used, record the latitude at the offset point.

NOTE: The following can be customized at the region level (e.g., decimal minutes to the nearest thousandth) as long as the final results recorded are within the specified tolerance to the nearest hundredth of a second or +/- 1.01 ft.

1.16.7.1 LATITUDE DEGREES

Record the latitude degrees of the plot center (or the offset point) as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 3 digits (1st digit is + or -, last 2 digits are numeric)

Tolerance: No errors

MQO: At least 99% of the time

Values:

1.16.7.2 LATITUDE MINUTES

Record the latitude minutes of the plot center (or the offset point) as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 – 59

1.16.7.3 LATITUDE SECONDS

Record the latitude decimal seconds of the plot center (or the offset point) to the nearest hundredth place as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 4 digits

Tolerance: +/- 140 ft

MQO: At least 99% of the time

Values: 0.00 - 59.99

1.16.8 Longitude

Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS. If the coordinates cannot be corrected and an offset point is used, record the longitude at the offset point.

NOTE: The following can be customized at the region level (e.g., decimal minutes to the nearest thousandth) as long as the final results recorded are within the specified tolerance to the nearest hundredth of a second or +/- 1.01 ft.

1.16.8.1 LONGITUDE DEGREES

Record the longitude degrees of the plot center (or the offset point) as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 4 digits (1st digit is + or -, last 3 digits are numeric)

Tolerance: No errors

MQO: At least 99% of the time

Values:

1.16.8.2 LONGITUDE MINUTES

Record the longitude minutes of the plot center (or the offset point) as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 – 59

1.16.8.3 LONGITUDE SECONDS

Record the longitude decimal seconds of the plot center (or the offset point) to the nearest hundredth place as determined by GPS.

When collected: When GPS UNIT > 0

Field width: 4 digits

Tolerance: +/- 140 ft

MQO: At least 99% of the time

Values: 0.00 – 59.99

1.16.9 UTM ZONE

1.16.10 EASTING (X) UTM

1.16.11 NORTHING (Y) UTM

1.16.12 Correction For "Offset" Location

As described in Section 1.14.2, 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 1.16.13 and 1.16.14.

1.16.13 AZIMUTH TO PLOT CENTER

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, 3 or 4

Field width: 3 digits

Tolerance: +/- 3 degrees

MQO: At least 99% of the time

Values: 000 when coordinates **are** collected at plot center
001 to 360 when coordinates **are not** collected at plot center

1.16.14 DISTANCE TO PLOT CENTER

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 1.16.2, if a laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 feet from the plot center. If a range finder is not used, the offset location must be within 61 meters.

When collected: When GPS UNIT = 2, 3 or 4

Field width: 3 digits

Tolerance: +/- 6 ft

MQO: At least 99% 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

1.16.15 GPS ELEVATION

Record the elevation above mean sea level of the plot center, in feet, as determined by GPS. If the coordinates cannot be corrected and an offset point is used, record the elevation at the offset point. If the coordinates are calculated, record 99999 because elevation cannot be calculated.

When collected: When GPS UNIT = 1, 2, 4 or 8

Field width: 6 digits (1st digit is + or -, last 5 digits are numeric)

Tolerance:

MQO: At least 99% of the time

Values: -00100 to +20000

1.16.16 GPS ERROR

Record the error as shown on the GPS unit to the nearest foot. As described in Section 1.16.2, make every effort to collect readings only when the error less than or equal to 70 feet. However, if after trying several different times during the day, at several different locations, this is not possible, record readings with an error of up to 999 feet.

When collected: When GPS UNIT = 1 or 2

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000 to 070 if possible

071 to 999 if an error of less than 70 cannot be obtained

1.16.17 NUMBER OF READINGS

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 = 1 or 2

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 001 to 999

1.16.18 GPS FILENAME (CORE OPTIONAL)

1.17 MACROPLOT BREAKPOINT DIAMETER (CORE OPTIONAL)

1.18 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

Tolerance: N/A

MQO: N/A

Values: English language words, phrases and numbers

1.19 CYCLE

Record the cycle number of the current plot.

When collected: All plots

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 01 to 99

1.20 PANEL
Record the panel number of the plot.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 5

1.21 PHASE
Record the phase number of the plot

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 2 Standard field plot (measured year-round)
- 3 Standard field plot with forest health variables (measured only during specified time frame)

1.22 PLOT IN CORRECT COUNTY?
Record the code that states if the plot center is in the correct county/municipio. This item will automatically default to '1' in the data recorder. If plot center lands in a county other than the county that it is assigned to, then enter code '0'. A screen will appear where the correct county is entered. This information will be automatically forwarded to FIA office staff when the plot is transmitted.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Plot center is not in the county the plot is assigned to
1	Plot center is in the county the plot is assigned to

1.23 CORRECT COUNTY
Record the unique FIPS (Federal Information Processing Standard) code identifying the correct county, parish, borough or municipio (or unit in AK) where the plot center is actually located.

When collected: All plots where PLOT IN CORRECT COUNTY = 0
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1

1.24 PAST DATE
Record the year, month, and day that the current plot was last inventoried in the same format as CURRENT DATE:

1.24.1 PAST YEAR
Record the year that the plot was last inventoried.

When collected: SAMPLE KIND = 2
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: ≤ 2005

1.24.2 PAST MONTH

Record the month that the plot was last inventoried.

When collected: SAMPLE KIND = 2
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% 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

1.24.3 PAST DAY

Record the day of the month that the plot was last inventoried.

When collected: SAMPLE KIND = 2,8 and 9
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

1.25 CRUISER NUMBER

Record the unique code assigned to identify individual cruisers.

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001-999

1.26 ASSISTANT CRUISER NUMBER(S)

Record the unique code assigned to identify up to two assistants on the plot. If the assistant(s) does not have a cruiser number, record 991 and/or 992.

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001-999

1.27 NUMBER OF ACCESSIBLE FOREST LAND CONDITIONS

Record the number of accessible forest land conditions that are sampled on the plot.

When collected: PLOT STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-9

1.28 NUMBER OF TREE ENTRIES

Record the total number of entries for the tree and sapling tally. This count includes entries to indicate no tally on a subplot or microplot.

When collected: PLOT STATUS = 1 or 4
 Field width: 3 digits
 Tolerance: No errors
 MQO: At least 99% of the time
 Values: 000-999

1.29 HORIZONTAL DISTANCE TO URBAN OR BUILT-UP LAND

Record the straight-line distance from plot center (subplot 1) to the nearest evidence of urban or built-up land. Only examine the single photo that includes the plot pin-prick.

Urban or built-up land — Land that is 4 hectares (10 acres) or more in size and comprised of areas of intensive human use with much of the land covered by manmade structures and associated clearings. Included are towns, villages, strip-developments along highways, power and communication facilities (excluding rights-of-way), industrial complexes, and institutions. Urban or built-up land is further defined as any 4 hectare (10 acre) area (202 x 202 M) composed of a mixture of land uses where urban or built-up land uses comprise more than 50 percent of the land area. Included are residential or commercial strips. Residential or commercial strips are at least 30 M (100 feet) wide and 4 hectares (10 acres) in size with uniform spacing of structures, often with lawns, driveways, and parking lots.

Active surface mines, active sand and gravel pits, and other areas TEMPORARILY devoid of vegetation due to man's activities are NOT considered urban or built-up land. Similarly, naturally formed talus slopes and rock outcrops, mine tailings and soil pushed aside from surface mine operations, and bare soil associated with crop tillage are not urban or built-up land. Buildings, permanent product storage bins, and equipment parking areas are considered urban or built-up land.

The presence or absence of a store in a strip development has no bearing on this classification. Where a strip development consists of a mixture of farmsteads and residences, or farmsteads or other urban or built-up land, then consider farmsteads as built-up land. (Farmstead—a tract of land, usually with a house, barn, etc., on which crops or livestock are raised.) A farmstead is otherwise considered agricultural land.

When collected: PLOT STATUS = 1
 Field width: 1 digit
 Tolerance: no errors
 MQO: At least 90% of the time
 Values:

- 1 30 M or less (100 ft or less)
- 2 31 to 90 M (101 to 300 ft)
- 3 91 to 150 M (301 to 500 ft)
- 4 151 to 300 M (501 to 1000 ft)
- 5 301 to 792 M (1001 ft to 1/2 mile)
- 6 >792 to 1584 M (1/2 to 1 mile)
- 7 >1584 to 4752 M (1 to 3 miles)
- 8 >4758 to 7920 M (3 to 5 miles)
- 9 Greater than 7920 M (Greater than 5 miles)

1.30 HORIZONTAL DISTANCE TO AGRICULTURAL LAND

Record the straight-line distance from the plot center (subplot 1) to the nearest evidence of agricultural land. Only examine the single photo that includes the plot pin-prick.

Agricultural Land — Land that is 4 hectares (10 acres) or more in size and used primarily for the production of crops or livestock. Evidence includes geometric field and road patterns and the traces produced by livestock or mechanized equipment. Included are cropland, idle farmland,

improved pasture, and other farmland (e.g., confined feeding areas, horse farms, farmsteads, nurseries, orchards, and vineyards).

When collected: PLOT STATUS = 1

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values:

- | | |
|---|--|
| 1 | 30 M or less (100 ft or less) |
| 2 | 31 to 90 M (101 to 300 ft) |
| 3 | 91 to 150 M (301 to 500 ft) |
| 4 | 151 to 300 M (501 to 1000 ft) |
| 5 | 301 to 792 M (1001 ft to 1/2 mile) |
| 6 | >792 to 1584 M (1/2 to 1 mile) |
| 7 | >1584 to 4752 M (1 to 3 miles) |
| 8 | >4758 to 7920 M (3 to 5 miles) |
| 9 | Greater than 7920 M (Greater than 5 miles) |

1.31 PLOT ACCESSIBILITY

Record the code to describe the accessibility of the plot. The code that is most significant for the plot should be selected. For example, if the plot is located in permanent water and is accessed by boat, the most appropriate code would be "4 – Plot is accessed by boat".

When collected: All plots

Field width: 1 digit

Tolerance: no errors

MQO: At least 90% of the time

Values:

- | | |
|---|---|
| 0 | Typical plot for the area |
| 1 | Plot suitable for a one-person crew |
| 2 | Plot affected by seasonal high water |
| 3 | Plot affected by permanent water (beaver pond, tidal swamp, etc.) |
| 4 | Plot is accessed by boat |
| 5 | Plot access requires long hike |
| 6 | Plot has significant permanent thick brush (rhododendron, bay, pocosin, etc.) |
| 7 | Plot has significant temporary thick brush (e.g., clearcut) |
| 8 | Plot has significant deadfall/windthrow |
| 9 | Other (describe in plot notes) |

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).

2.1 DETERMINATION OF CONDITION CLASS

2.1.1 Step 1: Delineate the plot area by CONDITION CLASS STATUS

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

1. Accessible forest land
2. Nonforest land
3. Noncensus water
4. Census water
5. Nonsampled

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted. Only delineate between conditions 2 – 5 above on subplots that have at least one accessible forest land condition (SUBPLOT STATUS = 1). Do not delineate between nonforest conditions 2 – 5 above on completely nonforest subplots (SUBPLOT STATUS = 2 or 3).

2.1.2 Step 2: Further subdivide Accessible Forest Land by 6 delineation 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 in any of the following attributes within the sampled area:

1. RESERVED STATUS
2. OWNER GROUP
3. FOREST TYPE
4. STAND SIZE CLASS
5. REGENERATION STATUS
6. TREE DENSITY

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 delineation purposes (see Sections 2.5.7 to 2.5.23).

2.2 CONDITION CLASS STATUS DEFINITIONS

1. Accessible 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 (Appendix 3) of any size 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, or managed grazing where direct human intervention is actively suppressing regeneration.
- (b) in several western woodland species (Appendix 3) where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that

prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.

To qualify as forest land, the prospective condition must be at least 0.4 hectare in size and 36.6 M wide measured stem-to-stem from the outer-most edge. Forested strips must be 36.6 M wide for a continuous length of at least 110.6 meters 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 percent 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 2).

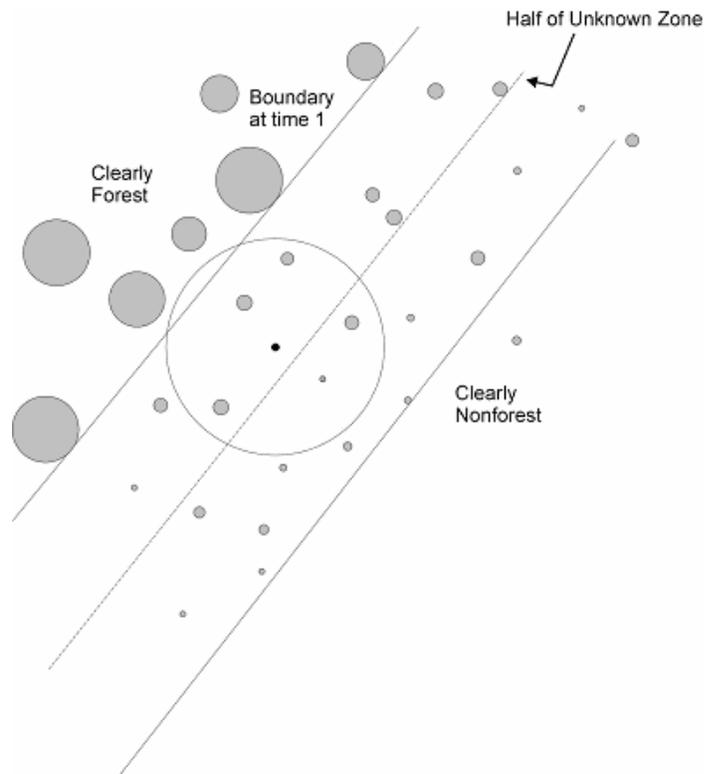


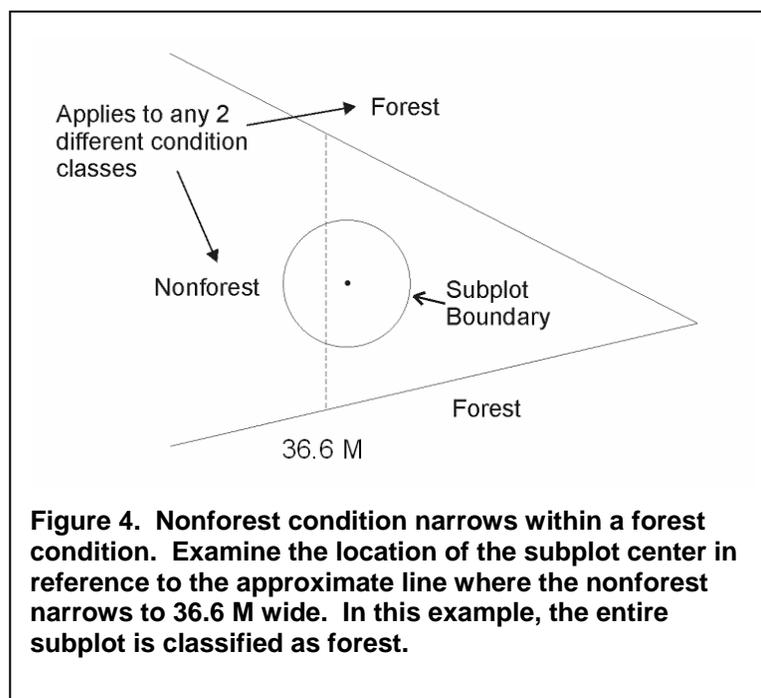
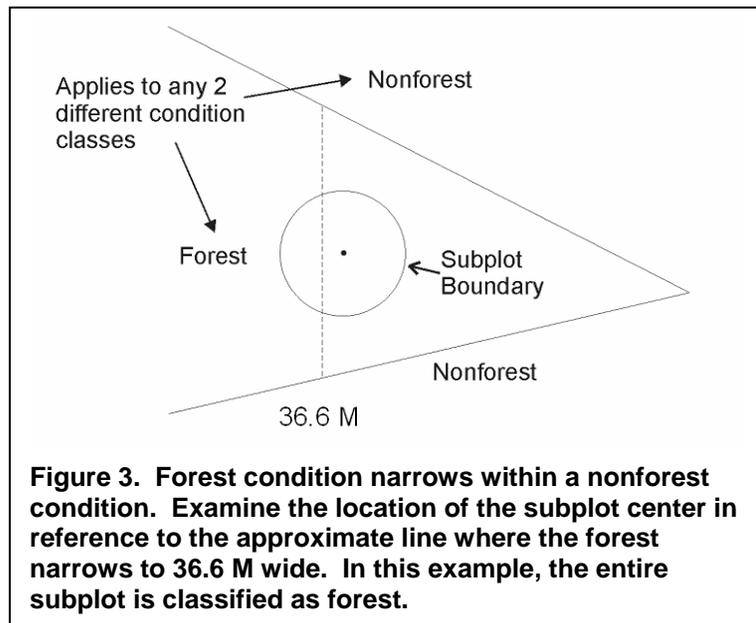
Figure 2. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

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 landowner 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 (36.6 M) 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 3 and 4. 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.



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 CLASS STATUS values defined in #'s 3, 4 and 5 in Section 2.2. To qualify, the area must be at least 0.4 hectare in size and 36.6 M wide; five exceptions are discussed at the beginning of Section 2.4. 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 plot visit to see if it has become forest land.
3. **Noncensus Water**
Lakes, reservoirs, ponds, and similar bodies of water 0.4 hectare to 1.82 hectares in size. Rivers, streams, canals, etc., 9.0 meters to 61.0 meters wide.
4. **Census Water**
Lakes, reservoirs, ponds, and similar bodies of water 1.82 hectares in size and larger; and rivers, streams, canals, etc., more than 61 meters wide (1990 U.S. Census definition).
5. **Nonsampled**
See section 2.4.3 CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled.

2.3 CONDITION CLASS ATTRIBUTES

A CONDITION CLASS NUMBER and a classification for CONDITION CLASS STATUS are 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:

<ul style="list-style-type: none"> 2.5.1 RESERVED STATUS 2.5.2 OWNER GROUP 2.5.3 FOREST TYPE 2.5.30 PR FOREST TYPE 2.5.4 STAND SIZE CLASS 2.5.5 REGENERATION STATUS 2.5.6 TREE DENSITY 	}	Attributes where a change causes a separate condition class
<ul style="list-style-type: none"> 2.5.7 OWNER CLASS 2.5.8 PRIVATE OWNER INDUSTRIAL STATUS 2.5.9 ARTIFICIAL REGENERATION SPECIES 2.5.10 STAND AGE 2.5.11 DISTURBANCE (up to 3 coded) 2.5.12 DISTURBANCE YEAR (1 per disturbance) 2.5.17 TREATMENT (up to 3 coded) 2.5.18 TREATMENT YEAR (1 per treatment) 2.5.23 PHYSIOGRAPHIC CLASS 	}	Ancillary - changes do not delineate a new condition class
<ul style="list-style-type: none"> 2.5.25 PRESENT LAND USE 2.5.26 STAND STRUCTURE 2.5.27 OPERABILITY 2.5.28 FIRE 2.5.29 GRAZING 2.5.31 PR PHYSIOGRAPHIC CLASS 	}	SRS Regional Items

When classifying CONDITION CLASS STATUS, OWNER GROUP, RESERVED STATUS, and PRESENT NONFOREST LAND USE, base the classification on what is present within the area defined by the fixed radius plot (macroplot, subplot, or microplot). When classifying all other condition class variables, base the classification on the macroplot.

2.4 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION CLASS STATUS:

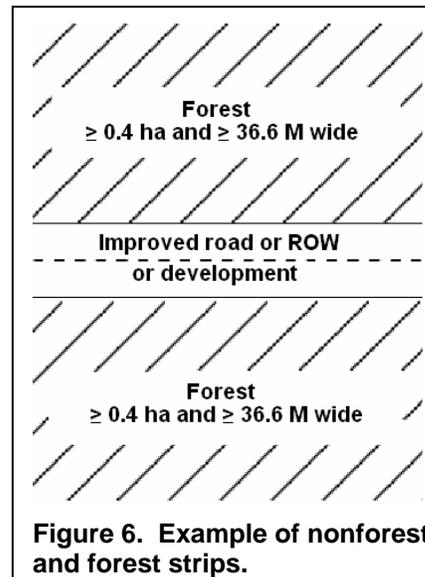
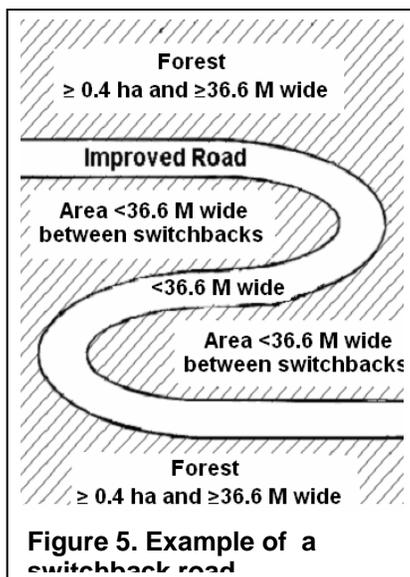
The first step in delineating condition classes is to recognize differences in CONDITION CLASS STATUS. The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 0.4 hectare in size, and each is at least 36.6 M 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 0.4 hectare in size and less than 36.6 M 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 0.4 hectare in size and less than 36.6 M in width are considered part of the nonforest condition class.

Five exceptions to these size and width requirements apply:

1. Developed nonforest condition: human-caused nonforest land condition classes such as homes or cabins that are less than 0.4 hectare in size and 36.6 M in width and are surrounded by forest land. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements (Figures 5 and 6).



- 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 0.4 hectare 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 0.4 hectare in size and less than 36.6 M 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. **This exception applies only to nonforest conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments.**

For many small intermingled strips, determine the total area that the alternating strips occupy, and classify according to the CONDITION CLASS 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 7. Figure 7 delineates the boundary between the forest and nonforest condition classes for four different examples. The plot center defines the plot condition for all strips covered by the arrow. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.

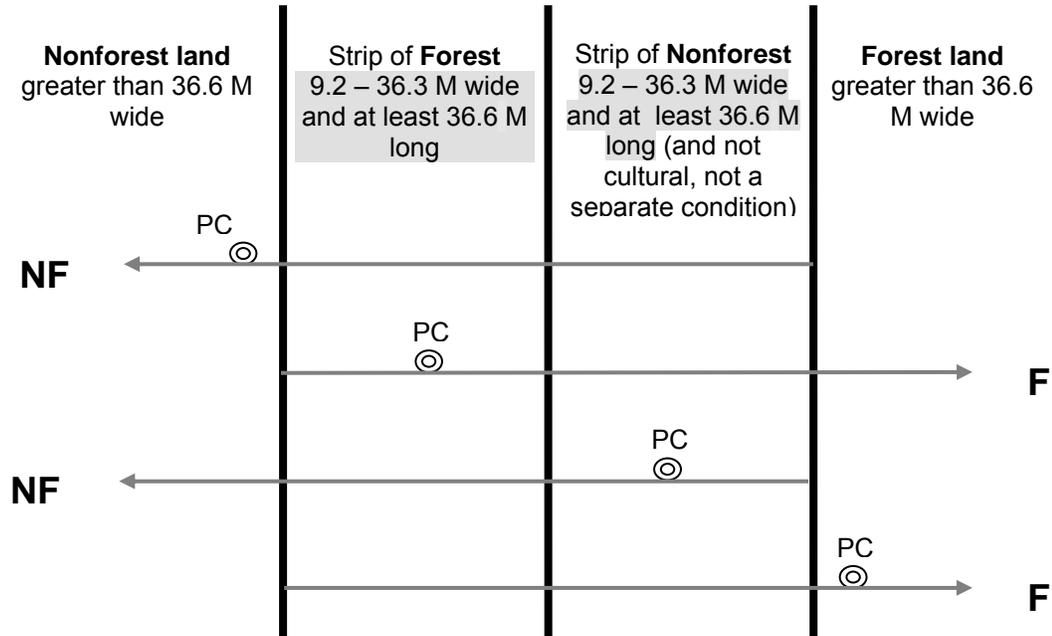


Figure 7. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

3. The 36.6 M minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 8).

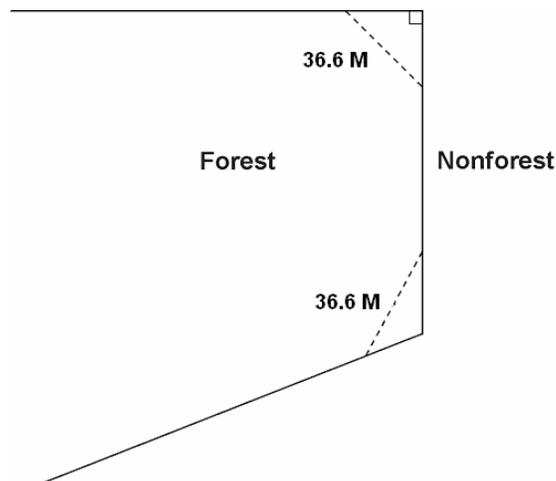


Figure 8. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

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 9.0 meters wide and cover at least 0.4 hectare. 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 that 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 0.4 hectare requirement; use professional judgment and common sense on any linear water feature.
5. Nonsampled conditions within accessible forest land are delineated, regardless of size, as a separate condition.

2.4.1 CONDITION CLASS NUMBER

On a plot, assign and record a number for each condition class. 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.

When collected: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

2.4.2 CONDITION CLASS STATUS

Record the code that describes the sampling status of the condition class. The instructions in Sections 2.3 and 2.4 apply when delineating condition classes that differ by CONDITION CLASS STATUS.

When collected: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

- | | |
|---|------------------------|
| 1 | Accessible forest land |
| 2 | Nonforest land |
| 3 | Noncensus water |
| 4 | Census water |
| 5 | Nonsampled |

2.4.3 CONDITION NONSAMPLED REASON

For portions of plots that cannot be sampled (CONDITION CLASS STATUS = 5), record one of the following reasons.

When collected: When CONDITION CLASS STATUS = 5
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: see next page

- 01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
- 02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. 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. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 03 Hazardous situation – 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 substance 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. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 10 Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.
- 11 Out of state boundary (OFFICE USE ONLY – valid only when PLOT NONSAMPLED REASON = 11)

2.5 DELINEATING 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 2.5.1 to 2.5.6. “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 0.4 hectare in size and at least 36.6 M 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 within accessible forest land. For each condition class recognized, many “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 2.5.7 to 2.5.23).

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within an macroplot (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 4.0.
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 four 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 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 seedlings-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.

4. Riparian forest area – A riparian forest area is defined as a forest area between 30.0 and 36.6 M wide, and 0.4 hectare or more in size, cumulative, and adjacent to but not necessarily present on both sides of 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, bogs, 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 delineation attribute from its adjacent accessible forest land condition class. Figures 9-14 provide examples of when to delineate riparian forest area as a separate condition class.

Note: When the width of forest adjacent to a stream is between 36.6 M and 45.7 M and the width of the riparian forest is at least 9.0 meters wide, the rules for identifying the non-riparian forest (at least 9.0 meters but less than 36.6 M) need to be modified. The non-riparian forest can be between 9.0 meters and 36.6 M and mapped as a separate condition as long as it meets the criteria for delineating a separate condition class, otherwise it will be an inclusion in the riparian forest condition class.

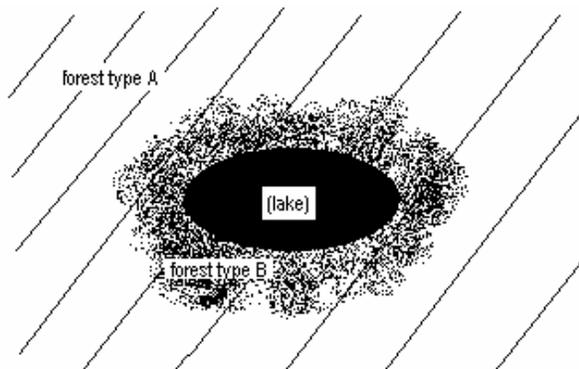


Figure 9. Forest type B is a separate condition class (riparian) if the band of it is between 9.1 M and 36.6 M wide, and is \geq 0.4 hectare in size.

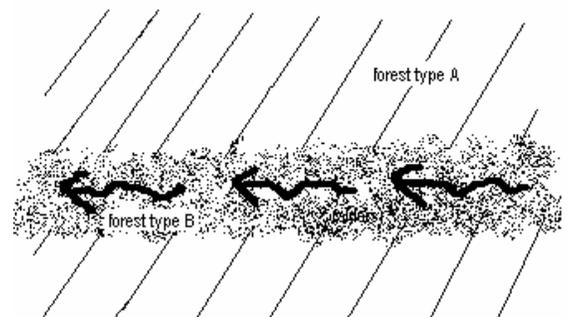


Figure 10. Forest type B is a separate condition class (riparian) if the band of it is between 9.1 M and 36.6 M wide, and is \geq 0.4 hectare in size.

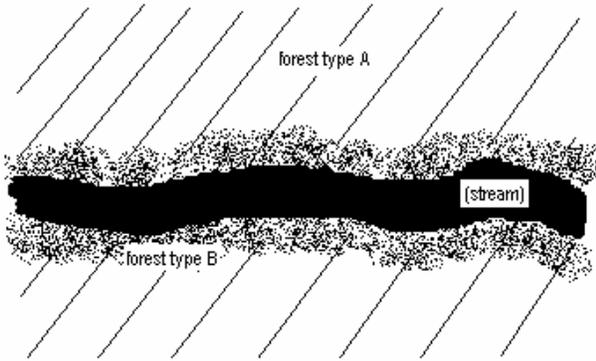


Figure 11. If the stream is < 9.1 M wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands falls between 9.1 M and 36.6 M wide, and is ≥ 0.4 hectare in size.

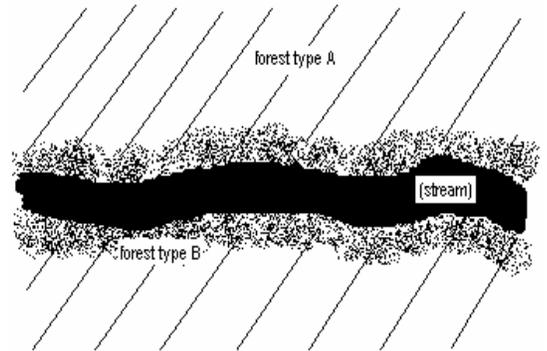


Figure 12. If the stream is > 9.1 M wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands falls between 9.1 M and 36.6 M wide and is ≥ 0.4 hectare in size.

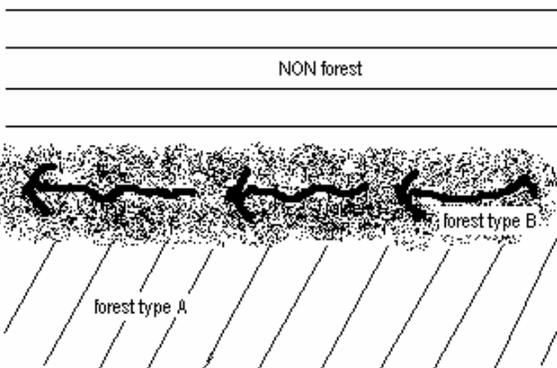


Figure 13. Forest type B is a separate condition class (riparian) if the band of it is between 9.1 M and 36.6 M wide, and is ≥ 0.4 hectare in size.

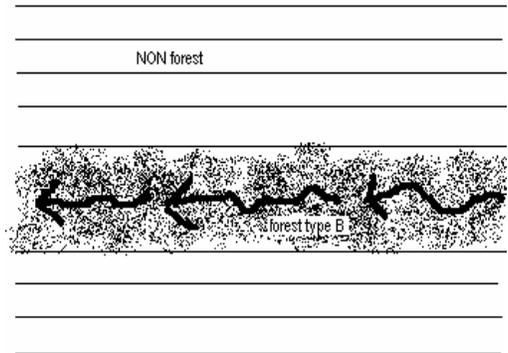


Figure 14. In a non-forested area, a band of forest type B that is < 36.6 M wide is NOT considered a riparian area. It is not a separate condition class at all.

2.5.1 RESERVED STATUS

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.

When collected: CORE: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- | | |
|---|--------------|
| 0 | Not reserved |
| 1 | Reserved |

2.5.2 OWNER GROUP

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 delineated 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: CORE: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

2.5.3 FOREST TYPE

2.5.30 PR FOREST TYPE

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

If STAND SIZE CLASS is nonstocked, then FOREST TYPE is determined by the following hierarchy:

- For SAMPLE KIND = 2 plots, record the FOREST TYPE of the condition at the previous inventory.
- For all other plots:
 1. Evaluate any seedlings available to determine the FOREST TYPE.
 2. If no seedlings exist, use adjacent stands and your best professional judgment to determine FOREST TYPE.

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

Field width: 3 digits

Tolerance: No errors in group or type

MQO: At least 99% of the time in group; at least 95% of the time in type. No MQO when STAND SIZE CLASS = 0.

Values:

001	Non-stocked forest (<10% crown closure)
002	Reversion to secondary forest (10 – 50% crown closure)
003	Young secondary forest
004	Mature secondary forest
005	Forest plantation (min 25% stocking planted)
006	Coffee shade, actively managed
007	Coffee shade, inactive
008	Lower montane (Tabonuco type)
009	Upper montane (Colorado type)
010	Palm brake
011	Cloud forest or elfin woodland
012	Xeric scrub
013	Mangrove
029	Other

The instructions in Sections 2.1 and 2.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST TYPE.

2.5.4 STAND SIZE CLASS

Record the code that best describes the predominant size class of all live trees in the condition class.

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

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Nonstocked
Meeting the definition of accessible forest land, and one of the following applies:
 - (a) less than 10 percent stocked by trees of any size, or
 - (b) for several western woodland species where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.
- 1 ≤ 125 mm (seedlings / saplings)
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 2/3 of the crown cover is in trees less than 125 mm DBH/DRC.
- 2 125 – 224 mm (softwoods) / 125 – 274 mm (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 125 mm DBH/DRC **and** the plurality of the crown cover is in softwoods between 125 – 224 mm diameter and/or hardwoods between 125 – 274 mm DBH, and for western woodland trees 125 – 224 mm DRC.
- 3 225 – 499 mm (softwoods) / 275 – 499 mm (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 125 mm DBH/DRC **and** the plurality of the crown cover is in softwoods between 225 – 499 mm diameter and/or hardwoods between 275 – 499 mm DBH, and for western woodland trees 225 – 499 mm DRC.
- 4 500 – 1000 mm
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 125 mm DBH/DRC **and** the plurality of the crown cover is in trees between 500 – 1000 mm DBH.
- 5 1014 + mm
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 125 mm DBH/DRC **and** the plurality of the crown cover is in trees ≥ 1014 mm DBH.
- 6 Cover trees (trees not on species list, used for plots classified as nonforest)
Less than 10 percent stocking by trees of any size, and greater than 5 percent **crown cover** of species that comprise cover trees.

The instructions in Sections 2.1 and 2.4 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

Within the sampled area on microplot, subplot, or macroplot, 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 STAND SIZE CLASS change. 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 standards 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 percent of the

crown cover in STAND SIZE CLASSES of 1, 2, 3, 4, or 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is 0. If 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 1. If less than 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 2, 3, 4, or 5, based on which of these STAND SIZE CLASSES has the most crown cover.

2.5.5 REGENERATION STATUS

Record the code that best describes the artificial regeneration that occurred in the condition.

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

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% 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 2.4 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.

NOTE: Plot records or verbal evidence from landowner is acceptable for determining regeneration status.

2.5.6 TREE DENSITY

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 that are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in Sections 2.1 and 2.4 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 condition classes are homogenous, i.e., when a change in density is the ONLY difference within what would otherwise be treated as only 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. Delineation by density should only be done when the less-dense condition is 50 percent or less as dense as the more dense condition.

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

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

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% 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:

- the eastern half of an otherwise homogeneous, 8.1 hectare stand has many trees killed by a bark beetle outbreak,
- one portion of a stand is partially cut over (with 3.7 square meters basal area per 0.4 hectare) while the other portion is undisturbed (with 9.3 square meters basal area per 0.4 hectare).

NOTE: In these examples, RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, and REGENERATION STATUS are the same.

ANCILLARY (NON-DELINEATING) VARIABLES

2.5.7 OWNER CLASS

2.5.8 PRIVATE OWNER INDUSTRIAL STATUS

2.5.9 ARTIFICIAL REGENERATION SPECIES

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 CLASS STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: See Appendix 3

2.5.10 STAND AGE

2.5.11 DISTURBANCE 1

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 0.4 hectare 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 re-measured plots recognize only those disturbances that have occurred since the previous inventory.

The following disturbance codes require "significant threshold" damage, which implies mortality and/or damage to 25 percent of all trees in a stand or 50 percent of an individual species' count. Additionally, some disturbances affect forests but initially may not affect tree growth or health (e.g., grazing, browsing, flooding, etc.). In these cases, a disturbance should be coded when at least 25 percent of the soil surface or understory vegetation has been affected.

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

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: see next page

Values:

<u>Code</u>	<u>Definition</u>
00	None - no observable disturbance
10	Insect damage (to both understory vegetation and trees)
11	insect damage to understory vegetation
12	insect damage to trees, including seedlings and saplings
20	Disease damage (to both understory vegetation and trees)
21	disease damage to understory vegetation
22	disease damage to trees, including seedlings and saplings
30	Fire (from crown and ground fire, either prescribed or natural)
31	ground fire
32	crown fire
40	Animal damage (other than listed below)
41	beaver (includes flooding caused by beaver)
42	porcupine
43	deer/ungulate
44	bear (CORE OPTIONAL)
45	rabbit (CORE OPTIONAL)
46	domestic animal/livestock (includes grazing):
50	Weather damage (other than listed below)
51	ice
52	wind (includes hurricane, tornado)
53	flooding (weather induced)
54	drought
55	earth movement/avalanches
60	Vegetation (suppression, competition, vines):
70	Unknown/not sure/other (include in NOTES)
80	Human-caused damage – any significant threshold of human-caused damage not described in the DISTURBANCE codes listed or in the TREATMENT codes listed. Must include a plot-level note to describe further.

2.5.12 DISTURBANCE YEAR 1

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

Tolerance: +/- 1 year for measurement cycles of 5 years
+/- 2 years for measurement cycles of > 5 years

MQO: At least 99% of the time

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

2.5.13 DISTURBANCE 2

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

2.5.14 DISTURBANCE YEAR 2

Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

2.5.15 DISTURBANCE 3

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

2.5.16 DISTURBANCE YEAR 3

Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

2.5.17 TREATMENT 1

Forestry treatments are a form of disturbance. These human disturbances are recorded separately here for ease of coding and analysis. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood, Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 0.4 hectare 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 CLASS STATUS = 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

<u>Code</u>	<u>Definition</u>
00	<u>None</u> - No observable treatment.
10	<u>Cutting</u> - The removal of one or more trees from a stand.
20	<u>Site preparation</u> - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	<u>Artificial regeneration</u> - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present resulted from planting or direct seeding.
40	<u>Natural regeneration</u> - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present (of any size) were established through the growth of existing trees and/or natural seeding or sprouting.
50	<u>Other silvicultural treatment</u> - The use of fertilizers, herbicides, girdling, pruning, or other activities (not covered by codes 10-40) designed to improve the commercial value of the residual stand, or chaining, which is a practice used on western woodlands to encourage wildlife forage.

2.5.18 TREATMENT YEAR 1

Record the year in which TREATMENT 1 occurred.

When collected: When TREATMENT 1 > 00

Field width: 4 digits

Tolerance: +/- 1 year for measurement cycles of 5 years

+/- 2 years for measurement cycles of > 5 years

MQO: At least 99% of the time

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

2.5.19 TREATMENT 2

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

- 2.5.20 TREATMENT YEAR 2
Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.
- 2.5.21 TREATMENT 3
If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions; code 00 if none.
- 2.5.22 TREATMENT YEAR 3
Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.
- 2.5.23 PHYSIOGRAPHIC CLASS

2.5.31 PR PHYSIOGRAPHIC CLASS

Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition within the plot area; land form, topographic position, and soil generally determine physiographic class.

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

Field width: 3digits

Tolerance: No errors

MQO: At least 80% of the time

Values:

- 1 Mountainous (Well inland and not on the coast)
 - 1 Ridge
 - 2 Valley
 - 1 Coves (Small upland valley without perennial stream)
 - 2 Bottomlands (Non-flooded parts of valley floor)
 - 3 Floodplains (Flooded parts of valley floor)
 - 3 Slope
 - 1 Upper
 - 2 Middle
 - 3 Lower
 - 2 Coastal plain (Flat areas along the coast)
 - 1 Ridge
 - 2 Valley
 - 1 Coves
 - 2 Bottomlands
 - 3 Floodplains
 - 3 Slope
 - 1 Upper
 - 2 Middle
 - 3 Lower
 - 3 Karst (Upland areas in the karst region; presence of mogotes)
 - 1 Ridge
 - 2 Valley
 - 1 Coves
 - 2 Bottomlands
 - 3 Floodplains
 - 3 Slope
 - 1 Upper
 - 2 Middle
 - 3 Lower
 - 4 Wetland (Lowland, wet areas: marshes, swamps, mangroves, etc.)
 - 1 Freshwater
 - 2 Saltwater
- 0 No tertiary classification

Physiographic class is assigned based on a primary, secondary and tertiary classification. For example, a plot that falls on the middle slope in the mountainous region would be given a physiographic class of '132' (1 = Mountainous, 3 = Slope, 2 = Middle). If no tertiary classification is applicable (i.e. ridge or freshwater/saltwater wetlands) then the third digit should be '0'. For example, a freshwater wetland would be classified as '410' (4 = Wetland, 1 = Freshwater, 0 = Not applicable).

2.5.24 PRESENT NONFOREST LAND USE

2.5.25 PRESENT LAND USE

Record the classification that indicates the land use of the condition.

Use codes 10, 30, 40 and 99 only for land not better described by one of the more detailed codes within each category.

When collected: All condition classes

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

Accessible Forestland (CONDITION CLASS STATUS = 1)

Forest land - See section 2.2 for complete definition.

01 Accessible timber land (SITE CLASS = 1- 6)

02 Accessible other forest land (SITE CLASS = 7)

10 Agricultural land (CONDITION CLASS STATUS = 2) - Land managed for crops, pasture, or other agricultural use. The area must be at least 0.4 hectare in size and 36.6 M wide. Use the 10 code only for cases not better described by one of the following:

11 Cropland

12 Pasture (improved through cultural practices)

13 Idle farmland

14 Orchard

15 Christmas tree plantation

16 Maintained wildlife openings

20 Rangeland (CONDITION CLASS STATUS = 2) - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 0.4 hectare in size and 36.6 M wide.

30 Developed (CONDITION CLASS STATUS = 2) - Land used primarily by humans for purposes other than forestry or agriculture. Use the 30 code only for land not better described by one of the following:

31 Cultural: business, residential, and other places of intense human activity.

32 Rights-of-way: improved roads, railway, power lines, maintained canal

33 Recreation: parks, skiing, golf courses

34 Mining

40 Other (CONDITION CLASS STATUS = 2) - Land parcels greater than 0.4 hectare in size and greater than 36.6 M wide, that do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow.

41 Marsh

42 Beach

91 Census Water (CONDITION CLASS STATUS = 4) - See section 2.2

92 Noncensus water (CONDITION CLASS STATUS = 3 - See section 2.2

99 Nonsampled (CONDITION CLASS STATUS = 5) - See section 2.2

2.5.26 PR SECONDARY LAND USE

Record the code that best describes the secondary land use of the condition if applicable.

When collected: PRESENT LAND USE = 01 or 02

Field width: 2 digits

Values: Use same codes for PRESENT LAND USE listed above

2.5.27 STAND STRUCTURE

Record the code that best describes the predominant canopy structure for the condition. When determining canopy structure, only consider the vertical position of the dominant and codominant trees in the stand. Do not consider trees that are intermediate or overtopped crown class. As a rule of thumb, a different story should comprise 25% of the stand.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Non-stocked - The condition is less than 10% stocked.
- 1 Single-storied - Most of the dominant/codominant tree crowns form a single canopy (i.e., most of the trees are approximately the same height).
- 2 Two-storied - The dominant/codominant tree crowns form two distinct canopy layers or stories.
- 3 Multi-storied - More than two recognizable levels characterize the crown canopy. Dominant/codominant trees of many sizes (diameters and heights) for a multilevel canopy.

2.5.28 FIRE

Record the presence or absence of fire on the condition since the last survey. Evidence of fire must occur within the subplot.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 No evidence of fire since last survey
- 1 Evidence of burning (either prescribed or wildfire)

2.5.29 GRAZING

Record the presence or absence of domestic animal grazing on the condition since the last survey. Evidence of grazing must occur within the subplot.

When collected: If CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 No evidence of livestock use (by domestic animals)
- 1 Evidence of grazing (including dung, tracks, trails, etc.)

3.0 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.

3.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When Collected: All subplots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

3.2 SUBPLOT/MACROPLOT STATUS

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

When collected: All subplots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Sampled – at least one accessible forest land condition present on subplot (remeasured trees on SK = 2 are relocated)
- 2 Sampled – no accessible forest land condition present on subplot
- 3 Nonsampled
- 9 Replacement – SAMPLE KIND 2 only; previous subplot could not be relocated. Does not include subplots that fall in clearcuts or have no remeasurement trees. Must have at least one accessible forest land condition present on the subplot at both present and previous inventory

3.3 SUBPLOT NONSAMPLED REASON

For entire subplots that cannot be sampled, record one of the following reasons.

When collected: When SUBPLOT/MACROPLOT STATUS = 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
- 02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. 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. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 03 Hazardous situation – 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 substance plantations, 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. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.
- 04 Time limitation
- 05 Lost data
- 10 Other

3.4 SUBPLOT CENTER CONDITION

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

When collected: All subplots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

3.5 MICROPLOT CENTER CONDITION

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

When collected: All microplots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

3.6 SUBPLOT SLOPE

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 predominantly of one direction, code the predominant slope percentage rather than the average.
- If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, 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 where most of the area lies.

When collected: All subplots with at least one accessible forest land condition present on subplot
(SUBPLOT/MACROPLOT STATUS = 1 or 9)

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 155

3.7 SUBPLOT ASPECT

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 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 at least one accessible forest land condition present on subplot
(SUBPLOT/MACROPLOT STATUS = 1 or 9)

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values:

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

3.8 SNOW/WATER DEPTH

Record to the nearest centimeter 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 lengths) may be measured with less certainty due to conditions at the time of measurement.

When collected: All subplots with at least one accessible forest land condition present on subplot
(SUBPLOT/ANNUALR PLOT STATUS = 1 or 9)

Field width: 3 digits (xxx)

Tolerance: +/- 15 cm

MQO: At the time of measurement (no MQO after initial date of visit)

Values: 000 to 999

3.9 SUBPLOT/MACROPLOT CONDITION LIST (CORE OPTIONAL)

This is a listing of all condition classes located within the 7.32 M radius around the subplot center. In regions measuring the CORE OPTIONAL macroplot, this is a listing of all condition classes located within the 17.95 M radius around the macroplot center. A maximum of four conditions is permitted at any individual subplot / macroplot. If a condition class has already been defined at a previously completed subplot / macroplot, 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.

When collected: All forested subplots (SUBPLOT STATUS = 1 or 9)

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1000 to 9876

4.0 BOUNDARY REFERENCES

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

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

4.1 REFERENCE PROCEDURE

Reference, within the sampled area on each microplot, subplot, and macroplot, the approximate boundary of each condition class that differs from the condition classes 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 delineated.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points and/or from microplot center to the reference points (Figures 15 and 16). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference or microplot 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.

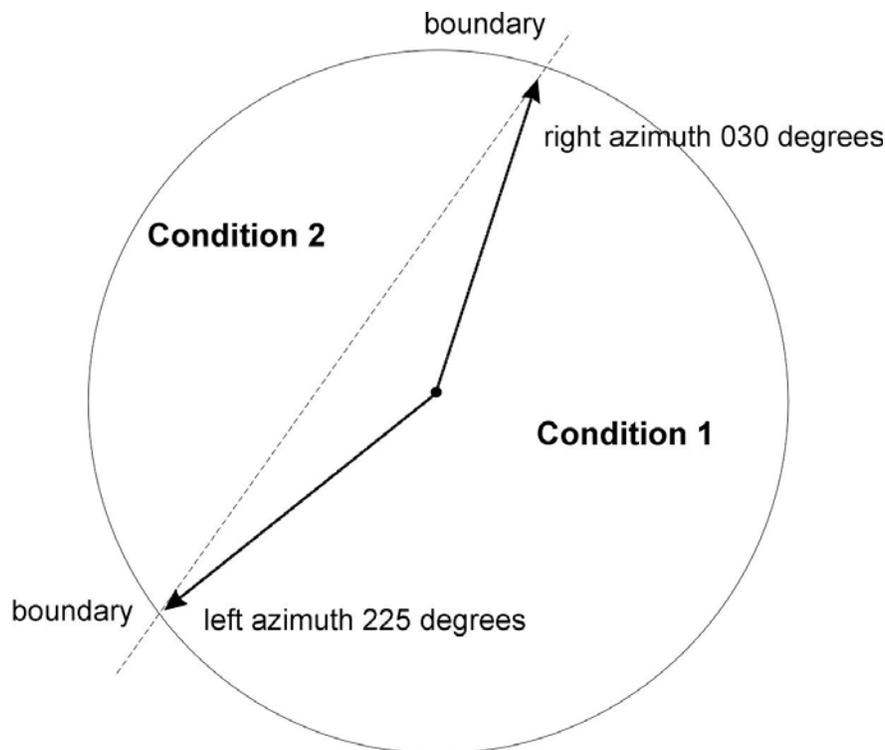


Figure 15. How to measure a straight boundary on a microplot, subplot, or macroplot.

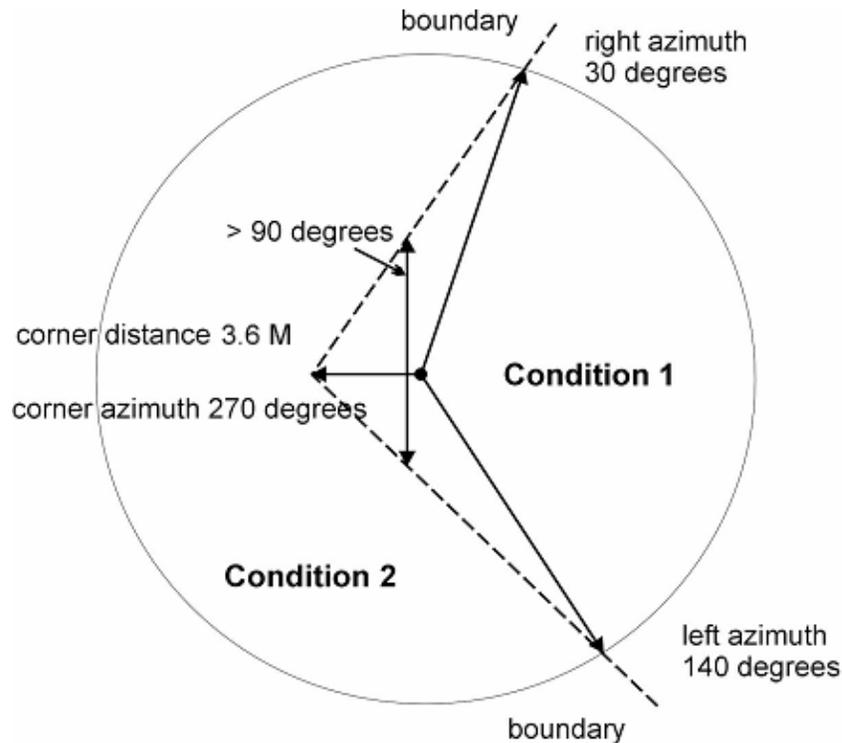


Figure 16. How to measure a boundary with a corner on a subplot or macroplot.

Microplot boundaries are referenced to the microplot center, and macroplot 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 2.4 for general condition class delineation guidelines. The following additional rules apply when referencing a boundary within a subplot, microplot, or macroplot:

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 percent of the subplot or microplot area. This

allows for slight variations in azimuths or distances due to the approximate nature of mapping procedures.

6. Define and map between nonforest land features, census and noncensus water only on subplots with at least one accessible forest land condition present (SUBPLOT STATUS = 1)

4.2 BOUNDARY DATA

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

4.2.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: All boundaries

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

4.2.2 PLOT TYPE

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

When collected: All boundaries

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- | | |
|---|---|
| 1 | Subplot boundary |
| 2 | Microplot boundary |
| 3 | Macroplot boundary (coded only when macroplots are taken) |

4.2.3 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

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- | | |
|---|---|
| 0 | No change - boundary is the same as indicated on plot map and/or data collected by a previous crew (BOUNDARY STATUS = 2). |
| 1 | Real change - new boundary, or boundary data has been changed or deleted to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded (BOUNDARY STATUS = 0, 1, 2). |
| 2 | Cruiser error - new boundary, or boundary has been changed or deleted to correct an error from previous crew (BOUNDARY STATUS = 0, 1, 2). |
| 3 | Procedural change - new boundary, or boundary has been changed or deleted to reflect a change in variable definition (BOUNDARY STATUS = 0, 1, 2). |

4.2.4 CONTRASTING CONDITION

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 macroplot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line. See section 3.0 for subplot data.

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

4.2.5 LEFT AZIMUTH

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

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 5 degrees
MQO: At least 90% of the time
Values: 001 to 360

4.2.6 CORNER AZIMUTH

Record the azimuth from the subplot, microplot, or macroplot 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
Field width: 3 digits
Tolerance: +/- 5 degrees
MQO: At least 90% of the time
Values: 000 to 360

4.2.7 CORNER DISTANCE

Record the horizontal distance, to the nearest centimeter, from the subplot, microplot, or macroplot center to a boundary corner point.

When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 3 digits
Tolerance: +/- 30 cm
MQO: At least 90% of the time
Values:

microplot	01 to 207 cm
subplot	01 to 732 cm

4.2.8 RIGHT AZIMUTH

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

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 5 degrees
MQO: At least 90% of the time
Values: 001 to 360

4.2.9 BOUNDARY STATUS

On SAMPLE KIND = 2 or 8 plots only, record the appropriate code indicating if the previous boundary is to be deleted, is a new boundary or is a remeasured boundary with or without change.

When collected: All boundaries on SAMPLE KIND = 2

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0	Deleted boundary record
1	New boundary record
2	Remeasured boundary record (with or without change)

5.0 TREE AND SAPLING DATA

Trees at least 125 millimeters 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 volume, growth, mortality, and removals; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Trees with a diameter at least 25 millimeter but less than 125 millimeters, 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 125 millimeters or larger, at which time they are tallied on the 7.32 M subplot and referenced (new AZIMUTH and HORIZONTAL DISTANCE taken) to the subplot center.

For multi-stemmed western woodland species, a cumulative DRC is used to compute diameter as described in Sections 5.9 and 5.9.4.

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 125 millimeters in diameter are tracked until they no longer qualify as standing dead. **Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be estimated.**

To qualify as a standing dead tally tree, dead trees must be at least 125 millimeters in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 1.37 M, and lean less than 45 degrees from vertical as measured from the base of the tree to 1.37 M..

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 1.37 M), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement. Trees cut below DBH do not qualify as tally trees. High stumps on naturally swell-butted trees (where it is normal to cut above 1.37 M.) do not qualify as standing dead trees.

The following apply at remeasurement:

- If at the previous visit a forked tree was recorded as two separate trees but should have been recorded as one tree, delete one tree and correct the diameter for the remaining tree. Record and explanation in TREE NOTES.
- If at the previous visit a forked tree was recorded as one tree but should have been recorded as two separate trees, correct the diameter for the remeasured tree to represent one tree, and add the other fork as a new tree. Record an explanation in TREE NOTES.

If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location. In cases where individual subplots are lost (cannot be relocated), use the following procedures:

- assign the appropriate present CONDITION CLASS STATUS Code(s) to the new subplot (usually CONDITION CLASS STATUS = 1 or 2)
- assign TREE STATUS = 0 and RECONCILE = 7 to all downloaded trees (i.e., incorrectly tallied at the previous survey)
assign RECONCILE codes 3 or 4 (i.e., missed live or missed dead) to all trees on the new subplot.
- assign the next TREE RECORD NUMBER.

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.

5.1 SUBPLOT NUMBER

Record the subplot number where the tree occurs. Also record for subplots that have no tally on the subplot or on the microplot either due to a nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission.

When Collected: All live tally trees \geq 25 mm DBH/DRC and standing dead tally trees \geq 125 mm DBH/DRC

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

5.2 TREE RECORD NUMBER

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 perimeter. On remeasured plots, use the previously assigned tree number. Saplings tallied on microplots will retain their initially assigned tree number if they grow to tree size. New and 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.

NOTE: If this is a Phase 3 plot, match the trees on this point to the hard copy list provided. Record the three-digit FHM tree number assigned to each standing tree.

When Collected: All tally trees on the four subplots and all saplings on the offset microplot; entry to record no tally on a subplot

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 000 or 001 to 999

5.3 CONDITION CLASS NUMBER

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 17).

Also record for subplots that have no tally on the subplot or on the microplot either due to a nonforest land use or a forested land use with low stocking. This is done to indicate to the edit check program that the subplot was accounted for and that the data was not lost during the transmission.

When Collected: All tally trees on the four subplots and all saplings on the offset microplot; entry to record no tally on a subplot trees

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

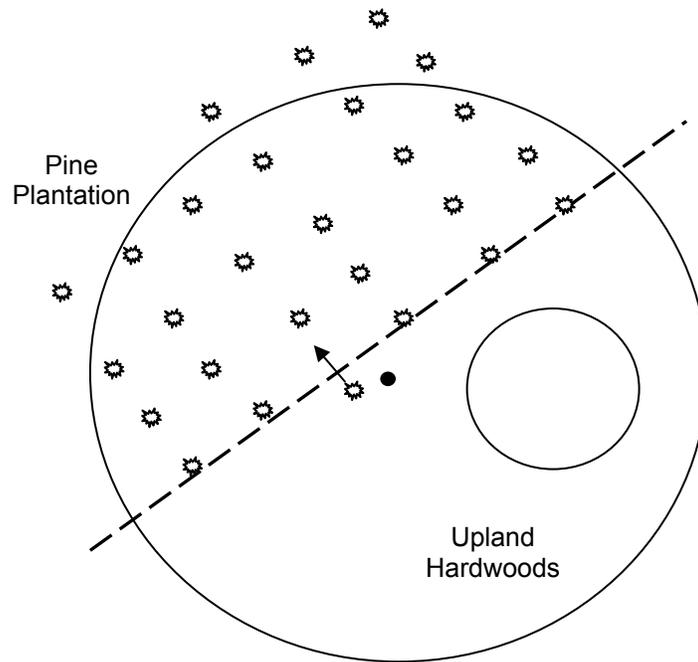


Figure 17. Ragged CONDITION CLASS boundary and tree condition class designation.

5.4 AZIMUTH

Record the AZIMUTH from the subplot center (for trees greater than or equal to 125 millimeters DBH/DRC) or the microplot center (for trees greater than or equal to 25 millimeter and less than 125 millimeters 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 (Appendix 3). 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.

When Collected: All live tally trees ≥ 25 mm DBH/DRC and standing dead tally trees ≥ 125 mm DBH/DRC

Field width: 3 digits

Tolerance: +/- 3 degrees

MQO: At least 90% of the time

Values: 001 to 360

5.5 HORIZONTAL DISTANCE

Record the measured HORIZONTAL DISTANCE, to the nearest centimeter, from the subplot center (for trees greater than or equal to 125 millimeters DBH/DRC) or microplot center (for trees greater than or equal to 25 millimeters and less than 125 millimeters DBH/DRC) to the pith of the tree at the base.

When Collected: All live tally trees ≥ 25 mm DBH/DRC and standing dead tally trees ≥ 125 mm DBH/DRC

Field width: 3 digits (xx.y)

Tolerance: Microplot: +/- 6 cm; Subplot: +/- 30 cm

MQO: At least 90% of the time

Values: Microplot: 001 to 207; Subplot: 001 to 732

5.6 PREVIOUS TREE STATUS

If not downloaded from the previous inventory, record PREVIOUS TREE STATUS for each remeasured tally tree. This code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change.

When collected: On remeasurement plots (SAMPLE KIND = 2), all previously tallied trees \geq 25 mm DBH

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

- 1 Live Tree – alive at the previous inventory
- 2 Dead tree – standing dead tree at the previous inventory

5.7 PRESENT TREE STATUS

Record a current PRESENT 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 new live tally trees \geq 25 mm DBH/DRC
All new dead tally trees \geq 125 mm DBH/DRC
On remeasurement plots, all previously tallied trees

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values: 0 - 3

- 0 No status — tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes (physically moved off plot). Requires RECONCILE code = 5-9.
- 1 Live tree – any live tree (new, remeasured or ingrowth)
- 2 Dead tree -- any dead tree (new, remeasured, or ingrowth), regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural or land clearing activity, and are assumed not to have been utilized.
- 3 Removed - a tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree is assumed to have been utilized.

Note: On remeasured plots, crews must collect new AZIMUTH and HORIZONTAL DISTANCE information from the subplot center for microplot saplings that grow to become subplot trees. For live subplot trees that shrink to become live saplings on the microplot, crews must collect new AZIMUTH and HORIZONTAL DISTANCE information from the microplot center.

5.7.1 RECONCILE

For remeasurement locations only, record a RECONCILE code for any new tally tree that was not tallied in the previous inventory, and for all no status remeasurement trees (PRESENT TREE STATUS = 0). This code is used to identify the reason a new tree appeared in the inventory, and identify the reason a remeasurement tree no longer qualifies as a tally tree. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: On SAMPLE KIND = 2: all new live tally trees ≥ 25 mm DBH/DRC (PRESENT TREE STATUS = 1 and no PREVIOUS TREE STATUS, all new dead tally trees ≥ 125 mm (PRESENT TREE STATUS = 2 and no PREVIOUS TREE STATUS), all no status trees (PRESENT TREE STATUS = 0)

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

Codes 1-4 are valid for new trees on the plot:

- 1 Ingrowth or reversions – either a new tally tree not qualifying as through growth or a new tree on land that was formerly nonforest and now qualifies as forest land (reversion or encroachment).
- 2 Through growth – new tally tree 125 millimeters DBH/DRC and larger, within the microplot, which was not missed at the previous inventory (i.e. went from seedling to pole between surveys).
- 3 Missed live – a live tree missed at previous inventory and that is live or dead now.
- 4 Missed dead – a dead tree missed at previous inventory that is dead now.

Codes 5-9 are valid for remeasured trees that no longer qualify as tally:

- 5 Shrank – live tree that shrank below threshold diameter on microplot/subplot/macroplot
- 6 Missing (moved) – tree was correctly tallied in previous inventory, but has now moved beyond the radius of the plot due to natural causes (i.e., small earth movement, hurricane). Tree must be either live before and still alive now or dead before and dead now. If tree was live before and now dead, this is a mortality tree and should have PRESENT TREE STATUS = 2 (not 0).
- 7 Cruiser error – erroneously tallied at previous inventory (includes lost subplots, see section 0.1 Plot Setup)
- 8 Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change
- 9 Tree was sampled before, but now the area where the tree was located is nonsampled. All trees on the nonsampled area have RECONCILE = 9.

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot/subplot/macroplot. For example, if a live remeasurement tree shrinks below the 125 millimeter DBH/DRC, then record the following combination of codes: PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 0, RECONCILE = 5. If a live measured tree shrinks below the 125 millimeter threshold on the subplot and is currently greater than or equal to 25 millimeter on the microplot, then record PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 1. Record all required items for a tally sapling. Use the tree coding guide in Appendix 8 to determine the national coding method for remeasurement trees.

5.7.2 STANDING DEAD

Record the code that describes whether the tree qualifies as standing dead or not. To qualify as a standing dead tally tree, dead trees must be at least 125 millimeters in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 1.37 M, and lean less than 45 degrees from vertical as measured from the base of the tree to 1.37 M. See Figures 18-20 for examples.

“Unbroken” is defined as at least 50 percent attached to the original source of growth. The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the base of the tree to the top of ACTUAL LENGTH.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 1.37 M), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

For western woodland species (Appendix 3) 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. For western woodland species with single stems to qualify as a standing dead tally tree,

dead trees must be at least 125 millimeters in diameter, be at least 30 cm in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

When collected: SAMPLE KIND = 2: All dead tally trees (PRESENT TREE STATUS = 2)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 No – tree does not qualify as standing dead
- 1 Yes – tree does qualify as standing dead

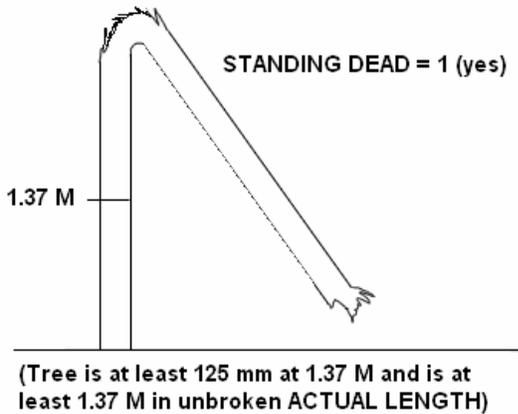


Figure 18. Example of an unbroken bole to 1.37 M.

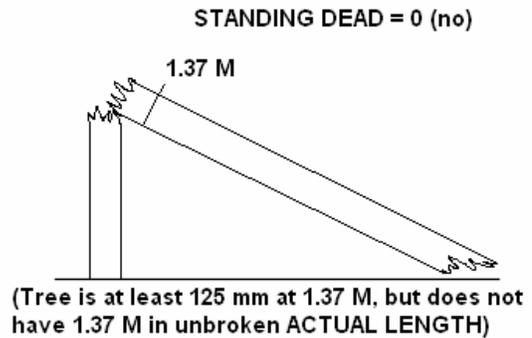
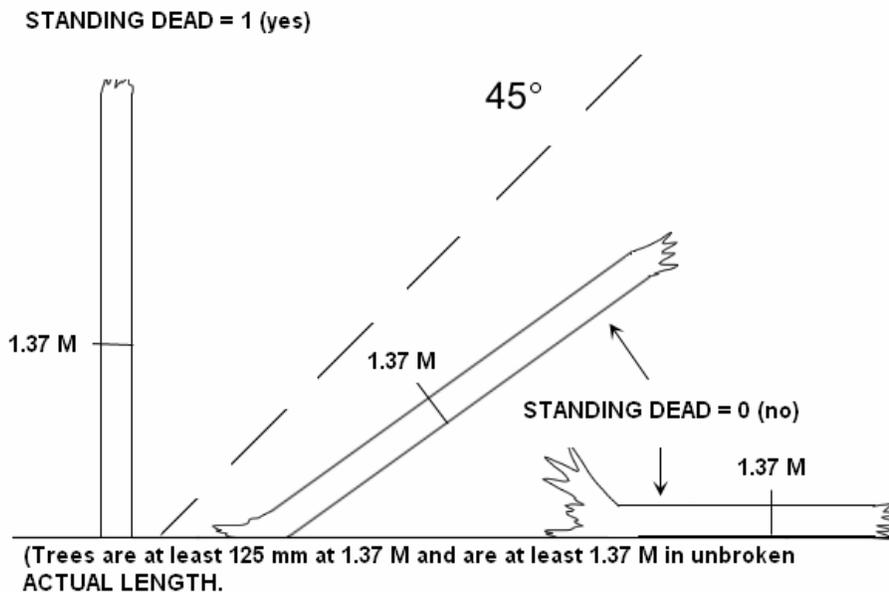


Figure 19. Example of an unbroken length of < 1.5 feet.



5.7.3 MORTALITY (CORE OPTIONAL)

5.8 SPECIES

Record the appropriate SPECIES code from the list in Appendix 3. If you encounter a species not listed in Appendix 3 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 9998 for unknown trees when the genus or species codes cannot be used. The generic code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. This is often the case with standing dead trees on newly established plots. In this case use the sample collections procedures described earlier in this paragraph.

When Collected: All tally trees

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time for genus, at least 95% of the time for species

Values: See Appendix 3

5.9 DIAMETER

Diameters are measured at either breast height (DBH) or at the root collar (DRC). Species requiring DRC, referred to as woodland species, are denoted with a "w" in Appendix 3. Trees with diameters between 25- and 124-millimeters are measured on the 207 cm radius microplot, those with diameters of 125-millimeters and larger are measured on the 732 cm radius subplots.

In order to accurately remeasure diameter (DBH or DRC) at the same point on the tree bole at successive visits, regions have the option of measuring and recording the distance from the ground to the point of diameter measurement, or marking the point of measurement with a scribe, crayon, paint, or aluminum nail. When marking trees for the first time, measure the diameter after the mark is in place. Use caution to avoid damaging trees with scribes and nails. Do not scribe or nail trees less than 76-millimeters in diameter, or species vulnerable to introduction of pathogens (e.g., aspen). Do not penetrate the cambium when using a bark scribe.

Remeasurement trees:

When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), there is an abnormality at the previous DIAMETER measurement point, or the previous location is more than 30 cm beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

When Collected: **SAMPLE KING = 1, 2, and 3:** All live tally trees ≥ 25 mm DBH/DRC and standing dead tally trees ≥ 125 mm DBH/DRC

Field width: 4 digits (xxxx)

Tolerance: +/- 3 mm per 508 mm increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2

+/- 25 mm per 508 mm increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5

MQO: At least 95% of the time. For example: a tree with a diameter of 410 in would have a tolerance of plus or minus 3 mm. (Note: the MQO for point of measurement is +/- 5 mm when the tree is first measured and within 30 cm of the location established by the previous crew when the tree is remeasured.)

Values: 0025 to 9999

5.9.1 PREVIOUS DIAMETER AT BREAST HEIGHT

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory.

5.9.2 DIAMETER AT BREAST HEIGHT (DBH)

Unless one of the following special situations is encountered, measure DBH at 1.37 M above the ground line on the uphill side of the tree. Round each measurement down to the last millimeter.

Special DBH situations:

1. **Forked tree:** In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates below 30 cm, between 30 cm and 1.37 M, or above 1.37 M.

 - **Trees forked below 30 cm.** Trees forked in this region are treated as distinctly separate trees (Figure 21). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 24 A-C). DBH is measured for each stem at 1.37 M above the ground. When stems originate from pith intersections below 30 cm, it is possible for some stems to be within the limiting distance of the microplot or subplot, and others to be beyond the limiting distance. If stems originating from forks that occur below 30 cm fork again between 30 cm and 1.37 M (Figure 24-E), the rules in the next paragraph apply.

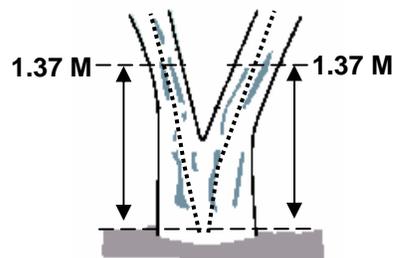


Figure 21. Forked below 30 cm.

- **Trees forked between 30 cm and 1.37 M.** Trees forked in this region are also counted as separate trees (Figure 22), but only one distance and azimuth (to the central stump) is used for all (Figure 24 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in clockwise order (from front to back when one stem is directly in front of another). The DBH of each fork is measured at a point 107 cm above the pith intersection. When forks originate from pith intersections between 30 cm and 1.37 M, the limiting distance is the same for all forks—they are either all on, or all off the plot.

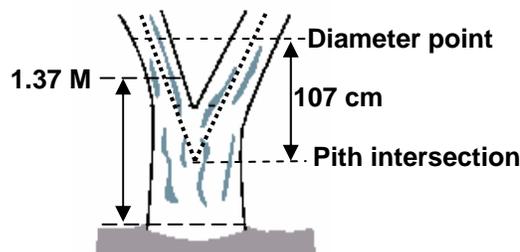


Figure 22. Forked between 30 cm-1.37 M.

Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 107 cm above the common pith intersection (Figure 24-F).

Once a stem is tallied as a fork that originated from a pith intersection between 30 cm and 1.37 M, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems just below the base of stem separation as shown in Figure 24-E (i.e., do not move the point of diameter the entire 107 cm above the first fork).

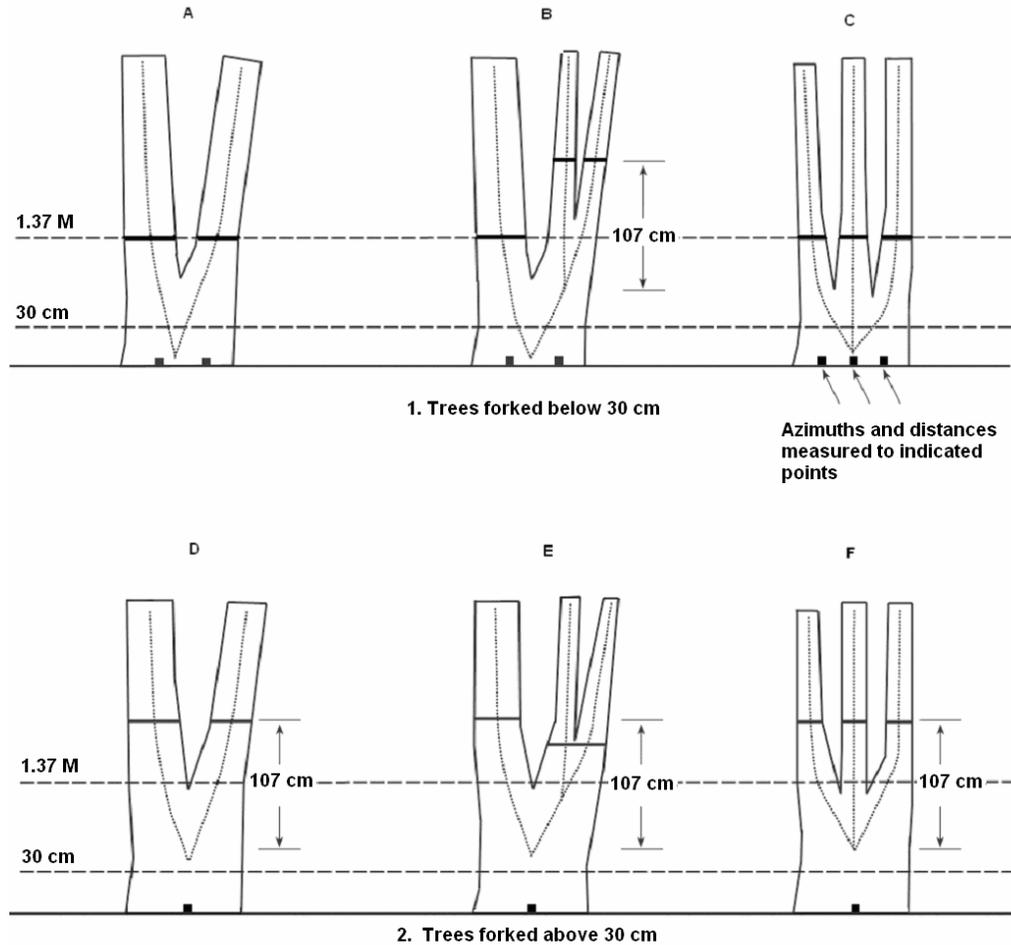


Figure 24. Summary of where to measure DBH, distance, and azimuth on forked trees.

- **Trees forked at or above 1.37 M.** Trees forked in this region count as one single tree (Figure 23). If a fork occurs at or immediately above 1.37 M, measure diameter below the fork just beneath any swelling that would inflate DBH.

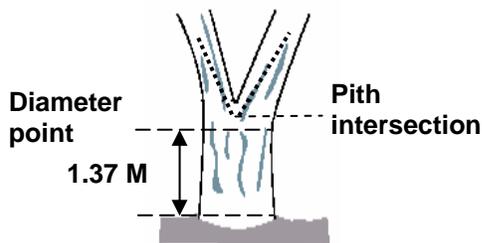


Figure 23. One tree.

2. **Stump Sprouts.** Stump sprouts originate between ground level and 1.37 M on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 30 cm are measured at 1.37 M from ground line. Stump sprouts originating between 30 cm and 1.37 M are measured at 107 cm above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 30 cm. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

3. **Tree with butt-swell or bottleneck:** Measure these trees 46 cm above the end of the swell or bottleneck if the swell or bottleneck extends 91 cm or more above the ground (Figure 25). Use a prism with a known BAF to determine diameter on trees where the diameter measurement point is too high to reach. See the coding summary for complete directions.

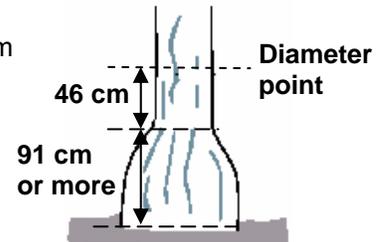


Figure 25. Bottleneck tree.

4. **Tree with irregularities at DBH:** On trees with swellings (Figure 26), bumps, depressions, and branches (Figure 27) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

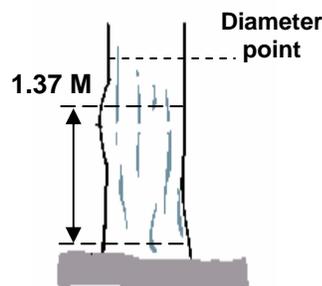


Figure 26. Tree with swelling.

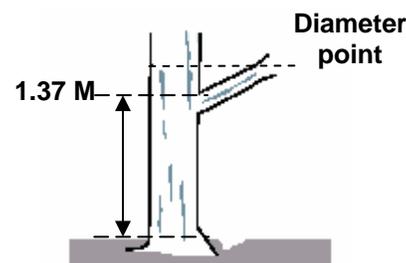


Figure 27. Tree with branch.

5. **Tree on slope:** Measure diameter at 1.37 M from the ground along the bole on the uphill side of the tree (Figure 28).

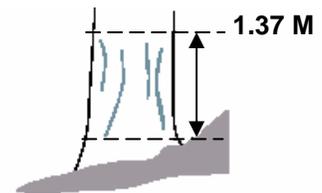


Figure 28. Tree on a slope.

6. **Leaning tree:** Measure diameter at 1.37 M from the ground along the bole. The 1.37 M distance is measured along the underside face of the bole (Figure 29).

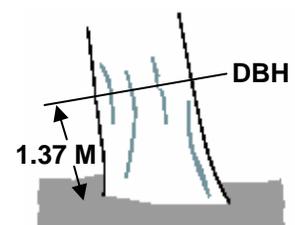


Figure 29. Leaning tree.

7. Turpentine tree: On trees with turpentine face extending above 1.37 M, estimate the diameter at 305 cm above the ground and multiply by 1.1 to estimate DBH outside bark.
8. Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, set the "DIAMETER CHECK" code to 1, and explain the situation in the notes.

9. Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark or at the point of measurement. Record the diameter, to the nearest millimeter, of the wood and bark that is still attached to the tree (Figure 30). If a tree has a localized abnormality (gouge, depression, etc.) at the point of point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 26 and 27).

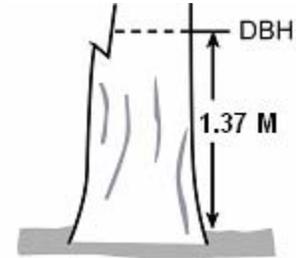


Figure 30. Tree with part of stem missing.

10. Live windthrown tree: Measure from the top of the root collar along the length to 1.37 M (Figure 31).

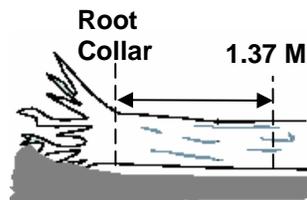


Figure 31. Tree on the ground.

11. Down live tree with tree-form branches growing vertical from main bole. When a down live tree, touching the ground, has vertical (less than 45 degrees from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.
 - If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 32).
 - If the pith intersection of the main down bole and vertical tree-like branch occurs below 1.37 M from the stump along the main bole, treat that branch as a separate tree, and measure DBH 107 cm above the pith intersection for both the main bole and the tree-like branch.

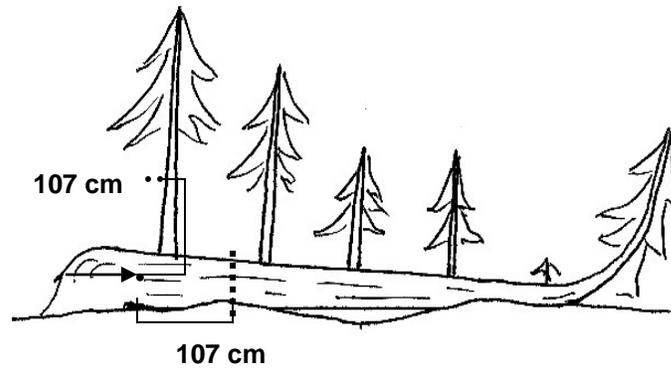


Figure 32. Down tree above duff.

- If the intersection between the main down bole and the tree-like branch occurs beyond the 1.37 M point from the stump along the main bole, treat that branch as part of the main down bole.
- If the pith of main tree bole is below the duff layer, ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 33). However, if the top of the main tree bole curves out of the ground towards a vertical angle, treat that portion of that top as an individual tree originating where the pith leaves the duff layer.

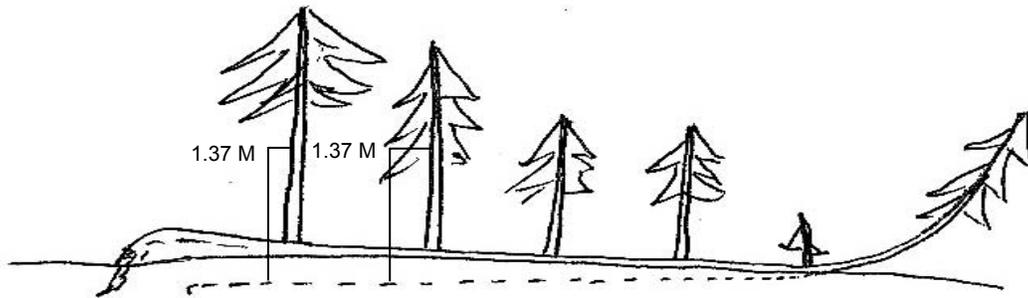
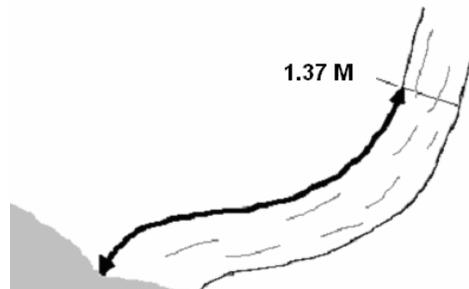


Figure 33. Down tree below duff.

12. Tree with curved bole (pistol butt tree): Measure along the bole on the uphill side (upper surface) of the tree (Figure 34).

Figure 34. Tree with curved bole (pistol butt tree).



- 5.9.3 PREVIOUS DIAMETER AT ROOT COLLAR
- 5.9.4 DIAMETER AT ROOT COLLAR (DRC)
 - 5.9.4.1 DRC STEM DIAMETER
 - 5.9.4.2 DRC STEM STATUS
- 5.10 PAST NUMBER OF STEMS
- 5.11 CURRENT NUMBER OF STEMS

5.12 DIAMETER CHECK

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: When PRESENT DIAMETER > 0

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

Note: If both codes 1 and 2 apply, use code 2.

5.13 ROTTEN/MISSING CULL

Record the percent rotten or missing cubic-foot cull for all live tally trees greater than or equal to 125 millimeters DBH/DRC (CORE), mortality trees with a PREVIOUS DIAMETER \geq 125 millimeters, and all new standing dead tally trees greater than or equal to 125 millimeters DBH/DRC (CORE OPTIONAL) when RECONCILE = 1 - 3.

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 30 cm stump to a 100-millimeter top. Do not include any cull estimate above ACTUAL LENGTH.

For mortality trees with a PREVIOUS DIAMETER \geq 125 millimeters that are NOT at least 152 cm in length or have \geq 50% ROTTEN/MISSING CULL, then record ROTTEN MISSING CULL = 99.

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.
- Metal in tree (e.g., sign, deer stands, fences, etc.).

Cull portions of the tree that contain embedded metal objects (e.g., fencing, nails) and sections between metal objects that are less than 122 cm in length, from the stump to the 100-millimeter top. Embedded aluminum is okay.

When Collected: All live tally trees \geq 125 mm DBH; all mortality trees with a PREVIOUS DIAMETER \geq 125 millimeters; and all PRESENT TREE STATUS = 2 with RECONCILE = 1 - 3

Field width: 2 digits

Tolerance: +/- 10 %

MQO: At least 90% of the time

Values: 00 to 99

5.14 TOTAL LENGTH

Record the TOTAL LENGTH of the tree, to the nearest tenth meter (decimeter) from ground level to the top of the tree. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a missing top (top is broken and completely detached from the tree), estimate what the total length would be if there were no missing top. Forked trees should be treated the same as unforked trees.

When Collected: Phase 2 CORE – SAMPLE KIND 1 and 2: All live tally trees \geq 125 mm DBH/DRC with intact top (not broken)

Field width: 3 digits
 Tolerance: +/- 10 % of true length
 MQO: At least 90% of the time
 Values 015 to 999

5.15 ACTUAL LENGTH

For trees with missing tops (top on live trees is completely detached; top on dead trees is greater than 50 percent detached from the tree). If the top is intact, this item may be omitted. Record the ACTUAL LENGTH of the tree to the nearest 30 cm from ground level to the break. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader (dead or alive) is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk). Forked trees should be treated the same as unforked trees.

When Collected: Phase 2 CORE - SAMPLE KIND 1 and 2: All live and standing dead tally trees (with broken or missing tops) \geq 125 mm DBH/DRC.

Field width: 3 digits
 Tolerance: +/- 10 % of true length
 MQO: At least 90% of the time
 Values: 015 to 999

5.16 LENGTH METHOD

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

When Collected: When TOTAL and/or ACTUAL LENGTHS are $>$ 0

Field width: 1 digit
 Tolerance: No errors
 MQO: At least 99% 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
- 4 Total is generated by office, actual is measured with an instrument (Standing dead trees with broken tops only)

5.17 CROWN CLASS

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 36). Base the assessment on the position of the crown at the time of observation. Example: a formerly overtopped tree which is now dominant due to tree removal is classified as dominant.

When Collected: All live tally trees \geq 25 mm DBH/DRC on the four subplots and the off-set microplots (PRESENT TREE STATUS = 1)

Field width: 1 digit
 Tolerance: No errors
 MQO: At least 85% of the time
 Values: 1 – 5 (See next page for value descriptions)

- 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 canopy 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, intermediate trees 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.

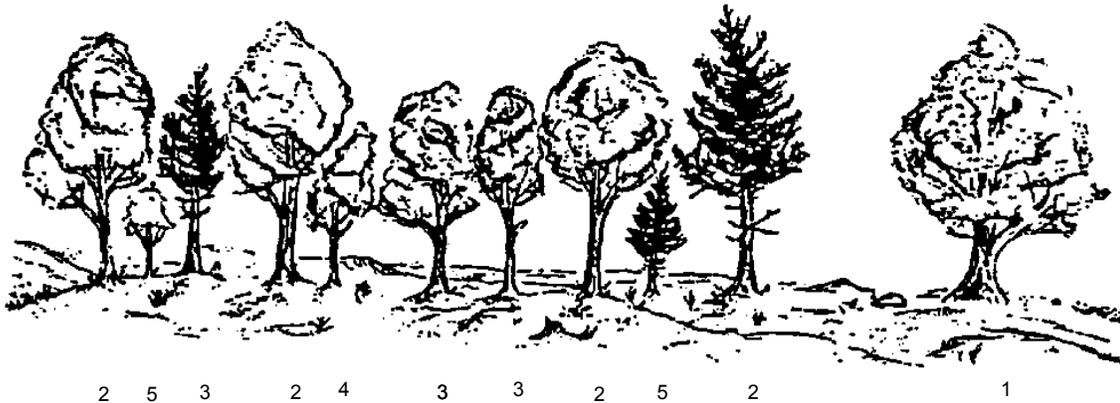


Figure 36. Examples of CROWN CLASS code definitions (numbers are the CROWN CLASS codes).

- 5.18 UNCOMPACTED LIVE CROWN RATIO (Phase 2 – CORE OPTIONAL, Phase 3 – CORE)
Record the UNCOMPACTED LIVE CROWN RATIO to the nearest one percent.
UNCOMPACTED LIVE CROWN RATIO is the percentage of actual tree length supporting live foliage (or in cases of extreme defoliation should be supporting live foliage) that is effectively contributing to tree growth. UNCOMPACTED LIVE CROWN RATIO is determined by the ratio of live crown length to actual tree length (Figure 37). Live crown length is determined from the last live foliage at the crown top (dieback in the upper portion of the crown is not part of the live crown) to the “base of live crown”. Many times there are additional live branches below the “base of live crown”. These branches are only included if they have a basal diameter greater than 25 millimeters and are within 152 cm of the base of the obvious live crown. The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole.

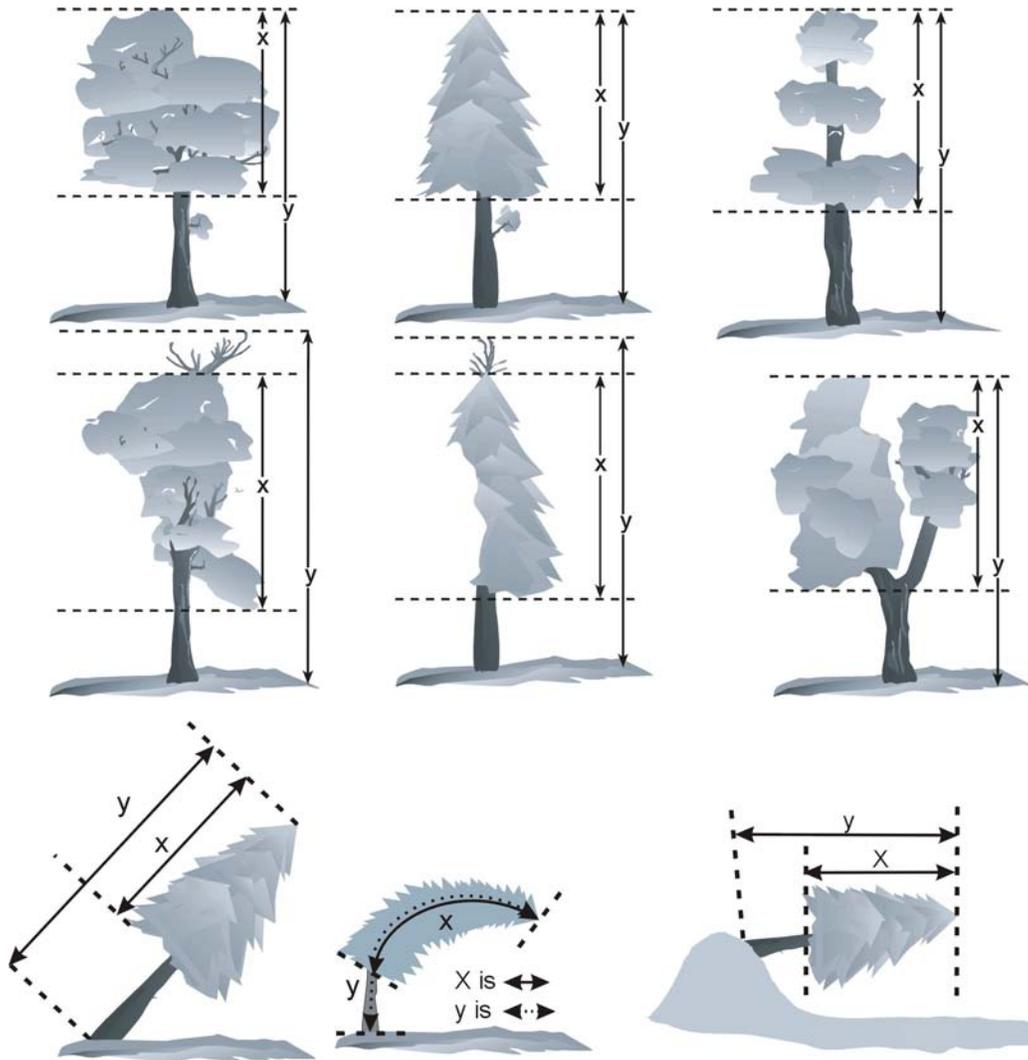


Figure 37. UNCOMPACTED LIVE CROWN RATIO examples.

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by actual tree length. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live twig for saplings. The live crown base for saplings is different from trees 125 millimeters DBH/DRC and larger; the 25-millimeter/152 cm rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 38).

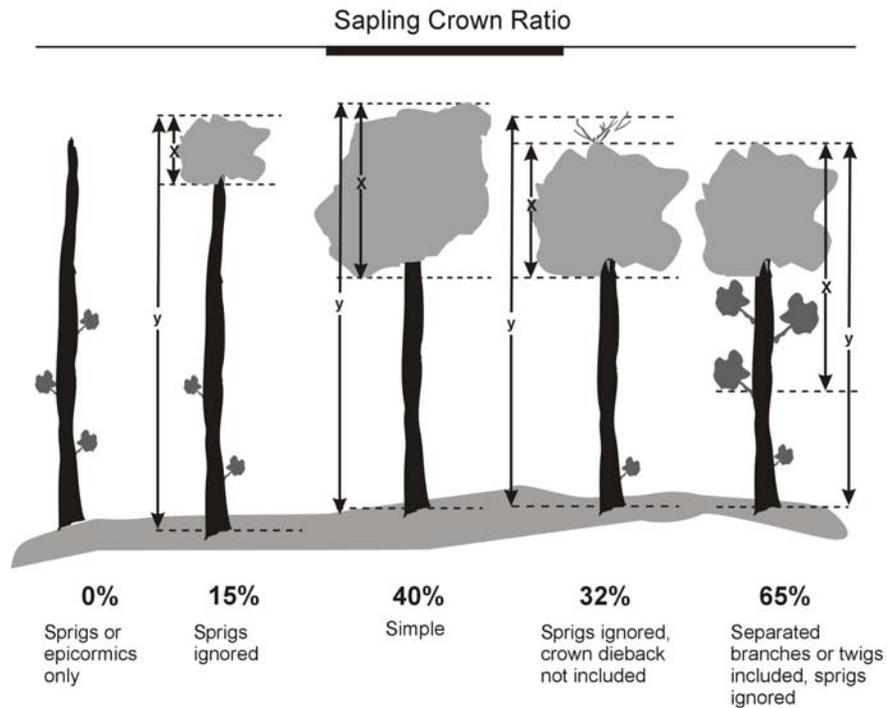


Figure 38. Sapling ratio determination examples.

When collected: Phase 3 plots (CORE) – All live tally trees ≥ 25 mm DBH/DRC
 Field width: 2 digits
 Tolerance: +/- 10%
 MQO: At least 90% of the time
 Values: 00 to 99 percent

5.19 COMPACTED CROWN RATIO

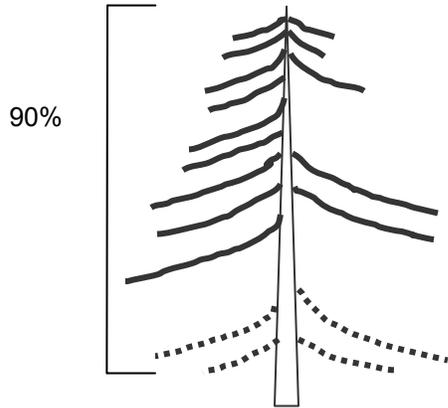
Record the COMPACTED CROWN RATIO for each live tally tree, 25 millimeters and larger, to the nearest one percent. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in the case of extreme defoliation should be supporting live foliage) and is expressed as a percentage of the actual tree length. 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.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 61 cm between whorls, do not compact crowns any tighter than the 61 cm spacing (Figure 39). Figure 40 shows an example of COMPACTED CROWN RATIO on a leaning tree.

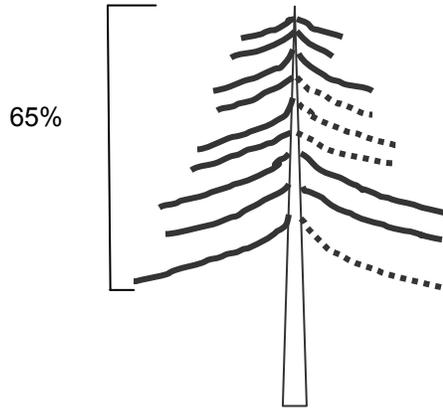
When Collected: All live tally trees ≥ 25 mm DBH/DRC
 Field width: 2 digits
 Tolerance: +/- 10 %
 MQO: At least 80% of the time
 Values: 00 to 99

Open-crown conifer (e.g., ponderosa pine) –

Uncompacted:

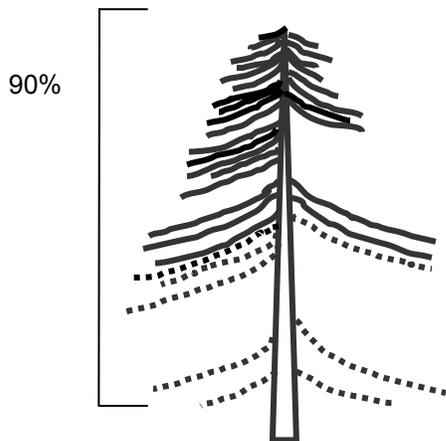


Compacted:



Dense-crown conifer (e.g., subalpine fir) –

Uncompacted:



Compacted:

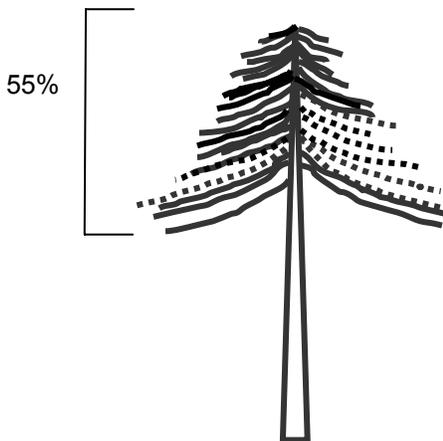


Figure 39. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of conifers.

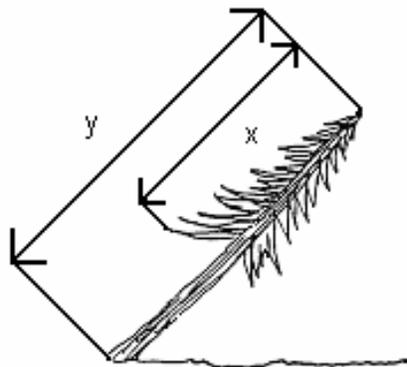


Figure 40. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO = $(x/y)100$.

5.20 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 5.20.3, 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 DAMAGE LOCATION 1-9, or record location code 0 (for no damage).

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.

5.20.1 DAMAGE LOCATION 1 (CORE OPTIONAL)

Record the location on the tree where DAMAGE TYPE 1 is found (Figure 42). If the same damage continues into two or more locations, record the appropriate code, 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 43). 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 25 millimeter or more than 152 cm from the rest of the crown. See Section 5.18 (UNCOMPACTED LIVE CROWN RATIO) for more details.

When Collected: CORE OPTIONAL: All live tally trees \geq 125 mm DBH/DRC
CORE OPTIONAL: All live tally trees \geq 25 mm DBH/DRC

Field width: 1 digit

Tolerance: +/- 1 location class

MQO: At least 80% of the time

Values:

- 0 No damage
- 1 Roots (exposed) and stump (30 cm in height from ground level)
For woodland species only: Since branches often originate below 30 cm, Location 1 should include the roots but stop where the branches originate, if that occurs below the 30 cm stump height. Any damage (open wound, etc.) found on a branch that originates below 30 cm should be given Location 7 (branches).
- 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 (>25 mm 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

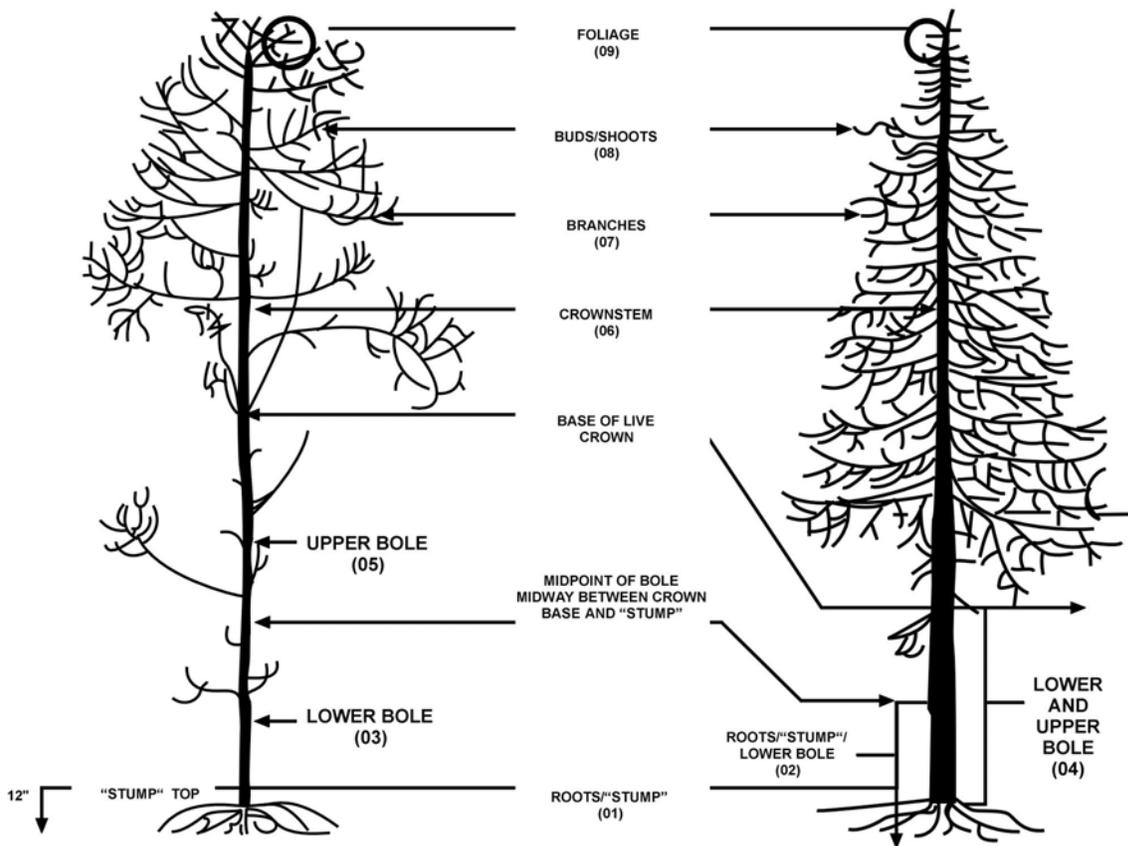


Figure 42. Location codes for damage.

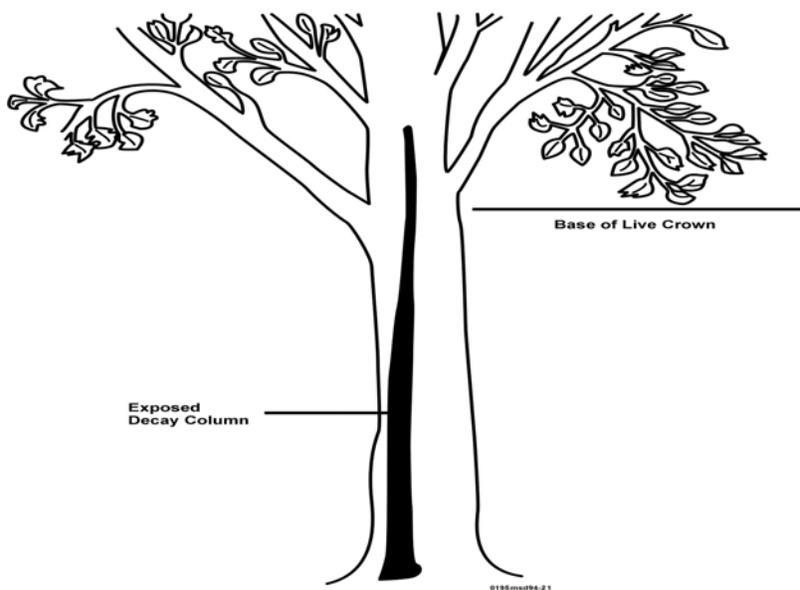


Figure 43. The damage runs from stump to crownstem. Code here should be 02 (roots and "stump" and lower bole) which represents the lowest locations of this multi-location damage.

5.20.2 DAMAGE TYPE 1 (CORE OPTIONAL)

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

Tolerance: No errors

MQO: 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 greater than or equal to 152 cm. 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 91 cm from bole): Broken roots within 91 cm 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 91 cm): Roots beyond 91 cm 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. For woodland species only: Since dead branches often originate below the 30 cm stump height and must be measured for DRC, there is no requirement that damage to branches can only occur to branches that originate within the live crown area.
- 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 the tree notes section. 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 5.20.3, DAMAGE SEVERITY.

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 91 cm from bole -- any occurrence
- 12 Brooms on roots or bole -- any occurrence.
- 13 Broken or dead roots -- exceeds 20% of roots, beyond 91 cm 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 91 cm from bole -- any occurrence
- 12 Brooms on roots or bole - -any occurrence.
- 13 Broken or dead roots -- exceeds 20% of roots, beyond 91 cm 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 91 cm 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 occurrence
- 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, except for woodland species where there is no requirement that damage to branches can only occur to branches that originate 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

5.20.3 DAMAGE SEVERITY 1 (CORE OPTIONAL)

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

Tolerance: +/- 1 valid class unless otherwise defined by the DAMAGE TYPE

MQO: 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 91 cm 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 91 cm, respectively, must be affected, then record in 10% classes. See Figure 44.

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

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

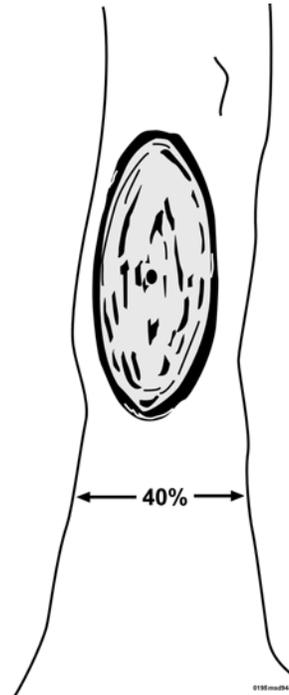


Figure 44. A canker which exceeds threshold. Since 40% of circumference is visible from any side, and since over half the visible side is taken up by the canker, it obviously exceeds the 20% minimum circumference threshold.

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 > 91 cm 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 91 cm 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 91 cm, respectively, must be affected. Then record in 10% classes. See Figure 45.

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

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

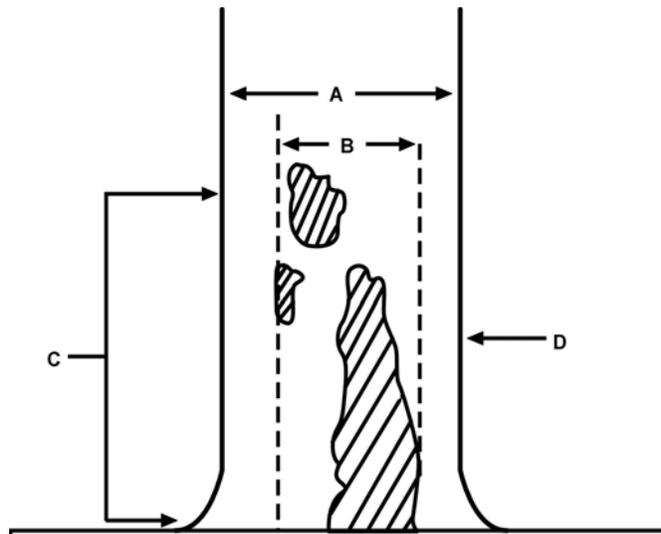


Figure 45. Multiple damage in "stump" and lower bole. A=approximately 40% of tree circumference; B=portion of tree circumference affected by damage; C=vertical distance within one meter; D=midpoint of occurrence at which circumference is measured.

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 91 cm, respectively, must be affected. Then record in 10% classes.

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

<u>Classes</u>	<u>Code</u>
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 greater than or equal to 152 cm

Severity class for code 05 -- Record "0" for the lowest location in which the crack occurs. For location 7 and location 1, 20% of branches and roots beyond 91 cm, respectively, must be affected. Then record in 10% classes.

DAMAGE TYPE Code 11 -- Broken bole or roots less than 91 cm 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 91 cm from bole that are broken or dead.

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

<u>Classes</u>	<u>Code</u>
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):

<u>Classes</u>	<u>Code</u>
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:

<u>Classes</u>	<u>Code</u>
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 (> 25 millimeter 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):

<u>Classes</u>	<u>Code</u>
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):

<u>Classes</u>	<u>Code</u>
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:

<u>Classes</u>	<u>Code</u>
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):

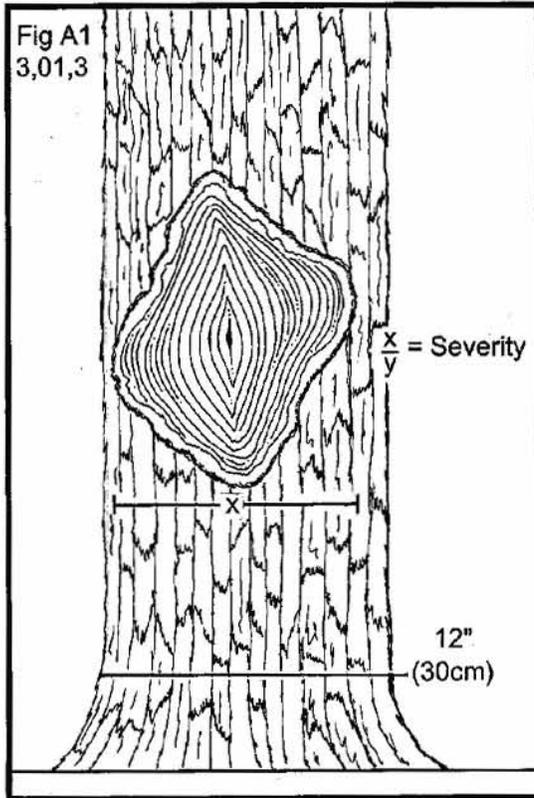
<u>Classes</u>	<u>Code</u>
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 31 -- Other

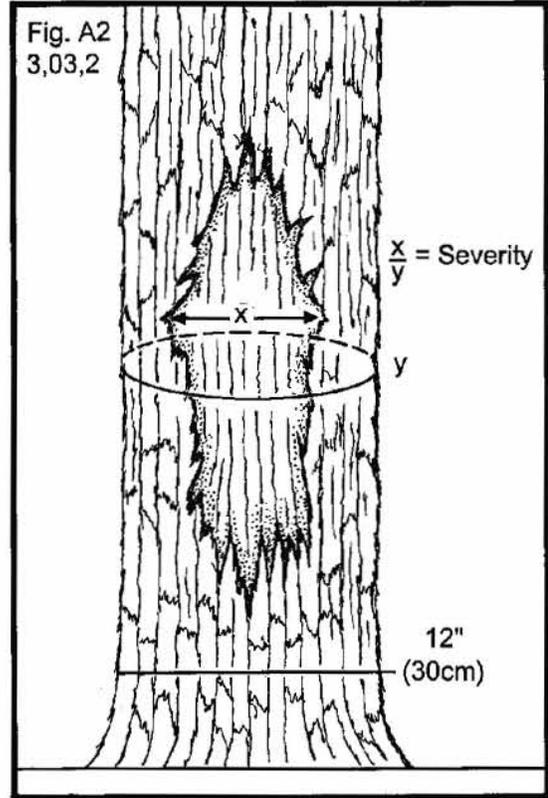
Severity classes for code 31:

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

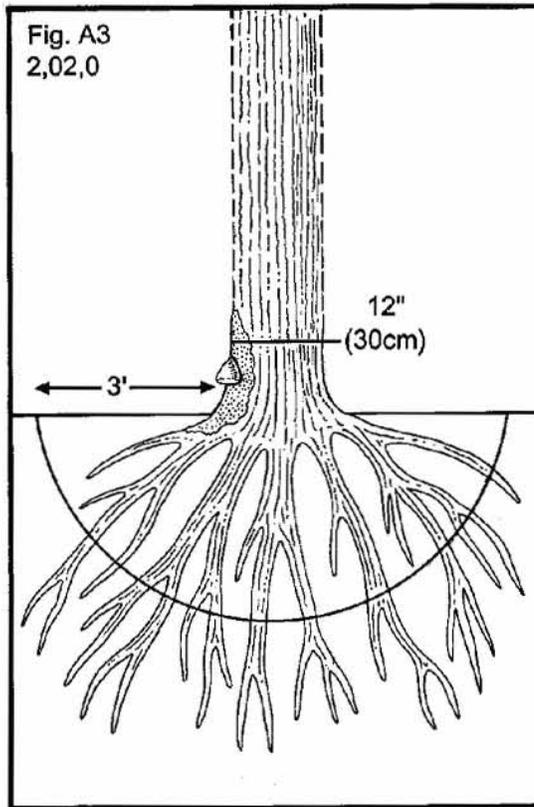
Examples are shown in Figures 46-52.



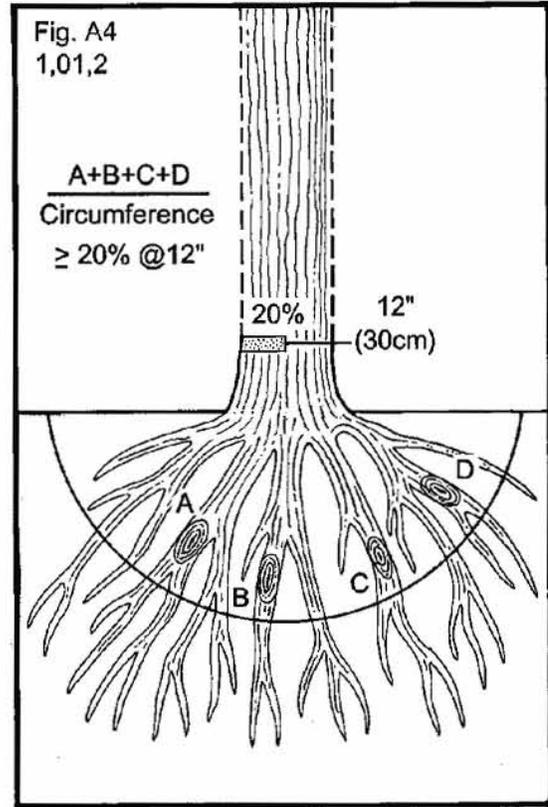
01 - Canker measured as widest distance between the outside of canker swelling (refer to Fig. 2 for y measurement)



03 - Open wound measured at widest point inside of wound margins

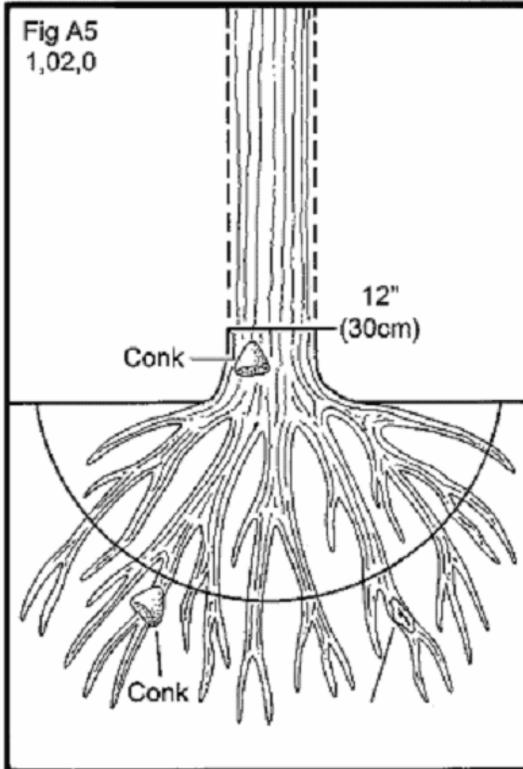


02 - Decay indicator on roots and lower bole

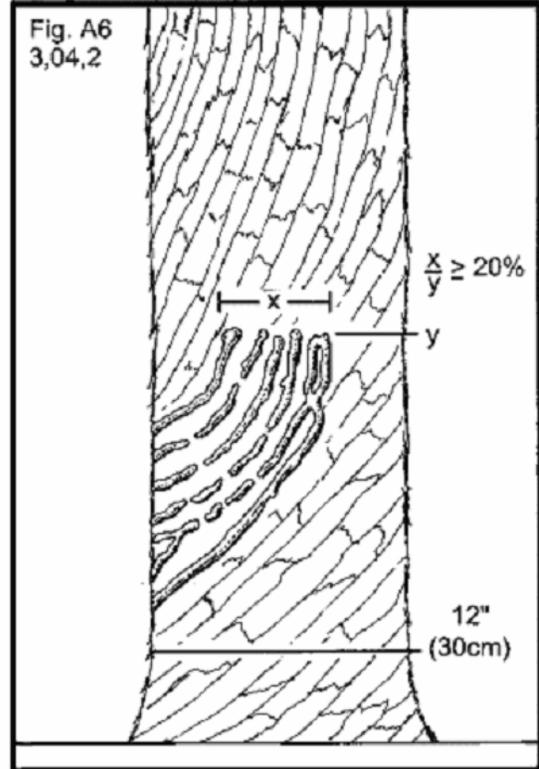


01 - Canker/gall on roots (within 91 cm of bole)

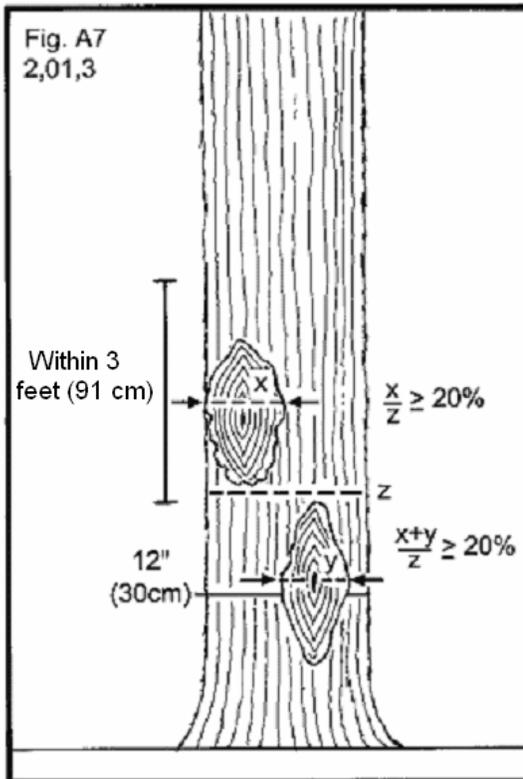
Figure 46. Examples of damage coding.



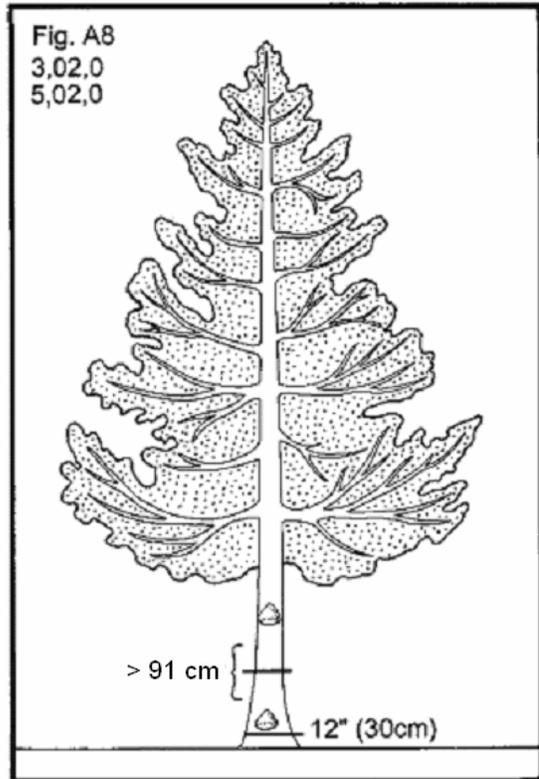
01 - Indicator of decay within 91 cm of bole. Beyond 91 cm of bole, indicators must affect $\geq 20\%$ of roots (see Fig. 12)



04 - Origin of resinosis in lower bole

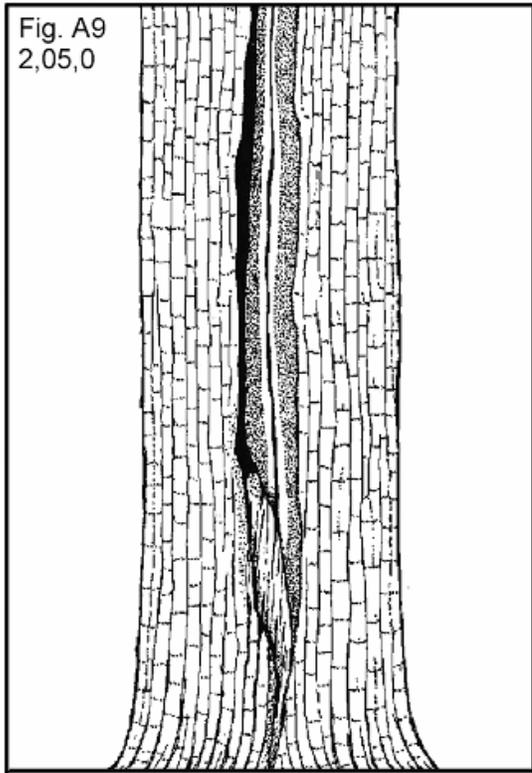


01 - Additive cankers within 91 cm in root and lower bole

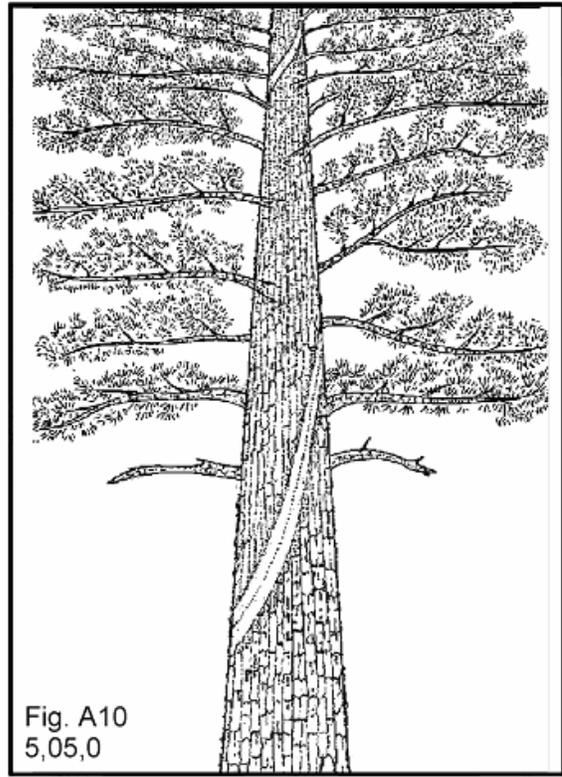


02 - Conks separated by >91 cm; 2 damages

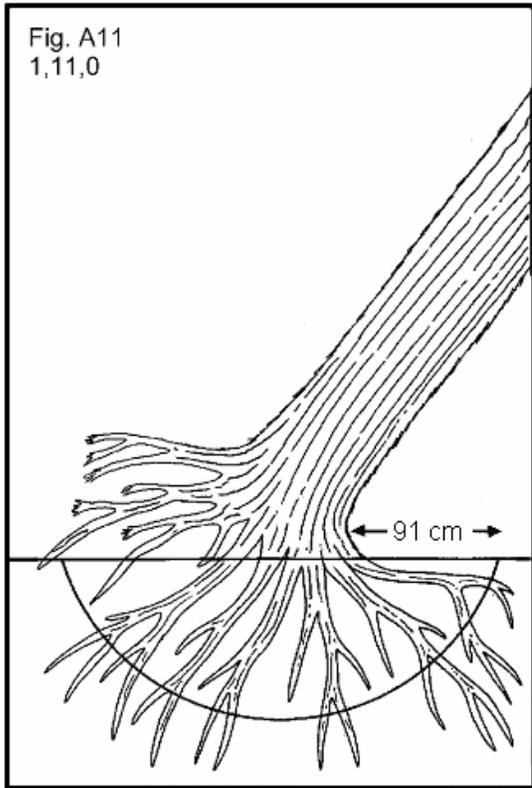
Figure 47. Examples of damage coding.



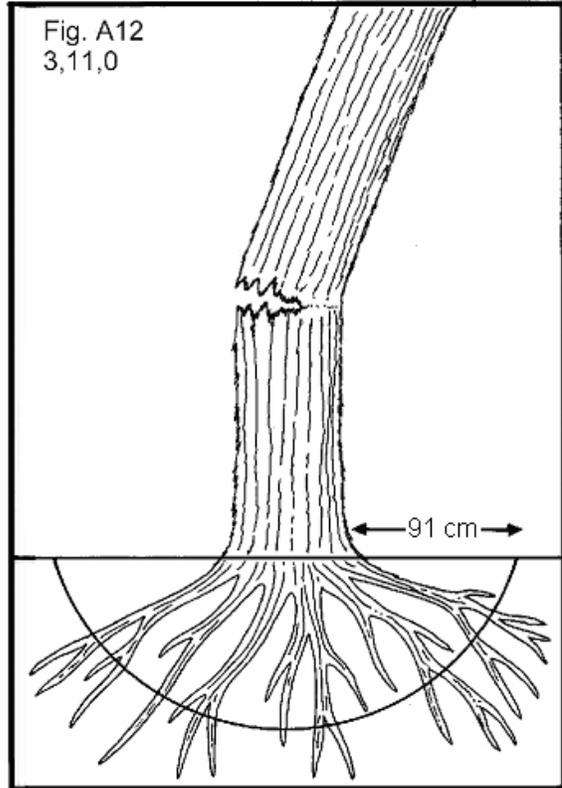
05 - Cracks and seams



05 - Lightning strike

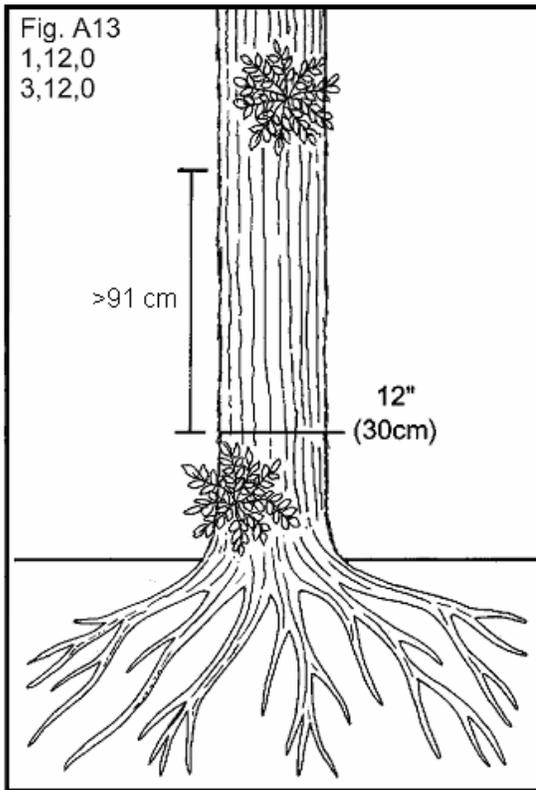


11 - Broken bole or roots <91 cm from bole,
broken roots must be visible

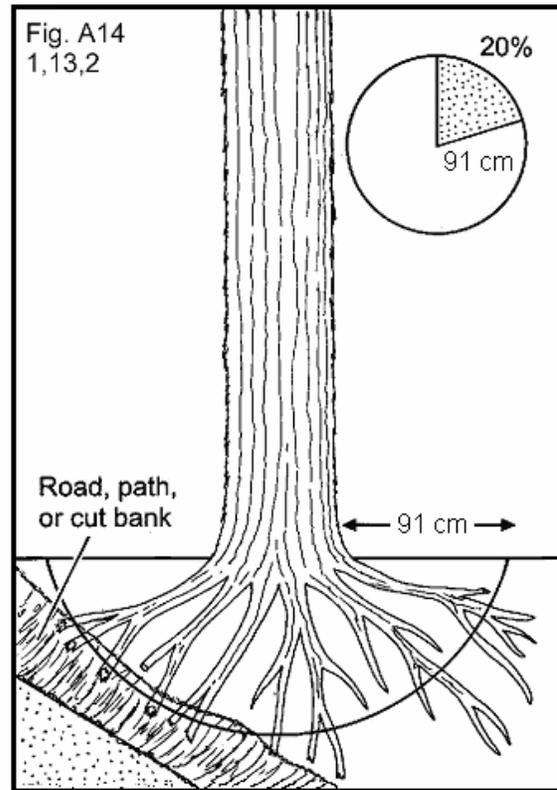


11 - Broken bole or roots <91 cm from bole

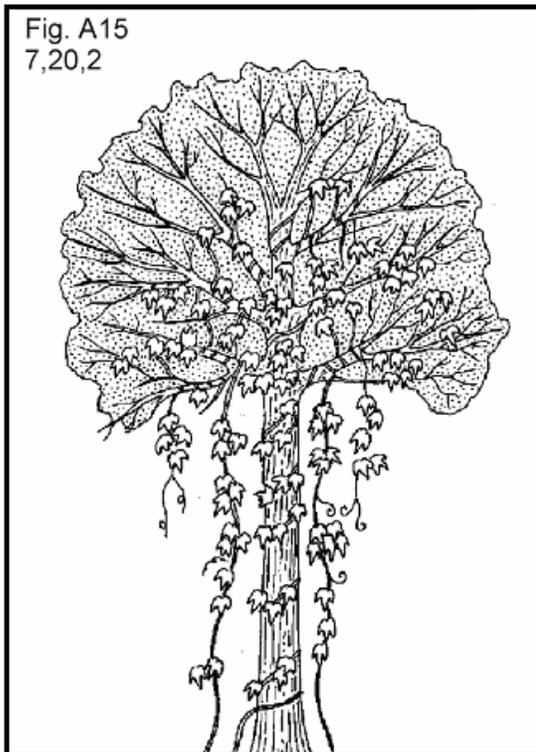
Figure 48. Examples of damage coding.



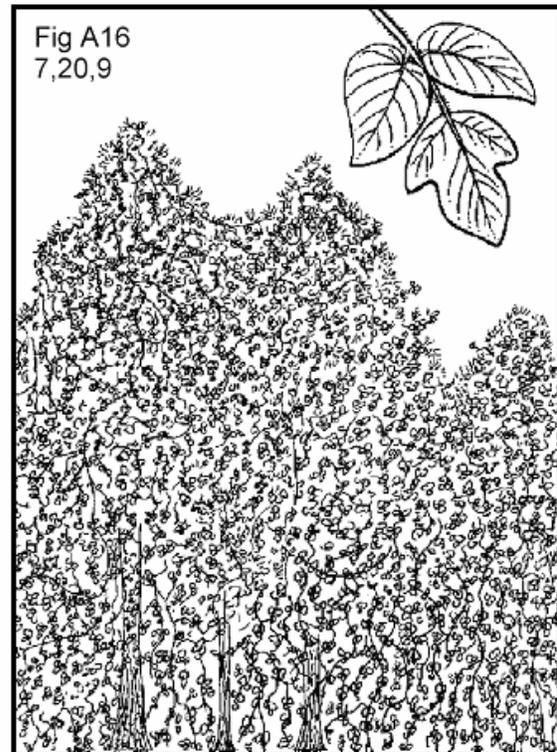
12 - Brooms on roots or bole



13 - Broken or dead roots >91 cm from bole

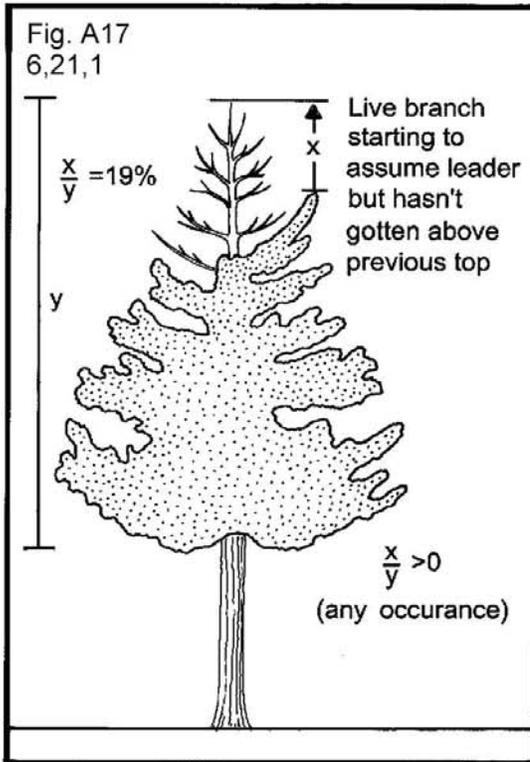


20 - Vines in crown

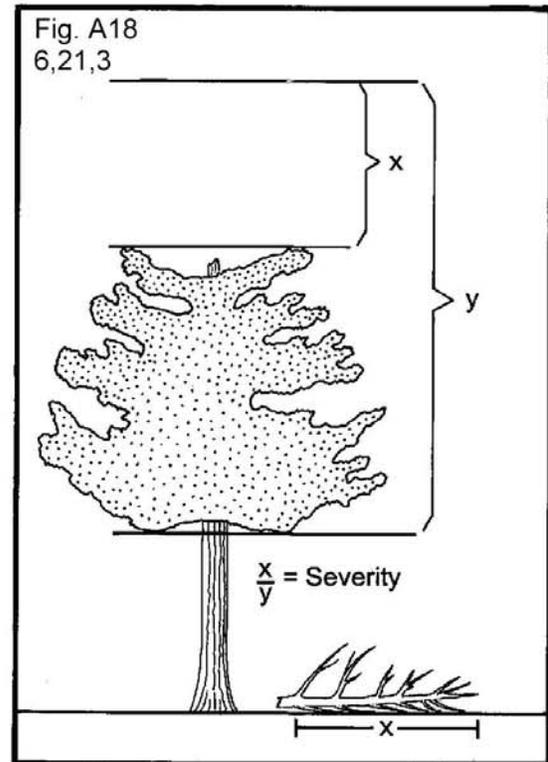


20 - Vines in crown

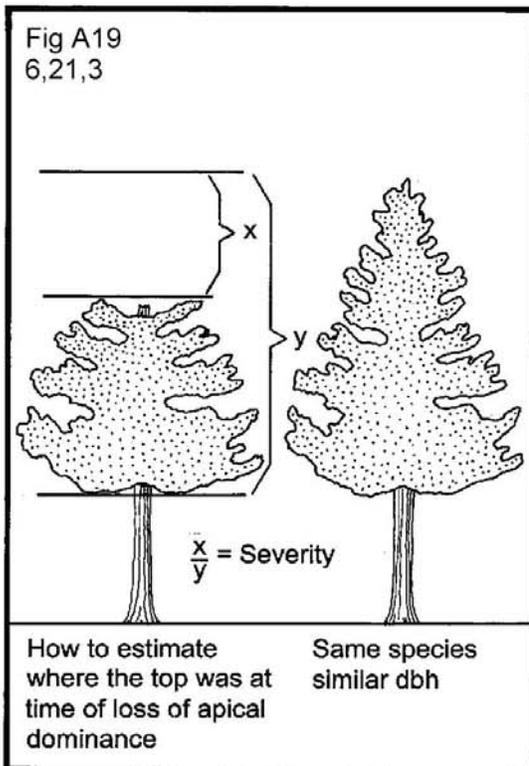
Figure 49. Examples of damage coding.



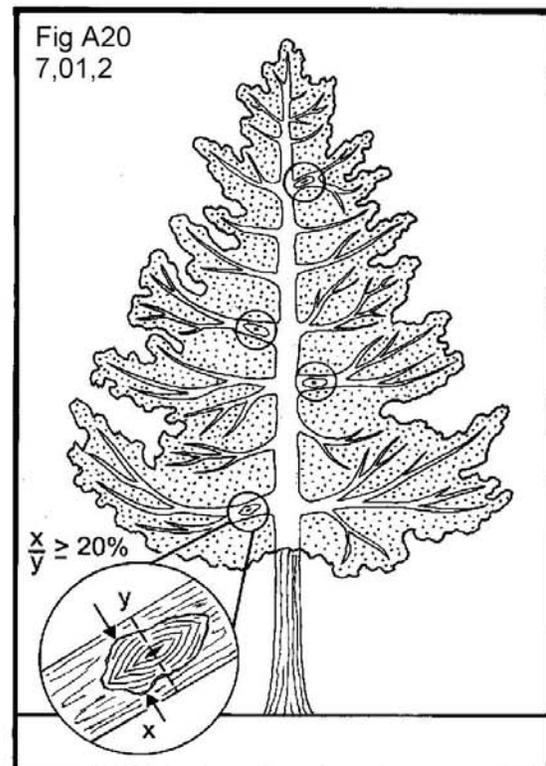
21 - Loss of apical dominance



21 - Loss of apical dominance, look for old top to estimate the top of x and y

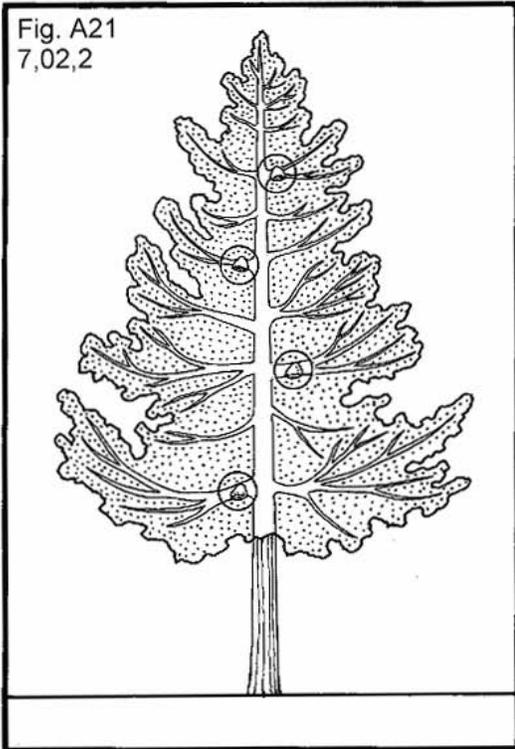


21 - Loss of apical dominance, look for same species of similar dbh

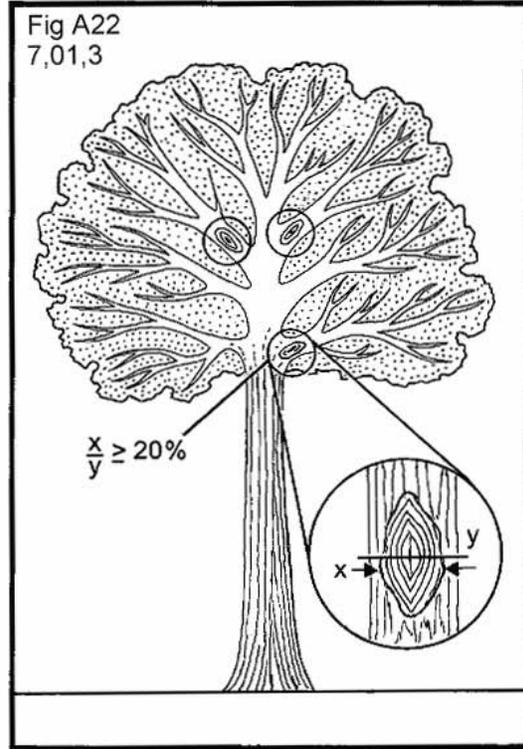


01 - Cankers above the threshold on $\geq 20\%$ of branches

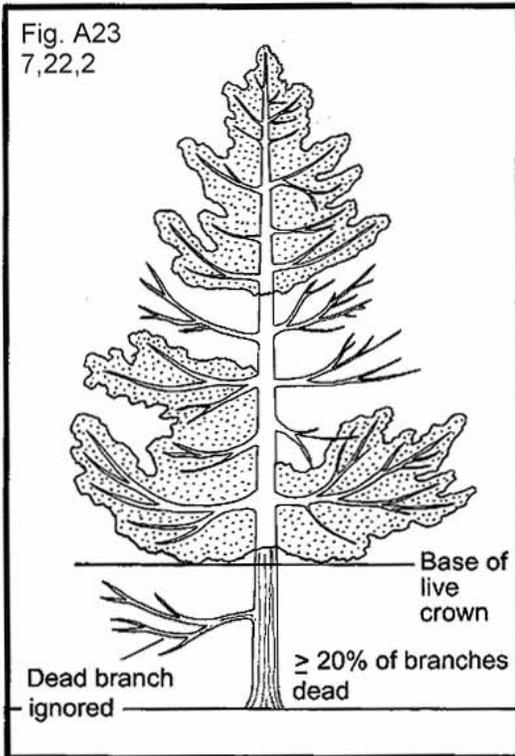
Figure 50. Examples of damage coding.



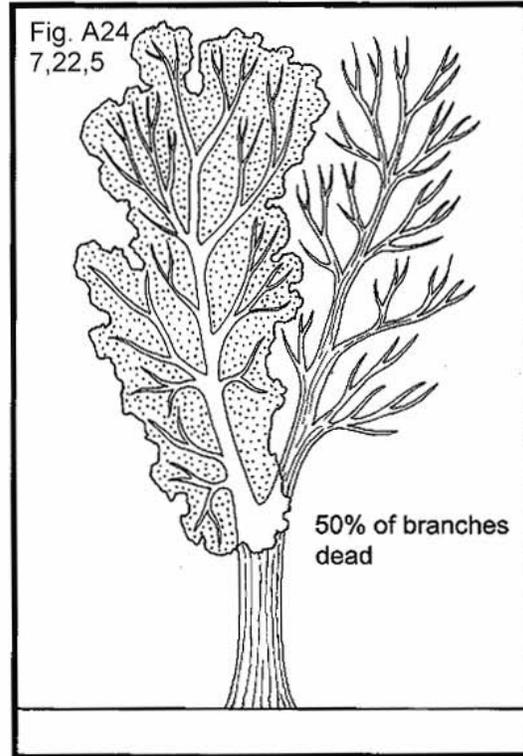
02 - Conks on $\geq 20\%$ of branches



01 - Cankers above threshold on $\geq 20\%$ of branches

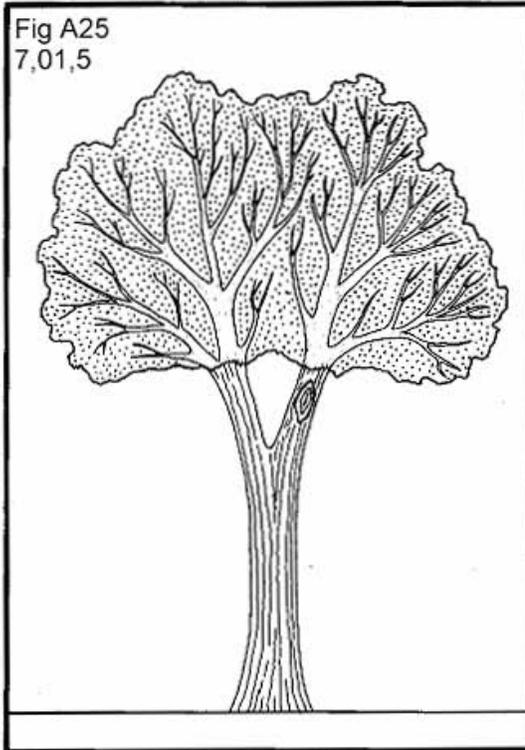


22 - Dead branches within the live crown area. If branches cannot easily be counted, estimate % area of live crown affected

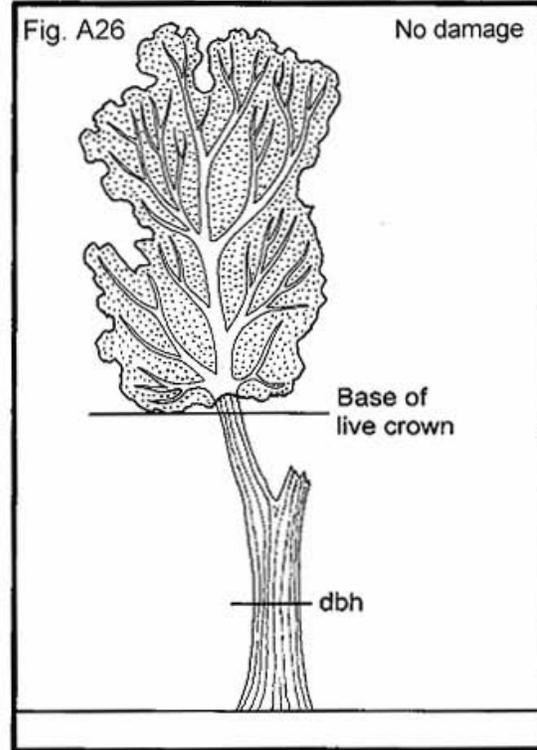


22 - Dead branches; only 2 branches present within live crown area, fines present and $\geq 20\%$ of branch dead

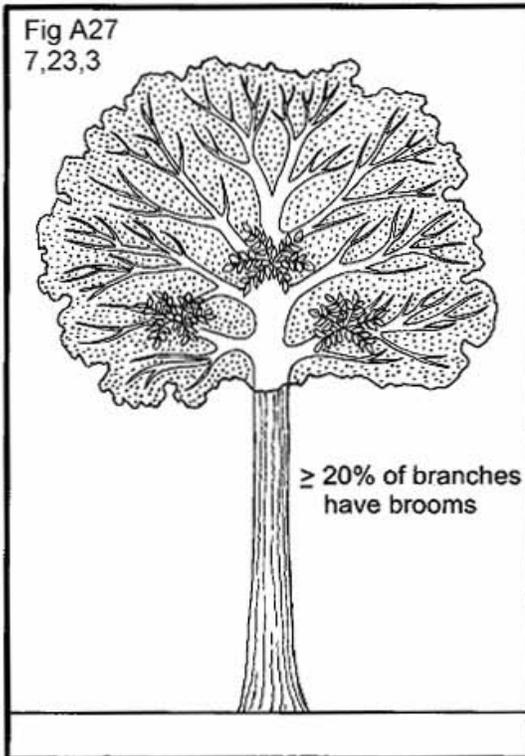
Figure 51. Examples of damage coding.



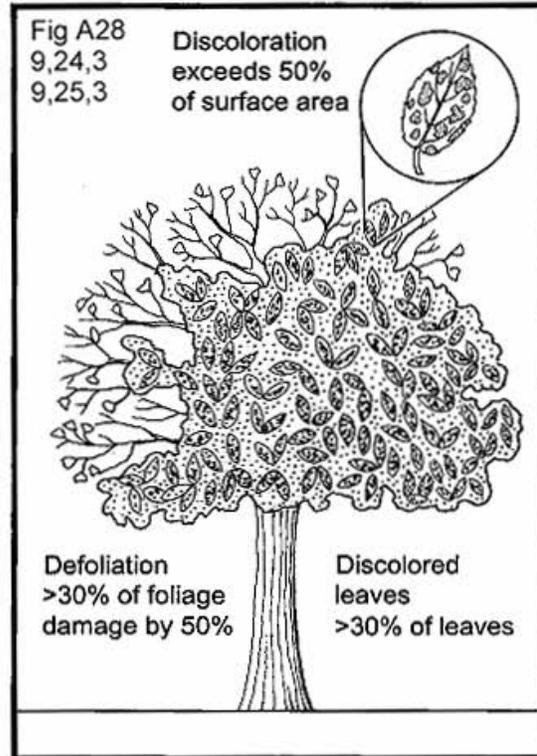
01 - Canker; no crown stem and only 2 branches present



No damage - base of live crown is above old fork, stub is a snag branch



23 - Excessive branching or brooms in crown



24 - Defoliation, 25 - Discoloration

Figure 52. 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 91 cm 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 91 cm 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 91 cm section (Figure 45).

Procedures to Measure Circumference Affected

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40 percent 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 91 cm section exceeds 1/2 of any face, then the 20 percent minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10 percent 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.

5.20.4 DAMAGE LOCATION 2 (CORE OPTIONAL)

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

5.20.5 DAMAGE TYPE 2 (CORE OPTIONAL)

Record the second damage type observed that meets the damage threshold definition in the lowest location. Follow the same procedures as for DAMAGE TYPE 1.

5.20.6 DAMAGE SEVERITY 2 (CORE OPTIONAL)

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.

5.21 CAUSE OF DEATH

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/other.

When Collected: CORE: SAMPLE KIND = 2 plots: all PREVIOUS TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 80% of the time

Values:

- 10 Insect
- 20 Disease
- 30 Fire
- 40 Animal
- 50 Weather
- 60 Vegetation (suppression, competition, vines/kudzu)
- 70 Unknown/not sure/other - includes death from human activity not related to silvicultural or landclearing activity (accidental, random, etc.). TREE NOTES required.
- 80 Silvicultural or landclearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to landclearing activity)
- 81 Live tree in a landclearing
- 82 Dead tree in a landclearing
- 83 Utilized tree in a landclearing

5.22 MORTALITY YEAR (CORE OPTIONAL)

Record the estimated year that remeasured trees died or were cut. For each remeasured tree that has died or been cut since the previous inventory, record the 4-digit year in which the tree died. Mortality year is also recorded for trees on land that has been converted to a nonforest land use, if it can be determined that a tree died before the land was converted. Record the year the tree was converted to a nonforest land use or the year the tree was cut or died, whichever was first.

When Collected: When CAUSE OF DEATH > 0

Field width: 4 digits

Tolerance: +/- 1 year for remeasurement cycles of 5 years

+/- 2 years for remeasurement cycles of > 5 years

MQO: At least 70% of the time

Values: 1995 or higher

5.23 DECAY CLASS

Record for each standing dead tally tree, 125 millimeters in diameter and larger, the code indicating the tree's stage of decay.

When Collected: All standing dead tally trees \geq 125 mm DBH/DRC on the four subplots

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 90% of the time

Values: Use the following table for guidelines:

Decay class 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.

- 5.24 LENGTH TO DIAMETER MEASUREMENT POINT (CORE OPTIONAL)
Record this item when tree diameter measurement locations are not monumented. For those trees measured directly at 1.37 M above the ground, leave this item blank. If the diameter is not measured at 1.37 M, record the actual length from the ground, to the nearest tenth meter (decimeter), at which the diameter was measured for each tally tree, 25 millimeter DBH and larger. Leave this item blank for western woodland species measured for diameter at root collar.

When Collected: When PRESENT DIAMETER > 0

Field width: 3 digits

Tolerance: +/- 6 cm

MQO: At least 90% of the time

Values: 003 – 457

- 5.25 ROUGH CULL (CORE OPTIONAL)
5.26 MISTLETOE CLASS (CORE OPTIONAL)

5.27 TREE NOTES

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

When collected: All trees

Field width: Alphanumeric character field

Tolerance: N/A

MQO: N/A

Values: English language words, phrases and numbers

5.28 ENTRY NUMBER

The entry number is pre-printed on tally sheets and is automatically created in Data Recorder.

When collected: All tally trees and entries to label no tally on subplot

Field width: 3 digits

Tolerance: no errors

MQO: At least 99% of the time

Values: 001 to 999

5.29 ABNORMAL TREE

Record the code that best describes any special characteristics of the tree that affect the diameter. If an abnormal code is necessary, document the occurrence in the tree notes and provide a sketch.

When Collected: All live and dead tally trees

Field width: 1 digit

Values:

- 0 No odd characteristics
- 1 Buttress or butt-swell over 1 M up the bole
- 2 Buttress or butt-swell between 30 cm and 1 M
- 3 Stem forks above DBH – diameter taken below 1.3/1.37 M
- 4 Fluted bole affects dbh
- 5 Reverse taper (upper diameters larger than lower)
- 6 Tree clump – multiple stems prohibit anything more than an estimate for diameters
- 7 Other – describe in notes and sketch

5.30 TREE CLASS

Record the code that indicates the tree class. All palm species are coded TREE CLASS = 3.

When collected: All SAMPLE KINDS: All live tally trees > 25 mm DBH;
SAMPLE KIND = 2 and 8: All TREE STATUS = 2 and RECONCILE = 1-3.

Field width: 1 digit

MQO: at least 90% of the time

Tolerance: no errors

Values: 2 – 4

- 2 Growing stock — Trees with one-third or more of the gross board foot volume in the entire sawlog section with commercial logs meeting grade, soundness, and size requirements or the potential to do so for poletimber-sized trees. A tree class 2 tree must have one 3.66 M log or two 2.44 M logs, now or prospectively, for live poletimber-sized trees to qualify as growing stock.
- 3 Rough cull — Trees that do not contain at least one 3.66 M log or two 2.44 M logs now or prospectively, primarily because of roughness or poor form. Less than 1/3 of its gross board-foot volume meets size, soundness, and grade requirements and less than 1/2 of the cubic-foot cull is rotten or unsound
- 4 Rotten cull — Trees that do not contain at least one 3.66 M log or two 2.44 M logs now or prospectively and/or do not meet grade specifications for percent sound primarily because of rot. All species not having 1/3 or more of its gross board-foot volume meeting size, soundness, and grade requirements, and over 1/2 of the cubic-foot cull is rotten or unsound.

5.31 FUSIFORM/COMANDRA RUST/ HARDWOOD DIEBACK INCIDENCE

Record the incidence of fusiform, comandra rust and dieback.

When collected: All live hardwoods and SPECIES = 111, 131 on the four subplots when DBH is > 125

Field width: 1 digit

Tolerance: No errors

MQO: At least 80% of the time

Values:

<u>Code</u>	<u>Agent</u>	<u>Description/Threshold</u>
0	None	
1	Fusiform, Comandra Rust	SPECIES 111, 131 ONLY: Record only those cankers that occur on the main stem or on a live branch within 30 cms of the stem. Many older galls appear as cankers with sunken rotten centers encircled by callus ridges. Witch's broom is common at galls. Masses of yellow-orange spores in the spring on the galls and canker margins.
2	Dieback	HARDWOODS ONLY: Record if 10% or more of the crown area is affected. Do not code for overtopped trees. Branches dieback from the tips. Just a few branches are affected at first with whole branches dying in the advanced stages. Frequently associated with stress caused by unfavorable environment, especially drought.

5.32 DIEBACK SEVERITY

Record the severity of hardwood crown dieback.

When collected: HARDWOOD Dieback Incidence = 2

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 80% of the time

Values: 1 to 9

<u>Code</u>	<u>Class in percent</u>	<u>Code</u>	<u>Class in percent</u>	<u>Code</u>	<u>Class in percent</u>
1	10-19	4	40-49	7	70-79
2	20-29	5	50-59	8	80-89
3	30-39	6	60-69	9	90-99

5.33 UTILIZATION CLASS

Record the code to identify the utilization class of utilized trees. The default code on data recorder = 1.

When collected: PRESENT TREE STATUS, OLD MICROPLOT STATUS or PRISM TREE STATUS = 3; or CAUSE OF DEATH = 83

Field width: 1 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Commercial utilization – some portion of the tree removed for commercial purposes. Commercial uses include sawlogs, pulpwood, veneer logs, poles, and other products such as firewood cut by commercial firewood operations.
- 2 Non-commercial utilization – some portion of the tree removed for non-commercial purposes. Non-commercial uses include domestic firewood use, barn poles, fence posts, domestic landscaping, rough slabs, etc.

6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting live seedlings within the 207 cm radius microplot located 90 degrees and 3.66 M from each subplot center within each of the four subplots. Conifer seedlings must be at least 15 cm in length and less than 125 mm at DBH/DRC in order to qualify for tallying, except longleaf pine, which must be 13 mm at the root collar. Hardwood seedlings must be at least 30 cm in length and less than 125 mm at DBH/DRC in order to qualify for tallying. For western woodland species, each stem on a single tree must be less than 125 mm in DRC. Seedlings are counted in groups by species and condition class, up to five individuals per species. Counts beyond five estimated. Only count seedlings occurring in accessible forest land condition classes.

6.1 SUBPLOT NUMBER

Use the procedures outlined in Section 3.1.

When Collected: All counts of seedlings

6.2 SPECIES

Use the procedures outlined in Section 5.8.

When Collected: All counts of seedlings

Field width: 4 digits

Tolerance: No errors for genus, no errors for species

MQO: At least 90% of the time for genus, at least 85% of the time for species

Values: See Appendix 3

6.3 CONDITION CLASS NUMBER

Use the procedures outlined in Section 2.0.

When Collected: All counts of seedlings

6.4 SEEDLING COUNT

On each microplot, record the number of live tally tree seedlings, by species and condition class. Count up to five individuals by species: estimate the total count if there are more than five individuals of any given species in any given condition class. When seedlings are distributed evenly on a microplot, a suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiply by four (given that there is only one condition class on the microplot). Repeat for each species. Conifer seedlings must be at least 15 cm in length and less than 125 mm at DBH to qualify for counting, except longleaf pine, which must be 13 mm at the root collar. Hardwood seedlings must be at least 30 cm in length and less than 125 mm at DBH in order to qualify for counting.

For western woodland species, each stem on a single tree must be less than 125 mm at DRC.

Multiple "suckers" that originate from the same location, and stump sprouts are considered one seedling. Do not tally or count "layers" (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Do not tally any seedlings that sprout from a live tally tree.

When Collected: Each accessible forest land condition class on each microplot

Field width: 3 digits

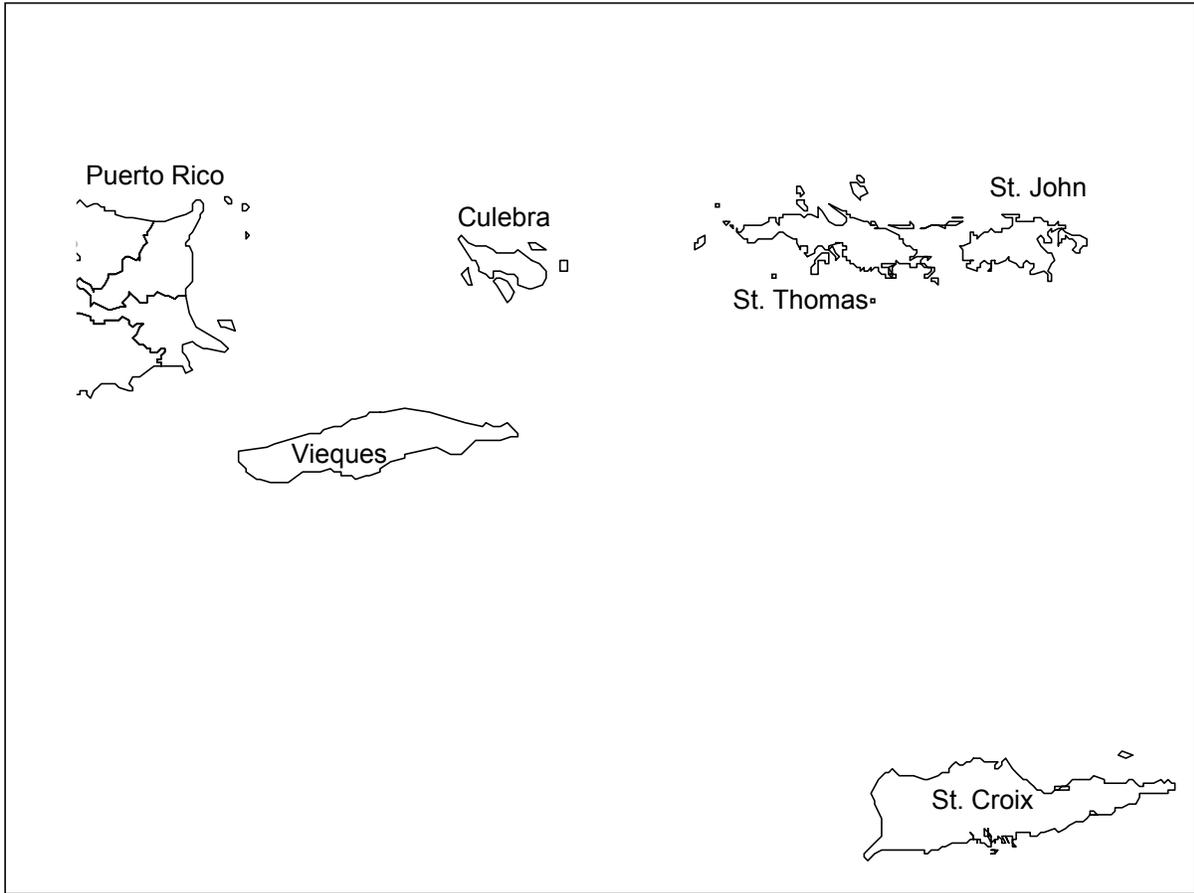
Tolerance: No errors for 5 or less per species; +/- 20% over a count of 5

MQO: At least 90% of the time

Values: 001 through 999

Appendix 1. State and County, Parish, or Borough FIPS Codes

(72) Puerto Rico	(055) Guanica	(113) Ponce
(001) Adjuntas	(057) Guayama	(115) Quebradillas
(003) Aguada	(059) Guayanilla	(117) Rincon
(005) Aguadilla	(061) Guaynabo	(119) Rio Grande
(007) Aguas Buenas	(063) Gurabo	(121) Sabana Grande
(009) Aibonito	(065) Hatillo	(123) Salinas
(011) Anasco	(067) Hormigueros	(125) San German
(013) Arecibo	(069) Humacao	(127) San Juan
(015) Arroyo	(071) Isabela Municipio	(129) San Lorenzo
(017) Barceloneta	(073) Jayuya	(131) San Sebastian
(019) Barranquitas	(075) Juana Diaz	(133) Santa Isabel
(021) Bayamon	(077) Juncos	(135) Toa Alta
(023) Cabo Rojo	(079) Lajas	(137) Toa Baja
(025) Caguas	(081) Lares	(139) Trujillo Alto
(027) Camuy	(083) Las Marias	(141) Utuado
(029) Canovanas	(085) Las Piedras	(143) Vega Alta
(031) Carolina	(087) Loiza	(145) Vega Baja
(033) Catano	(089) Luquillo	(147) Vieques
(035) Cayey	(091) Manati	(149) Villalba
(037) Ceiba	(093) Maricao	(151) Yabucoa
(039) Ciales	(095) Maunabo	(153) Yuaco
(041) Cidra	(097) Mayaguez	
(043) Coamo	(099) Moca	(78) U.S. Virgin Islands
(045) Comerio	(101) Morovis	(010) St. Croix Island
(047) Corozal	(103) Naguabo	(020) St. John Island
(049) Culebra	(105) Naranjito	(030) St. Thomas Island
(051) Dorado	(107) Orocovis	
(053) Fajardo	(109) Patillas	
(054) Florida	(111) Penuelas	



Appendix 2. Tree Data

A. Puerto Rico tree species codes by scientific name

0024	<i>Acacia anegadensis</i>	0051	* <i>Anthocephalus chinensis</i>
0003	<i>Acacia farnesiana</i>	0055	<i>Antidesma bunias</i>
0034	<i>Acacia macracantha</i>	0882	<i>Antirhea acutata</i>
1013	<i>Acacia mangium</i>	0884	<i>Antirhea coriacea</i>
0038	<i>Acacia muricata</i>	0065	<i>Antirhea lucida</i>
0041	<i>Acacia nilotica</i>	0052	<i>Antirhea obtusifolia</i>
0063	<i>Acacia suma</i>	0885	<i>Antirhea portoricensis</i>
0064	<i>Acacia tortuosa</i>	0886	<i>Antirhea sintenisii</i>
0005	* <i>Achras zapota</i>	0053	<i>Araucaria angustifolia</i>
0006	<i>Acnistus arborescens</i>	0066	* <i>Araucaria excelsa</i>
0002	<i>Acrocarpus fraxinifolius</i>	0066	<i>Araucaria heterophylla</i>
0008	* <i>Acrocomia aculeata</i>	0498	<i>Ardisia glauciflora</i>
0008	<i>Acrocomia media</i>	0968	<i>Ardisia luquillensis</i>
0822	<i>Adelia ricinella</i>	0054	<i>Ardisia obovata</i>
0010	<i>Adenanthera pavonina</i>	1016	<i>Ardisia solanacea</i>
0001	* <i>Adenoropium multifidum</i>	0056	<i>Artocarpus altilis</i>
0011	<i>Aegiphila martinicensis</i>	0056	* <i>Artocarpus communis</i>
0014	* <i>Aeschrion excelsa</i>	0057	* <i>Artocarpus heterophyllus</i>
0017	<i>Afromosia elata</i>	0057	<i>Artocarpus integrifolius</i>
0013	<i>Agathis australis</i>	0433	<i>Asterandra grandifolia</i>
0015	<i>Agathis robusta</i>	0451	* <i>Ateramnus lucidus</i>
0864	* <i>Agati grandiflora</i>	0639	* <i>Aulomyrcia citrifolia</i>
0016	<i>Aiphanes acanthophylla</i>	0641	* <i>Aulomyrcia leptoclada</i>
0372	* <i>Aklema petiolare</i>	0062	<i>Averrhoa carambola</i>
1014	<i>Albizia adinocephala</i>	0061	<i>Avicennia germinans</i>
0020	<i>Albizia lebbek</i>	0061	* <i>Avicennia nitida</i>
0021	<i>Albizia procera</i>	0016	* <i>Bactris acanthophylla</i>
0023	<i>Alchornea latifolia</i>	0067	* <i>Badiera penaea</i>
0025	<i>Alchorneopsis floribunda</i>	0072	<i>Bambusa vulgaris</i>
0025	* <i>Alchorneopsis portoricensis</i>	0074	<i>Banara portoricensis</i>
1015	<i>Aleurites fordii</i>	0096	<i>Banara vanderbiltii</i>
0022	<i>Aleurites moluccana</i>	0100	<i>Barringtonia asiatica</i>
0026	<i>Allophylus crassinervis</i>	0076	<i>Bauhinia monandra</i>
0027	* <i>Allophylus occidentalis</i>	1017	<i>Bauhinia multinervia</i>
0027	<i>Allophylus racemosus</i>	0102	<i>Bauhinia pauletia</i>
0261	<i>Alsophila bryophila</i>	0113	<i>Bauhinia purpurea</i>
0031	<i>Alstonia scholaris</i>	0077	<i>Bauhinia tomentosa</i>
0746	* <i>Amomis caryophyllata</i>	0069	<i>Bauhinia variegata</i>
0475	* <i>Amomis grisea</i>	0078	<i>Beilschmiedia pendula</i>
0331	<i>Amphitecna latifolia</i>	0071	<i>Berrya cordifolia</i>
0032	<i>Amyris balsamifera</i>	0110	<i>Biancea sappan</i>
0033	<i>Amyris elemifera</i>	0080	<i>Bixa orellana</i>
0036	<i>Anacardium excelsum</i>	0079	<i>Blighia sapida</i>
0035	<i>Anacardium occidentale</i>	0086	<i>Bocconia frutescens</i>
0040	* <i>Anamomis fragrans</i>	0081	<i>Bontia daphnoides</i>
0037	<i>Andira inermis</i>	0085	* <i>Bourreria domingensis</i>
0039	* <i>Andrachne cuneifolia</i>	0084	<i>Bourreria succulenta</i> var. <i>succulenta</i>
0042	<i>Aniba bracteata</i>	1018	<i>Bourreria succulenta</i> var. <i>revoluta</i>
0999	<i>Aniba nilotica</i>	0085	<i>Bourreria virgata</i>
0044	* <i>Anneslea portoricensis</i>	0844	<i>Brassaia actinophylla</i>
0043	<i>Annona cheirimola</i>	0087	<i>Brownea grandiceps</i>
0045	<i>Annona diversifolia</i>	0088	<i>Brunellia comocladifolia</i>
0046	<i>Annona glabra</i>	0089	<i>Brunfelsia americana</i>
0047	<i>Annona montana</i>	0090	<i>Brunfelsia densifolia</i>
0048	<i>Annona muricata</i>	0091	<i>Brunfelsia lactea</i>
0049	<i>Annona reticulata</i>	0393	<i>Brunfelsia portoricensis</i>
0050	<i>Annona squamosa</i>	0092	* <i>Buchenavia capitata</i>
0051	* <i>Anthocephalus cadamba</i>	0092	<i>Buchenavia tetraphylla</i>

0093	<i>Bucida buceras</i>	0146	<i>Carica papaya</i>
0308	* <i>Bumelia bellonis</i>	0148	<i>Casearia aculeata</i>
0310	* <i>Bumelia cubensis</i>	0149	<i>Casearia arborea</i>
0094	* <i>Bumelia krugii</i>	0150	* <i>Casearia bicolor</i>
0095	* <i>Bumelia obovata</i>	0151	<i>Casearia decandra</i>
0309	* <i>Bumelia salicifolia</i>	0152	<i>Casearia guianensis</i>
0097	<i>Bunchosia glandulifera</i>	0153	<i>Casearia sylvestris</i>
0098	<i>Bunchosia glandulosa</i>	0076	* <i>Caspereopsis monandra</i>
0099	<i>Bunchosia nitida</i>	0474	* <i>Cassia alata</i>
0101	<i>Bursera simaruba</i>	0516	* <i>Cassia emarginata</i>
0114	<i>Buxus portoricensis</i>	0155	* <i>Cassia fistula</i>
0115	<i>Buxus vahlii</i>	0154	<i>Cassia glauca</i>
0103	* <i>Byrsonima coriacea</i>	0158	<i>Cassia grandis</i>
0104	<i>Byrsonima crassifolia</i>	0156	* <i>Cassia javanica</i>
1019	* <i>Byrsonima cuneata</i>	0156	* <i>Cassia nodosa</i>
0106	* <i>Byrsonima horneana</i>	1041	* <i>Cassia planisiliqua</i>
0105	<i>Byrsonima lucida</i>	0720	* <i>Cassia polyphylla</i>
1019	<i>Byrsonima ophiticola</i>	0157	* <i>Cassia siamea</i>
0108	<i>Byrsonima spicata</i>	0266	* <i>Cassia spectabilis</i>
0112	<i>Byrsonima wadsworthii</i>	1040	<i>Cassia surattensis</i>
0116	<i>Caesalpinia coriaria</i>	0328	<i>Cassine xylocarpa</i>
0776	<i>Caesalpinia pulcherrima</i>	0160	* <i>Cassipourea alba</i>
0544	<i>Caesalpinia punctata</i>	0161	* <i>Cassipourea elliptica</i>
0110	* <i>Caesalpinia sappan</i>	0161	<i>Cassipourea guianensis</i>
0044	* <i>Calliandra caracasana</i>	0162	<i>Castilla elastica</i>
0044	<i>Calliandra portoricensis</i>	0394	<i>Casuarina cristata</i>
0109	<i>Callicarpa ampla</i>	0163	<i>Casuarina cunninghamiana</i>
0117	<i>Callistemon citrinus</i>	0164	<i>Casuarina equisetifolia</i>
0117	* <i>Callistemon lanceolatus</i>	0165	<i>Casuarina glauca</i>
0111	* <i>Callitris glauca</i>	0394	* <i>Casuarina lepidophloia</i>
0111	<i>Callitris hugelii</i>	0167	<i>Catalpa longissima</i>
0120	* <i>Calocarpum sapota</i>	0166	* <i>Cecropia peltata</i>
0118	<i>Calophyllum antillanum</i>	0166	<i>Cecropia schreberiana</i>
0118	* <i>Calophyllum brasiliense</i>	0169	* <i>Cedrela mexicana</i>
0118	* <i>Calophyllum calaba</i>	0169	<i>Cedrela odorata</i>
0119	<i>Calophyllum inophyllum</i>	0172	<i>Ceiba acuminata</i>
0128	<i>Calotropis procera</i>	0174	<i>Ceiba aesculifolia</i>
0121	* <i>Calycogonium squamulosum</i>	0171	<i>Ceiba pentandra</i>
0123	<i>Calyptranthes krugii</i>	0173	<i>Celtis trinervia</i>
1020	<i>Calyptranthes luquillensis</i>	0175	* <i>Cephalocereus royenii</i>
0122	<i>Calyptranthes pallens</i>	0515	<i>Ceratonia siliqua</i>
0124	<i>Calyptranthes portoricensis</i>	0939	* <i>Cerbera thevetia</i>
0125	<i>Calyptranthes sintenisii</i>	0240	* <i>Cerdana alliodora</i>
0126	<i>Calyptranthes thomasiana</i>	0395	<i>Cestrum laurifolium</i>
0129	<i>Calyptranthes zuzygium</i>	0180	<i>Cestrum macrophyllum</i>
0136	<i>Calyptronoma rivalis</i>	0176	* <i>Chalcas exotica</i>
1037	* <i>Calyptropsidium sintenisii</i>	0548	<i>Chionanthus axilliflorus</i>
0132	* <i>Camphora camphora</i>	0549	<i>Chionanthus compactus</i>
0438	* <i>Cananga blainii</i>	0550	<i>Chionanthus domingensis</i>
0134	* <i>Cananga caribaea</i>	0556	<i>Chionanthus holdridgei</i>
0135	<i>Cananga odorata</i>	0520	<i>Chionanthus ligustrinus</i>
0137	<i>Canella winteriana</i>	1021	<i>Chionanthus milliflorus</i>
0144	<i>Capparis amplissima</i>	0181	<i>Chione venosa</i>
0139	<i>Capparis baducca</i>	0130	<i>Chlorophora excelsa</i>
0140	* <i>Capparis coccolobifolia</i>	0182	<i>Chlorophora tinctoria</i>
0141	<i>Capparis cynophallophora</i>	0268	<i>Chrysalidocarpus lutescens</i>
0142	<i>Capparis flexuosa</i>	0183	<i>Chrysobalanus icaco</i> var <i>icaco</i>
0139	* <i>Capparis frondosa</i>	0184	<i>Chrysobalanus icaco</i> var. <i>pellocarpus</i>
0140	<i>Capparis hastata</i>	0183	* <i>Chrysobalanus pellocarpus</i>
0143	<i>Capparis indica</i>	0186	<i>Chrysophyllum argenteum</i>
0144	* <i>Capparis portoricensis</i>	0188	<i>Chrysophyllum bicolor</i>
0145	<i>Carapa guianensis</i>	0187	<i>Chrysophyllum cainito</i>

0189	<i>Chrysophyllum oliviforme</i>	0229	* <i>Colubrina colubrina</i>
0190	<i>Chrysophyllum pauciflorum</i>	0231	<i>Colubrina elliptica</i>
0178	<i>Chukrasia tabularis</i>	0231	* <i>Colubrina reclinata</i>
0738	* <i>Cicca disticha</i>	0494	<i>Colubrina verrucosa</i>
0132	<i>Cinnamomum camphora</i>	0233	<i>Comocladia dodonaea</i>
0194	<i>Cinnamomum cassia</i>	0234	<i>Comocladia glabra</i>
0735	<i>Cinnamomum elongatum</i>	0236	<i>Conocarpus erectus</i>
0736	<i>Cinnamomum montanum</i>	0651	* <i>Consolea moniliformis</i>
0200	<i>Cinnamomum verum</i>	0693	* <i>Consolea rubescens</i>
0192	<i>Citharexylum caudatum</i>	1023	<i>Copaifera officinalis</i>
0193	<i>Citharexylum fruticosum</i>	0127	<i>Cordia alba</i>
0207	<i>Citharexylum spinosum</i>	0240	<i>Cordia alliodora</i>
0269	<i>Citharexylum tristachyum</i>	0277	* <i>Cordia blancoi</i>
0199	<i>Citrus aurantifolia</i>	0241	<i>Cordia borinquensis</i>
0195	<i>Citrus aurantium</i>	0242	<i>Cordia collococca</i>
0211	* <i>Citrus grandis</i>	0237	* <i>Cordia dentata</i>
0197	<i>Citrus limon</i>	0242	* <i>Cordia glabra</i>
0211	<i>Citrus maxima</i>	0243	<i>Cordia laevigata</i>
0220	<i>Citrus medica</i>	0277	<i>Cordia obliqua</i>
0198	<i>Citrus paradisi</i>	0862	<i>Cordia rickseckeri</i>
0222	<i>Citrus reticulata</i>	0978	<i>Cordia rupicola</i>
0196	<i>Citrus sinensis</i>	0863	<i>Cordia sebestena</i>
0270	<i>Clerodendrum aculeatum</i>	0244	<i>Cordia sulcata</i>
0333	<i>Cleyera albopunctata</i>	0245	<i>Cornutia obovata</i>
0201	<i>Clibadium erosum</i>	0246	<i>Cornutia pyramidata</i>
0202	<i>Clidemia hirta</i>	0278	<i>Couropita guianensis</i>
0271	<i>Clidemia polystachya</i>	0247	<i>Crescentia cujete</i>
1022	<i>Clitoria fairchildiana</i>	0248	<i>Crescentia linearifolia</i>
0204	<i>Clusia clusioides</i>	0396	<i>Crescentia portoricensis</i>
0204	* <i>Clusia grisebachiana</i>	0249	* <i>Critonia portoricensis</i>
0203	<i>Clusia gundlachii</i>	0814	<i>Crossopetalum rhacoma</i>
0204	* <i>Clusia krugiana</i>	0250	<i>Croton astroites</i>
0205	<i>Clusia minor</i>	0251	<i>Croton poecilanthus</i>
0206	<i>Clusia rosea</i>	0252	<i>Croton rigidus</i>
0466	<i>Cnemidaria horrida</i>	0258	<i>Cryptotomeria japonica</i>
0580	<i>Cnidioscolus aconitifolius</i>	0232	<i>Cunninghamia lanceolata</i>
0224	* <i>Coccoloba borinquensis</i>	0254	<i>Cupania americana</i>
0235	<i>Coccoloba costata</i>	0255	<i>Cupania triquetra</i>
0209	<i>Coccoloba diversifolia</i>	0256	<i>Cupressus lusitanica</i>
0212	<i>Coccoloba krugii</i>	0279	<i>Cupressus sempervirens</i>
0214	<i>Coccoloba microstachya</i>	0257	* <i>Curcas curcas</i>
0272	<i>Coccoloba pallida</i>	0521	* <i>Curcas hernandiifolius</i>
0210	<i>Coccoloba pubescens</i>	0465	<i>Cyathea andina</i>
0215	<i>Coccoloba pyrifolia</i>	0259	<i>Cyathea arborea</i>
0216	<i>Coccoloba rugosa</i>	0265	* <i>Cyathea brittoniana</i>
0217	<i>Coccoloba sintenisii</i>	0265	<i>Cyathea furfuracea</i>
0224	<i>Coccoloba swartzii</i>	0028	<i>Cyathea parvula</i>
0218	<i>Coccoloba uvifera</i>	0260	<i>Cyathea portoricensis</i>
0219	<i>Coccoloba venosa</i>	0261	* <i>Cyathea pubescens</i>
0273	<i>Coccothrinax alta</i>	0429	* <i>Cybianthus sintenisii</i>
0276	<i>Coccothrinax argentea</i>	0262	<i>Cynometra portoricensis</i>
0274	* <i>Coccothrinax discreta</i>	0263	<i>Cyrilla racemiflora</i>
0275	* <i>Coccothrinax eggersiana</i>	0291	<i>Dacryodes excelsa</i>
0276	* <i>Coccothrinax sanctae-thomae</i>	0292	<i>Dalbergia sissoo</i>
0223	<i>Cochlospermum vitifolium</i>	0293	<i>Daphnopsis americana</i>
0225	<i>Cocos nucifera</i>	0294	<i>Daphnopsis helleriana</i>
1024	<i>Codiaeum variegatum</i>	0295	<i>Daphnopsis philippiana</i>
0227	<i>Coffea arabica</i>	0297	<i>Delonix regia</i>
0226	<i>Coffea dewevrei</i>	0299	<i>Dendropanax arboreus</i>
0228	<i>Cola acuminata</i>	0300	<i>Dendropanax laurifolius</i>
0228	* <i>Cola vera</i>	1025	<i>Dialium guianensis</i>
0229	<i>Colubrina arborescens</i>	0301	* <i>Didymopanax gleasonii</i>

0302	* <i>Didymopanax morototonii</i>	0377	<i>Eugenia corozalensis</i>
0304	<i>Dillenia indica</i>	0350	<i>Eugenia domingensis</i>
0306	* <i>Diospyros digyna</i>	0357	<i>Eugenia eggersii</i>
0306	<i>Diospyros revoluta</i>	0358	* <i>Eugenia floribunda</i>
0557	<i>Diospyros sintenisii</i>	0354	* <i>Eugenia foetida</i>
0308	* <i>Dipholis bellonis</i>	0040	* <i>Eugenia fragrans</i>
0310	* <i>Dipholis cubensis</i>	0390	<i>Eugenia haematocarpa</i>
0309	* <i>Dipholis salicifolia</i>	0359	<i>Eugenia jambos</i>
0310	* <i>Dipholis sintenisiana</i>	0360	* <i>Eugenia lancea</i>
0312	<i>Ditta myricoides</i>	0361	<i>Eugenia ligustrina</i>
0314	* <i>Dodonaea ehrenbergii</i>	0362	* <i>Eugenia malaccensis</i>
0314	<i>Dodonaea viscosa</i>	0354	<i>Eugenia maleolens</i>
0315	<i>Dovyalis hebecarpa</i>	0363	<i>Eugenia monticola</i>
0311	<i>Dracaena fragrans</i>	0354	* <i>Eugenia myrtoides</i>
0316	* <i>Drepanocarpus lunatus</i>	0364	<i>Eugenia procera</i>
0318	<i>Drypetes alba</i>	0365	<i>Eugenia pseudopsidium</i>
0319	<i>Drypetes glauca</i>	0366	<i>Eugenia rhombea</i>
0320	<i>Drypetes ilicifolia</i>	0367	<i>Eugenia serrasuela</i>
0321	<i>Drypetes lateriflora</i>	0380	<i>Eugenia sessiliflora</i>
0006	* <i>Dunalia arborescens</i>	0368	<i>Eugenia sintenisii</i>
0323	<i>Duranta erecta</i>	0369	<i>Eugenia stahlia</i>
0323	* <i>Duranta repens</i>	0370	<i>Eugenia stewardsonii</i>
0328	* <i>Elaeodendron xylocarpum</i>	0381	<i>Eugenia underwoodii</i>
0101	* <i>Elaphrium simaruba</i>	0386	<i>Eugenia uniflora</i>
0331	* <i>Engallagma latifolia</i>	0375	<i>Eugenia xerophytica</i>
0337	<i>Entandrophragma angolese</i>	0371	<i>Eupatorium polyodon</i>
0334	<i>Enterolobium cyclocarpum</i>	0249	<i>Eupatorium portoricense</i>
0332	<i>Erithalis fruticosa</i>	0388	<i>Euphorbia lactea</i>
0333	* <i>Eroteum albopunctatum</i>	0391	<i>Euphorbia neriifolia</i>
0376	<i>Erythrina berteriana</i>	0372	<i>Euphorbia petiolaris</i>
0317	<i>Erythrina corallodendron</i>	0392	<i>Euphorbia tirucalli</i>
0324	<i>Erythrina crista-galli</i>	0373	<i>Euphorbia longana</i>
0325	<i>Erythrina eggersii</i>	0374	* <i>Euterpe globosa</i>
0335	<i>Erythrina fusca</i>	0382	<i>Exostema caribaeum</i>
0335	* <i>Erythrina glauca</i>	0383	<i>Exostema ellipticum</i>
0325	* <i>Erythrina horrida</i>	0384	<i>Exostema sanctae-luciae</i>
0379	<i>Erythrina poeppigiana</i>	0385	<i>Exothea paniculata</i>
0326	<i>Erythrina variegata</i> var. <i>orientalis</i>	0403	<i>Faramea occidentalis</i>
0338	<i>Erythroxyllum areolatum</i>	0409	<i>Ficus americana</i>
0340	* <i>Erythroxyllum brevipes</i>	0400	<i>Ficus carica</i>
0340	<i>Erythroxyllum rotundifolium</i>	0407	<i>Ficus citrifolia</i>
0341	<i>Erythroxyllum rufum</i>	0405	* <i>Ficus crassinervia</i>
0387	<i>Erythroxyllum urbanii</i>	0404	<i>Ficus drupacea</i>
0344	<i>Eucalyptus bangalore</i>	0406	<i>Ficus elastica</i>
0389	<i>Eucalyptus citriodora</i>	0401	<i>Ficus indica</i>
0307	<i>Eucalyptus deglupta</i>	0407	* <i>Ficus laevigata</i>
0348	<i>Eucalyptus grandis</i>	0402	<i>Ficus lyrata</i>
0342	<i>Eucalyptus kironiana</i>	0408	<i>Ficus microcarpa</i>
0347	<i>Eucalyptus maculata</i>	0404	* <i>Ficus mysorensis</i>
0349	<i>Eucalyptus maideni</i>	0398	<i>Ficus nekbuda</i>
0346	<i>Eucalyptus paniculata</i>	0398	* <i>Ficus nekbudu</i>
0329	<i>Eucalyptus resinifera</i>	0413	<i>Ficus nota</i>
0343	<i>Eucalyptus robusta</i>	0424	<i>Ficus obtusifolia</i>
0345	<i>Eucalyptus saligna</i>	0408	* <i>Ficus retusa</i>
0350	* <i>Eugenia aeruginea</i>	0409	* <i>Ficus sintenisii</i>
0351	<i>Eugenia axillaris</i>	0422	<i>Ficus stahlia</i>
0360	<i>Eugenia biflora</i>	0419	<i>Ficus sycomorus</i>
0352	<i>Eugenia boqueronensis</i>	0405	<i>Ficus trigonata</i>
0353	<i>Eugenia borinquensis</i>	0420	<i>Flacourtia indica</i>
0354	* <i>Eugenia buxifolia</i>	0439	<i>Forestiera eggersiana</i>
0355	<i>Eugenia confusa</i>	0441	<i>Forestiera rhamnifolia</i>
0356	<i>Eugenia cordata</i>	0412	<i>Forestiera segregata</i>

0399	<i>Fortunella margarita</i>	0472	<i>Hernandia sonora</i>
0448	<i>Fraxinus uhdei</i>	0474	* <i>Herpetica alata</i>
0415	<i>Funtumia elastica</i>	0476	<i>Heterotrichum cymosum</i>
0450	<i>Garcinia dulcis</i>	0478	<i>Hibiscus elatus</i>
0823	<i>Garcinia hessii</i>	1026	<i>Hibiscus pernambucensis</i>
0454	<i>Garcinia mangostana</i>	0477	<i>Hibiscus rosa-sinensis</i>
0819	<i>Garcinia portoricensis</i>	0479	<i>Hibiscus tiliaceus</i>
0416	<i>Garcinia tinctoria</i>	0481	<i>Hippomane mancinella</i>
0417	<i>Gaussia attenuata</i>	0484	<i>Hirtella rugosa</i>
0418	<i>Genipa americana</i>	0485	<i>Hirtella triandra</i>
0724	<i>Gesneria pedunculosa</i>	0488	* <i>Homalium leiogynum</i>
0421	<i>Ginoria rohrii</i>	0488	<i>Homalium racemosum</i>
0423	<i>Gliricidia sepium</i>	0490	* <i>Hufelandia pendula</i>
0425	<i>Goetzea elegans</i>	0492	<i>Hura crepitans</i>
0427	<i>Gomidesia lindeniana</i>	0494	* <i>Hybosperma spinosum</i>
0428	<i>Gossypium barbadense</i>	0495	<i>Hyeronima clusioides</i>
0456	<i>Gossypium hirsutum</i> var. <i>punctatum</i>	0496	<i>Hymenaea courbaril</i>
0456	* <i>Gossypium purpurascens</i>	0497	<i>Hypelate trifoliata</i>
0610	* <i>Graffenrieda ottoschulzii</i>	0500	<i>Hyperbaena laurifolia</i>
0429	<i>Grammadenia sintenisii</i>	0070	* <i>Icacorea glauciflora</i>
0430	<i>Grevillea robusta</i>	0054	* <i>Icacorea guadalupensis</i>
0431	<i>Guajacum officinale</i>	0501	* <i>Ichthyomethis piscipula</i>
0432	<i>Guajacum sanctum</i>	0462	<i>Ilex cookii</i>
0948	<i>Guapira discolor</i>	0503	<i>Ilex guianensis</i>
0949	<i>Guapira fragrans</i>	0504	<i>Ilex macfadyenii</i>
0950	<i>Guapira obtusata</i>	0505	<i>Ilex nitida</i>
0435	<i>Guarea glabra</i>	0506	<i>Ilex riedlaei</i>
0436	* <i>Guarea guara</i>	0507	<i>Ilex sideroxyloides</i>
0436	<i>Guarea guidonia</i>	0508	<i>Ilex sintenisii</i>
0435	* <i>Guarea ramiflora</i>	0509	<i>Ilex urbaniana</i>
0436	* <i>Guarea trichilioides</i>	0512	* <i>Inga fagifolia</i>
0438	<i>Guatteria blainii</i>	0511	<i>Inga fastuosa</i>
0134	<i>Guatteria caribaea</i>	0514	* <i>Inga inga</i>
0253	<i>Guazuma ulmifolia</i>	0512	<i>Inga laurina</i>
0442	<i>Guettarda elliptica</i>	0513	<i>Inga quaternata</i>
0443	<i>Guettarda krugii</i>	0510	<i>Inga spectabilis</i>
0444	* <i>Guettarda laevis</i>	0514	<i>Inga vera</i>
0446	<i>Guettarda odorata</i>	0518	<i>Ixora ferrea</i>
0445	<i>Guettarda ovalifolia</i>	0524	<i>Jacaranda mimosifolia</i>
0446	* <i>Guettarda parviflora</i>	0526	* <i>Jacquinia arborea</i>
0397	<i>Guettarda pungens</i>	0526	<i>Jacquinia armillaris</i>
0447	<i>Guettarda scabra</i>	0526	* <i>Jacquinia barbasco</i>
0444	<i>Guettarda valenzuelana</i>	0527	<i>Jacquinia berteroi</i>
0449	<i>Gyminda latifolia</i>	0522	<i>Jacquinia revoluta</i>
0451	<i>Gymnanthes lucida</i>	0464	<i>Jacquinia umbellata</i>
0453	<i>Haematoxylum campechianum</i>	0257	<i>Jatropha curcas</i>
0536	* <i>Haemocharis portoricensis</i>	0521	<i>Jatropha hernandiifolia</i>
0457	* <i>Haenianthus obovatus</i>	0001	<i>Jatropha multifida</i>
0457	* <i>Haenianthus salicifolius</i>	0528	<i>Juglans jamaicensis</i>
0457	<i>Haenianthus salicifolius</i> var. <i>obovatus</i>	0519	<i>Khaya grandifolia</i>
0459	* <i>Hamelia erecta</i>	0529	<i>Khaya nyasica</i>
0459	<i>Hamelia patens</i>	0531	<i>Khaya senegalensis</i>
0460	<i>Hebestigma cubense</i>	0535	<i>Kigelia pinnata</i>
0461	<i>Hedyosmum arborescens</i>	0537	<i>Kleinhovia hospita</i>
0463	<i>Helicteres jamaicensis</i>	0530	<i>Krugiodendron ferreum</i>
0465	* <i>Hemitelia escuquensis</i>	0150	<i>Laetia procera</i>
0466	* <i>Hemitelia wilsonii</i>	0533	<i>Lagerstroemia indica</i>
0468	<i>Henriettea fascicularis</i>	0532	<i>Lagerstroemia speciosa</i>
0469	<i>Henriettea macfadyenii</i>	0534	<i>Laguncularia racemosa</i>
0470	<i>Henriettea membranifolia</i>	0536	<i>Laplacea portoricensis</i>
0121	<i>Henriettea squamulosum</i>	0538	* <i>Laugeria resinosa</i>
0471	<i>Henriettea triflora</i>	0662	* <i>Laurocerasus myrtifolia</i>

0664	*Laurocerasus occidentalis	0584	*Maytenus elliptica
0542	Lawsonia inermis	0585	Maytenus elongata
0652	Leandra krugiana	0584	Maytenus laevigata
0539	*Lemaireocereus hystrix	0586	Maytenus ponceana
0467	Leptocereus quadricostatus	0588	Mecranium amygdalinum
0543	*Leucaena glauca	0589	*Melaleuca leucadendron
0543	Leucaena leucocephala	0589	Melaleuca quinquenervia
0544	*Libidibia punctata	0590	Melia azedarach
0547	Licaria brittoniana	0592	Melicoccus bijugatus
0545	Licaria parvifolia	0594	Meliosma herbertii
0545	*Licaria salicifolia	0595	Meliosma obtusifolia
0546	Licaria triandra	0597	Melochia tomentosa
0517	Ligustrum amurense	0599	*Menendezia biflora
0548	*Linociera axilliflora	0600	*Menendezia stahlii
0549	*Linociera caribaea	0601	*Menendezia urbanii
0550	*Linociera domingensis	0602	Mesua ferrea
0556	*Linociera holdridgei	0603	Metopium toxiferum
0520	*Linociera ligustrina	0609	Miconia affinis
0551	Lonchocarpus domingensis	0605	Miconia foveolata
0552	Lonchocarpus glaucifolius	0606	Miconia impetolaris
0553	Lonchocarpus heptaphyllus	0607	Miconia laevigata
0553	*Lonchocarpus pentaphyllus	0608	Miconia lanata
0785	*Lucuma multiflora	0609	*Miconia microcarpa
0554	Luehea speciosa	0917	Miconia mirabilis
0571	Lunania buchii	0610	Miconia ottoschulzii
0571	*Lunania ekmanii	0611	Miconia pachyphylla
0473	Lunania racemosa	0612	Miconia prasina
0587	Lyonia rubiginosa	0613	Miconia punctata
1027	Lysiloma latisiliqua	0614	Miconia pycnoneura
0557	*Maba sintenisii	0615	Miconia racemosa
0316	Machaerium lunatum	0616	Miconia rubiginosa
0559	Machaonia portoricensis	0918	Miconia serrulata
0167	*Macrocatalpa longissima	0617	Miconia sintenisii
0558	Maesopsis eminii	0618	Miconia subcorymbosa
0561	Magnolia portoricensis	0619	Miconia tetrandra
0562	Magnolia splendens	0620	Miconia thomasiana
0565	Malpighia coccigera	0621	Micropholis chrysophylloides
0567	Malpighia emarginata	0622	*Micropholis curvata
0566	Malpighia fucata	0624	Micropholis garciniifolia
0569	Malpighia infestissima	1028	Mimosa arenosa
0576	Malpighia linearis	0546	*Misanteca triandra
0569	*Malpighia pallens	9998	Miscellaneous/unknown species
0567	*Malpighia puniceifolia	0597	*Moluchia tomentosa
0568	Mammea americana	0627	Monodora tenuifolia
0570	Mangifera indica	0628	*Montezuma grandiflora
0572	Manilkara bidentata	0628	*Montezuma speciosissima
0573	*Manilkara duplicata	0630	Morinda citrifolia
0574	*Manilkara emarginata	0632	*Moringa moringa
0574	Manilkara jaimiqui	0632	Moringa oleifera
0575	*Manilkara nitida	0631	Morisonia americana
0573	Manilkara pleeana	0633	Morus alba
0005	Manilkara zapota	0635	Morus nigra
0577	Mappia racemosa	0636	Mouriri domingensis
0740	Margaritaria nobilis	0629	Mouriri helleri
0660	Marlierea sintenisii	1029	Muntingia calabura
0865	*Mastichodendron foetidissimum	0176	Murraya paniculata
0582	Matayba apetala	0638	*Myrcia berberis
0581	Matayba domingensis	0639	Myrcia citrifolia
0582	*Matayba oppositifolia	0640	Myrcia deflexa
0548	*Mayepea axilliflora	0638	Myrcia fallax
0550	*Mayepea domingensis	0641	Myrcia leptoclada
0591	Maytenus cymosa	0648	Myrcia paganii

0642	<i>Myrcia splendens</i>	0655	<i>Pandanus utilis</i>
0040	<i>Myrcianthes fragrans</i>	0712	* <i>Paralabatia portoricensis</i>
1031	<i>Myrciaria floribunda</i>	0714	<i>Parathesis crenulata</i>
0649	<i>Myrica cerifera</i>	0714	* <i>Parathesis serrulata</i>
0650	<i>Myrica holdridgeana</i>	0479	* <i>Paritium tiliaceum</i>
0643	<i>Myrospermum frutescens</i>	0717	<i>Parkia biglandulosa</i>
1030	<i>Myroxylon balsamum</i>	1033	<i>Parkia timoriana</i>
0647	* <i>Myroxylon schwaneckeanum</i>	0718	<i>Parkinsonia aculeata</i>
0804	<i>Myrsine coriacea</i>	0656	<i>Parmentiera aculeata</i>
0805	<i>Myrsine guianensis</i>	0719	<i>Parmentiera cereifera</i>
0783	* <i>Nageia coriacea</i>	0656	* <i>Parmentiera edulis</i>
0670	* <i>Nectandra antillana</i>	0720	* <i>Peirania polyphylla</i>
0671	* <i>Nectandra coriacea</i>	0722	* <i>Peltophorum ferrugineum</i>
0672	* <i>Nectandra krugii</i>	0722	* <i>Peltophorum inerme</i>
0673	* <i>Nectandra membranacea</i>	0722	<i>Peltophorum pterocarpa</i>
0674	* <i>Nectandra patens</i>	0723	<i>Pentadesma butyracea</i>
0675	* <i>Nectandra sintenisii</i>	0724	* <i>Pentarhaphia albiflora</i>
0677	<i>Neea buxifolia</i>	0730	<i>Pera bumeliifolia</i>
0787	* <i>Neltuma juliflora</i>	0726	<i>Persea americana</i>
0051	<i>Neolamarckia cadamba</i>	0726	* <i>Persea persea</i>
0538	<i>Neolaugeria resinosa</i>	0715	* <i>Persea portoricensis</i>
0260	* <i>Nephelea portoricensis</i>	0715	<i>Persea urbaniana</i>
0679	<i>Nerium oleander</i>	0729	* <i>Petesioides pendula</i>
0680	<i>Ochna mossambicensis</i>	0731	<i>Petitia domingensis</i>
0682	<i>Ochroma lagopus</i>	0634	<i>Phialanthus grandifolius</i>
0682	* <i>Ochroma pyramidale</i>	0784	* <i>Phlebotaenia cowellii</i>
0671	<i>Ocotea coriacea</i>	0735	* <i>Phoebe elongata</i>
0684	* <i>Ocotea cuneata</i>	0736	* <i>Phoebe montana</i>
0685	<i>Ocotea floribunda</i>	0738	<i>Phyllanthus acidus</i>
0686	<i>Ocotea foeniculacea</i>	0039	<i>Phyllanthus cuneifolius</i>
1032	<i>Ocotea globosa</i>	0059	<i>Phyllanthus juglandifolius</i>
0672	<i>Ocotea krugii</i>	0740	* <i>Phyllanthus nobilis</i>
0687	<i>Ocotea leucoxyton</i>	0742	<i>Picramnia pentandra</i>
0673	<i>Ocotea membranacea</i>	0657	* <i>Picrasma antillana</i>
0688	<i>Ocotea moschata</i>	0657	<i>Picrasma excelsa</i>
0684	<i>Ocotea nemodaphne</i>	0744	<i>Pictetia aculeata</i>
0674	<i>Ocotea patens</i>	0658	<i>Pilocarpus racemosus</i>
0689	<i>Ocotea portoricensis</i>	0175	<i>Pilosocereus royenii</i>
0675	<i>Ocotea sintenisii</i>	0437	<i>Pimenta dioica</i>
0690	<i>Ocotea spathulata</i>	0746	* <i>Pimenta racemosa</i>
0691	<i>Ocotea wrightii</i>	0475	<i>Pimenta racemosa</i> var. <i>grisea</i>
0692	<i>Oncoba echinata</i>	0746	<i>Pimenta racemosa</i> var. <i>racemosa</i>
0651	<i>Opuntia moniliformis</i>	0747	<i>Pinus ayacahuite</i>
0693	<i>Opuntia rubescens</i>	1034	<i>Pinus caribaea</i>
0695	<i>Ormosia krugii</i>	0752	<i>Pinus caribaea</i> var. <i>bahamensis</i>
0696	<i>Oroxylum rhodoxylon</i>	1035	<i>Pinus caribaea</i> var. <i>hondurensis</i>
0652	* <i>Ossaea krugiana</i>	0745	<i>Pinus cembroides</i>
0697	<i>Ottoschulzia rhodoxylon</i>	0763	<i>Pinus douglasiana</i>
0653	<i>Ouratea ilicifolia</i>	0753	<i>Pinus echinata</i>
0699	<i>Ouratea littoralis</i>	0704	<i>Pinus elliotii</i>
0654	<i>Ouratea striata</i>	0754	<i>Pinus elliotii</i> var. <i>elliottii</i>
0701	<i>Oxandra lanceolata</i>	0645	<i>Pinus insularis</i>
0702	<i>Oxandra laurifolia</i>	0793	<i>Pinus massoniana</i>
0703	* <i>Padus capuli</i>	0755	<i>Pinus merkusii</i>
0707	<i>Palicourea alpina</i>	0767	<i>Pinus michoacana</i>
0708	* <i>Palicourea barbinervia</i>	0772	<i>Pinus montezumae</i>
0711	* <i>Palicourea crocea</i>	0741	<i>Pinus nelsonii</i>
0711	<i>Palicourea crocea</i> var. <i>crocea</i>	0756	<i>Pinus occidentalis</i>
0710	<i>Palicourea crocea</i> var. <i>riparia</i>	0757	<i>Pinus oocarpa</i>
0709	<i>Palicourea domingensis</i>	0758	<i>Pinus patula</i>
0708	<i>Palicourea guianensis</i>	0694	<i>Pinus pinceana</i>
0710	* <i>Palicourea riparia</i>	0762	<i>Pinus pseudostrobus</i>

0759	<i>Pinus radiata</i>	0663	<i>Psychotria nutans</i>
0760	<i>Pinus strobus</i>	0482	* <i>Psychotria pinularis</i>
0761	<i>Pinus taeda</i>	0795	<i>Psychotria pubescens</i>
0748	<i>Piper aduncum</i>	0796	<i>Pterocarpus indicus</i>
0749	<i>Piper amalago</i>	1038	<i>Pterocarpus macrocarpus</i>
0750	<i>Piper blattarum</i>	0669	<i>Pterocarpus marsupium</i>
0713	<i>Piper glabrescens</i>	0797	<i>Pterocarpus officinalis</i>
0706	<i>Piper hispidum</i>	0798	* <i>Pterocarpus vernalis</i>
0775	<i>Piper jacquemontianum</i>	0800	<i>Punica granatum</i>
0705	<i>Piper marginatum</i>	0799	<i>Quararibea turbinata</i>
0706	* <i>Piper scabrum</i>	0803	* <i>Quasia amara</i>
0659	<i>Piper swartzianum</i>	0801	<i>Randia aculeata</i>
0713	* <i>Piper treleaseanum</i>	0801	* <i>Randia mitis</i>
0751	* <i>Piper tuberculatum</i>	0804	* <i>Rapanea ferruginea</i>
0775	* <i>Piper wydlerianum</i>	0805	* <i>Rapanea guianensis</i>
0764	<i>Piptadenia peregrina</i>	0807	<i>Rauwolfia nitida</i>
0501	<i>Piscidia carthagenensis</i>	0809	<i>Ravenia urbanii</i>
0501	* <i>Piscidia piscipula</i>	0808	<i>Revenala madagascariensis</i>
0765	<i>Pisonia albida</i>	0810	<i>Reynosia guama</i>
0766	<i>Pisonia subcordata</i>	0811	<i>Reynosia krugii</i>
0768	<i>Pithecellobium arboreum</i>	0812	<i>Reynosia uncinata</i>
0769	<i>Pithecellobium dulce</i>	0814	* <i>Rhacoma crossopetalum</i>
0770	* <i>Pithecellobium saman</i>	0816	<i>Rhamnus sphaerosperma</i>
0771	<i>Pithecellobium unguis-cati</i>	0819	* <i>Rheedia acuminata</i>
0773	<i>Platanus occidentalis</i>	0823	* <i>Rheedia hessii</i>
0774	<i>Platymiscium pinnatum</i>	0819	* <i>Rheedia portoricensis</i>
0777	<i>Pleodendron macranthum</i>	0821	<i>Rhizophora mangle</i>
0778	* <i>Plinia dussii</i>	0822	* <i>Ricinella ricinella</i>
0779	<i>Plumeria alba</i>	0820	<i>Ricinus communis</i>
0780	<i>Plumeria krugii</i>	0825	<i>Rocheffortia acanthophora</i>
1036	<i>Plumeria obtusa</i>	0824	<i>Rocheffortia cuneata</i>
1036	* <i>Plumeria portoricensis</i>	0827	<i>Rollinia mucosa</i>
0782	<i>Plumeria rubra</i>	0829	<i>Rondeletia inermis</i>
0783	<i>Podocarpus coriaceus</i>	0830	<i>Rondeletia pilosa</i>
0784	<i>Polygala cowellii</i>	0831	<i>Rondeletia portoricensis</i>
0068	<i>Polygala penaea</i>	0264	* <i>Roseodendron donnell-smithii</i>
0068	* <i>Polygala portoricensis</i>	0833	<i>Roystonea borinquena</i>
0712	<i>Pouteria dictyoneura</i>	0834	<i>Roystonea regia</i>
0661	<i>Pouteria hotteana</i>	0835	* <i>Sabal bermudana</i>
0785	<i>Pouteria multiflora</i>	0836	<i>Sabal causiarum</i>
0120	<i>Pouteria sapota</i>	0835	* <i>Sabal domingensis</i>
0374	<i>Prestoea montana</i>	0835	<i>Sabal umbraculifera</i>
0786	<i>Prockia crucis</i>	0838	<i>Sabinea florida</i>
0787	* <i>Prosopis juliflora</i>	0839	<i>Sabinea punicea</i>
0787	<i>Prosopis pallida</i>	0841	<i>Salix chilensis</i>
0502	<i>Prosopis spicigera</i>	0841	* <i>Salix humboldtiana</i>
0662	<i>Prunus myrtifolia</i>	0770	<i>Samanea saman</i>
0664	<i>Prunus occidentalis</i>	0843	<i>Sambucus mexicana</i>
0703	<i>Prunus serotina</i>	0845	<i>Samyda dodecandra</i>
0666	<i>Pseudocedrela kotschy</i>	0483	<i>Samyda spinulosa</i>
0788	<i>Pseudolmedia spuria</i>	0847	<i>Sapindus saponaria</i>
0700	<i>Psidium amplexicaule</i>	0849	<i>Sapium laurocerasus</i>
0789	<i>Psidium guajava</i>	0005	* <i>Sapota achras</i>
0131	<i>Psidium insulanum</i>	0853	* <i>Sarcomphalus domingensis</i>
1037	<i>Psidium sintenisii</i>	0854	* <i>Sarcomphalus reticulatus</i>
0790	<i>Psychotria berteriana</i>	0879	* <i>Sarcomphalus taylorii</i>
0791	<i>Psychotria brachiata</i>	0856	<i>Savia sessiliflora</i>
0792	<i>Psychotria brownei</i>	0857	<i>Schaefferia frutescens</i>
0667	<i>Psychotria grandis</i>	0844	* <i>Schefflera actinophylla</i>
0794	<i>Psychotria maleolens</i>	0301	<i>Schefflera gleasonii</i>
0480	<i>Psychotria maricaensis</i>	0302	<i>Schefflera morototonii</i>
0482	<i>Psychotria microdon</i>	0852	<i>Schinus terebinthifolius</i>

0858	Schizolobium parahybum	0899	*Symplocos polyantha
0851	Schleichera oleosa	0359	*Syzygium jambos
0851	*Schleichera trijuga	0362	Syzygium malaccense
0860	Schoepfia arenaria	0900	Tabebuia chrysantha
0867	Schoepfia obovata	0264	Tabebuia donnell-smithii
0846	Schoepfia schreberi	0900	*Tabebuia glomerata
0157	*Sciacassia siamea	0907	Tabebuia haemantha
0862	*Sebesten rickseckeri	0908	Tabebuia heterophylla
0863	*Sebesten sebestena	0908	*Tabebuia pallida
0848	Securinea acidoton	0910	Tabebuia rigida
0474	Senna alata	0909	Tabebuia rosea
0516	Senna atomaria	0911	Tabebuia schumanniana
1039	Senna multijuga	0915	Tabernaemontana citrifolia
0720	Senna polyphylla	0915	*Tabernaemontana oppositifolia
0157	Senna siamea	0913	Tamarindus indica
0266	Senna spectabilis	0917	*Tamonea guianensis
1041	Senna surattensis	0918	*Tamonea macrophylla
0864	Sesbania grandiflora	0920	*Taonabo heptasepala
0880	Sida eggertii	0921	*Taonabo luquillensis
0310	Sideroxylon cubense	0924	*Taonabo pachyphylla
0865	Sideroxylon foetidissimum	0923	*Taonabo peduncularis
0095	Sideroxylon obovatum	0924	*Taonabo stahlia
0308	Sideroxylon portoricense	0925	Taxodium mucronatum
0309	Sideroxylon salicifolium	0903	Tecoma stans
1012	Simarouba amara	0928	Tectona grandis
0868	Simarouba tulae	0538	*Terebraria resinosa
0778	Siphoneugena densiflora	0936	Terminalia amazonica
0901	Sloanea amygdalina	0930	Terminalia catappa
0869	Sloanea berteriana	1043	Terminalia ivorensis
1001	Sloanea caribaea	0931	Terminalia latifolia
1002	Sloanea massoni	0929	Terminalia myriocarpa
0870	Solanum drymophilum	1044	Terminalia oblonga
0872	Solanum erianthum	0936	*Terminalia obovata
0887	*Solanum ficifolium	0933	Terminalia superba
0871	Solanum rugosum	0920	Ternstroemia heptasepala
1042	Solanum torvum	0921	Ternstroemia luquillensis
0872	*Solanum verbascifolium	0923	Ternstroemia peduncularis
0859	Solanum wrightii	0924	Ternstroemia stahlia
0874	Spathodea campanulata	0919	Ternstroemia subsessilis
0875	Spathodea nilotica	0932	Tetragastris balsamifera
0876	Spondias cytherea	0934	Tetrazygia angustifolia
0876	*Spondias dulcis	0599	Tetrazygia biflora
0877	Spondias mombin	0935	Tetrazygia elaeagnoides
0878	Spondias purpurea	0601	Tetrazygia urbanii
0539	Stenocereus peruvianus	0937	Theobroma cacao
0882	*Stenostomum acutatum	0628	Thespesia grandiflora
0884	*Stenostomum coriaceum	0938	Thespesia populnea
0052	*Stenostomum obtusifolium	0939	Thevetia peruviana
0885	*Stenostomum portoricense	0940	*Thouinia portoricensis
0888	Sterculia apetala	0941	Thouinia striata
0889	Sterculia foetida	0940	Thouinia striata var. portoricensis
0890	Styrax portoricensis	0942	*Thrinax microcarpa
0892	Suriana maritima	0943	Thrinax morrisii
0893	*Swietenia candollei	0944	*Thrinax ponceana
0895	Swietenia humilis	0940	*Thyana portoricensis
0893	Swietenia macrophylla	0941	*Thyana striata
0902	Swietenia macrophylla x mahognai	0170	Toona ciliata
0894	Swietenia mahagoni	0946	Toona sureni
0891	Swinglea glutinosa	0947	Torrubasia cuneifolia
0896	Symplocos lanata	0948	*Torrubia discolor
0897	Symplocos martinicensis	0949	*Torrubia fragrans
0898	Symplocos micrantha	0950	*Torrubia obtusata

0953	<i>Tournefortia filiflora</i>	0536	* <i>Wickstroemia portoricensis</i>
0951	<i>Trema lamarckiana</i>	0982	<i>Widdringtonia whytei</i>
0951	* <i>Trema lamarckianum</i>	0985	<i>Ximenia americana</i>
0952	<i>Trema micrantha</i>	0646	<i>Xylosma buxifolia</i>
0952	* <i>Trema micranthum</i>	0970	<i>Xylosma pachyphylla</i>
0954	<i>Trichilia hirta</i>	0974	<i>Xylosma schaefferioides</i>
0955	<i>Trichilia pallida</i>	0647	<i>Xylosma schwaneckeanum</i>
0956	<i>Trichilia triacantha</i>	0986	<i>Yucca aloifolia</i>
0957	<i>Triphasia trifolia</i>	0983	* <i>Yucca elephantipes</i>
0958	<i>Triplaris americana</i>	0984	<i>Yucca gloriosa</i>
0959	<i>Triplaris caracasana</i>	0983	<i>Yucca guatemalensis</i>
0961	<i>Triplaris cumingiana</i>	0489	<i>Zanthoxylum bifoliolatum</i>
0960	<i>Trophis racemosa</i>	0988	<i>Zanthoxylum caribaeum</i>
0962	<i>Turpinia occidentalis</i>	0989	<i>Zanthoxylum flavum</i>
0962	* <i>Turpinia paniculata</i>	0990	<i>Zanthoxylum martinicense</i>
0971	<i>Urera baccifera</i>	0991	<i>Zanthoxylum monophyllum</i>
0972	<i>Urera caracasana</i>	0992	<i>Zanthoxylum punctatum</i>
0973	<i>Urera chlorocarpa</i>	0993	<i>Zanthoxylum spinifex</i>
0003	* <i>Vachellia farnesiana</i>	0995	<i>Ziziphus mauritiana</i>
0978	* <i>Varronia rupicola</i>	0854	<i>Ziziphus reticulata</i>
0979	<i>Vitex divaricata</i>	0853	<i>Ziziphus rignonii</i>
0729	<i>Wallenia pendula</i>	0879	<i>Ziziphus taylorii</i>
0981	<i>Weinmannia pinnata</i>	0359	* <i>Zyzygium jambos</i>

* indicates species is a synonym

B. Puerto Rico tree species codes by scientific name

0001	*Adenoropium multifidum	0052	*Stenostomum obtusifolium
0001	Jatropha multifida	0053	Araucaria angustifolia
0002	Acrocarpus fraxinifolius	0054	Ardisia obovata
0003	Acacia farnesiana	0054	*Icacorea guadalupensis
0003	*Vachellia farnesiana	0055	Antidesma bunias
0005	*Achras zapota	0056	Artocarpus altilis
0005	Manilkara zapota	0056	*Artocarpus communis
0005	*Sapota achras	0057	*Artocarpus heterophyllus
0006	Acnistus arborescens	0057	Artocarpus integrifolius
0006	*Dunalia arborescens	0059	Phyllanthus juglandifolius
0008	*Acrocomia aculeata	0061	Avicennia germinans
0008	Acrocomia media	0061	*Avicennia nitida
0010	Adenanthera pavonina	0062	Averrhoa carambola
0011	Aegiphila martinicensis	0063	Acacia suma
0013	Agathis australis	0064	Acacia tortuosa
0014	*Aeschrion excelsa	0065	Antirhea lucida
0015	Agathis robusta	0066	*Araucaria excelsa
0016	Aiphanes acanthophylla	0066	Araucaria heterophylla
0016	*Bactris acanthophylla	0067	*Badiera penaea
0017	Afrormosia elata	0068	Polygala penaea
0020	Albizia lebeck	0068	*Polygala portoricensis
0021	Albizia procera	0069	Bauhinia variegata
0022	Aleurites moluccana	0070	*Icacorea glauciflora
0023	Alchornea latifolia	0071	Berrya cordifolia
0024	Acacia anegadensis	0072	Bambusa vulgaris
0025	Alchorneopsis floribunda	0074	Banara portoricensis
0025	*Alchorneopsis portoricensis	0076	Bauhinia monandra
0026	Allophylus crassinervis	0076	*Caspereopsis monandra
0027	*Allophylus occidentalis	0077	Bauhinia tomentosa
0027	Allophylus racemosus	0078	Beilschmiedia pendula
0028	Cyathea parvula	0079	Blighia sapida
0031	Alstonia scholaris	0080	Bixa orellana
0032	Amyris balsamifera	0081	Bontia daphnoides
0033	Amyris elemifera	0084	Bourreria succulenta var succulenta
0034	Acacia macracantha	0085	*Bourreria domingensis
0035	Anacardium occidentale	0085	Bourreria virgata
0036	Anacardium excelsum	0086	Bocconia frutescens
0037	Andira inermis	0087	Brownea grandiceps
0038	Acacia muricata	0088	Brunellia comocladiifolia
0039	*Andrachne cuneifolia	0089	Brunfelsia americana
0039	Phyllanthus cuneifolius	0090	Brunfelsia densifolia
0040	*Anamomis fragrans	0091	Brunfelsia lactea
0040	*Eugenia fragrans	0092	*Buchenavia capitata
0040	Myrcianthes fragrans	0092	Buchenavia tetraphylla
0041	Acacia nilotica	0093	Bucida buceras
0042	Aniba bracteata	0094	*Bumelia krugii
0043	Annona cheirimola	0095	*Bumelia obovata
0044	*Anneslea portoricensis	0095	Sideroxylon obovatum
0044	*Calliandra caracasana	0096	Banara vanderbiltii
0044	Calliandra portoricensis	0097	Bunchosia glandulifera
0045	Annona diversifolia	0098	Bunchosia glandulosa
0046	Annona glabra	0099	Bunchosia nitida
0047	Annona montana	0100	Barringtonia asiatica
0048	Annona muricata	0101	Bursera simaruba
0049	Annona reticulata	0101	*Elaphrium simaruba
0050	Annona squamosa	0102	Bauhinia pauletia
0051	*Anthocephalus cadamba	0103	*Byrsonima coriacea
0051	*Anthocephalus chinensis	0104	Byrsonima crassifolia
0051	Neolamarckia cadamba	0105	Byrsonima lucida
0052	Antirhea obtusifolia	0106	*Byrsonima horneana

0108	Byrsonima spicata	0157	Senna siamea
0109	Callicarpa ampla	0158	Cassia grandis
0110	Biancea sappan	0160	*Cassipourea alba
0110	*Caesalpinia sappan	0161	*Cassipourea elliptica
0111	*Callitris glauca	0161	Cassipourea guianensis
0111	Callitris hugelii	0162	Castilla elastica
0112	Byrsonima wadsworthii	0163	Casuarina cunninghamiana
0113	Bauhinia purpurea	0164	Casuarina equisetifolia
0114	Buxus portoricensis	0165	Casuarina glauca
0115	Buxus vahlii	0166	*Cecropia peltata
0116	Caesalpinia coriaria	0166	Cecropia schreberiana
0117	Callistemon citrinus	0167	Catalpa longissima
0117	*Callistemon lanceolatus	0167	*Macrocatalpa longissima
0118	Calophyllum antillanum	0169	*Cedrela mexicana
0118	*Calophyllum brasiliense	0169	Cedrela odorata
0118	*Calophyllum calaba	0170	Toona ciliata
0119	Calophyllum inophyllum	0171	Ceiba pentandra
0120	*Calocarpum sapota	0172	Ceiba acuminata
0120	Pouteria sapota	0173	Celtis trinervia
0121	*Calycogonium squamulosum	0174	Ceiba aesculifolia
0121	Henriettea squamulosum	0175	*Cephalocereus royenii
0122	Calyptranthes pallens	0175	Pilosocereus royenii
0123	Calyptranthes krugii	0176	*Chalcas exotica
0124	Calyptranthes portoricensis	0176	Murraya paniculata
0125	Calyptranthes sintenisii	0178	Chukrasia tabularis
0126	Calyptranthes thomasi	0180	Cestrum macrophyllum
0127	Cordia alba	0181	Chione venosa
0128	Calotropis procera	0182	Chlorophora tinctoria
0129	Calyptranthes zuzygium	0183	Chrysobalanus icaco var icaco
0130	Chlorophora excelsa	0183	*Chrysobalanus pellocarpus
0131	Psidium insulanum	0184	Chrysobalanus icaco var. pellocarpus
0132	*Camphora camphora	0186	Chrysophyllum argenteum
0132	Cinnamomum camphora	0187	Chrysophyllum cainito
0134	*Cananga caribaea	0188	Chrysophyllum bicolor
0134	Guatteria caribaea	0189	Chrysophyllum oliviforme
0135	Cananga odorata	0190	Chrysophyllum pauciflorum
0136	Calyptronoma rivalis	0192	Citharexylum caudatum
0137	Canella winteriana	0193	Citharexylum fruticosum
0139	Capparis baducca	0194	Cinnamomum cassia
0139	*Capparis frondosa	0195	Citrus aurantium
0140	*Capparis coccolobifolia	0196	Citrus sinensis
0140	Capparis hastata	0197	Citrus limon
0141	Capparis cynophallophora	0198	Citrus paradisi
0142	Capparis flexuosa	0199	Citrus aurantifolia
0143	Capparis indica	0200	Cinnamomum verum
0144	Capparis amplissima	0201	Clibadium erosum
0144	*Capparis portoricensis	0202	Clidemia hirta
0145	Carapa guianensis	0203	Clusia gundlachii
0146	Carica papaya	0204	Clusia clusioides
0148	Casearia aculeata	0204	*Clusia grisebachiana
0149	Casearia arborea	0204	*Clusia krugiana
0150	*Casearia bicolor	0205	Clusia minor
0150	Laetia procera	0206	Clusia rosea
0151	Casearia decandra	0207	Citharexylum spinosum
0152	Casearia guianensis	0209	Coccoloba diversifolia
0153	Casearia sylvestris	0210	Coccoloba pubescens
0154	Cassia glauca	0211	*Citrus grandis
0155	*Cassia fistula	0211	Citrus maxima
0156	*Cassia javanica	0212	Coccoloba krugii
0156	*Cassia nodosa	0214	Coccoloba microstachya
0157	*Cassia siamea	0215	Coccoloba pyrifolia
0157	*Sciacassia siamea	0216	Coccoloba rugosa

0217	<i>Coccoloba sintenisii</i>	0271	<i>Clidemia polystachya</i>
0218	<i>Coccoloba uvifera</i>	0272	<i>Coccoloba pallida</i>
0219	<i>Coccoloba venosa</i>	0273	<i>Coccothrinax alta</i>
0220	<i>Citrus medica</i>	0274	* <i>Coccothrinax discreta</i>
0222	<i>Citrus reticulata</i>	0275	* <i>Coccothrinax eggersiana</i>
0223	<i>Cochlospermum vitifolium</i>	0276	<i>Coccothrinax argentea</i>
0224	* <i>Coccoloba borinquensis</i>	0276	* <i>Coccothrinax sanctae-thomae</i>
0224	<i>Coccoloba swartzii</i>	0277	* <i>Cordia blancoi</i>
0225	<i>Cocos nucifera</i>	0277	<i>Cordia obliqua</i>
0226	<i>Coffea dewevrei</i>	0278	<i>Couroupita guianensis</i>
0227	<i>Coffea arabica</i>	0279	<i>Cupressus sempervirens</i>
0228	<i>Cola acuminata</i>	0291	<i>Dacryodes excelsa</i>
0228	* <i>Cola vera</i>	0292	<i>Dalbergia sissoo</i>
0229	<i>Colubrina arborescens</i>	0293	<i>Daphnopsis americana</i>
0229	* <i>Colubrina colubrina</i>	0294	<i>Daphnopsis helleriana</i>
0231	<i>Colubrina elliptica</i>	0295	<i>Daphnopsis philippiana</i>
0231	* <i>Colubrina reclinata</i>	0297	<i>Delonix regia</i>
0232	<i>Cunninghamia lanceolata</i>	0299	<i>Dendropanax arboreus</i>
0233	<i>Comocladia dodonaea</i>	0300	<i>Dendropanax laurifolius</i>
0234	<i>Comocladia glabra</i>	0301	* <i>Didymopanax gleasonii</i>
0235	<i>Coccoloba costata</i>	0301	<i>Schefflera gleasonii</i>
0236	<i>Conocarpus erectus</i>	0302	* <i>Didymopanax morototonii</i>
0237	* <i>Cordia dentata</i>	0302	<i>Schefflera morototonii</i>
0240	* <i>Cerdana alliodora</i>	0304	<i>Dillenia indica</i>
0240	<i>Cordia alliodora</i>	0306	* <i>Diospyros digyna</i>
0241	<i>Cordia borinquensis</i>	0306	<i>Diospyros revoluta</i>
0242	<i>Cordia collococca</i>	0307	<i>Eucalyptus deglupta</i>
0242	* <i>Cordia glabra</i>	0308	* <i>Bumelia bellonis</i>
0243	<i>Cordia laevigata</i>	0308	* <i>Dipholis bellonis</i>
0244	<i>Cordia sulcata</i>	0308	<i>Sideroxylon portoricense</i>
0245	<i>Cornutia obovata</i>	0309	* <i>Bumelia salicifolia</i>
0246	<i>Cornutia pyramidata</i>	0309	* <i>Dipholis salicifolia</i>
0247	<i>Crescentia cujete</i>	0309	<i>Sideroxylon salicifolium</i>
0248	<i>Crescentia linearifolia</i>	0310	* <i>Bumelia cubensis</i>
0249	* <i>Critonia portoricensis</i>	0310	* <i>Dipholis cubensis</i>
0249	<i>Eupatorium portoricense</i>	0310	* <i>Dipholis sintenisiana</i>
0250	<i>Croton astroites</i>	0310	<i>Sideroxylon cubense</i>
0251	<i>Croton poecilanthus</i>	0311	<i>Dracaena fragrans</i>
0252	<i>Croton rigidus</i>	0312	<i>Ditta myricoides</i>
0253	<i>Guazuma ulmifolia</i>	0314	* <i>Dodonaea ehrenbergii</i>
0254	<i>Cupania americana</i>	0314	<i>Dodonaea viscosa</i>
0255	<i>Cupania triquetra</i>	0315	<i>Dovyalis hebecarpa</i>
0256	<i>Cupressus lusitanica</i>	0316	* <i>Drepanocarpus lunatus</i>
0257	* <i>Curcas curcas</i>	0316	<i>Machaerium lunatum</i>
0257	<i>Jatropha curcas</i>	0317	<i>Erythrina corallodendron</i>
0258	<i>Cryptotomeria japonica</i>	0318	<i>Drypetes alba</i>
0259	<i>Cyathea arborea</i>	0319	<i>Drypetes glauca</i>
0260	<i>Cyathea portoricensis</i>	0320	<i>Drypetes ilicifolia</i>
0260	* <i>Nephelea portoricensis</i>	0321	<i>Drypetes lateriflora</i>
0261	<i>Alsophila bryophila</i>	0323	<i>Duranta erecta</i>
0261	* <i>Cyathea pubescens</i>	0323	* <i>Duranta repens</i>
0262	<i>Cynometra portoricensis</i>	0324	<i>Erythrina crista-galli</i>
0263	<i>Cyrilla racemiflora</i>	0325	<i>Erythrina eggersii</i>
0264	* <i>Roseodendron donnell-smithii</i>	0325	* <i>Erythrina horrida</i>
0264	<i>Tabebuia donnell-smithii</i>	0326	<i>Erythrina variegata</i> var. <i>orientalis</i>
0265	* <i>Cyathea brittoniana</i>	0328	<i>Cassine xylocarpa</i>
0265	<i>Cyathea furfuracea</i>	0328	* <i>Elaeodendron xylocarpum</i>
0266	* <i>Cassia spectabilis</i>	0329	<i>Eucalyptus resinifera</i>
0266	<i>Senna spectabilis</i>	0331	<i>Amphitecna latifolia</i>
0268	<i>Chrysalidocarpus lutescens</i>	0331	* <i>Engallagma latifolia</i>
0269	<i>Citharexylum tristachyum</i>	0332	<i>Erithalis fruticosa</i>
0270	<i>Clerodendrum aculeatum</i>	0333	<i>Cleyera albopunctata</i>

0333	* <i>Eroteum albopunctatum</i>	0386	<i>Eugenia uniflora</i>
0334	<i>Enterolobium cyclocarpum</i>	0387	<i>Erythroxyllum urbanii</i>
0335	<i>Erythrina fusca</i>	0388	<i>Euphorbia lactea</i>
0335	* <i>Erythrina glauca</i>	0389	<i>Eucalyptus citriodora</i>
0337	<i>Entandrophragma angolese</i>	0390	<i>Eugenia haematocarpa</i>
0338	<i>Erythroxyllum areolatum</i>	0391	<i>Euphorbia neriifolia</i>
0340	* <i>Erythroxyllum brevipes</i>	0392	<i>Euphorbia tirucalli</i>
0340	<i>Erythroxyllum rotundifolium</i>	0393	<i>Brunfelsia portoricensis</i>
0341	<i>Erythroxyllum rufum</i>	0394	<i>Casuarina cristata</i>
0342	<i>Eucalyptus kironiana</i>	0394	* <i>Casuarina lepidophloia</i>
0343	<i>Eucalyptus robusta</i>	0395	<i>Cestrum laurifolium</i>
0344	<i>Eucalyptus bangalore</i>	0396	<i>Crescentia portoricensis</i>
0345	<i>Eucalyptus saligna</i>	0397	<i>Guettarda pungens</i>
0346	<i>Eucalyptus paniculata</i>	0398	<i>Ficus nekbuda</i>
0347	<i>Eucalyptus maculata</i>	0398	* <i>Ficus nekbudu</i>
0348	<i>Eucalyptus grandis</i>	0399	<i>Fortunella margarita</i>
0349	<i>Eucalyptus maideni</i>	0400	<i>Ficus carica</i>
0350	* <i>Eugenia aeruginea</i>	0401	<i>Ficus indica</i>
0350	<i>Eugenia domingensis</i>	0402	<i>Ficus lyrata</i>
0351	<i>Eugenia axillaris</i>	0403	<i>Faramea occidentalis</i>
0352	<i>Eugenia boqueronensis</i>	0404	<i>Ficus drupacea</i>
0353	<i>Eugenia borinquensis</i>	0404	* <i>Ficus mysorensis</i>
0354	* <i>Eugenia buxifolia</i>	0405	* <i>Ficus crassinervia</i>
0354	* <i>Eugenia foetida</i>	0405	<i>Ficus trigonata</i>
0354	<i>Eugenia maleolens</i>	0406	<i>Ficus elastica</i>
0354	* <i>Eugenia myrtoides</i>	0407	<i>Ficus citrifolia</i>
0355	<i>Eugenia confusa</i>	0407	* <i>Ficus laevigata</i>
0356	<i>Eugenia cordata</i>	0408	<i>Ficus microcarpa</i>
0357	<i>Eugenia eggersii</i>	0408	* <i>Ficus retusa</i>
0358	* <i>Eugenia floribunda</i>	0409	<i>Ficus americana</i>
0359	<i>Eugenia jambos</i>	0409	* <i>Ficus sintenisii</i>
0359	* <i>Syzygium jambos</i>	0412	<i>Forestiera segregata</i>
0359	* <i>Zyzygium jambos</i>	0413	<i>Ficus nota</i>
0360	<i>Eugenia biflora</i>	0415	<i>Funtumia elastica</i>
0360	* <i>Eugenia lancea</i>	0416	<i>Garcinia tinctoria</i>
0361	<i>Eugenia ligustrina</i>	0417	<i>Gaussia attenuata</i>
0362	* <i>Eugenia malaccensis</i>	0418	<i>Genipa americana</i>
0362	<i>Syzygium malaccense</i>	0419	<i>Ficus sycomorus</i>
0363	<i>Eugenia monticola</i>	0420	<i>Flacourtia indica</i>
0364	<i>Eugenia procera</i>	0421	<i>Ginoria rohrii</i>
0365	<i>Eugenia pseudopsidium</i>	0422	<i>Ficus stahlia</i>
0366	<i>Eugenia rhombea</i>	0423	<i>Gliricidia sepium</i>
0367	<i>Eugenia serrasuela</i>	0424	<i>Ficus obtusifolia</i>
0368	<i>Eugenia sintenisii</i>	0425	<i>Goetzea elegans</i>
0369	<i>Eugenia stahlia</i>	0427	<i>Gomidesia lindeniana</i>
0370	<i>Eugenia stewardsonii</i>	0428	<i>Gossypium barbadense</i>
0371	<i>Eupatorium polyodon</i>	0429	* <i>Cybianthus sintenisii</i>
0372	* <i>Aklema petiolare</i>	0429	<i>Grammadenia sintenisii</i>
0372	<i>Euphorbia petiolaris</i>	0430	<i>Grevillea robusta</i>
0373	<i>Euphorbia longana</i>	0431	<i>Guajacum officinale</i>
0374	* <i>Euterpe globosa</i>	0432	<i>Guajacum sanctum</i>
0374	<i>Prestoea montana</i>	0433	<i>Asterandra grandifolia</i>
0375	<i>Eugenia xerophytica</i>	0435	<i>Guarea glabra</i>
0376	<i>Erythrina berteriana</i>	0435	* <i>Guarea ramiflora</i>
0377	<i>Eugenia corozalensis</i>	0436	* <i>Guarea guara</i>
0379	<i>Erythrina poeppigiana</i>	0436	<i>Guarea guidonia</i>
0380	<i>Eugenia sessiliflora</i>	0436	* <i>Guarea trichilioides</i>
0381	<i>Eugenia underwoodii</i>	0437	<i>Pimenta dioica</i>
0382	<i>Exostema caribaeum</i>	0438	* <i>Cananga blainii</i>
0383	<i>Exostema ellipticum</i>	0438	<i>Guatteria blainii</i>
0384	<i>Exostema sanctae-luciae</i>	0439	<i>Forestiera eggersiana</i>
0385	<i>Exothea paniculata</i>	0441	<i>Forestiera rhamnifolia</i>

0442	<i>Guettarda elliptica</i>	0495	<i>Hyeronima clusioides</i>
0443	<i>Guettarda krugii</i>	0496	<i>Hymenaea courbaril</i>
0444	* <i>Guettarda laevis</i>	0497	<i>Hypelate trifoliata</i>
0444	<i>Guettarda valenzuelana</i>	0498	<i>Ardisia glauciflora</i>
0445	<i>Guettarda ovalifolia</i>	0500	<i>Hyperbaena laurifolia</i>
0446	<i>Guettarda odorata</i>	0501	* <i>Ichthyomethis piscipula</i>
0446	* <i>Guettarda parviflora</i>	0501	<i>Piscidia carthagenensis</i>
0447	<i>Guettarda scabra</i>	0501	* <i>Piscidia piscipula</i>
0448	<i>Fraxinus uhdei</i>	0502	<i>Prosopis spicigera</i>
0449	<i>Gyminda latifolia</i>	0503	<i>Ilex guianensis</i>
0450	<i>Garcinia dulcis</i>	0504	<i>Ilex macfadyenii</i>
0451	* <i>Ateramnus lucidus</i>	0505	<i>Ilex nitida</i>
0451	<i>Gymnanthes lucida</i>	0506	<i>Ilex riedlaei</i>
0453	<i>Haematoxylum campechianum</i>	0507	<i>Ilex sideroxyloides</i>
0454	<i>Garcinia mangostana</i>	0508	<i>Ilex sintenisii</i>
0456	<i>Gossypium hirsutum</i> var. <i>punctatum</i>	0509	<i>Ilex urbaniana</i>
0456	* <i>Gossypium purpurascens</i>	0510	<i>Inga spectabilis</i>
0457	* <i>Haenianthus obovatus</i>	0511	<i>Inga fastuosa</i>
0457	* <i>Haenianthus salicifolius</i>	0512	* <i>Inga fagifolia</i>
0457	<i>Haenianthus salicifolius</i> var. <i>obovatus</i>	0512	<i>Inga laurina</i>
0459	* <i>Hamelia erecta</i>	0513	<i>Inga quaternata</i>
0459	<i>Hamelia patens</i>	0514	* <i>Inga inga</i>
0460	<i>Hebestigma cubense</i>	0514	<i>Inga vera</i>
0461	<i>Hedyosmum arborescens</i>	0515	<i>Ceratonia siliqua</i>
0462	<i>Ilex cookii</i>	0516	* <i>Cassia emarginata</i>
0463	<i>Helicteres jamaicensis</i>	0516	<i>Senna atomaria</i>
0464	<i>Jacquinia umbellata</i>	0517	<i>Ligustrum amurense</i>
0465	<i>Cyathea andina</i>	0518	<i>Ixora ferrea</i>
0465	* <i>Hemitelia escuquensis</i>	0519	<i>Khaya grandifolia</i>
0466	<i>Cnemidaria horrida</i>	0520	<i>Chionanthus ligustrinus</i>
0466	* <i>Hemitelia wilsonii</i>	0520	* <i>Linociera ligustrina</i>
0467	<i>Leptocereus quadricostatus</i>	0521	* <i>Curcas hernandiifolius</i>
0468	<i>Henriettea fascicularis</i>	0521	<i>Jatropha hernandiifolia</i>
0469	<i>Henriettea macfadyenii</i>	0522	<i>Jacquinia revoluta</i>
0470	<i>Henriettea membranifolia</i>	0524	<i>Jacaranda mimosifolia</i>
0471	<i>Henriettea triflora</i>	0526	* <i>Jacquinia arborea</i>
0472	<i>Hernandia sonora</i>	0526	<i>Jacquinia armillaris</i>
0473	<i>Lunania racemosa</i>	0526	* <i>Jacquinia barbasco</i>
0474	* <i>Cassia alata</i>	0527	<i>Jacquinia berteroi</i>
0474	* <i>Herpetica alata</i>	0528	<i>Juglans jamaicensis</i>
0474	<i>Senna alata</i>	0529	<i>Khaya nyasica</i>
0475	* <i>Amomis grisea</i>	0530	<i>Krugiodendron ferreum</i>
0475	<i>Pimenta racemosa</i> var. <i>grisea</i>	0531	<i>Khaya senegalensis</i>
0476	<i>Heterotrichum cymosum</i>	0532	<i>Lagerstroemia speciosa</i>
0477	<i>Hibiscus rosa-sinensis</i>	0533	<i>Lagerstroemia indica</i>
0478	<i>Hibiscus elatus</i>	0534	<i>Laguncularia racemosa</i>
0479	<i>Hibiscus tiliaceus</i>	0535	<i>Kigelia pinnata</i>
0479	* <i>Paritium tiliaceum</i>	0536	* <i>Haemocharis portoricensis</i>
0480	<i>Psychotria maricaensis</i>	0536	<i>Laplacea portoricensis</i>
0481	<i>Hippomane mancinella</i>	0536	* <i>Wickstroemia portoricensis</i>
0482	<i>Psychotria microdon</i>	0537	<i>Kleinhovia hospita</i>
0482	* <i>Psychotria pinularis</i>	0538	* <i>Laugeria resinosa</i>
0483	<i>Samyda spinulosa</i>	0538	<i>Neolaugeria resinosa</i>
0484	<i>Hirtella rugosa</i>	0538	* <i>Terebraria resinosa</i>
0485	<i>Hirtella triandra</i>	0539	* <i>Lemaireocereus hystrix</i>
0488	* <i>Homalium leiogynum</i>	0539	<i>Stenocereus peruvianus</i>
0488	<i>Homalium racemosum</i>	0542	<i>Lawsonia inermis</i>
0489	<i>Zanthoxylum bifoliolatum</i>	0543	* <i>Leucaena glauca</i>
0490	* <i>Hufelandia pendula</i>	0543	<i>Leucaena leucocephala</i>
0492	<i>Hura crepitans</i>	0544	<i>Caesalpinia punctata</i>
0494	<i>Colubrina verrucosa</i>	0544	* <i>Libidibia punctata</i>
0494	* <i>Hybosperma spinosum</i>	0545	<i>Licaria parvifolia</i>

0545	* <i>Licaria salicifolia</i>	0599	* <i>Menendezia biflora</i>
0546	<i>Licaria triandra</i>	0599	<i>Tetrazygia biflora</i>
0546	* <i>Misanteca triandra</i>	0600	* <i>Menendezia stahlia</i>
0547	<i>Licaria brittoniana</i>	0601	* <i>Menendezia urbanii</i>
0548	<i>Chionanthus axilliflorus</i>	0601	<i>Tetrazygia urbanii</i>
0548	* <i>Linociera axilliflora</i>	0602	<i>Mesua ferrea</i>
0548	* <i>Mayepea axilliflora</i>	0603	<i>Metopium toxiferum</i>
0549	<i>Chionanthus compactus</i>	0605	<i>Miconia foveolata</i>
0549	* <i>Linociera caribaea</i>	0606	<i>Miconia impetolaris</i>
0550	<i>Chionanthus domingensis</i>	0607	<i>Miconia laevigata</i>
0550	* <i>Linociera domingensis</i>	0608	<i>Miconia lanata</i>
0550	* <i>Mayepea domingensis</i>	0609	<i>Miconia affinis</i>
0551	<i>Lonchocarpus domingensis</i>	0609	* <i>Miconia microcarpa</i>
0552	<i>Lonchocarpus glaucifolius</i>	0610	* <i>Graffenrieda ottoschulzii</i>
0553	<i>Lonchocarpus heptaphyllus</i>	0610	<i>Miconia ottoschulzii</i>
0553	* <i>Lonchocarpus pentaphyllus</i>	0611	<i>Miconia pachyphylla</i>
0554	<i>Luehea speciosa</i>	0612	<i>Miconia prasina</i>
0556	<i>Chionanthus holdridgei</i>	0613	<i>Miconia punctata</i>
0556	* <i>Linociera holdridgei</i>	0614	<i>Miconia pycnoneura</i>
0557	<i>Diospyros sintenisii</i>	0615	<i>Miconia racemosa</i>
0557	* <i>Maba sintenisii</i>	0616	<i>Miconia rubiginosa</i>
0558	<i>Maesopsis eminii</i>	0617	<i>Miconia sintenisii</i>
0559	<i>Machaonia portoricensis</i>	0618	<i>Miconia subcorymbosa</i>
0561	<i>Magnolia portoricensis</i>	0619	<i>Miconia tetrandra</i>
0562	<i>Magnolia splendens</i>	0620	<i>Miconia thomasiana</i>
0565	<i>Malpighia coccigera</i>	0621	<i>Micropholis chrysophylloides</i>
0566	<i>Malpighia fucata</i>	0622	* <i>Micropholis curvata</i>
0567	<i>Malpighia emarginata</i>	0624	<i>Micropholis garciniifolia</i>
0567	* <i>Malpighia puniceifolia</i>	0627	<i>Monodora tenuifolia</i>
0568	<i>Mammea americana</i>	0628	* <i>Montezuma grandiflora</i>
0569	<i>Malpighia infestissima</i>	0628	* <i>Montezuma speciosissima</i>
0569	* <i>Malpighia pallens</i>	0628	<i>Thespesia grandiflora</i>
0570	<i>Mangifera indica</i>	0629	<i>Mouriri helleri</i>
0571	<i>Lunania buchii</i>	0630	<i>Morinda citrifolia</i>
0571	* <i>Lunania ekmanii</i>	0631	<i>Morisonia americana</i>
0572	<i>Manilkara bidentata</i>	0632	* <i>Moringa moringa</i>
0573	* <i>Manilkara duplicata</i>	0632	<i>Moringa oleifera</i>
0573	<i>Manilkara pleeana</i>	0633	<i>Morus alba</i>
0574	* <i>Manilkara emarginata</i>	0634	<i>Phialanthus grandifolius</i>
0574	<i>Manilkara jaimiqui</i>	0635	<i>Morus nigra</i>
0575	* <i>Manilkara nitida</i>	0636	<i>Mouriri domingensis</i>
0576	<i>Malpighia linearis</i>	0638	* <i>Myrcia berberis</i>
0577	<i>Mappia racemosa</i>	0638	<i>Myrcia fallax</i>
0580	<i>Cnidocolus aconitifolius</i>	0639	* <i>Aulomyrcia citrifolia</i>
0581	<i>Matayba domingensis</i>	0639	<i>Myrcia citrifolia</i>
0582	<i>Matayba apetala</i>	0640	<i>Myrcia deflexa</i>
0582	* <i>Matayba oppositifolia</i>	0641	* <i>Aulomyrcia leptoclada</i>
0584	* <i>Maytenus elliptica</i>	0641	<i>Myrcia leptoclada</i>
0584	<i>Maytenus laevigata</i>	0642	<i>Myrcia splendens</i>
0585	<i>Maytenus elongata</i>	0643	<i>Myrospermum frutescens</i>
0586	<i>Maytenus ponceana</i>	0645	<i>Pinus insularis</i>
0587	<i>Lyonia rubiginosa</i>	0646	<i>Xylosma buxifolia</i>
0588	<i>Mecranium amygdalinum</i>	0647	* <i>Myroxylon schwaneckeanum</i>
0589	* <i>Melaleuca leucadendron</i>	0647	<i>Xylosma schwaneckeanum</i>
0589	<i>Melaleuca quinquenervia</i>	0648	<i>Myrcia paganii</i>
0590	<i>Melia azedarach</i>	0649	<i>Myrica cerifera</i>
0591	<i>Maytenus cymosa</i>	0650	<i>Myrica holdridgeana</i>
0592	<i>Melicoccus bijugatus</i>	0651	* <i>Consolea moniliformis</i>
0594	<i>Meliosma herbertii</i>	0651	<i>Opuntia moniliformis</i>
0595	<i>Meliosma obtusifolia</i>	0652	<i>Leandra krugiana</i>
0597	<i>Melochia tomentosa</i>	0652	* <i>Ossaea krugiana</i>
0597	* <i>Moluchia tomentosa</i>	0653	<i>Ouratea ilicifolia</i>

0654	<i>Ouratea striata</i>	0708	<i>Palicourea guianensis</i>
0655	<i>Pandanus utilis</i>	0709	<i>Palicourea domingensis</i>
0656	<i>Parmentiera aculeata</i>	0710	<i>Palicourea crocea</i> var. <i>riparia</i>
0656	* <i>Parmentiera edulis</i>	0710	* <i>Palicourea riparia</i>
0657	* <i>Picrasma antillana</i>	0711	* <i>Palicourea crocea</i>
0657	<i>Picrasma excelsa</i>	0711	<i>Palicourea crocea</i> var. <i>crocea</i>
0658	<i>Pilocarpus racemosus</i>	0712	* <i>Paralabatia portoricensis</i>
0659	<i>Piper swartzianum</i>	0712	<i>Pouteria dictyoneura</i>
0660	<i>Marlierea sintenisii</i>	0713	<i>Piper glabrescens</i>
0661	<i>Pouteria hotteana</i>	0713	* <i>Piper treleaseanum</i>
0662	* <i>Laurocerasus myrtifolia</i>	0714	<i>Parathesis crenulata</i>
0662	<i>Prunus myrtifolia</i>	0714	* <i>Parathesis serrulata</i>
0663	<i>Psychotria nutans</i>	0715	* <i>Persea portoricensis</i>
0664	* <i>Laurocerasus occidentalis</i>	0715	<i>Persea urbaniana</i>
0664	<i>Prunus occidentalis</i>	0717	<i>Parkia biglandulosa</i>
0666	<i>Pseudocedrela kotschy</i>	0718	<i>Parkinsonia aculeata</i>
0667	<i>Psychotria grandis</i>	0719	<i>Parmentiera cereifera</i>
0669	<i>Pterocarpus marsupium</i>	0720	* <i>Cassia polyphylla</i>
0670	* <i>Nectandra antillana</i>	0720	* <i>Peirania polyphylla</i>
0671	* <i>Nectandra coriacea</i>	0720	<i>Senna polyphylla</i>
0671	<i>Ocotea coriacea</i>	0722	* <i>Peltophorum ferrugineum</i>
0672	* <i>Nectandra krugii</i>	0722	* <i>Peltophorum inerme</i>
0672	<i>Ocotea krugii</i>	0722	<i>Peltophorum pterocarpa</i>
0673	* <i>Nectandra membranacea</i>	0723	<i>Pentadesma butyracea</i>
0673	<i>Ocotea membranacea</i>	0724	<i>Gesneria pedunculosa</i>
0674	* <i>Nectandra patens</i>	0724	* <i>Pentarrhaphia albiflora</i>
0674	<i>Ocotea patens</i>	0726	<i>Persea americana</i>
0675	* <i>Nectandra sintenisii</i>	0726	* <i>Persea persea</i>
0675	<i>Ocotea sintenisii</i>	0729	* <i>Petesoides pendula</i>
0677	<i>Neea buxifolia</i>	0729	<i>Wallenia pendula</i>
0679	<i>Nerium oleander</i>	0730	<i>Pera bumeliifolia</i>
0680	<i>Ochna mossambicensis</i>	0731	<i>Petitia domingensis</i>
0682	<i>Ochroma lagopus</i>	0735	<i>Cinnamomum elongatum</i>
0682	* <i>Ochroma pyramidale</i>	0735	* <i>Phoebe elongata</i>
0684	* <i>Ocotea cuneata</i>	0736	<i>Cinnamomum montanum</i>
0684	<i>Ocotea nemodaphne</i>	0736	* <i>Phoebe montana</i>
0685	<i>Ocotea floribunda</i>	0738	* <i>Cicca disticha</i>
0686	<i>Ocotea foeniculacea</i>	0738	<i>Phyllanthus acidus</i>
0687	<i>Ocotea leucoxydon</i>	0740	<i>Margaritaria nobilis</i>
0688	<i>Ocotea moschata</i>	0740	* <i>Phyllanthus nobilis</i>
0689	<i>Ocotea portoricensis</i>	0741	<i>Pinus nelsonii</i>
0690	<i>Ocotea spathulata</i>	0742	<i>Picramnia pentandra</i>
0691	<i>Ocotea wrightii</i>	0744	<i>Pictetia aculeata</i>
0692	<i>Oncoba echinata</i>	0745	<i>Pinus cembroides</i>
0693	* <i>Consolea rubescens</i>	0746	* <i>Amomis caryophyllata</i>
0693	<i>Opuntia rubescens</i>	0746	* <i>Pimenta racemosa</i>
0694	<i>Pinus pinceana</i>	0746	<i>Pimenta racemosa</i> var. <i>racemosa</i>
0695	<i>Ormosia krugii</i>	0747	<i>Pinus ayacahuite</i>
0696	<i>Oroxylum rhodoxylon</i>	0748	<i>Piper aduncum</i>
0697	<i>Ottoschulzia rhodoxylon</i>	0749	<i>Piper amalago</i>
0699	<i>Ouratea littoralis</i>	0750	<i>Piper blattarum</i>
0700	<i>Psidium amplexicaule</i>	0751	* <i>Piper tuberculatum</i>
0701	<i>Oxandra lanceolata</i>	0752	<i>Pinus caribaea</i> var. <i>bahamensis</i>
0702	<i>Oxandra laurifolia</i>	0753	<i>Pinus echinata</i>
0703	* <i>Padus capuli</i>	0754	<i>Pinus elliotii</i> var. <i>elliottii</i>
0703	<i>Prunus serotina</i>	0755	<i>Pinus merkusii</i>
0704	<i>Pinus elliotii</i>	0756	<i>Pinus occidentalis</i>
0705	<i>Piper marginatum</i>	0757	<i>Pinus oocarpa</i>
0706	<i>Piper hispidum</i>	0758	<i>Pinus patula</i>
0706	* <i>Piper scabrum</i>	0759	<i>Pinus radiata</i>
0707	<i>Palicourea alpina</i>	0760	<i>Pinus strobus</i>
0708	* <i>Palicourea barbinervia</i>	0761	<i>Pinus taeda</i>

0762	<i>Pinus pseudostrobus</i>	0819	<i>Garcinia portoricensis</i>
0763	<i>Pinus douglasiana</i>	0819	* <i>Rheedia acuminata</i>
0764	<i>Piptadenia peregrina</i>	0819	* <i>Rheedia portoricensis</i>
0765	<i>Pisonia albida</i>	0820	<i>Ricinus communis</i>
0766	<i>Pisonia subcordata</i>	0821	<i>Rhizophora mangle</i>
0767	<i>Pinus michoacana</i>	0822	<i>Adelia ricinella</i>
0768	<i>Pithecellobium arboreum</i>	0822	* <i>Ricinella ricinella</i>
0769	<i>Pithecellobium dulce</i>	0823	<i>Garcinia hessii</i>
0770	* <i>Pithecellobium saman</i>	0823	* <i>Rheedia hessii</i>
0770	<i>Samanea saman</i>	0824	<i>Rocheportia cuneata</i>
0771	<i>Pithecellobium unguis-cati</i>	0825	<i>Rocheportia acanthophora</i>
0772	<i>Pinus montezumae</i>	0827	<i>Rollinia mucosa</i>
0773	<i>Platanus occidentalis</i>	0829	<i>Rondeletia inermis</i>
0774	<i>Platymiscium pinnatum</i>	0830	<i>Rondeletia pilosa</i>
0775	<i>Piper jacquemontianum</i>	0831	<i>Rondeletia portoricensis</i>
0775	* <i>Piper wydlerianum</i>	0833	<i>Roystonea borinquena</i>
0776	<i>Caesalpinia pulcherrima</i>	0834	<i>Roystonea regia</i>
0777	<i>Pleodendron macranthum</i>	0835	* <i>Sabal bermudana</i>
0778	* <i>Plinia dussii</i>	0835	* <i>Sabal domingensis</i>
0778	<i>Siphoneugena densiflora</i>	0835	<i>Sabal umbraculifera</i>
0779	<i>Plumeria alba</i>	0836	<i>Sabal causiarum</i>
0780	<i>Plumeria krugii</i>	0838	<i>Sabinea florida</i>
0782	<i>Plumeria rubra</i>	0839	<i>Sabinea punicea</i>
0783	* <i>Nageia coriacea</i>	0841	<i>Salix chilensis</i>
0783	<i>Podocarpus coriaceus</i>	0841	* <i>Salix humboldtiana</i>
0784	* <i>Phlebotaenia cowellii</i>	0843	<i>Sambucus mexicana</i>
0784	<i>Polygala cowellii</i>	0844	<i>Brassaia actinophylla</i>
0785	* <i>Lucuma multiflora</i>	0844	* <i>Schefflera actinophylla</i>
0785	<i>Pouteria multiflora</i>	0845	<i>Samyda dodecandra</i>
0786	<i>Prockia crucis</i>	0846	<i>Schoepfia schreberi</i>
0787	* <i>Neltuma juliflora</i>	0847	<i>Sapindus saponaria</i>
0787	* <i>Prosopis juliflora</i>	0848	<i>Securinea acidoton</i>
0787	<i>Prosopis pallida</i>	0849	<i>Sapium laurocerasus</i>
0788	<i>Pseudolmedia spuria</i>	0851	<i>Schleichera oleosa</i>
0789	<i>Psidium guajava</i>	0851	* <i>Schleichera trijuga</i>
0790	<i>Psychotria berteriana</i>	0852	<i>Schinus terebinthifolius</i>
0791	<i>Psychotria brachiata</i>	0853	* <i>Sarcomphalus domingensis</i>
0792	<i>Psychotria brownei</i>	0853	<i>Ziziphus rignonii</i>
0793	<i>Pinus massoniana</i>	0854	* <i>Sarcomphalus reticulatus</i>
0794	<i>Psychotria maleolens</i>	0854	<i>Ziziphus reticulata</i>
0795	<i>Psychotria pubescens</i>	0856	<i>Savia sessiliflora</i>
0796	<i>Pterocarpus indicus</i>	0857	<i>Schaefferia frutescens</i>
0797	<i>Pterocarpus officinalis</i>	0858	<i>Schizolobium parahybum</i>
0798	* <i>Pterocarpus vidalianus</i>	0859	<i>Solanum wrightii</i>
0799	<i>Quararibea turbinata</i>	0860	<i>Schoepfia arenaria</i>
0800	<i>Punica granatum</i>	0862	<i>Cordia rickseckeri</i>
0801	<i>Randia aculeata</i>	0862	* <i>Sebesten rickseckeri</i>
0801	* <i>Randia mitis</i>	0863	<i>Cordia sebestena</i>
0803	* <i>Quasia amara</i>	0863	* <i>Sebesten sebestena</i>
0804	<i>Myrsine coriacea</i>	0864	* <i>Agati grandiflora</i>
0804	* <i>Rapanea ferruginea</i>	0864	<i>Sesbania grandiflora</i>
0805	<i>Myrsine guianensis</i>	0865	* <i>Mastichodendron foetidissimum</i>
0805	* <i>Rapanea guianensis</i>	0865	<i>Sideroxylon foetidissimum</i>
0807	<i>Rauvolfia nitida</i>	0867	<i>Schoepfia obovata</i>
0808	<i>Revenala madagascariensis</i>	0868	<i>Simarouba tulae</i>
0809	<i>Ravenia urbanii</i>	0869	<i>Sloanea berteriana</i>
0810	<i>Reynosia guama</i>	0870	<i>Solanum drymophilum</i>
0811	<i>Reynosia krugii</i>	0871	<i>Solanum rugosum</i>
0812	<i>Reynosia uncinata</i>	0872	<i>Solanum erianthum</i>
0814	<i>Crossopetalum rhacoma</i>	0872	* <i>Solanum verbascifolium</i>
0814	* <i>Rhacoma crossopetalum</i>	0874	<i>Spathodea campanulata</i>
0816	<i>Rhamnus sphaerosperma</i>	0875	<i>Spathodea nilotica</i>

0876	<i>Spondias cytherea</i>	0933	<i>Terminalia superba</i>
0876	* <i>Spondias dulcis</i>	0934	<i>Tetrazygia angustifolia</i>
0877	<i>Spondias mombin</i>	0935	<i>Tetrazygia elaeagnoides</i>
0878	<i>Spondias purpurea</i>	0936	<i>Terminalia amazonica</i>
0879	* <i>Sarcomphalus taylorii</i>	0936	* <i>Terminalia obovata</i>
0879	<i>Ziziphus taylorii</i>	0937	<i>Theobroma cacao</i>
0880	<i>Sida eggertii</i>	0938	<i>Thespesia populnea</i>
0882	<i>Antirhea acutata</i>	0939	* <i>Cerbera thevetia</i>
0882	* <i>Stenostomum acutatum</i>	0939	<i>Thevetia peruviana</i>
0884	<i>Antirhea coriacea</i>	0940	* <i>Thouinia portoricensis</i>
0884	* <i>Stenostomum coriaceum</i>	0940	<i>Thouinia striata</i> var. <i>portoricensis</i>
0885	<i>Antirhea portoricensis</i>	0940	* <i>Thyana portoricensis</i>
0885	* <i>Stenostomum portoricense</i>	0941	<i>Thouinia striata</i>
0886	<i>Antirhea sintenisii</i>	0941	* <i>Thyana striata</i>
0887	* <i>Solanum ficifolium</i>	0942	* <i>Thrinax microcarpa</i>
0888	<i>Sterculia apetala</i>	0943	<i>Thrinax morrisii</i>
0889	<i>Sterculia foetida</i>	0944	* <i>Thrinax ponceana</i>
0890	<i>Styrax portoricensis</i>	0946	<i>Toona sureni</i>
0891	<i>Swinglea glutinosa</i>	0947	<i>Torrabasia cuneifolia</i>
0892	<i>Suriana maritima</i>	0948	<i>Guapira discolor</i>
0893	* <i>Swietenia candollei</i>	0948	* <i>Torrubia discolor</i>
0893	<i>Swietenia macrophylla</i>	0949	<i>Guapira fragrans</i>
0894	<i>Swietenia mahagoni</i>	0949	* <i>Torrubia fragrans</i>
0895	<i>Swietenia humilis</i>	0950	<i>Guapira obtusata</i>
0896	<i>Symplocos lanata</i>	0950	* <i>Torrubia obtusata</i>
0897	<i>Symplocos martinicensis</i>	0951	<i>Trema lamarckiana</i>
0898	<i>Symplocos micrantha</i>	0951	* <i>Trema lamarckianum</i>
0899	* <i>Symplocos polyantha</i>	0952	<i>Trema micrantha</i>
0900	<i>Tabebuia chrysantha</i>	0952	* <i>Trema micranthum</i>
0900	* <i>Tabebuia glomerata</i>	0953	<i>Tournefortia filiflora</i>
0901	<i>Sloanea amygdalina</i>	0954	<i>Trichilia hirta</i>
0902	<i>Swietenia macrophylla</i> x <i>mahognai</i>	0955	<i>Trichilia pallida</i>
0903	<i>Tecoma stans</i>	0956	<i>Trichilia triacantha</i>
0907	<i>Tabebuia haemantha</i>	0957	<i>Triphasia trifolia</i>
0908	<i>Tabebuia heterophylla</i>	0958	<i>Triplaris americana</i>
0908	* <i>Tabebuia pallida</i>	0959	<i>Triplaris caracasana</i>
0909	<i>Tabebuia rosea</i>	0960	<i>Trophis racemosa</i>
0910	<i>Tabebuia rigida</i>	0961	<i>Triplaris cumingiana</i>
0911	<i>Tabebuia schumanniana</i>	0962	<i>Turpinia occidentalis</i>
0913	<i>Tamarindus indica</i>	0962	* <i>Turpinia paniculata</i>
0915	<i>Tabernaemontana citrifolia</i>	0968	<i>Ardisia luquillensis</i>
0915	* <i>Tabernaemontana oppositifolia</i>	0970	<i>Xylosma pachyphylla</i>
0917	<i>Miconia mirabilis</i>	0971	<i>Urera baccifera</i>
0917	* <i>Tamonea guianensis</i>	0972	<i>Urera caracasana</i>
0918	<i>Miconia serrulata</i>	0973	<i>Urera chlorocarpa</i>
0918	* <i>Tamonea macrophylla</i>	0974	<i>Xylosma schaefferioides</i>
0919	<i>Ternstroemia subsessilis</i>	0978	<i>Cordia rupicola</i>
0920	* <i>Taonabo heptasepala</i>	0978	* <i>Varronia rupicola</i>
0920	<i>Ternstroemia heptasepala</i>	0979	<i>Vitex divaricata</i>
0921	* <i>Taonabo luquillensis</i>	0981	<i>Weinmannia pinnata</i>
0921	<i>Ternstroemia luquillensis</i>	0982	<i>Widdringtonia whytei</i>
0923	* <i>Taonabo peduncularis</i>	0983	* <i>Yucca elephantipes</i>
0923	<i>Ternstroemia peduncularis</i>	0983	<i>Yucca guatemalensis</i>
0924	* <i>Taonabo pachyphylla</i>	0984	<i>Yucca gloriosa</i>
0924	* <i>Taonabo stahlia</i>	0985	<i>Ximenia americana</i>
0924	<i>Ternstroemia stahlia</i>	0986	<i>Yucca aloifolia</i>
0925	<i>Taxodium mucronatum</i>	0988	<i>Zanthoxylum caribaeum</i>
0928	<i>Tectona grandis</i>	0989	<i>Zanthoxylum flavum</i>
0929	<i>Terminalia myriocarpa</i>	0990	<i>Zanthoxylum martinicense</i>
0930	<i>Terminalia catappa</i>	0991	<i>Zanthoxylum monophyllum</i>
0931	<i>Terminalia latifolia</i>	0992	<i>Zanthoxylum punctatum</i>
0932	<i>Tetragastris balsamifera</i>	0993	<i>Zanthoxylum spinifex</i>

0995	<i>Ziziphus mauritiana</i>	1028	<i>Mimosa arenosa</i>
0999	<i>Aniba nilotica</i>	1029	<i>Muntingia calabura</i>
1001	<i>Sloanea caribaea</i>	1030	<i>Myroxylon balsamum</i>
1002	<i>Sloanea massoni</i>	1031	<i>Myrciaria floribunda</i>
1012	<i>Simarouba amara</i>	1032	<i>Ocotea globosa</i>
1013	<i>Acacia mangium</i>	1033	<i>Parkia timoriana</i>
1014	<i>Albizia adinocephala</i>	1034	<i>Pinus caribaea</i>
1015	<i>Aleurites fordii</i>	1035	<i>Pinus caribaea</i> var <i>hondurensis</i>
1016	<i>Ardisia solanacea</i>	1036	<i>Plumeria obtusa</i>
1017	<i>Bauhinia multinervia</i>	1036	* <i>Plumeria portoricensis</i>
1018	<i>Bourreria succulenta</i> var. <i>revoluta</i>	1037	* <i>Calyptropsidium sintenisii</i>
1019	* <i>Byrsonima cuneata</i>	1037	<i>Psidium sintenisii</i>
1019	<i>Byrsonima ophiticola</i>	1038	<i>Pterocarpus macrocarpus</i>
1020	<i>Calyptranthes luquillensis</i>	1039	<i>Senna multijuga</i>
1021	<i>Chionanthus milliflorus</i>	1040	<i>Cassia surattensis</i>
1022	<i>Clitoria fairchildiana</i>	1041	* <i>Cassia planisiliqua</i>
1023	<i>Copaifera officinalis</i>	1041	<i>Senna surattensis</i>
1024	<i>Codiaeum variegatum</i>	1042	<i>Solanum torvum</i>
1025	<i>Dialium guianensis</i>	1043	<i>Terminalia ivorensis</i>
1026	<i>Hibiscus pernambucensis</i>	1044	<i>Terminalia oblonga</i>
1027	<i>Lysiloma latisiliqua</i>	9998	Miscellaneous/unknown species

* indicates species is a synonym

CUBIC FOOT CULL PROCEDURES

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.

Also cull portions of the tree that contain embedded metal objects (e.g., fencing, nails) and sections between metal objects that are less than 122 cm in length.

Cubic Meter Volume of Short Logs (Cubic decimeters)										
DIB (cm) Midpoint	Length of log or section (M)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
1.0	4	8	12	16	20	24	27	31	35	39
12.5	6	12	18	25	31	37	43	49	55	61
15.0	9	18	27	35	44	53	62	71	80	88
17.5	12	24	36	48	60	72	84	96	108	120
20.0	16	31	47	63	79	94	110	126	141	157
22.5	20	40	30	80	99	119	139	159	179	199
25.0	25	49	74	98	123	147	172	196	221	245
30.0	35	71	106	141	177	212	247	283	318	353
35.0	48	96	144	192	241	289	337	385	433	481
10.0	63	126	188	251	314	377	440	503	565	628
45.0	80	159	239	318	398	477	557	636	716	795
50.0	98	196	295	393	491	589	687	785	884	982
55.0	119	238	355	475	594	713	832	950	1069	1188
60.0	141	283	424	565	707	848	990	1131	1272	1414
65.0	166	332	498	664	830	995	1161	1327	1493	1659
70.0	192	385	577	770	962	1155	1347	1539	1732	1924
75.0	221	442	663	884	1104	1325	1546	1767	1988	2209
80.0	251	503	754	1005	1257	1508	1759	2011	2262	2513
85.0	284	567	851	1135	1419	1702	1986	2270	2554	2837
90.0	318	636	954	1272	1590	1909	2227	2545	2863	3181
95.0	354	709	1063	1418	1772	2126	2481	2835	3190	3544
100.0	393	785	1178	1571	1964	2356	2749	3142	3534	3927

BOARD FOOT CULL PROCEDURES

Record the percentage of rotten and missing board-foot volume, to the nearest 1 percent. When estimating board-foot cull, only consider the cull in the sawlog portion of the tree, from a 1-ft stump to a 7-inch top for pines, from a 1-ft stump to 9-inch top on hardwoods. Do not include any cull estimate above actual length. Board foot cull cannot be coded greater than 67 percent. If the actual amount of board foot cull is greater than 67 percent, then TREE CLASS #2, and board foot cull is not required.

Board-foot cull is the volume within the entire sawlog portion of all live trees that cannot be recovered for use as lumber because of rot, sweep or crook, or other defect. Cull volume includes the entire volume of sections that do not meet minimum log grade requirements. This includes all sections less than 8 feet in length and the cull volume within sawlogs. Board foot cull is assigned for those trees receiving a tree grade, according to the section length (in feet), from a 1-foot stump to a 7-inch top in softwood or 9 inch top in hardwood.

Sweep and Crook

Estimate the length, small-end DIB, and sweep or crook departure of the affected section. If the length is 6 feet or less, treat as crook. To determine board-foot deduction, see the tables for sweep and crook in the appendix. If sweep or crook is so excessive that the section is cull, record the entire volume of the section as cull. This is the area within the heavy black lines of the sweep/crook tables.

Other Board-Foot Cull

Determine the length and the small-end DIB of the section containing decay, missing wood, fork, etc. Estimate the percentage of the section that is unusable for lumber, ties, or timber, ignoring cull defect that could normally be removed in slabbing. Apply this percentage to the total volume contained in the section, as shown in the board foot cull table.

Sawlog Stoppers

Measure the main stem to the point above which no sawlog can be produced to meet log grade standards (size and soundness) and to a minimum top of 7.0 inches DOB for softwoods and 9.0 inches DOB for hardwoods.

The sawlog cannot extend above a point where taper becomes excessive as evidenced by:

- (1) A fork with less than 8 foot sawlog above it (12 feet if this is the only log in the tree)
- (2) A limb with a base diameter equal to one half or more of the stem diameter below the limb, or a group of smaller limbs 2.0 inches or larger within a 1 foot section with equivalent diameter which collectively influence taper to the same degree.

Sawlog length should not extend above a sawlog section that does not meet minimum grade specifications and which has less than 8 feet of sawlog length above it (12 feet if this is the only log in the tree).

Board-Foot Volume of Short Logs										
DIB small end	Length of log or section (feet)									
	1	2	3	4	6	8	10	12	14	16
6	1	2	2	3	5	8	10	13	16	19
7	1	3	4	5	8	12	15	19	24	28
8	2	4	6	8	12	17	22	27	33	39
9	3	5	8	10	16	22	29	36	43	51
10	3	7	10	13	21	29	37	46	55	65
11	4	9	13	17	26	36	46	57	68	80
12	5	10	16	21	32	44	57	69	83	97
13	6	13	19	25	39	53	68	83	99	115
14	8	15	23	30	46	63	80	98	117	136
16	10	20	31	41	62	84	108	131	158	181
18	13	26	40	53	81	109	139	169	200	232
20	17	33	50	67	102	137	174	212	251	290
22	21	41	62	82	125	169	214	259	306	354
24	25	50	74	99	151	203	257	311	368	424
26	29	59	88	118	179	241	304	368	435	501
28	35	69	104	138	210	281	356	430	507	584
30	40	80	120	160	243	325	411	497	585	674
32	46	92	137	183	278	373	470	568	669	770
34	52	104	156	208	316	423	534	644	758	872
36	59	117	176	235	356	477	601	725	853	981
38	66	132	197	263	398	533	672	811	954	1096
40	73	146	220	293	443	593	747	902	1060	1218

Crook Deduction in Board Feet															
Crook departure (inches)	Crook length (feet)	Scaling diameter of section with crook (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	2	0	0	0	1	1	1	1	1	1	2	2	2	2	2
	3	1	1	1	1	1	1	2	2	2	2	3	3	3	4
	4	1	1	1	1	1	2	2	3	3	3	4	4	4	5
	5	1	1	1	1	2	2	3	3	4	4	5	5	6	6
	6	1	1	2	2	2	3	3	4	5	5	6	6	7	8
2	1	0	0	0	1	1	1	1	1	1	2	2	2	2	3
	2	1	1	1	1	1	2	2	2	3	3	4	4	4	5
	3	1	1	2	2	2	3	3	4	4	4	6	6	7	7
	4	1	1	2	2	3	3	4	5	6	7	8	8	9	10
	5	1	2	2	3	3	4	5	6	8	8	10	10	11	13
	6	2	2	3	4	4	5	7	8	9	10	13	13	14	15
3	1	0	0	1	1	1	1	2	2	2	3	3	3	3	4
	2	1	1	2	2	2	2	3	4	4	5	5	6	7	7
	3	1	2	2	3	3	4	5	6	7	8	8	9	10	11
	4	2	2	3	3	4	5	6	8	9	10	10	12	13	15
	5	2	3	4	4	5	6	8	10	11	13	13	16	17	19
	6	2	3	4	5	6	8	10	12	14	15	15	19	20	23
4	1	1	1	1	1	1	2	2	2	3	3	3	4	4	5
	2	1	2	2	2	3	3	4	5	6	7	7	8	9	10
	3	1	2	3	3	4	5	7	8	9	10	10	12	13	15
	4	2	3	4	3	5	7	9	10	12	13	13	17	18	20
	5	2	3	5	6	7	9	11	13	15	17	17	21	22	25
	6	3	5	6	7	8	11	13	15	18	20	20	25	27	30
5	1	-	-	1	2	2	2	3	3	4	4	4	5	6	6
	2	-	-	2	3	4	4	5	6	7	8	8	10	11	12
	3	-	-	4	4	5	7	8	10	11	12	12	16	17	19
	4	-	-	5	6	6	9	11	13	15	17	17	21	22	25
	5	-	-	6	7	8	11	13	16	19	21	21	26	28	31
	6	-	-	8	9	10	13	16	19	23	26	26	32	34	36
6	1	-	-	-	2	2	2	3	4	4	5	5	6	7	8
	2	-	-	-	3	4	5	6	7	9	10	10	13	13	15
	3	-	-	-	4	6	8	10	12	13	15	15	19	20	22
	4	-	-	-	7	8	10	13	15	18	20	20	25	27	30
	5	-	-	-	9	10	13	16	19	23	25	25	32	34	38
	6	-	-	-	11	13	16	20	23	27	31	31	38	41	45
8	1	-	-	-	-	-	3	5	5	6	7	7	8	9	10
	2	-	-	-	-	-	7	9	10	12	13	13	17	18	20
	3	-	-	-	-	-	10	13	16	18	20	20	25	27	30
	4	-	-	-	-	-	14	17	20	24	27	27	33	36	40
	5	-	-	-	-	-	17	22	26	30	34	34	42	45	50
	6	-	-	-	-	-	21	26	31	36	41	41	51	54	60
10	1	-	-	-	-	-	-	-	6	7	8	8	10	11	12
	2	-	-	-	-	-	-	-	12	14	16	16	21	23	25
	3	-	-	-	-	-	-	-	19	22	25	25	31	34	37
	4	-	-	-	-	-	-	-	26	29	34	34	41	45	49
	5	-	-	-	-	-	-	-	32	37	42	42	52	57	62
	6	-	-	-	-	-	-	-	39	45	51	51	63	69	75

In dashed (-) spaces, crook exceeds the maximum that is allowed and culls the entire section. Boxed spaces are sound for softwoods, but cull for hardwoods.

Sweep Deduction in Board Feet															
Sweep departure (inches)	Sweep length (feet)	Scaling diameter of section with sweep (inches)													
		6	7	8	9	10	12	14	16	18	20	22	24	26	28
2	6	1	1	2	2	3	3	4	5	6	6	7	8	9	9
	8	1	1	2	2	3	4	5	5	6	7	8	8	9	10
	10	1	1	2	2	3	4	4	5	6	7	7	8	9	10
	12	1	1	2	2	2	3	4	4	5	6	6	6	7	8
	14	1	1	1	1	1	2	2	2	3	3	3	4	4	5
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	6	2	3	3	5	5	6	7	9	10	11	13	14	15	17
	8	2	3	4	6	6	7	9	10	12	14	15	17	19	20
	10	2	4	5	6	6	8	10	12	13	15	17	19	20	22
	12	3	4	5	7	7	9	11	12	14	16	18	19	21	23
	14	3	4	5	7	7	9	10	12	14	16	17	19	21	23
16	3	4	5	6	6	8	10	11	13	14	16	18	19	21	
4	6	3	4	5	6	7	8	11	13	15	17	18	20	22	24
	8	4	5	6	7	9	11	14	16	18	21	23	25	28	30
	10	5	6	8	9	10	13	16	19	21	24	27	29	32	35
	12	5	7	8	10	12	14	18	20	23	26	29	32	35	38
	14	6	8	9	11	12	16	19	22	25	28	31	35	38	41
16	6	8	10	11	13	16	19	23	26	29	32	35	39	42	
5	6	-	5	6	8	9	11	14	16	19	22	24	27	29	32
	8	5	7	8	10	12	15	18	21	24	27	31	34	37	40
	10	6	8	10	12	14	18	21	25	29	33	36	40	44	48
	12	8	10	12	12	16	20	25	29	33	37	41	45	50	54
	14	9	11	13	16	18	22	27	32	36	41	45	50	54	59
16	10	12	15	17	20	24	29	34	39	44	48	53	58	63	
6	6	-	-	8	9	11	14	17	20	24	27	30	33	36	39
	8	-	-	11	12	14	18	22	26	30	34	38	42	46	50
	10	-	10	13	15	18	23	27	32	36	41	46	51	56	60
	12	-	12	15	18	21	26	32	37	42	48	53	58	64	69
	14	11	15	18	20	23	29	36	41	47	53	59	65	71	77
16	13	16	20	23	26	32	39	45	52	58	64	71	77	83	
7	6	-	-	-	11	13	16	21	24	28	32	36	39	43	47
	8	-	-	-	15	17	22	27	31	36	41	46	51	56	60
	10	-	-	-	19	21	27	33	39	44	50	56	62	67	73
	12	-	-	-	22	25	32	39	45	52	58	65	71	78	84
	14	-	-	-	25	29	36	44	51	58	66	73	81	88	95
16	-	-	24	28	33	40	49	57	64	72	80	88	96	104	
8	6	-	-	-	-	-	19	24	28	33	37	41	46	50	54
	8	-	-	-	-	-	25	31	37	42	48	54	59	65	70
	10	-	-	-	-	25	32	39	46	52	59	66	72	79	86
	12	-	-	-	-	30	37	46	53	61	69	76	84	92	100
	14	-	-	-	-	34	43	52	61	69	78	87	96	105	113
16	-	-	-	34	39	48	58	68	77	87	97	106	116	125	
9	6	-	-	-	-	-	-	27	32	37	42	47	52	57	62
	8	-	-	-	-	-	29	36	42	48	55	61	68	74	80
	10	-	-	-	-	-	37	44	52	60	67	75	83	91	99
	12	-	-	-	-	-	43	52	61	70	80	88	97	106	115
	14	-	-	-	-	-	50	61	71	81	91	101	111	121	131
16	-	-	-	-	-	57	68	79	90	102	113	124	135	146	

In dashed (-) spaces, excessive sweep culls the entire section. Boxed spaces are sound for softwoods, but cull for hardwoods.

TREE GRADE PROCEDURES

HARDWOOD TREE GRADES

HARDWOOD TREE GRADES			
GRADING FACTORS	GRADE 1	GRADE 2	GRADE 3
Length of grading zone (ft)	Butt 16	Butt 16	Butt 16
Length of grading section ^a (ft)	Best 12	Best 12	Best 12
Minimum DBH (in)	16 ^b	13	11
Minimum DIB at the top of the grading section (in)	13 ^b 16 20	11 ^c 12	8
Clear cuttings on 3rd best face ^d minimum length (ft)	7 5 3	3 3	2
number on face (max)	2	2 3	unlimited
yield in face length (min)*	5/6	4/6	3/6
Cull deduction, including crook and sweep but excluding shake, maximum w/in grading section (%)	9	9 ^e	50

^a Whenever a 14- or 16-ft section of the butt log is better than the best 12-ft 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 the top of the grading section may be 12-in and DBH may be 15-in.

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

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

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

*Minimum Yield in Face Length			
Face Length	Grade 1 Min. Yield	Grade 2 Min. Yield	Grade 3 Min. Yield
12-ft	10-ft	8-ft	6-ft
14-ft	11.7-ft	9.3-ft	7-ft
16-ft	13.3-ft	10.7-ft	8-ft

HARDWOOD TIE AND TIMBER GRADE 4	
GRADING FACTORS	SPECIFICATIONS
Length of grading zone (ft)	Butt 16
Scaling diameter (in)	8-in DIB and larger
Length, w/o trim (ft)	12-ft and longer
Clear cuttings	No requirements (not graded on cutting basis)
Maximum sweep allowance	One-fourth DIB of small end for half logs, and one-half DIB for logs 16-ft long
Sound surface defects -	
Single knots	Any number, if none has an average collar ^a diameter that is more than one-third of the log diameter at the point of occurrence.
Whorled knots	Any number, provided the sum of the collar diameters does not exceed one-third the log diameter at the point of occurrence.
Knots	Any number not exceeding knot specifications, if they do not extend more than 3-in into the contained tie or timber.
Unsound surface defects ^b	Any number and size, if they do not extend into contained tie or timber. If they extend into contained tie or timber, they shall not exceed size, number, and depth of limits for sound defects.

^a Knot collar is the average of the vertical and horizontal diameters of the limb, or knot swelling, as measured flush with the surface of the log.

^b Interior defects are not visible in standing trees. They are considered in grading cut logs. No interior defects are permitted except one shake not more than one-third the width of the contained tie or timber, and one split not more than 5-in long.

HARDWOOD TREE GRADE 5

Record TREE GRADE 5 for hardwood species that do not meet the length of grading zone requirement for TREE GRADE 1-4, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

These logs must still meet the size, soundness and surface yield requirements for a grade 1-4 log. The only difference is that the length of the grading zone extends beyond the butt 16-foot log.

Since these logs are in the upper portion of the tree, determining the surface yield is impractical. When determining if TREE GRADE = 5, simply make sure the log appears to meet the size and soundness requirements of a TREE GRADE 4 (no internal rot). If it is clear the upper log does have internal rot, then it must be examined further to determine if it can at least meet the size, soundness and surface yield requirements of a TREE GRADE 3 (the log must be at least 8 inches DIB, with no more than 50% board foot cull in the section, at least 3/6 of the section length clear of defects, and at least 2 feet between defects.)

Log abnormalities that are defects in factory logs include the following:

Adventitious bud clusters	Limb
Bulge, butt or stem	Knots
High bumps	Knot overgrowths
Burl	Low bumps
Butt scar	Overgrowths following insect damage or bird peck*
Canker	Seams, if not superficial
Conk	Wounds extending into the bole
Flutes, if not superficial	
Holes extending into the bole	
Embedded metal (fence)	

Bird pecks: There must be four bird pecks within a square foot to affect the tree grade. First, determine the tree grade without the bird pecks. If the tree grade is determined to be 1 or 2, then down grade the tree by one grade. If the tree graded out to be a 3 or 4 without the bird pecks, then ignore them as defects and record the initial tree grade.

Abnormalities not ordinarily limiting cuttings are butt swell, flanges and surface rise.

SOUTHERN PINE TREE GRADES

SOUTHERN PINE TREE GRADES			
All pines except eastern white pine. Includes eastern red cedar.			
FACE LENGTH	GRADE 1	GRADE 2	GRADE 3
Butt 16-ft*	3 or 4 clear faces	1 or 2 clear faces	No clear faces

After the tentative grade is established, the tree will be **reduced one grade** for each of the following:

Sweep - Degrade any tentative Grade 1 or 2 tree one grade if sweep in the lower 12-ft of the grading section amounts to 3 or more inches and equals or exceeds one-fourth the DBH.

Heart rot - Degrade any tentative Grade 1 or 2 tree one grade if conks, punk knots, or other evidence of advanced heart rot is found anywhere on the tree stem.

Note - No tree can be degraded below Grade 3, provided the total scaling deductions for sweep and/or rot do not exceed two-thirds the gross scale of the tree. Trees with total scaling deductions in excess of two-thirds are classified as cull (Tree Class 3 or 4).

A face is one-fourth the circumference of the 16-ft grading section and extends the full length of the grading section. Clear faces are those free from knots measuring more than 1/2-in in diameter, overgrown knots of any size, and holes more than 1/4-in in diameter. Faces may be rotated, if necessary, to obtain the maximum number of clear faces on the grading section.

*Note: Only grade the length of the log up to a 7-inch top DOB. The 7-inch top DOB must be between 12 and 16 feet off of the 1-ft stump to be TREE CLASS 2.

SOUTHERN PINE TREE GRADE 5

Record TREE GRADE 5 for southern pine species that do not have a 12-foot log in the butt 16-foot grading section due primarily to poor form, but do have either an upper 12-foot log or 2 non-contiguous 8-foot logs, and the total board foot cull deduction is less than 67%.

Appendix 3. Glossary

Accessible Forest Land – Land that is within sampled area (the population of interest), is accessible and 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 (appendix 3) of any size 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, grazing, or recreation activities, or
- b) in several western woodland types where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevent normal regeneration and succession such as regular mowing, grazing, or recreation activities.

ACTUAL LENGTH – For trees with broken or missing tops. The actual length of the tree is recorded to the nearest 30 cm 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.

Agricultural Land – Land managed for crops, pasture, or other agricultural use. Evidence includes geometric field and road patterns, fencing, and the traces produced by livestock or mechanized equipment. The area must be at least 0.4 hectare in size and 36.6 M. wide at the point of occurrence.

Annular plot – a circular ring with a beginning radius of 7.32 M from subplot center and an ending radius of 17.95 M.

ARTIFICIAL REGENERATION SPECIES – Indicates the predominant species that is planted or seeded in an artificially regenerated condition.

Blind check – a re-installation done by a qualified inspection crew without production crew data on hand; a full re-installation of the plot for the purpose of obtaining a measure of data quality. The two data sets are maintained separately. Discrepancies between the two sets of data are not reconciled. Blind checks are done on production plots only.

Bole – The main stem of a tree, extending from one foot above the ground to the point on the tree where DOB reaches 122 cm.

Boundary – The intersection of two or more conditions on a subplot or microplot. Each boundary is described by recording the azimuth and horizontal distance from the subplot or microplot center to the left and right points of where the boundary intersects the perimeter of the subplot or microplot. An azimuth and distance to a corner point may also be described, if one exists. If multiple boundaries exist at a subplot, they are recorded in the order of their occurrence on the subplot, starting from north and proceeding around the compass.

Census Water – Rivers and streams that are more than 61 meters wide and bodies of water that are greater than 1.82 hectares in size.

Certification plot – a plot installed by a certification candidate. It may be a training plot or a production plot. The candidate working alone installs the plot.

Cold check – an inspection done either as part of the training process, or as part of the ongoing QC program. Normally the installation crew is not present at the time of inspection. The inspector has the completed data in-hand at the time of inspection. The inspection can include the whole plot or a subset of the plot. Discrepancies between the two sets of data may be reconciled. Cold checks are done on production plots only.

CONDITION CLASS – The combination of discrete landscape and forest attributes that identify and define different strata on the plot. Examples of such attributes include condition class status, forest type, stand origin, stand size, owner group, reserve status and stand density.

Cropland – Land under cultivation within the past 24 months, including orchards and land in soil improving crops, but excluding land cultivated in developing improved pasture.

CROWN CLASS – A classification of trees based on dominance in relation to adjacent trees within the stand as indicated by crown development and the amount of sunlight received from above and sides.

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

Diameter at Breast Height (DBH) – The diameter of the bole of a tree at breast height (1.37 M above the ground), measured outside of the bark.

Diameter at Root Collar (DRC) – The diameter of a tree measured at the ground line or stem root collar, measured outside of the bark.

Diameter Outside Bark (DOB) – A diameter that may be taken at various points on a tree, or log, **outside** of the bark. Diameter Outside Bark is often estimated.

Federal Information Processing Standard (FIPS) – A unique code identifying U.S. States and counties (or units in Alaska).

Forest Industry Land – Land owned by companies or individuals that operate wood-using plants.

Forest Trees – Plants having a well-developed, woody stem and usually more than 3.66 M in height at maturity.

FOREST TYPE – A classification of forest land based upon the trees or tree communities that constitute the majority of stocking on the site.

GPS – Global Positioning System. Information from this system is collected and used to determine the latitude and longitude of each plot.

Hardwoods – Dicotyledonous trees, usually broad-leaved and deciduous.

Hot check – an inspection normally done as part of the training process. The inspector is present on the plot with the trainee and provides immediate feedback regarding data quality. Data errors are corrected. Hot checks can be done on training plots or production plots.

Idle Farmland -- Former cropland or pasture that has not been tended within the last 2 years and that has less than 10 percent stocking with live trees.

Improved Pasture -- Land that is currently maintained and used for grazing. Evidence of maintenance, besides the degree of grazing, includes condition of fencing, presence of stock ponds, periodic brush removal, seeding, irrigation, or mowing.

Inclusion – An area that would generally would be recognized as a separate condition, except that it is not large enough to qualify. For example, a ½ acre pond within a forested stand.

Industrial Wood – All roundwood products, except firewood.

Inspection crew – a crew of qualified QC/QA individuals whose primary responsibility is the training, certification and inspection of production crews.

Land Area – As defined by the Bureau of the Census: The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean tide); streams, sloughs, estuaries and canals less than 61 meters in width, and ponds less than 1.82 hectares in area.

Macroplot – A circular, fixed area plot with a radius of 17.95 M. Macroplots may be used for sampling relatively rare events.

Maintained Road – Any road, hard topped or other surfaces, that is plowed or graded periodically and capable of use by a large vehicle. Rights-of-way that are cut or treated to limit herbaceous growth are included in this area.

Marsh – Low, wet areas characterized by heavy growth of weeds and grasses and an absence of trees.

Measurement Quality Objective (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.

Merchantable Top – The point on the bole of trees above which merchantable material cannot be produced. Merchantable top is 46 cm for western woodland species and 122 cm for all other species.

Microplot – A circular, fixed-radius plot with a radius of 2.07 M that is used to sample trees less than 125 mm at DBH, as well as other vegetation.

National Forest Land – Federal lands which have been legally designated as National Forests or purchase units, and other lands under the administration of the Forest Service, including experimental areas and Bankhead-Jones Title III lands.

Native American (Indian) Land – Tribal lands held in fee, or trust, by the Federal government but administered for Indian tribal groups and Indian trust allotments. This land is considered “Private Lands”, Owner Group 40.

Non-census Water – Bodies of water from 0.4 to 1.82 hectares in size and water courses from 9.1 to 60.9 meters in width.

Nonforest Land -- Land that does not support, or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 36.6 M wide, and clearings, etc., more than one acre in size, to qualify as nonforest land.

Nonstockable – Areas of forest land that are not capable of supporting trees because of the presence of rock, water, etc.

Other Federal Lands – Federal land other than National Forests. These include lands administered by the USDI Bureau of Land Management, USDI National Park Service, USDI Fish and Wildlife Service, Department of Defense, Department of Energy, Army Corps of Engineers, and military bases.

OWNER CLASS -- A variable that classifies land into fine categories of ownership.

OWNER GROUP – A variable that classifies land into broad categories of ownership; Forest Service, Other Federal Agency, State and Local Government, and Private. Differing categories of Owner Group on a plot require different conditions.

Phase 1 (P1) – FIA activities done as part of remote-sensing and/or aerial photography.

Phase 2 (P2) – FIA activities done on the network of ground plots formerly known as FIA plots.

Phase 3 (P3) – FIA activities done on a subset of Phase 2 plots formerly known as Forest Health Monitoring plots. Additional ecological indicator information is collected from Phase 3 plots.

Plot – A cluster of four subplots that samples approximately .07 hectare. The subplots are established so that subplot 1 is centered within the sample and the centers of subplots 2, 3, and 4 are located 36.6 M from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and macroplot.

PRIVATE OWNER INDUSTRIAL STATUS – Indicates whether Private land owners own and operate a wood processing plant.

Production crew – a crew containing at least one certified individual. The crew is involved in routine installation of plots.

Production plot – a plot that belongs to the 2,428 hectare grid database. It may also be used for training purposes.

REGENERATION STATUS – A stand descriptor that indicates whether a stand has been naturally or artificially regenerated.

Reserved Land – Land that is withdrawn from timber utilization by a public agency or by law.

RESERVE STATUS – An indication of whether the land in a condition has been reserved.

Saplings – Live trees 25 to 124 mm DBH.

Seedlings – Live trees less than 25 mm DBH that are at least 30 cm tall.

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

STAND AGE – A stand descriptor that indicates the average age of the live trees not overtopped in the predominant stand size-class of a condition.

STAND DENSITY – A stand descriptor that indicates the relative tree density of a condition class. The classification is based 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.

STAND SIZE – A stand descriptor that indicates which size-class of trees that are not overtopped constitutes the majority of stocking in the stand.

State, County and Municipal Lands – Lands owned by states, counties, and local public agencies or municipalities, or lands leased to these government units for 50 years or more.

Stocking – The relative degree of occupancy land by trees, measured as basal area or the number of trees in a stand by size or age and spacing, compared to the basal area or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard.

Subplot – A circular, fixed-area plot with a radius of 7.32 M. Each subplot represents ¼ of the fixed plot sample unit.

TOTAL LENGTH – The total length of the tree, recorded to the nearest 30 cm 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, the total length is estimated to what the length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees

Training plot – a plot established for training or certification purposes only. It does NOT belong to the 2,428 hectare grid database.

Transition Zone – An area where a distinct boundary between two or more different conditions cannot be determined.

Appendix 4. Tolerance / MQO / Value / Units Table

Core optional variables are in italics. n/a is not applicable.

Variable Name	Tolerance	MQO	Units	Factor
General Description				
New Subplot Location	+/- 2.1 M	at least 95% of the time	M	10
New Microplot Location	+/- 30 cm	at least 95% of the time	cm	10
Plot Level Data				
STATE	No errors	at least 99% of the time	n/a	5
COUNTY	No errors	at least 99% of the time	n/a	5
PLOT NUMBER	No errors	at least 99% of the time	n/a	5
PLOT STATUS	No errors	at least 99% of the time	n/a	5
PLOT NONSAMPLED REASON	No errors	at least 99% of the time	n/a	1
SUBPLOTS EXAMINED	No errors	at least 90% of the time	n/a	
SAMPLE KIND	No errors	at least 99% of the time	n/a	5
PREVIOUS PLOT NUMBER	No errors	at least 99% of the time	n/a	
FIELD GUIDE VERSION	No errors	at least 99% of the time	n/a	1
YEAR	No errors	at least 99% of the time	year	1
MONTH	No errors	at least 99% of the time	month	1
DAY	No errors	at least 99% of the time	day	1
<i>DECLINATION</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>degrees</i>	
HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	at least 90% of the time	n/a	1
WATER ON PLOT	No errors	at least 90% of the time	n/a	1
QA STATUS	No errors	at least 99% of the time	n/a	1
CREW TYPE	No errors	at least 99% of the time	n/a	1
GPS UNIT	No errors	at least 99% of the time	n/a	1
GPS SERIAL NUMBER	No errors	at least 99% of the time	n/a	1
<i>GPS DATUM</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>n/a</i>	
<i>COORDINATE SYSTEM</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>n/a</i>	
LATITUDE DEGREES	No errors	at least 99% of the time	degrees	1
LATITUDE MINUTES	No errors	at least 99% of the time	minutes	1
LATITUDE SECONDS	+/- 140 ft	at least 99% of the time	seconds	1
LONGITUDE DEGREES	No errors	at least 99% of the time	degrees	1
LONGITUDE MINUTES	No errors	at least 99% of the time	minutes	1
LONGITUDE SECONDS	+/- 140 ft	at least 99% of the time	seconds	1
UTM ZONE	No errors	at least 99% of the time	n/a	
<i>EASTING (X) UTM</i>	<i>+/- 140 ft</i>	<i>at least 99% of the time</i>		
<i>NORTHING (Y) UTM</i>	<i>+/- 140 ft</i>	<i>at least 99% of the time</i>		
AZIMUTH TO PLOT CENTER	+/- 3 degrees	at least 99% of the time	degrees	1
DISTANCE TO PLOT CENTER	+/- 1.8 M	at least 99% of the time	M	1
GPS ELEVATION		at least 99% of the time	feet	1
GPS ERROR	No errors	at least 99% of the time	feet	1
NUMBER OF READINGS	No errors	at least 99% of the time	n/a	1
<i>GPS FILENAME</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>n/a</i>	
<i>MACROPLOT BREAKPOINT DIAMETER</i>	<i>No errors</i>	<i>at least 99% of the time</i>	<i>inches</i>	
PLOT-LEVEL NOTES	n/a	n/a	n/a	1 to 5
CYCLE	No errors	At least 99% of the time	n/a	1
PANEL	No errors	At least 99% of the time	n/a	1
PHASE	No errors	At least 99% of the time	n/a	1
PLOT IN CORRECT COUNTY?	No errors	At least 99% of the time	n/a	1
CORRECT COUNTY	No errors	at least 99% of the time	n/a	1
PAST YEAR	No errors	At least 99% of the time	n/a	1
PAST MONTH	No errors	At least 99% of the time	n/a	1
PAST DAY	No errors	At least 99% of the time	n/a	1
CRUISER NUMBER	No errors	at least 99% of the time	n/a	1
ASSISTANT CRUISER NUMBER(S)	No errors	at least 99% of the time	n/a	1
NUMBER OF ACCESSIBLE FORESTLAND CONDITIONS	No errors	at least 99% of the time	n/a	1
NUMBER OF TREE ENTRIES	No errors	at least 99% of the time	n/a	1
HORIZONTAL DISTANCE TO URBAN OR BUILT- UP LAND	No errors	At least 90% of the time	n/a	1
HORIZONTAL DISTANCE TO AGRICULTURAL LAND	No errors	At least 90% of the time	n/a	1
PLOT ACCESSIBILITY	No errors	at least 99% of the time	n/a	1
Condition Class Information				
CONDITION CLASS NUMBER	No errors	at least 99% of the time	n/a	1
CONDITION CLASS STATUS	No errors	at least 99% of the time	n/a	5
CONDITION NONSAMPLED REASON	No errors	at least 99% of the time	n/a	1

Variable Name	Tolerance	MQO	Units	Factor
RESERVED STATUS	No errors	at least 99% of the time	n/a	3
OWNER GROUP	No errors	at least 99% of the time	n/a	3
FOREST TYPE	No errors	at least 99% of the time in group at least 95% of the time in type no MQO when STAND SIZE CLASS = 0	n/a	5
PR FOREST TYPE	No errors	at least 99% of the time in group at least 95% of the time in type no MQO when STAND SIZE CLASS = 0	n/a	5
STAND SIZE CLASS	No errors	at least 99% of the time	class	5
REGENERATION STATUS	No errors	at least 99% of the time	n/a	5
TREE DENSITY	No errors	at least 99% of the time	n/a	1
OWNER CLASS	No errors	at least 99% of the time	class	2
PRIVATE OWNER INDUSTRIAL STATUS	No errors	at least 99% of the time	n/a	1
ARTIFICIAL REGENERATION SPECIES	No errors	at least 99% of the time	n/a	1
STAND AGE	+/- 10%	at least 95% of the time	Year	5
DISTURBANCE 1	No errors	at least 99% of the time	n/a	5
DISTURBANCE YEAR 1	+/- 1 year for 5-year measure. cycles +/- 2 years for > 5-year measure. cycles	at least 99% of the time	year	1
DISTURBANCE 2	No errors	at least 99% of the time	n/a	5
DISTURBANCE YEAR 2	+/- 1 year for 5-year measure. cycles +/- 2 years for > 5-year measure. cycles	at least 99% of the time	year	1
DISTURBANCE 3	No errors	at least 99% of the time	n/a	5
DISTURBANCE YEAR 3	+/- 1 year for 5-year measure. cycles +/- 2 years for > 5-year measure. cycles	at least 99% of the time	year	1
TREATMENT 1	No errors	at least 99% of the time	n/a	5
TREATMENT YEAR 1	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	at least 99% of the time	year	1
TREATMENT 2	No errors	at least 99% of the time	n/a	5
TREATMENT YEAR 2	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	at least 99% of the time	year	1
TREATMENT 3	No errors	at least 99% of the time	n/a	5
TREATMENT YEAR 3	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	at least 99% of the time	year	1
PHYSIOGRAPHIC CLASS	No errors	at least 80% of the time	n/a	3
PRESENT NONFOREST LAND USE	No errors	at least 99% of the time	n/a	5
PRESENT LAND USE	No errors	At least 99% of the time	n/a	5
STAND STRUCTURE	No errors	At least 99% of the time	n/a	1
OPERABILITY	No errors	At least 99% of the time	n/a	1
FIRE	No errors	At least 99% of the time	n/a	1
GRAZING	No errors	At least 99% of the time	n/a	1
Subplot Information				
SUBPLOT NUMBER	No errors	at least 99% of the time	n/a	1
SUBPLOT/ MACROPLOT STATUS	No errors	at least 99% of the time	n/a	5
SUBPLOT NONSAMPLED REASON	No errors	at least 99% of the time	n/a	1
SUBPLOT CENTER CONDITION	No errors	at least 99% of the time	n/a	5
MICROPLOT CENTER CONDITION	No errors	at least 99% of the time	n/a	5
SUBPLOT SLOPE	+/- 10 %	at least 90% of the time	percent	1
SUBPLOT ASPECT	+/- 10 degrees	at least 90% of the time	degrees	1
SNOW/WATER DEPTH	+/- 15 cm	at the time of measurement	cm	1
SUBPLOT/ MACROPLOT CONDITION LIST	No errors	at least 99% of the time	n/a	1
Boundary Data				
SUBPLOT NUMBER	No errors	at least 99% of the time	n/a	1
PLOT TYPE	No errors	at least 99% of the time	n/a	1
BOUNDARY CHANGE	No errors	at least 99% of the time	n/a	1
CONTRASTING CONDITION	No errors	at least 99% of the time	n/a	1
LEFT AZIMUTH	+/- 5 degrees	at least 90% of the time	degrees	3

Variable Name	Tolerance	MQO	Units	Factor
CORNER AZIMUTH	+/- 5 degrees	at least 90% of the time	degrees	3
CORNER DISTANCE	+/- 30 cm	at least 90% of the time	cm	3
RIGHT AZIMUTH	+/- 5 degrees	at least 90% of the time	degrees	3
BOUNDARY STATUS	No errors	At least 99% of the time	n/a	1
Tree and Sapling Data				
SUBPLOT NUMBER	No errors	at least 99% of the time	n/a	1
TREE RECORD NUMBER	No errors	at least 99% of the time	n/a	1
CONDITION CLASS NUMBER	No errors	at least 99% of the time	n/a	1
AZIMUTH	+/- 3 degrees	at least 90% of the time	degrees	1
HORIZONTAL DISTANCE	microplot: +/- 6 cm subplot: +/- 30 cm	at least 90% of the time	centi- meters	1
PREVIOUS TREE STATUS	No errors	at least 95% of the time	n/a	5
PRESENT TREE STATUS	No errors	at least 95% of the time	n/a	5
RECONCILE	No errors	at least 95% of the time	n/a	5
STANDING DEAD	No errors	At least 99% of the time	n/a	1
MORTALITY	No errors	at least 85% of the time	n/a	
SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	n/a	2
DIAMETER	+/- 3 mm per 508 mm increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2 +/- 25 mm per 508 mm increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5	at least 95% of the time	mm	Saplings & snags = 1, pole & sawtimber =5
DRC STEM DIAMETER	+/- 0.2 inch per stem	at least 95% of the time	inch	
DRC STEM STATUS	No errors	at least 95% of the time	n/a	
PAST NUMBER OF STEMS	No errors	at least 90% of the time	n/a	
CURRENT NUMBER OF STEMS	No errors	at least 90% of the time	n/a	
DIAMETER CHECK	No errors	at least 99% of the time	n/a	1
ROTTEN / MISSING CULL	+/- 10%	at least 90% of the time	percent	2
TOTAL LENGTH	+/- 10% of true length	at least 90% of the time	feet	Saplings & snags = 1, pole & sawtimber =5
ACTUAL LENGTH	+/- 10% of true length	at least 90% of the time	feet	Saplings & snags = 1, pole & sawtimber =5
LENGTH METHOD	No errors	at least 99% of the time	n/a	1
CROWN CLASS	No errors	at least 85% of the time	n/a	2
UNCOMPACTED LIVE CROWN RATIO	+/- 10%	at least 90% of the time	percent	
COMPACTED CROWN RATIO	+/- 10%	at least 80% of the time	percent	1
DAMAGE LOCATION 1	+/- 1 location class	at least 80% of the time	class	
DAMAGE TYPE 1	No errors	at least 80% of the time	n/a	
DAMAGE SEVERITY 1	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	at least 80% of the time	class	
DAMAGE LOCATION 2	+/- 1 location class	at least 80% of the time	class	
DAMAGE TYPE 2	No errors	at least 80% of the time	n/a	
DAMAGE SEVERITY 2	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	at least 80% of the time	class	
CAUSE OF DEATH	No errors	at least 80% of the time	n/a	1
MORTALITY YEAR	+/- 1 year for 5-year measure. cycles +/- 2 years for > 5-year measure. cycles	at least 70% of the time	year	1
DECAY CLASS	+/- 1 class	at least 90% of the time	class	1
LENGTH TO DIAMETER MEASUREMENT POINT	+/- 6 cm	at least 90% of the time	decimeter	1
ROUGH CULL	+/- 10 %	at least 90% of the time	percent	
MISTLETOE CLASS	+/- 1 class	at least 90% of the time	class	
TREE NOTES	n/a	n/a	n/a	n/a
ENTRY NUMBER	No errors	At least 99% of the time	n/a	1
ABNORMAL TREE	No errors	At least 90% of the time	n/a	1
TREE CLASS	No errors	At least 90% of the time	n/a	5
FUSIFORM/ COMANDRA RUST/ HARDWOOD DIEBACK	No errors	At least 80% of the time	n/a	1
DIEBACK SEVERITY	+/- 1 class	At least 80% of the time	Class	1
UTILIZATION CLASS	No errors	At least 99% of the time	n/a	1

Variable Name	Tolerance	MQO	Units	Factor
Seedling Data				
SUBPLOT NUMBER	No errors	at least 99% of the time	n/a	1
SPECIES	No errors	at least 90% of the time for genus at least 85% of the time for species	n/a	1
CONDITION CLASS NUMBER	No errors	at least 99% of the time	n/a	1
SEEDLING COUNT	No errors for 5 or less per species +/- 20% over a count of 5	at least 90% of the time	number	1

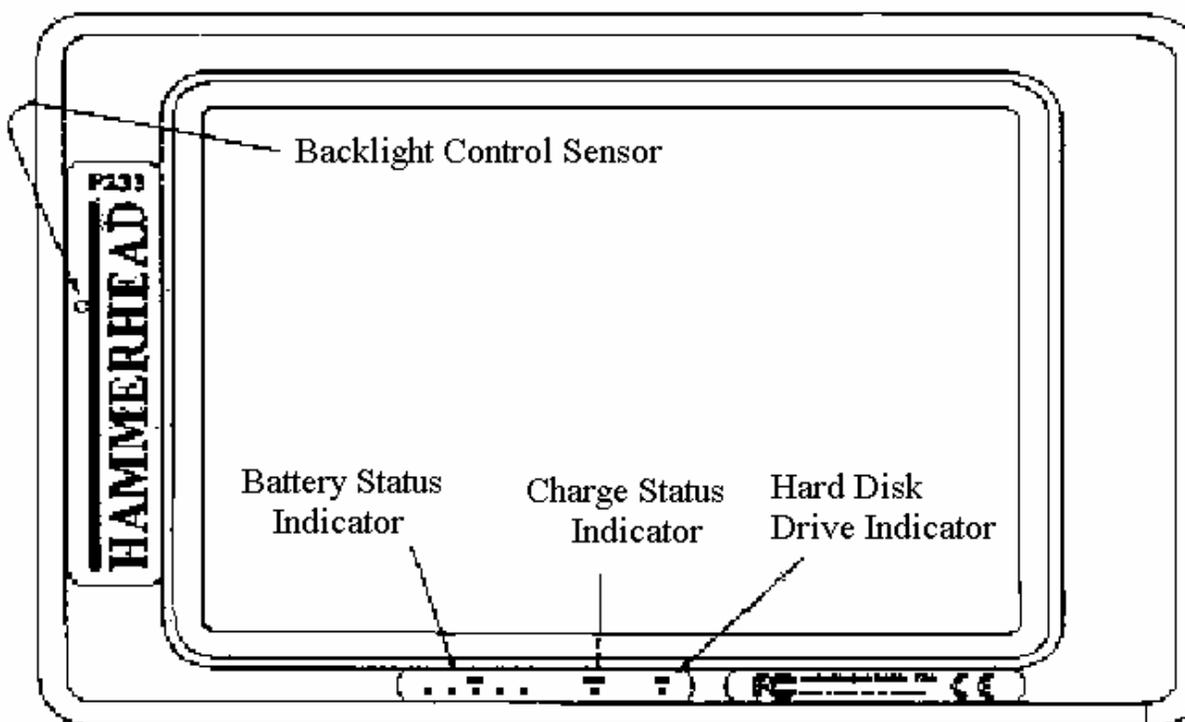
SUPPLEMENT A: DATA RECORDER INSTRUCTIONS

Basic Hammer Head User's Guide

The current Data Recorder in use in the field is the Hammer Head P-233. It is a Windows 95, ruggedized lap top computer with a Pen Based interface. We run several specialized programs that allow the field personnel to collect and transmit data. The units are built around a 233 MHz Intel Pentium processor.

Hammer Head specifications:

- minimum of 32 MB of main memory
- minimum of 3 GB of hard drive space
- two PCMCIA slots – one of which we use for a modem
- one infrared port
- pen services software
- 9.5" 640x480 backlit transfective monochrome LCD display
- one extra battery



FRONT VIEW

The front panel features include:

A battery status indicator which uses five LED's and operates like a fuel gauge showing the status of the battery charge.

A charge status indicator which is lit whenever external power is supplied. It blinks slowly when the battery is charging and remains on steady when the battery is fully charged.

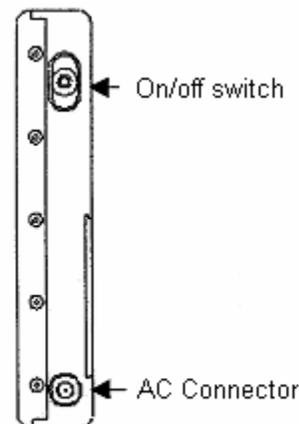
A hard drive indicator which flashes as the hard drive is accessed.

A backlight control sensor which automatically turns the backlight off in bright light to save battery **power**.

On the right side:

The on/off switch. It is a rubber covered push switch, when pressed once turns the machine on.

When pressed again it will power the machine down automatically following proper Windows shutdown procedures.



RIGHT SIDE VIEW

This switch can also be used to bring the system out of sleep mode by pressing it one time.

If the machine locks up, the on/off switch can be held in for 10-15 seconds and the machine will do hard shutdown of the machine. This should only be done when normal shutdown procedures will not work.

The newer machines come with an external power port for charging and operating the machine from another power source.

On the left side:

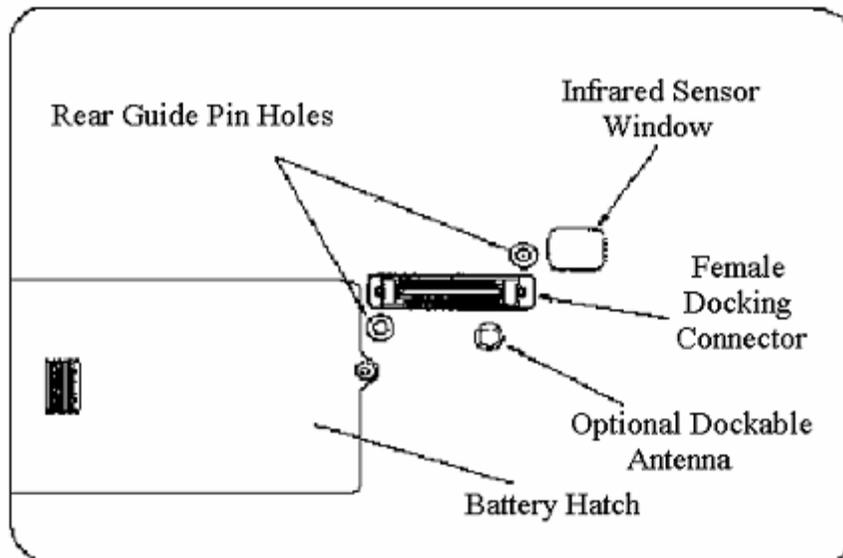
A cover for the PCMCIA slots encases a waterproof RJ11 connector for a standard phone line. This is the connection used to dial into the Starkville system to download county data and transmit field data.

On the back side:

The machine has a female docking connector. It is used to attach a port replicator. This is where all external devices are connected.

There is a small transparent port that is the infrared sensor window.

The battery hatch is also located on the rear and has a sliding cover. The battery compartment is sealed to prevent water from entering the machine even if the hatch is off.



REAR VIEW

Batteries and Charging Procedures:

The red LED's on the front panel indicate the power status of the battery. At full charge all five indicators will be lit. As battery power decreases the lights will turn off from right to left.

The last indicator will begin to flash when approximately three to five minutes of battery power remain. There is also a warning screen that will appear prompting you to change the battery.

If the battery is allowed to completely fail there could be loss of data and the machine may require scan disk to be run before it will reboot. This is a problem in the field as it requires a keyboard to initiate scandisk.

Under normal operation the batteries will last approximately four hours if power management features are turned on. Battery life is also dependent on temperature. The batteries are NOT hot swappable! You MUST shut the machine down before removing the battery!

For the P-233 models the battery indicator light will not reinitialize when a new battery is installed. You must run the reset gas gauge tool once the machine is brought back up. The HH3 models will recognize the fresh battery and reinitialize on its own.

The battery status indicators are based on time of usage and depend on the new battery being fully charged to give an accurate reading. Each unit comes with a power supply that will power the unit and also charge the battery. It is marked with Walkabout Computer's logo.

Each unit also comes with an external charger that will charge two batteries. It charges one at a time and has a light for each battery that turns green when the batteries have a full charge. This unit is made by SPAN and the power supply is also marked with their name. DO NOT plug the SPAN power supply into the Hammer Head – it will fit, but IT WILL DAMAGE THE MACHINE!!! PLEASE BE CAREFUL. Only use the SPAN power supply with the SPAN external battery charger!!!!

Port replicator:

All external devices supplied with the unit (Zip drive, printer, charger, keyboard...) are connected by means of the port replicator. The port replicator also serves as a stand for the machine when used on a desk. It uses two thumb screws to attach it to the machine. It attaches directly to the female docking connector on the back of the unit.

Pen:

The pen is attached to the case with a tether and is the primary input device for the machine. The pen functions like a two-button mouse. There are two switches, one in the tip and a pink button on the side. Regular left mouse operations are done by simply tapping or double tapping the pen to the screen as you would click a mouse. Right mouse functions are accomplished by holding down the pink button on the side of the pen and tapping the screen. The pen requires some getting used to, but once familiar it works quite well.

The small plastic tip in the pen is replaceable and several tips are included with the unit as well as a circular metal band that is used to remove the tip. Simply pull the old tip out and gently push the new one in. The pen is not totally waterproof. It will tolerate rain, but not immersion. If the pen gets too wet it will start to act erratically. If this happens you can remove the plastic tip and sling the pen to get most of the water out. This will usually get you through the day and with the tip out it will dry out overnight. There are no batteries in the pen and, other than the tip, it is not made to come apart.

Temperatures:

The units will operate in temperatures from slightly below freezing to quite high temperatures. Do NOT leave the units in the vehicle overnight when the temps are low and expect it to boot in the morning. The machine will have to warm up before the hard drive will spin up and the display can work! Battery life is also shorter in colder weather.

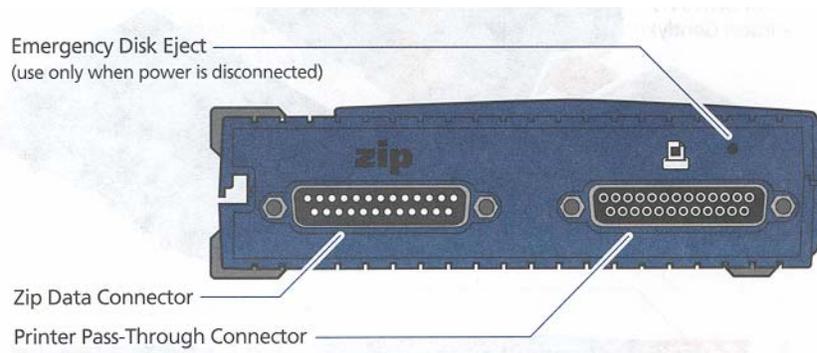
If left face up in direct sunlight in high temps the display may turn dark and be difficult to read. This condition will go away when the unit cools down. This is especially bad if left on the dash of a hot vehicle in the summer.

Zip Drive:

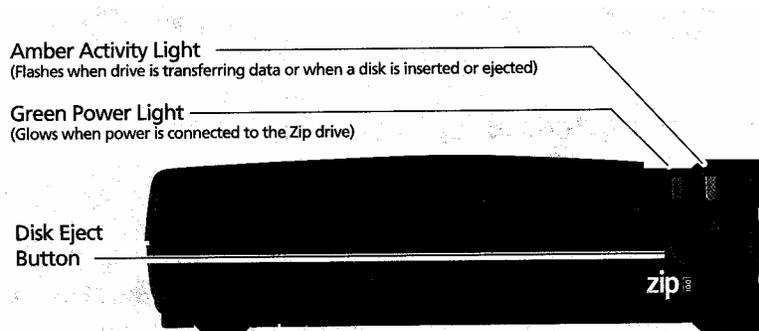
Each unit comes with a Zip drive for storing backup data. The zip drive attaches to the port replicator with a parallel or USB cable depending on the PDR and zip drive. The cable and drive are marked as to how they attach. The zip drive comes with a power supply that is marked ZIP also. Use it only with the Zip drive.

If using a parallel cable attach the Zip drive before starting the machine. If the machine is already on before the Zip drive is attached you will have to reboot the machine for it to recognize the drive.

There are two disks sent out with each unit and a tools disk. It is recommended that you alternate your backups between the two disks. The Tools disk cannot be used to write backups to. If a disk ever becomes stuck in the drive there is a small hole in the back of the drive that you can insert a straightened out paper clip and eject the disk. Do NOT try to pry it out or physically pull it out, this will damage the drive!



NEVER insert a 3 1/2 " floppy disk into the Zip drive! It will damage the drive.



Printer:

Each unit comes with a HP deskjet 340 or deskjet 350 portable printer. These come with a battery, charger and infrared adaptor. As before, the charger is marked with HP's logo and is to be used only with the printer.

The printer can be attached to the port replicator with a parallel cable or be run through zip drive as long as the Zip drive is powered. This way both can be used.

You can also print via the infrared port on the back of the Hammer Head. The printer comes with an infrared adaptor that plugs into the same port as a cable. The infrared adaptor has a range of about three feet and must have a clear path between the port on the machine and the port on the adaptor. On the task bar at the bottom right hand corner of the screen on the Hammer Head there is a small dish shaped symbol that indicates the infrared port on the hammerhead. When the unit and the printer are aligned there will be two of these symbols shown connected. The port on the adaptor swivels to make it easier to get them to align. You may choose which printer you want to use (either the hpdeskjet340 (infrared) or cable printer) by using the dropdown menu on the print screen.

The paper feeder on the back of the printer will hold around thirty sheets. The printers have instructions printed on the inside of the front door and on the back for operation and assembly. The part number for the print cartridge is also listed there. The print cartridges are normally available at Wal-Mart and most office supply stores.

Handwriting Recognition:

The handwriting recognition system can be used in almost all programs. It can be tailored to personal preferences by clicking on the Handwriter Settings icon in the control panel. You can set the machine for right or left hand writing and for the way you make most characters. However, most people use the drop down keypad function for data entry instead of writing by hand.

For additional information you can also refer to Walkabout's users guide.

For more specific questions or problems you can contact:

Joe Johnson 865/862/2036
Haimes Critz 662/338/3118

SUPPLEMENT B: GPS INSTRUCTIONS

INTRODUCTION

It has become necessary for the Forest Inventory and Analysis (FIA) crews to collect precise position coordinates of inventory sample plot centers. The purposes are 1) to allow FIA data to be accurately incorporated into GIS applications and other data bases and 2) to enhance plot recovery.

The purpose of this manual is to provide the operator with a brief history of the technology and with the procedures used by FIA crews to obtain position coordinates, calculate a coordinate, navigate to a coordinate, and other field applications.

THE GLOBAL POSITIONING SYSTEM

The concept for a Global Positioning System (GPS) dates back to the early days of space exploration. U.S. scientists tracking the Soviet Union's Sputnik satellite in the 1950s used the doppler effect of the satellite's radio beacon to determine its orbit. They realized that they could use the same process to determine a position on the earth. Development of the system began in 1973. The first satellites were launched in 1978. Today's system utilizes accurate clocks and measures the time required for a radio signal to travel between the satellite and receiver.

Previously, collecting accurate positions was limited because of the bulk and inconvenience of GPS receivers. These early versions had low accuracy and could not obtain a position fix in real time. Recent developments have provided a methodology capable of accurate position estimates (± 12 meters) in a small, handheld, lightweight receiver. With the aid of a base station, accuracies of less than 0.5 centimeter are obtainable.

The Global Positioning System is a space-based radio positioning system designed to provide suitably equipped users with highly accurate positioning, velocity, and time data. It is comprised of three segments:

The space segment consists of a constellation of GPS satellites in orbit around the earth. There are 21 operational satellites. There are three or four operational satellites in each of the six orbital planes. Additionally, there are up to three spare satellites. The satellites orbit the earth twice each day at an altitude of 10,900 miles.

The control segment is comprised of a Master Control Station (MCS) and a number of monitoring stations located around the world. The MCS tracks, monitors, and manages the satellite constellation. It also updates the navigation data messages transmitted by the satellites.

The user segment consists of a variety of radio navigation receivers designed to receive, decode, and process the GPS satellite signals.

The system is managed by the Department of Defense (DOD). To prevent enemy forces from utilizing our GPS system, an intentional error is introduced, Selective Availability (SA). SA is the largest source of error within the system. SA induces up to a 100-meter error into any position estimate. To overcome SA, military GPS units have a special chip with a decoding "key" installed that removes the SA. Recently, the U.S. Department of Agriculture (USDA) and the U.S. Department of the Interior (USDI) have been granted authority to purchase GPS receivers with this chip. There are two models available to these agencies: the Trimble Centurion and the Rockwell Precise Lightweight GPS Receiver (PLGR). Receivers equipped with the decoding chip are referred to as Precise Positioning Service (PPS).

In May 2000, SA was deactivated by the DOD. All GPS units have the same ± 12 meter accuracy. The DOD has, however, reserved the right to activate SA whenever national security dictates.

SECURITY

PPS receivers because of the security module installed within them are very sensitive security items. As an operator of these receivers, you are assuming a great responsibility, one far and above that of just having signed for another piece of expensive equipment. The security and accountability of your receiver must be your first priority. **Any incident or violation of the restrictions will immediately involve the National Security Agency (NSA) and the FBI.** If they determine that the incident may have

compromised key security, the Department of Defense can press for criminal prosecution. They are serious about this. A compromise of the “key” code within your receiver could cause the changing of all keys world-wide, a very expensive and disruptive procedure.

The use of this receiver is authorized by Memorandum of Understanding (MOU) between the Department of Defense and the Department of Agriculture. The continued use of this receiver and the Precise Positioning Service is at the sole discretion of the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence.

Pursuant to the MOU, the Federal Radionavigation Plan, and current guidance from the National Security Agency and the Department of Defense Space Command, **the use of PPS receivers is limited to permanent or temporary Federal employees, who are U.S. citizens, or state government employees who are U.S. citizens and are under the supervision of Federal employees.** The use of PPS receivers by others than those mentioned above is currently considered detrimental to security.

The internal security module and cryptographic keys remain the property of the National Security Agency. As such, PPS receivers must be returned to the Agency GPS-PPS Coordinator in a timely manner, upon demand. Requests for return of equipment may also come from the Federal GPS-PPS Coordinator or the controlling authority at Space Command. However, you should never surrender any PPS receiver without first checking with the Agency GPS-PPS Coordinator.

The PPS receiver is considered unclassified by the DOD. However, the receiver contains cryptographic logic which makes the receiver a DOD “High Value Item”. **As such, any loss, theft, tampering, or destruction of a receiver must be reported by the custodian to the Agency GPS-PPS Coordinator immediately.** Serious infractions which may constitute sabotage, loss through negligence, theft, or espionage are punishable under various sections of the United States Code.

The custodian is responsible for all property accounting, including prompt response to the annual inventory by the Federal GPS-PPS Coordinator. The receiver cannot be processed as excess property. The receiver must be returned to the Agency GPS-PPS Coordinator for proper disposal.

When not in use, PPS receivers should be kept in a secure location such as a locked drawer, cabinet, or storage space. Receivers should never be stored in vehicles.

Shipping of PPS receivers must be via traceable mail such as FedEx, UPS, etc.

PPS equipment cannot be shipped or hand-carried outside of the United States (encrypted or not encrypted), without prior approval from the controlling authority at DOD. Outside of the United States is considered to be any other place besides the conterminous United States, Alaska, and Hawaii. The Agency GPS-PPS Coordinator must be contacted prior to any shipping or carrying of PPS receivers outside of the United States, as defined.

When traveling, receivers should be carried in carry-on luggage rather than checked luggage on commercial transport. That carry-on luggage should be in your possession at all times. The receiver cannot be inspected or handled by anyone out of your sight. Do not leave a receiver in plain sight in a locked vehicle. Do not leave a receiver in an unlocked vehicle.

All Forest Service receivers must have a property tag attached. Compliance will be checked each time the unit is sent in to be rekeyed.

THE ROCKWELL PLGR

FIA has chosen to purchase the Rockwell PLGR (pronounced “plugger”). One of the reasons for its selection was its ability to obtain a position fix under a forest canopy. The PLGR is capable of far more than simply calculating the desired position and elevation. Cruisers quickly learned it can be used to navigate to the plot, determine the course to plot, obtain a photo reference azimuth, and determine areas.

REPORTABLE INCIDENTS

If any of the following incidents happens to the PLGR, **report it immediately to the SRS GPS Coordinator or to the Missoula Technology and Development Center (MTDC):**

Lost receiver: Know where your receiver is at all times. If you lend it to someone, keep that information in a notebook.

Stolen receiver: Keep your receiver locked-up, even in the office.

Appears to have been tampered with: Do not attempt to repair or for any other reason attempt to get into the receiver case. NSA will consider that a possible compromise of the code module.

Damaged. Regardless of the extent, a damaged unit must be returned to MTDC.

If loss or damage to the unit is determined to be the result of negligence, you will be held financially responsible in addition to facing possible criminal charges.

Do not place the PLGR or other equipment on the top of your vehicle after completing a plot. Too many PLGRs and data recorders have been lost or damaged when the driver pulls away.

For future reference:

SRS GPS Coordinator:

Horace Brooks

Southern Research Station

4700 Old Kingston Pike

Knoxville, TN 37919

Phone: 865-862-2100

Fax: 828-230-0076

E-Mail: hbrooks@fs.fed.us

In addition to the property tag mentioned earlier, all SRS FIA PLGRs must have a tag instructing the finder to call 865-862-2000.

When transferring a PLGR to another person, an Acknowledgement of Receipt of PLGR GPS Unit must be completed by the receiving party and sent to the SRS GPS Coordinator. An example of this form appears at the end of this manual.

COSTS

This technology does not come cheap:

Item	Cost (\$)
PLGR	2000
NiCad Battery	56
NiCad Charging Station	281
12v. Cell Phone Battery	35
3.6v. Memory Battery	5
External Antenna	188
External Antenna Cable	75
External Power Cable	26
AC/DC Power Adapter	30

CRYPTOGRAPHIC KEY

The PLGR will need to be keyed annually by the MTDC. This usually occurs during the last quarter of the calendar year. With overnight shipping, this procedure will require three business days. Therefore, cruisers need to schedule their work so as to have the use of another PLGR while theirs is being rekeyed, or be prepared to return to plots to obtain coordinates when the PLGR has been returned.

SHIPPING

The PLGR must be shipped via traceable mail. Because of the excellent service and corporate account, SRS prefers to use FedEx. The account number will be provided when required.

When shipping the PLGR to MTDC for rekeying, include a paid, return shipping label.

POWER MANAGEMENT

The PLGR requires 12 volts to operate. External power sources must be between 12 and 32 volts DC. For field operations, there are three power source options:

AA battery pack: Utilizes eight AA batteries. Cruisers report the AA batteries will power the unit for about four hours, sometimes more, usually less. The short life expectancy and cost of AA batteries makes this an expensive option.

Rechargeable NiCad battery: A good NiCad battery is rated for about fours of use. Cruisers report the NiCad battery lasts up to six hours. However, the useful life decreases as the battery develops a memory with age. An external charger is provided with the battery for overnight charging. Connecting an external power source to the PLGR recharges the NiCad battery within 36 hours. The initial cost of the battery and charger make this is a relatively expensive option.

Cell phone battery: This is a 12-volt, lead-acid battery that is used as an external power source. This battery can power the unit for 16 hours easily. The battery requires nine hours to charge. This option is relatively inexpensive and is recommended if the PLGR is used for several hours each day.

Two sources of power should be taken into the field at all times. Most cruisers use either the cell phone battery or the NiCad battery as their primary power source and the AA battery pack as a reserve.

When installing the AA battery pack or the NiCad battery, **do not drop the pack into the battery compartment.** The contacts at the bottom of the compartment can be broken. Gently slide the battery into the compartment.

The PLGR also uses a 3.6-volt lithium battery to maintain the data, setup information and cryptographic key. This battery is similar in size to a AA battery. Don't get them confused. The memory battery is replaced annually. The GPS Coordinator will provide one as needed. Instructions are provided with the replacement battery.

While operating the PLGR, you may receive one or more power warning messages:
Low Primary Power: Your AA/NiCad battery is low. Replace the battery.

Lost External Power: You have lost external power. This is most likely the result of a loose connection or low external battery power. However, a frayed power cord or a blown fuse in the external power cord is also a possibility.

Low Memory Battery: The memory battery is low. Replace the memory battery.

It is recommended that you maintain a fresh primary battery, whether for overnight or extended storage. The PLGR will attempt to operate using the memory battery if there is no other power source. The unit will begin the startup cycle when turned ON. But after a few seconds the screen goes blank. **Do not continue pressing the "ON" button when this occurs.** Continued attempts to turn the unit ON will drain the memory battery. You risk losing the key and any stored data.

You may monitor your battery's performance on the Battery Status Page.

Press MENU, STATUS will be blinking

Press the Down-arrow. The bottom line of the first STATUS page displays the source of power: Battery or Vehicle

Press the Down-arrow. The Battery Status page is now displayed.

The first line displays the type of battery installed. You will need to change this if the type battery installed is not correctly displayed. If a NiCad battery is installed, the PLGR will automatically sense it and display: "NiCad". If you are using a AA-pack, you will need to tell the PLGR the type of battery being used. Press the right-arrow. Use the up-/down-arrow to scroll between the battery options: AA-Alk, BA-5800, and AA-Lith.

The third line displays the elapsed time the battery has been used.

If you have just installed a fresh battery, you will want to reset (RST) the time used. Press the left-/right-arrow until RST is blinking. Pressing the up-/down-arrow will reset the time used to zero.

The fourth line displays the calculated time left on the battery. This figure is notoriously overly optimistic.

MAINTENANCE AND TESTING

With the exception of replacing batteries, the PLGR requires little maintenance. Inspect the gasket inside the battery cover for damage and dirt. Clean if necessary.

The PLGR has two tests:

The self-test is run every time the unit is turned ON. The self-test results can be seen by pressing the MENU key and selecting STATUS. If the self-test failed, press the up-arrow key to see the self-test failure page. See paragraph 2.7.1 of the Operations and Maintenance Manual for self-test messages.

A second, more comprehensive test is run at the command of the operator. Press the MENU key and select TEST. This test requires several minutes to complete. During this time, the PLGR cannot perform any navigation functions or provide any position coordinates.

Do not attempt to repair a malfunctioning PLGR. Return it to your GPS Coordinator.

OPERATION

There are two iron-clad rules for operating the PLGR. If these rules are not complied with, the receiver will be disabled.

Do not press the “CLR/MARK” and the “NUM LOCK” keys simultaneously! This will erase (zeroize) all stored data and destroy the key. This feature was incorporated for use by the military. In the event of imminent capture, soldiers can prevent the enemy from using the technology against us.

Do not remove the memory battery plug on the bottom of the unit! Removing the battery plug will disconnect the memory battery. It will zeroize the unit if there is no other power source. When replacing this battery, the unit must be connected to an outside power source.

You can easily determine if the PLGR is keyed. On the second page of MENU options, “CRYPTO” should be displayed in the lower left-hand corner. If it is not displayed, then the unit is no longer keyed and must be returned to MTDC for rekeying.

KEYPAD

Left/Right-Arrow Keys

The Left-arrow (←) and Right-arrow (→) keys move the cursor from field to field in the display. Press the right-arrow key, and the cursor moves right across the display. It then moves down to the next line as if the display were a single line. As the last field on the bottom is reached, the cursor wraps to the first selectable field on the top of the display. Pressing the left-arrow key causes the cursor to move to the left, then up to the previous display line.

Up-/Down-Arrow Keys

The Up-arrow (↑) and Down-arrow (↓) keys are used to change display pages, change number/alpha field values, and activate functions. The operation performed depends on what field is selected when the keys are depressed.

When the cursor is on an option field, pressing the up-/down-arrow key scrolls through the options.

When the cursor is on a changeable value field, pressing the up-/down-arrow keys increases or decreases the field to the next higher/lower available value. When held, the key causes scrolling to speed up.

When the cursor is on the paging (P) field in the lower right-hand corner of the display, pressing the up-/down-arrow keys scrolls to additional pages.

MENU Key

The MENU key displays the system menu pages. The menu consists of display pages that allow you to monitor PLGR operation and control operating functions and interfaces with other equipment

WP Key

Pressing the WP key brings up the waypoint menu display. The waypoint functions allow you to manage waypoint data, calculate coordinates of a waypoint, and determine routes and distance data from one waypoint to another.

POS Key

Pressing the POS key brings up the position display. The position display pages display current position, time, speed, satellite tracking status, current datum, magnetic variation, operator identification, and bullseye position. Pressing the POS key while in another display displays the last-used position page.

Pressing and holding the POS key for approximately five seconds causes the operating mode to toggle between averaging and continuous tracking modes.

NAV Key

Pressing the NAV key brings up the navigation information displays. The first page selects the display mode, navigation method, and destination waypoint. More pages are available to display the various waypoint navigation information. Pressing the NAV key while in another display displays the last-used navigation page.

MARK Key

The MARK key is used to activate the MARK (marking present position) and Man Overboard (MOB) waypoint selection page. On this page, the first unused waypoint is automatically selected for storage. The waypoint may be changed to any waypoint number and can be used with either MARK or MOB selection.

NUM LOCK Key

Pressing the NUM LOCK key toggles the keypad between control mode and numeric mode. An N is displayed at the lower right of the display in the numeric mode.

0 thru 9 Keys

In the numeric mode, pressing a 0 thru 9 enters its numeric value into the selected field. If a nonnumeric field is selected, keypad operation is the same as described for the control mode.

CLR Key

The CLR key moves the cursor to the left. This allows wrong entries to be reentered.

PLGR SETUP

The first time you use the PLGR and after rekeying, you'll need to set several parameters. These parameters make the information specific to your location and needs. Once these values are set, they become the default values.

Turn the unit on. The PLGR goes through a self-test routine for a few seconds, briefly displays the battery status, and then displays the Position screen.

Press the MENU key. STATUS will be blinking.

Press the RIGHT-ARROW key. SETUP will be blinking

Press the DOWN-ARROW key. The first page of the setup menu is now displayed.

Press the LEFT-ARROW key so the field value for SV-TYPE is blinking. Press the DOWN-ARROW so "mixed" is displayed. Press the RIGHT-ARROW. Note the double-arrow beside the "P" in the lower right corner.

Press the DOWN-ARROW to move to the next page.

Press the RIGHT-ARROW so the field value for SETUP UNITS is blinking. Use the DOWN-ARROW to scroll between the options. Stop when "L/L-dms" is displayed. "L/L-dms" signifies latitude/longitude-degrees, minutes, seconds.

Press the RIGHT-ARROW to set the units for Distance and Elevation. Use the DOWN-ARROW to scroll between the options. Stop when "ENGLISH" is displayed.

Press the RIGHT-ARROW so the value for Elev is blinking. Use the DOWN-ARROW to toggle to "feet".

Press the RIGHT-ARROW. Use the DOWN-ARROW to toggle to "MSL".

Press the RIGHT-ARROW so the value for ANG is blinking. Scroll through the options until "DEG" is displayed.

Press the RIGHT-ARROW. Scroll through the options until "Mag" is displayed. This parameter is used when calculating coordinates. Since our compasses are not set for declination, we want to use magnetic North rather than true or grid North.

Press the RIGHT-ARROW and DOWN-ARROW to go to the next page. This is the Magnetic Variation page.

Press the RIGHT-ARROW. The value for TYPE should be blinking. Scroll through the options until "Calc" is displayed.

Press the RIGHT-ARROW. Scroll through the options until "deg" is displayed.

Press the RIGHT-ARROW and DOWN-ARROW to proceed to the next page.

Press the RIGHT-ARROW to move to the "WAGE" field. WAGE should be "on". "WAGE" signifies Wide Area GPS Enhancements. When ON, the PLGR process enhanced clock correction signals from the satellites.

Press the RIGHT-ARROW to move to the "ELHold" field. ELHold should be "automatic".

Press the RIGHT-ARROW to move to the "TIME" field. Use the DOWN-ARROW to scroll to the correct time zone correction for your locality:

EST	LOC=Z-0500	EDT	LOC=Z-0400
CST	LOC=Z-0600	CDT	LOC=Z-0500

This parameter is not critical to PLGR operations. When set correctly, the time displayed on the second Position page will be the correct local time.

Move the cursor to the "ERR:" field. Use the DOWN-ARROW to scroll to "EHE" for the two-dimensional error.

Press the RIGHT-ARROW and DOWN-ARROW to move to the next page.

Press the RIGHT-ARROW and scroll through the options for "DTM:" Stop when "NAR" for North American Datum 1983 is displayed.

Press the RIGHT-ARROW to move to the "AUTOMATIC OFF TIMER:". Scroll to select "20 min". This function is used to save battery power. It is enabled only when battery power is being used. This function starts when a good solution is obtained and resets every time a keystroke is entered.

Press the RIGHT-ARROW.

Your PLGR is now set up and ready to calculate your position. Press the "POS" key.

After the PLGR has run its self-tests and displays the Position screen, the PLGR downloads the daily almanac and verifies the cryptographic key. These processes are automatic and require 12 to 25 minutes. You will get the quickest position lock and most precise solutions with the current almanac. You may get a solution before the almanac has been updated; but it will likely have a higher error estimate. Therefore, it is recommended that you turn the unit on while you are driving to your work area. You can connect the PLGR to the vehicle's electrical system using the external power cord. This will preserve

your battery power. Use the external antennae or place the unit on the dashboard (safety permitting) while driving to the work area.

OBTAINING A POSITION FIX

When the PLGR is turned on, the default screen is the Position screen. You need do nothing to get a position fix. You must track four satellites to obtain a position fix. However, if after 20 to 25 minutes you have not obtained a fix, turn the unit OFF and back ON. Sometimes the unit gets hung-up trying to track a satellite. Cycling it OFF and ON forces it to look at other satellites.

Several factors influence satellite reception. Satellite signals can be blocked by terrain, vegetation, and the human body. Although weather is not supposed to effect PLGR operations, cruisers have reported difficulty obtaining a position fix on overcast days. Orienting the PLGR's antennae vertically aids in signal reception.

The tracking mode is displayed in the upper left corner of the screen. The error estimate is displayed in the upper right corner. The Latitude and Longitude are displayed on the second and third lines. Finally, the elevation is displayed in the lower left corner.

The default operating mode for the PLGR is continuous (CONT). "CONT" is displayed in the upper left corner of the first Position screen. In this mode the PLGR continually calculates and displays the current position estimate. Once the PLGR has a fix on the position, you will note that the seconds of latitude and longitude constantly change. If you were to plot these coordinates, you would find that they are clustered around a central location. It is that central location we want to record. To determine that central location, the PLGR can calculate the running average of these coordinates.

There are two methods used to switch from continuous mode to averaging mode.

While the first Position screen is displayed, press and hold the POS key for five seconds. This toggles between the two modes. "AVG 00000" will replace "CONT" in the upper left corner of the screen.

This second method can be used to improve performance in very low signal environments, such as under dense foliage.

a) Go to the SETUP menu.

Change the SETUP MODE to "STBY",

Press MENU and return to the Setup menu.

Now change the SETUP MODE to "AVG".

Press the POS key.

For a brief instant, you will see "STBY" in the upper left corner before it changes to "AVG 00000".

While in averaging mode, **do not move the PLGR**. The PLGR must obtain a valid position fix for 13 seconds before averaging will begin. This may require some time. Solutions will be averaged once per second. The first position screen displays the averaged value and the sample counter. Although there is no established rule for determining the sample number required to ensure an accurate estimate, FIA has selected 180 samples as the minimum required.

The maximum allowable error estimate is ± 70 feet. The PLGR routinely has error estimates in the low-20s. The error estimate is a function of the satellites relationship to the receiver. As the satellites orbit the Earth, this relationship, or geometry, changes. Consequently, the error estimate is constantly changing.

Occasionally, you may want to reset the sample counter. For example, the satellite geometry has changed, and you are now receiving a lower error estimate.

Press the left-/right-arrow, and the sample counter will begin to blink.

Press the up-/down-arrow key to reset the counter.

Pressing the left-/right-arrow key a second time returns the cursor to the paging (P) field in the lower right corner.

On the rare occasion that you cannot obtain a position fix, there are two options. You can try again at a different time of day when the satellite geometry has changed. Or, you can obtain a position fix off the

plot center, determine the bearing and distance to the plot center, and use the PLGR's range-calc feature (discussed later).

Once you have the required number of samples, record the error estimate and the number of samples on your form(s) or data recorder. The error estimate and number of samples are not stored electronically in the PLGR. You have the option to record the coordinate on paper or data recorder, or you can save the coordinate in the PLGR's memory for entry onto the data recorder and form(s) at a later time.

SAVING A POSITION FIX

The PLGR can store up to 999 waypoints, 1 – 999.

MARK saves the current position's coordinates. To save a position fix or waypoint (WP), press MARK. The PLGR will automatically assign the first available WP to that position. At this time you may change the WP number, by pressing the NUM LOCK key and entering the desired WP number, or using the up-/down-arrow key to scroll to the desired WP number. Once the desired WP number is displayed, pressing MARK a second time saves the entry. If you used the NUM LOCK feature, remember to press NUM LOCK again to return to the control mode before pressing MARK a second time. If the waypoint you have selected is already assigned, pressing MARK a second time overwrites the previously stored coordinate.

There is no rule for assigning waypoints. However, most cruisers assign the waypoint the same number as the plot number. Other waypoints used in association with that plot receive waypoint number(s) beginning or ending with the plot number. For example, plot 36 would be assigned WP 36. Associated waypoints, such as the SP, would be assigned WP 361, 362, 363, or 136, 236, 336....

MANUALLY ENTERING A WAYPOINT

It will be necessary to manually enter a coordinate occasionally. SRS recently adopted a hexagon design for plot locations. If there is an existing plot located in the hexagon, that plot is used to represent the hex. In the event there is no plot in the hex, an empty hex, coordinates will be provided for the new plot's location. These coordinates must be manually entered into the PLGR.

Press WP, select ENTER, and press NUM LOCK.

Press the right-arrow and enter the desired waypoint number.

Pressing the right-arrow once allows you to name the waypoint if you want. Otherwise, press the right-arrow a second time.

Press the right-arrow a third time. The PLGR defaults to North latitude. All of our coordinates are North latitude.

Enter the degrees, minutes, and seconds north latitude.

Press the up-/down-arrow to toggle the longitude to "W". All of our longitudes are West longitude.

Press the right-arrow and enter the degrees, minutes, and seconds west longitude.

There is no elevation to enter. Press the right-arrow twice.

Press the up-/down arrow. You will see "WAYPOINT STORED"

Press any control mode key: POS to go to the position screen, NAV to navigate to a waypoint, WP to work with waypoints, etc. To enter additional waypoints, press the down arrow to return to the entry screen (step 2).

CALCULATING A WAYPOINT

On occasion it will be necessary to calculate a waypoint. Rather than occupy a nonforest plot, we will calculate its coordinates. Having found the plot starting point (SP), you may want to calculate the plot center (PC) coordinate and use the PLGR to facilitate finding the plot.

Before you can calculate a waypoint, you must first have a waypoint stored in the PLGR. This waypoint may be a saved (marked) WP or a manually entered waypoint. This will usually be a marked WP that represents the SP. You must also have an azimuth and distance from the stored WP to the PC. This you will obtain from having drawn-up the photo or be provided by the previous crew.

Press WP and select RNG-CALC.

Use the right-arrow to move the cursor to the first numeric field.

Enter the waypoint number for the beginning point.

Move the cursor to the RNG field, and enter the distance and units to the desired location.

Move the cursor to the AZ field, and enter the azimuth to the desired location.
Move the cursor to the paging (P) field in the lower right corner. For our purposes, we do not need to enter an elevation.
Press the down-arrow to go to the next page. The calculated coordinate is now displayed. You can record the calculated coordinate on your data recorder or form(s).
To save the calculated coordinate as a waypoint:
Press the down arrow to go to the next page. This page is similar to the MARK page. Change the waypoint assignment if you desire.
Press the left-/right arrow key to move the cursor so STORE is blinking.
Pressing the up-/down-arrow while STORE is blinking will save the calculated coordinate as the assigned waypoint.

NAVIGATING TO A WAYPOINT

You will want to use the PLGR to locate a point. This may be the PC of an established plot or a new plot, in the case of an empty hex.

The PLGR has several navigation scenarios pre-programmed. These navigation programs contain a number of parameters that are not needed for our application. Many of these functions require a minimum ground speed (approximately 1.5 kph) before they can be used. Also, the parameters of interest do not appear on one screen. The user must select one page to get the distance and another page to get the azimuth to plot. It is recommended that you enter a custom navigation program.

To enter a custom navigation screen, go to the CUSTOM NAV option in the MENU. You may select any parameter(s) that you feel will be useful. However, there are three parameters that are considered minimal: Waypoint and Error Estimate (WP/EHE), Azimuth to Waypoint (AZ), and Distance to Waypoint (RNG). A fourth parameter 2-Dimensional Steering (STR2d) is useful. After displaying the desired parameter, going to the next line selects that parameter. When you have selected all of the desired parameters, press any function key (MENU, POS, NAV, etc.) to exit and save your custom navigation screen.

Press MENU three times.

Select CUSTOM NAV.

Press the right-arrow and use the up-/down-arrow to scroll through the options until WP/EHE is displayed.

Press the right-arrow to go to the next line

Select AZ.

Press the right-arrow.

Select RNG.

Go to the next line.

Select STR2d.

These four items will be displayed on a single screen. Any other parameters you may choose would be displayed on the second and subsequent screens. Other parameters might include Ground Speed (GS), Slope Range (SR), Tracking (TRK), and Tracking and Ground Speed (TRK/GS),

To navigate to a waypoint, you first must configure the display mode and navigation method.

Press NAV.

Use the arrow keys to select CUSTOM (if you have defined a custom navigation screen) or SLOW as the display mode. SLOW navigation mode is used when traveling on foot over rough or difficult terrain.

Use the arrow keys to select DIRECT as the navigation method. DIRECT is used to navigate from the present position directly to the destination. Other methods require a predefined course or route.

Use the arrow keys to move to the second line and select the destination waypoint.

Move the cursor to the paging field, and go to the next page.

The navigation parameters are displayed on the second and subsequent screens.

You may use the PLGR to establish a plot. In the case of an empty hex, you will be provided with coordinates. Plot the location on your county map to determine the location and the appropriate photo. Use the map and photo to approach the area. Use the PLGR to direct you when you are close. When navigating to the plot, the position mode must be continuous. When you are prepared to set the plot, switch to the averaging mode. Before setting the PC, you must have the minimum 180 samples. Use a compass and tape to close the remaining bearing and distance to the plot.

DETERMINE THE COURSE TO PLOT

This feature is used to determine the bearing and distance from the SP to the PC. For distances less than 500 feet, it is recommended that you use the PDRS traverse program. The PLGR's solution may not be within the quality assurance tolerance level for these shorter distances.

Obtain and MARK the coordinates for the SP and PC.

Press WP and select DIST.

Enter the waypoint that represents the SP.

Enter the waypoint that represents the PC.

The distance (RNG) and azimuth (AZ) are calculated and displayed.

You may also use the NAV function. This requires either the SP or PC coordinate be marked.

Obtain and mark the coordinate for the SP/PC.

Obtain the coordinate of the SP/PC.

Press the NAV key and enter the waypoint representing the marked SP/PC.

Go to the second NAV screen and obtain the distance and azimuth to the destination waypoint. If the marked coordinate is the SP, record the reverse azimuth of the solution.

DETERMINE AREAS

One acre is the minimum size requirement for forest, nonforest, and within forest conditions. Therefore, accurately determining areas is essential. The PLGR calculates areas to the nearest 0.1 acre. If the calculated area is 0.4 hectare, you may want to use the DIST function to obtain the azimuth and distances between waypoints and use the PDRS area feature to ensure the area is not 0.95 to 0.4 hectares.

Obtain and mark coordinates around the perimeter of the area in question. Up to 26 waypoints can be used to define a single route. If you require more than 26 waypoints to define the perimeter, divide the area into two or more parcels.

Press WP and select ROUTE

Select ENTER

The PLGR defaults to the first unassigned route number. Assign a route number and name if desired.

Enter the waypoints corresponding to the perimeter.

To save the route, either scroll through to the end of the route list and select the SAVE option, or press one of the major function keys (MENU, POS, WP, etc.).

After the route has been saved, select the POLY option of the ROUTE menu. This displays the circumference and the area of the defined polygon.

DETERMINE PHOTO REFERENCE AZIMUTH

In hilly/mountainous and undeveloped areas, finding a linear feature that can be used as a reference azimuth is difficult. The PLGR can be used to obtain an azimuth between two identifiable points.

However, using the PLGR to obtain a Reference Azimuth should not become an everyday practice.

Identify two points on the photo that you will be able to locate on the ground. These points should be widely spaced, further is better.

Obtain and mark coordinates of the first point. Because of the scale of the photos, it is not necessary to use averaging mode for this application.

Obtain coordinates for the second point.

Use the procedures described above to determine the azimuth between the two points.

CLEAR WAYPOINTS

Periodically, you will want to clear stored waypoints.

Press WP and select CLEAR.

Using the arrow keys, select the range of waypoints you want to delete.

Pressing the up-/down-arrow while "ACTIVATE" is blinking will begin the process.

The PLGR now needs confirmation that you want to delete the waypoints. If the range is correct, use the arrow buttons to select CONFIRM. If the range is incorrect, select CANCEL to stop the operation.

OTHER USEFULL SCREENS

Information contained on a number of screens will help you monitor the PLGR's performance.

STATUS

Page 1 displays the GPS Status, Self-Test Results, Antenna Source, and Power Source.

Page 2 displays the Battery Type, Recharge Status, Time Battery Used, and Time Battery Left.

Page 4 is the Satellite Tracking Status and shows the signal status of the satellites being tracked.

Pressing the left-/right-arrow toggles the first column to display a fifth satellite.

Line 1 displays the number of the satellite (SV) being tracked/searched

Line 2 displays the signal strength (CN). 34 dB is considered nominal.

Line 3 displays the code type (CD) being transmitted by the satellite.

Line 4 displays the satellite status (ST): I=interference, R=recovery, S=search, and T=Track

Page 5 shows the satellite status information:

Line 1 displays the number of the visible satellite (SV).

Line 2 displays the satellite's health: OK or BAD.

Line 3 displays the azimuth to each satellite (AZ).

Line 4 displays the elevation angle of each satellite and whether the satellite is ascending or descending.

POSITION

Page 1 displays the current position information

Page 2 displays the Time, Date, Track, and Ground Speed.

Page 3 displays the satellite usage summary that includes the almanac age.

Page 4 displays the current datum, the magnetic variation, and the operator ID.

Section 12. Crowns: Measurements and Sampling

12.1 OVERVIEW

Crown indicators are designed to be used together. Each indicator comprises a piece of information that can be used individually or as a factor in combination with other indicators. Each variable, alone or in combination with others, adds to the overall rating given each tree. It is important to realize that models are designed to rate trees on how they look, from thriving to almost dead and to help predict future conditions of trees and forest ecosystems.

VIGOR CLASS, UNCOMPACTED LIVE CROWN RATIO, CROWN LIGHT EXPOSURE and CROWN POSITION are determined for each sapling. Foliage below the point used for UNCOMPACTED LIVE CROWN RATIO is not considered in VIGOR CLASS determination. All sapling measurements are done during plot establishment and whenever plot remeasurement occurs.

Crown evaluations, including UNCOMPACTED LIVE CROWN RATIO, LIGHT EXPOSURE, POSITION, DENSITY, DIEBACK, and TRANSPARENCY are made on all trees with DBH/DRC (DRC in the West) 125 mm or larger. Trees with high scores for UNCOMPACTED LIVE CROWN RATIO and DENSITY, and low scores for DIEBACK and FOLIAGE TRANSPARENCY have increased potential for carbon fixation, nutrient storage and increased potential for survival and reproduction. Crown evaluations allow for the quantitative assessment of current tree conditions and provide an integrated measure of site conditions, stand density and influence of external stresses. All crown measurements are taken during plot establishment and whenever plot remeasurement occurs.

Note: This indicator is CORE OPTIONAL for all phase 2 plots.

Two persons make all crown measurements. Individuals should be ½ to 1 tree length from the base of the tree to obtain a good view of the crown. Move away from each other at least 4 meters to take these measurements. A position of 90 degrees to each other from the tree base is ideal (Figure 12.3). When estimates made by two individuals disagree, they should discuss the reasons for their ratings until an agreement is reached, or use the methods below to resolve the situation.

If the numbers for a crown measurement estimated by two crew members do not match, arrive at the final value by: (1) taking an average, if the numbers differ by 10 percent (2 classes) or less; (2) changing positions, if the numbers differ by 15 percent or more and attempting to narrow the range to 10 percent or less if crew members cannot agree; or (3) averaging the two estimates for those trees that actually have different ratings from the two viewing areas (ratings of 30 and 70 would be recorded as 50).

12.2 CROWN DEFINITIONS

Crown Shape

Crown shape is the silhouette of a tree, drawn from branch tip to branch tip, which contains all of a tree's foliage as it grows in a stand. Exclude abnormally long branches beyond the edge of the crown for this silhouette. Normally, silhouettes are derived from vigorous, open grown trees and tend to be species-specific. For Phase 3 purposes, silhouettes vary with age and spacing. Tree crowns tend to flatten out with age and be more slender when growing in crowded conditions. Crown shape is important when measuring CROWN DENSITY and is used to estimate crown biomass. Crown shape is used as an outline for the sides of the tree.

Crown Top

The crown top is the highest point of a standing tree. Young trees usually have more conical-shaped crowns and the main terminal is the top. Older trees and many hardwoods have globose and flat-topped crowns, where a lateral branch is the highest point. For some measurements the highest live foliage is considered the live crown top. Other measurements include a dead top. Some crown measurements assess how much of the expected crown is present and include broken or missing tops.

Dieback

This is recent mortality of branches with fine twigs, which begins at the terminal portion of a branch and proceeds toward the trunk. Dieback is only considered when it occurs in the upper and outer portions of the

tree. When whole branches are dead in the upper crown, without obvious signs of damage such as breaks or animal injury, assume that the branches died from the terminal portion of the branch. Dead branches in the lower portion of the live crown are assumed to have died from competition and shading. Dead branches in the lower live crown are not considered as part of crown dieback, unless there is continuous dieback from the upper and outer crown down to those branches.

Epicormic

Shoot growth, from latent or suppressed buds, that arises from old branches, from the trunk or near large branch wounds or breaks. Epicormics remain epicormics until they regain the size of previous branches for trees with no branches 25 mm or larger in diameter at the base above the swelling. For trees that had 25 mm or larger branches when the epicormics formed, epicormics become branches once they reach 25 mm in diameter.

Live Branch

A live branch is any woody lateral growth supporting foliage, and is 25 mm or larger in diameter at the base above the swelling where it joins a main stem or larger branch. Small trees or certain tree species greater than 125 mm DBH/DRC may have only live twigs which have not yet reached 25 mm or larger at the point of attachment. If the death of larger branches is not the cause of these twigs, the twigs are considered branches for these smaller branched trees until the tree matures to a point where twigs have attained 25 mm or larger in diameter at the base above the swelling where it joins a main stem or larger branch.

Live Crown Base

The live crown base is an imaginary horizontal line drawn across the trunk from the bottom of the lowest live foliage of the "obvious live crown" for trees and from the lowest live foliage of the lowest twig for saplings. The "obvious live crown" is described as the point on the tree where most live branches/twigs above that point are continuous and typical for a tree species (and/or tree size) on a particular site. Include most crown branches/twigs, but exclude epicormic twigs/sprigs and straggler branches that usually do not contribute much to the tree's growth. The base of the live branch/twig bearing the lowest foliage may be above or below this line.

For trees 125 mm DBH/DRC or greater, if any live branch is within 152 cm below this "obvious live crown" line, a new horizontal line is established. Create the new line at the base of live foliage on that branch. Continue this evaluation process until no live branches are found within 152 cm of the foliage of the lowest qualifying branch (Figure 12-1).

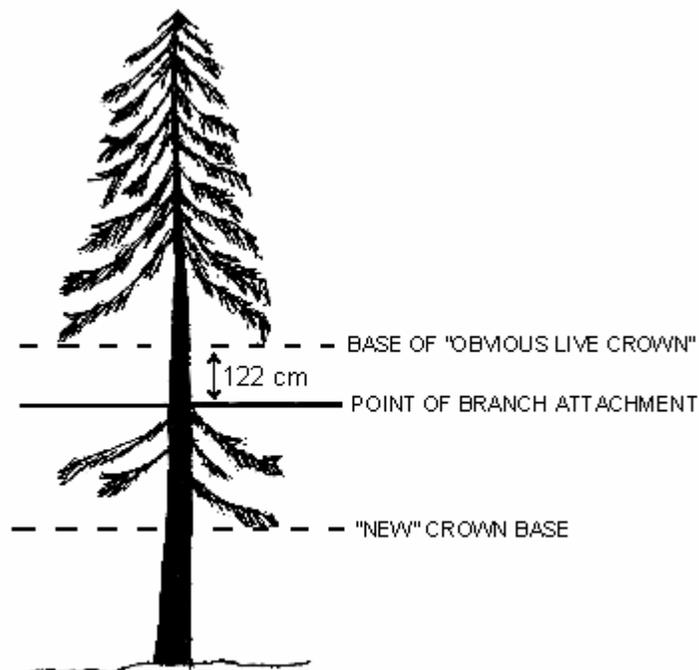


Figure 12-1. Determining the base of the live crown.

Occasionally, all original major crown branches/twigs are dead or broken and many new twigs/sprigs develop. These situations are likely to occur in areas of heavy thinning, commercial clearcuts and severe weather damage:

- Trees that had an "obvious live crown" with live branches now have no crown to measure until the new live twigs become live branches. When these new live branches appear, draw the new live crown base to the live foliage of the lowest live branch that now meets the 152 cm rule.
- Saplings and small trees that had only live twigs should establish the crown base at the base of the live foliage on the new lowest live twig. If no live twigs are present, there is no crown to measure.

Overstory Canopy Zone

The area delineated by the average live crown height determined from the UNCOMPACTED LIVE CROWN RATIO of overstory trees. The bottom of the overstory canopy zone is the average height of the live crown bases. The top of the zone is the average height for the live crown tops.

Snag Branch

A dead upper crown branch without twigs or sprigs attached to it. A lower branch on woodland trees such as juniper is not considered a snag branch unless the branch reaches into the upper crown, or reached into the upper crown when the branch was alive. A branch that died due to shading in any crown is not a snag branch.

Sprig

Any woody or non-woody lateral growth, without secondary branching, less than 25 mm in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

Twig

Any woody lateral growth, with secondary branching, less than 25 mm in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

12.3 CROWN DENSITY-FOLIAGE TRANSPARENCY CARD

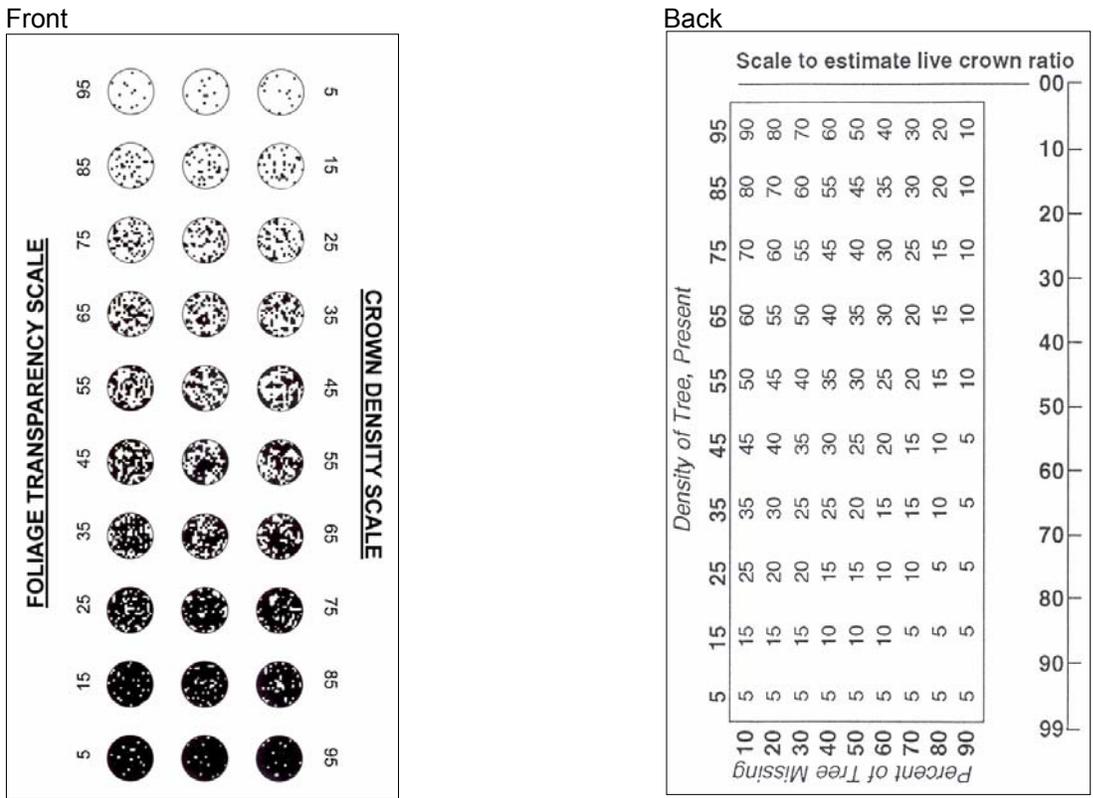


Figure 12-2. Density-Transparency card

The crown density - foliage transparency card (Figure 12-2) should be used as a training aid until crew personnel are comfortable with all ratings. White areas of the card represent skylight visible through the crown area and black areas represent a portion of the tree that is blocking skylight. After training, use the card to calibrate your eyes at the start of each day and rate those trees that do not fit into an obvious class. For CROWN DENSITY, hold the card so that "Crown Density" is right-side up ("Foliage Transparency" should be upside down). Use the numbers that are right-side up. Conversely, for FOLIAGE TRANSPARENCY, make sure that "Foliage Transparency" is right-side up. Crews should refer to specific CROWN DENSITY or FOLIAGE TRANSPARENCY sections for a definition of aspects that are included in the crown rating.

The back of the crown density - foliage transparency card has two uses: for CROWN DENSITY when a portion of the crown is missing and a general scale for estimating UNCOMPACTED LIVE CROWN RATIO. Crews should refer to the CROWN DENSITY and UNCOMPACTED LIVE CROWN RATIO sections for the use of this side of the card.

12.4 CROWN RATING PRECAUTIONS

Crews must be especially careful when making evaluations, and pay special attention to certain factors that may affect measurements in the field. These factors include:

- Distance and slope from the tree
- View of the crown
- Climatic conditions
- Heavy defoliation
- Leaning trees
- Trees with no "crown" by definition

Distance and slope from the tree -

Crews must attempt to stay at least 1/2 to 1 tree length from the tree being evaluated. Some ratings change with proximity to the tree. In some situations, it is impossible to satisfy this step, but the crew should do the best it can in each case. All evaluations are made at grade (same elevation as base of the tree) or up slope from the tree. This may not be possible in all cases but evaluating trees from the down slope side should be avoided.

View of the crown -

Crew members should evaluate trees when standing at an angle to each other, striving to obtain the best view of the crown. The ideal positions are at 90 degrees to each other on flat terrain (Figure 12-3). If possible, never evaluate the tree from the same position or at 180 degrees. In a thick canopy forest, getting a good perspective of the crown becomes difficult. Overlapping branches, background trees and lack of a good viewing area can cause problems when rating some trees. Crews need to move laterally to search for a good view. Take special care when rating such trees.

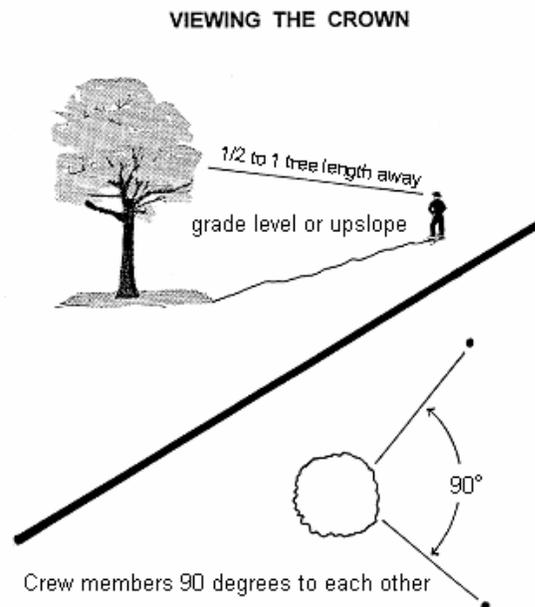


Figure 12-3. Crew positions for viewing crowns.

Climatic conditions -

Cloudy or overcast skies, fog, rain and poor sun angles may affect the accuracy of crown estimates. Crews need to be especially careful during poor lighting conditions to obtain the best possible view of the crown for the given climate conditions.

Heavy defoliation -

During heavy defoliation, CROWN DIEBACK may be overestimated and FOLIAGE TRANSPARENCY may be underestimated due to the difficulty in differentiating dead twigs from defoliated twigs. The use of binoculars may help in separating dead twigs from defoliated twigs.

Leaning trees -

So that crown dimensions are measured consistently on both leaning and upright trees, UNCOMPACTED LIVE CROWN RATIO and CROWN DENSITY for leaning and down trees must be rated in relation to the actual length of the tree bole (as opposed to height above the ground). CROWN POSITION and CROWN LIGHT EXPOSURE should still be estimated relative to the tree's actual location in the canopy. FOLIAGE

rarely
angle.

TRANSPARENCY will
be affected by lean
Place a note in the PDR

TREE NOTES field that the tree is leaning if it is leaning more than 45 degrees from vertical.

Trees with no "crown" by definition (epicormics or sprigs only) -

After a sudden release or damage, a tree may have very dense foliage, but no crown. These situations are coded as follows: UNCOMPACTED LIVE CROWN RATIO = 00, CROWN LIGHT EXPOSURE = 0, CROWN POSITION = 3, CROWN DENSITY = 00, CROWN DIEBACK = 99, FOLIAGE TRANSPARENCY = 99. This combination of codes is a flag for trees with no crowns.

After a sudden release or damage, a sapling may have very dense foliage, but no crown as it only has sprigs. These situations are coded as follows: UNCOMPACTED LIVE CROWN RATIO = 00, CROWN LIGHT EXPOSURE = 0, CROWN POSITION = 3, sapling VIGOR = 3. This combination of codes is a flag for saplings with no crowns.

12.5 UNCOMPACTED LIVE CROWN RATIO

UNCOMPACTED LIVE CROWN RATIO is a percentage determined by dividing the live crown length by the actual tree length (Figure 12-5). Record the UNCOMPACTED LIVE CROWN RATIO to the nearest 1%.

Saplings

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by actual tree length, then enter the appropriate code into the PDR. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live foliage on the lowest live twig for saplings. Be sure to eliminate vine foliage as best you can when determining the live crown. The live crown base for saplings is different from trees 125 mm DBH/DRC and larger. The 152 cm/25 mm rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 12-4).

When the two estimates do not agree, follow the guidelines listed at the end of section 12.1 *Overview*.

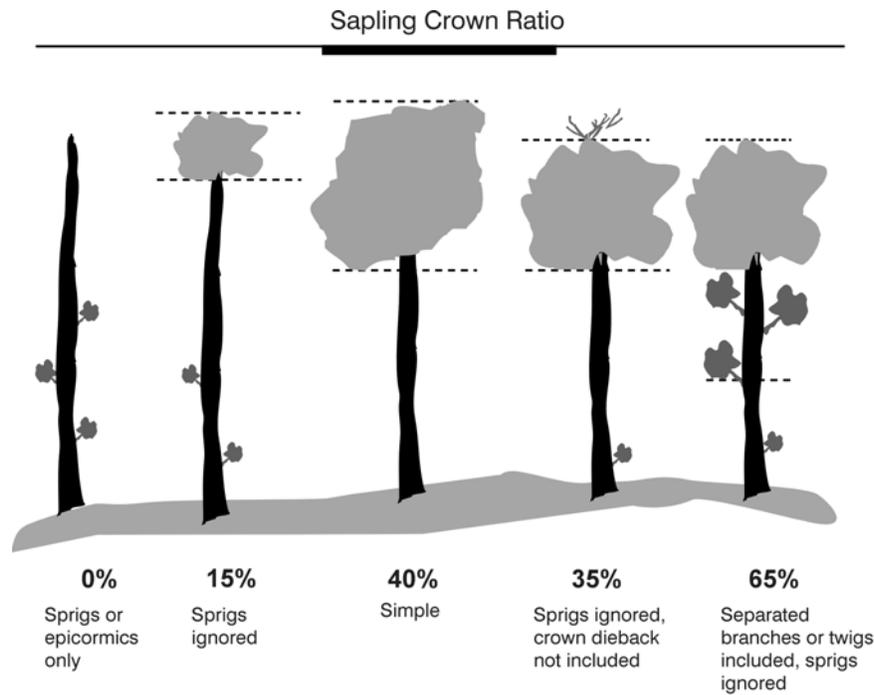


Figure12-4. Sapling UNCOMPACTED LIVE CROWN RATIO determination examples.

Trees

Live crown length is the distance from the live crown top (dieback in the upper portion of the crown is not part of the live crown) to the "obvious live crown" base (Figure 12-6). Many times there are additional live branches below the "obvious live crown". These branches are only included if they have a basal diameter greater than 25 mm and are within 152 cm of the base of the obvious live crown (Figure 12-1). The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole. Occasionally, small trees or certain species may not have 25 mm diameter branches. If this occurs, use the 152 cm rule, and apply it to branches that you feel contribute significantly to tree growth.

An individual can use the UNCOMPACTED LIVE CROWN RATIO scale on the back of the crown density - foliage transparency card to help estimate ratios (Figure 12-2). Hold the card in one hand, parallel to the trunk of the tree being evaluated and move the card closer or farther from your eye until the 0 is at the live crown top and the 99 is at the base of the tree where it meets the ground. Then place your finger at the live crown base. A clinometer can also be used to verify the UNCOMPACTED LIVE CROWN RATIO by determining the values of both lengths and determining the ratio of the two values.

When estimates between crew members do not agree, follow the guidelines listed at the end of section 12.1 *Overview*.

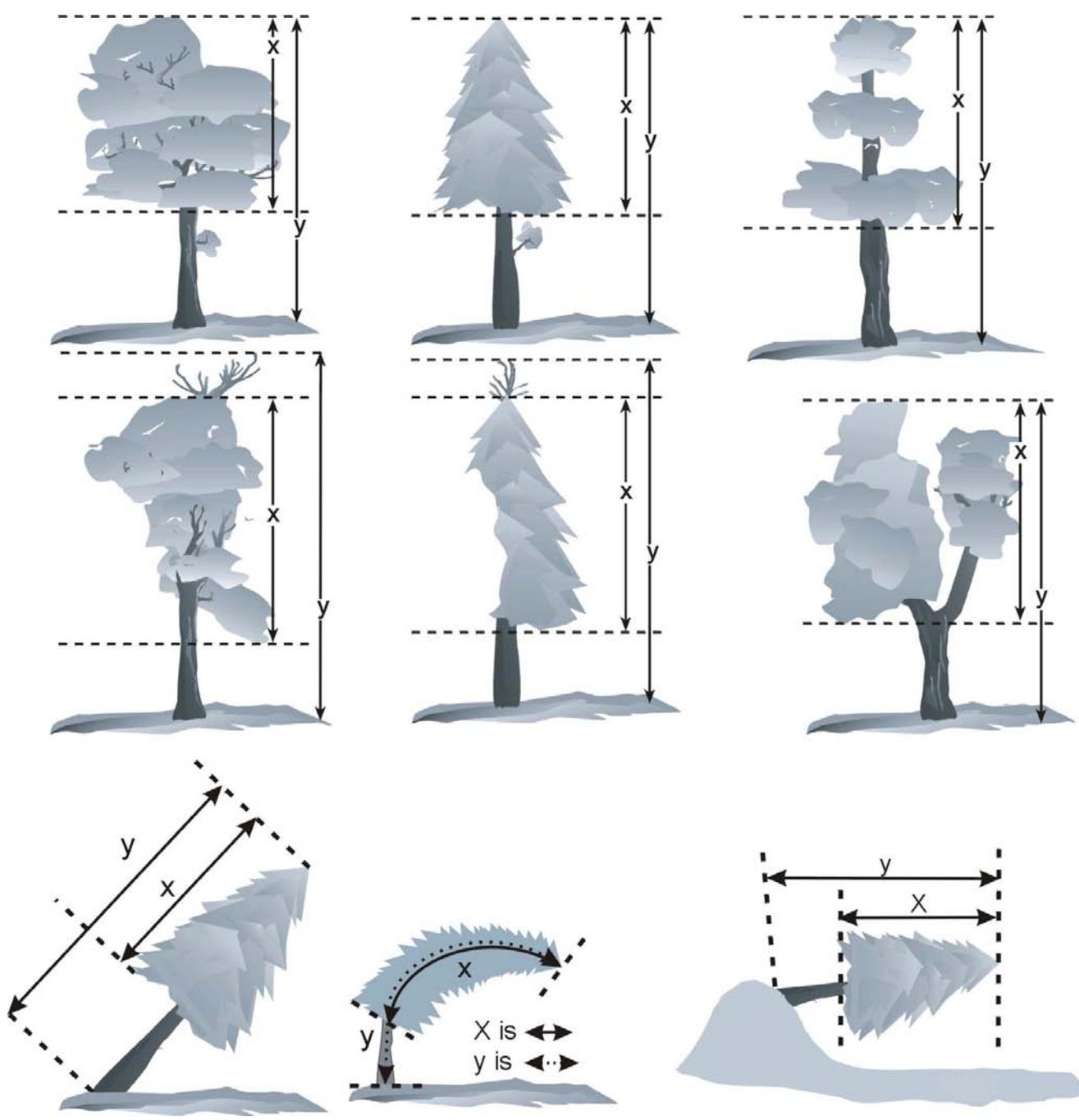


Figure 12-5. UNCOMPACTED LIVE CROWN RATIO examples.

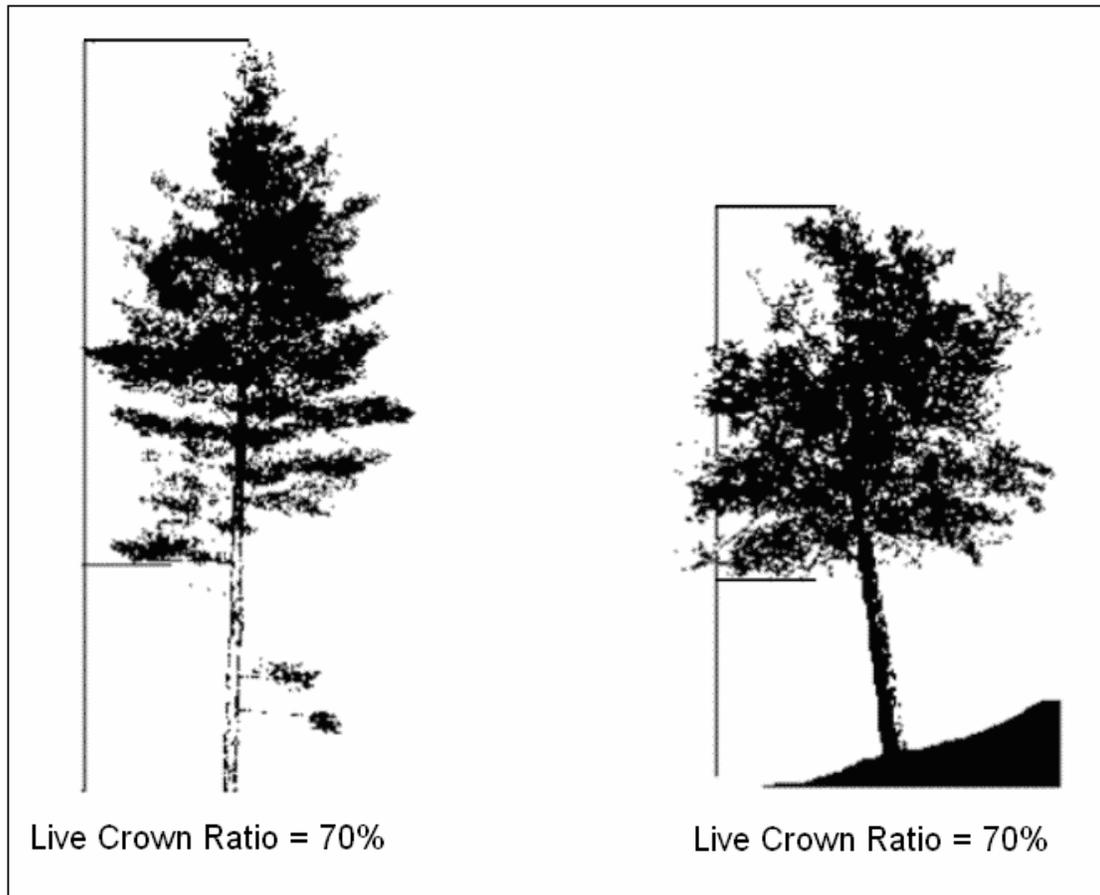


Figure 12-6. UNCOMPACTED LIVE CROWN RATIO outline and rating examples

When collected: All live trees \geq 25 mm DBH/DRC
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 99 percent

12.6 CROWN LIGHT EXPOSURE

Rate the UNCOMPACTED LIVE CROWN RATIO for each side of the tree separately using the criteria for estimating total UNCOMPACTED LIVE CROWN RATIO. Visually divide the crown vertically into four equal sides. In order for a side to qualify for tally, the side must have an uncompact live crown ratio of at least 35 percent. Additionally for a side to qualify, a continuous portion of live crown 35 percent or more in length must be completely exposed to direct light. For this measurement, a tree cannot shade itself (e.g., umbrella shaped trees). Try to divide the crown in such a way that as many sides as possible receive full light. Count the number of sides that would receive direct light if the sun were directly above the tree. Add one if the tree receives direct light from the top (Figure 12-7).

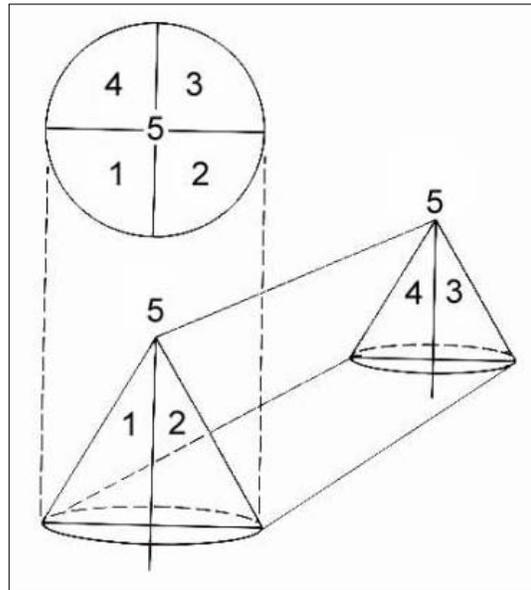


Figure 12-7. Dividing the crown.

Note: The entire side (25 percent of the crown circumference) must be receiving full light to qualify. A sliver of a side receiving light does not qualify. Trees with all sides having less than a 35 percent UNCOMPACTED LIVE CROWN RATIO can have a maximum crown exposure of one. Individual sides with less than 35 percent UNCOMPACTED LIVE CROWN RATIO should not be counted (Figure 12-8).

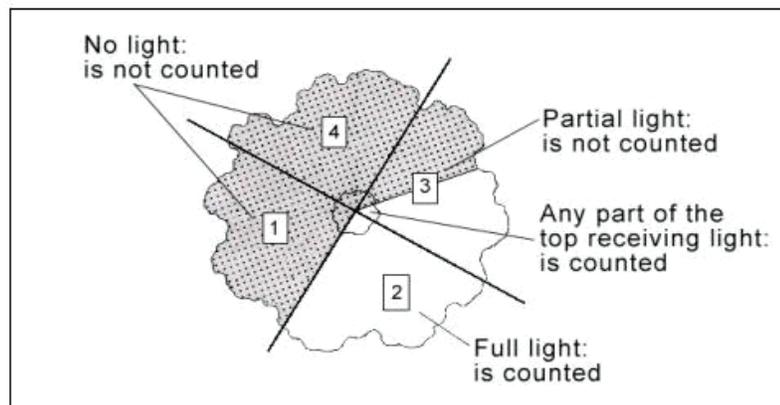


Figure 12-8. CROWN LIGHT EXPOSURE.

When collected: All live trees \geq 25 mm DBH/DRC

Field width: 1 digit

Tolerance: within 1 if $>$ 0

MQO: At least 85% of the time

Values:

Code	Definition
0	The tree receives no full light because it is shaded by trees, vines, or other vegetation; the tree has no crown by definition.
1	The tree receives full light from the top or 1 side.
2	The tree receives full light from the top and 1 side (or 2 sides without the top).
3	The tree receives full light from the top and 2 sides (or 3 sides without the top).
4	The tree receives full light from the top and 3 sides.
5	The tree receives full light from the top and 4 sides.

12.7 CROWN POSITION

Determine the relative position of each tree in relation to the overstory canopy zone (Figure 12-9). Codes 1-3 should be used in stands where the tree crown cover is closed (>50 percent cover). If the tree crowns are not closed (<50 percent cover) and the area is greater than 0.4 ha in size, then assign code 4. When code 4 is used, it is assigned to all trees in the stand except trees with no crown by definition. Code 4 is typically used in the following cases:

- Trees and saplings in stands, over 0.4 ha in size, where crown cover is less than 50 percent.
- Trees and saplings in clumps less than 0.4 ha in size (i.e., not a condition class) when the overall forest (the condition class), over 0.4 ha in size, is a patchwork of open areas and clumps of trees.

Code 1 is not used for saplings.

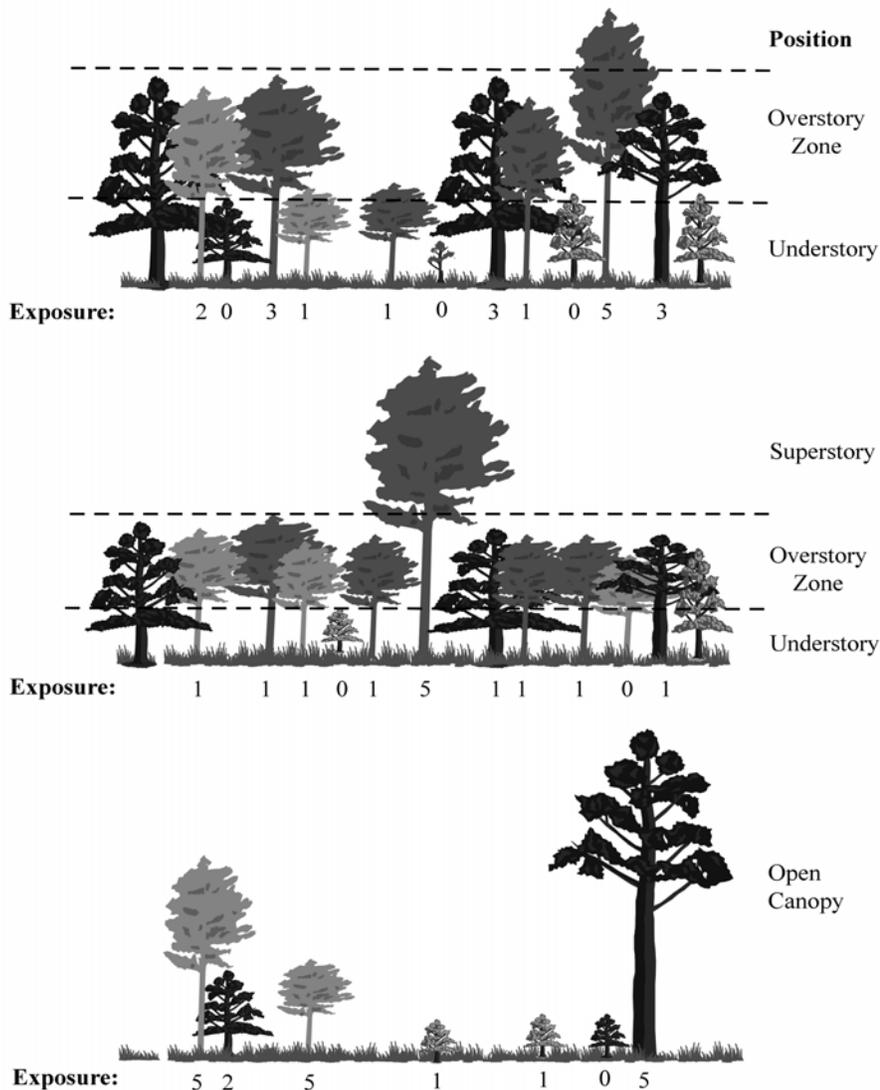


Figure 12-9. CROWN LIGHT EXPOSURE and CROWN POSITION.

When collected: All live trees ≥ 25 mm DBH/DRC
 Field width: 1 digit
 Tolerance: No errors
 MQO: At least 85% of the time
 Values:

Code	Definition
1	Superstory. The live crown top must be two times the height of the top of the overstory canopy zone. The tree is open grown because most of the crown is above the overstory canopy zone (pioneers, seed trees, whips, remnants from previous stands, etc.). NOT USED FOR SAPLINGS.
2	Overstory. The live crown top is above the middle of the overstory canopy zone.
3	Understory. The live crown top is at or below the middle of the overstory canopy zone, or tree has no crown by definition.
4	Open Canopy. An overstory canopy zone is not evident because the tree crowns in this condition are not fully closed (<50% cover). Most of the trees in this stand are not competing with each other for light.

12.8 CROWN VIGOR CLASS

See Figure 12-10 for a visual description of the sapling CROWN VIGOR classes.

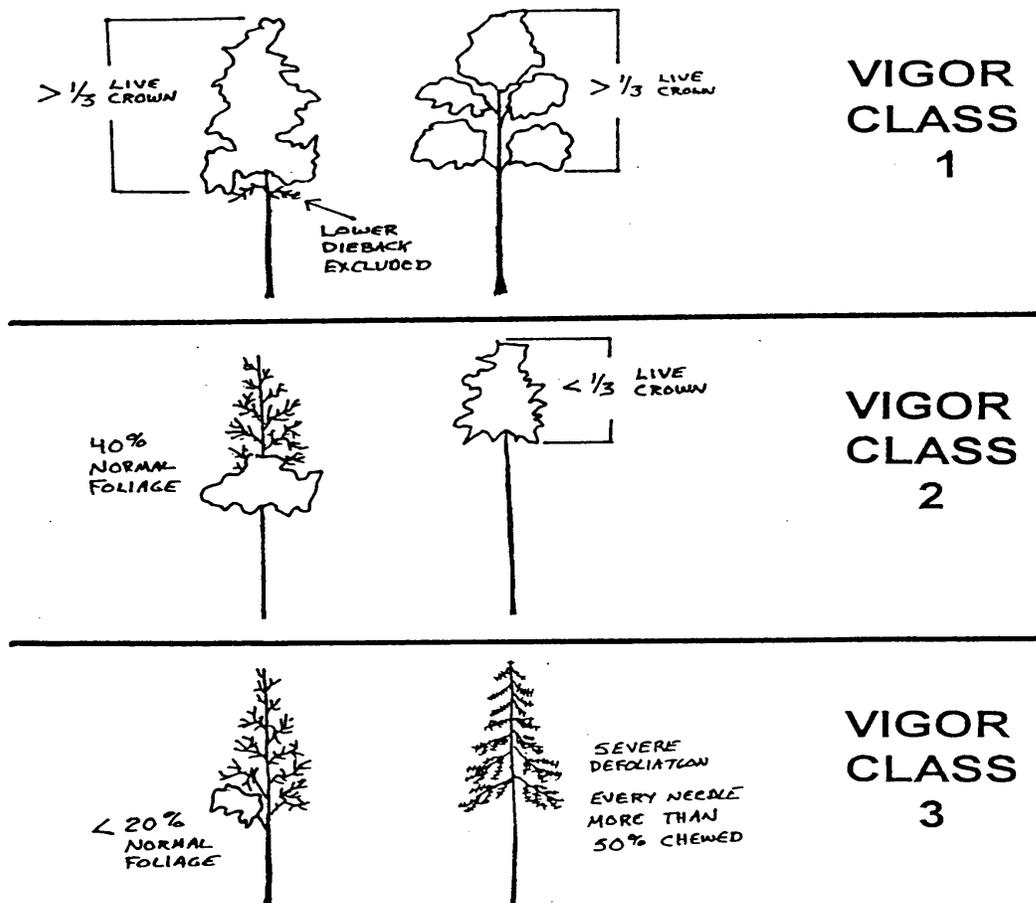


Figure 12-10. Sapling CROWN VIGOR classes.

When collected: All live trees \geq 25 mm DBH/DRC and $<$ 125 mm in DBH/DRC
 Field width: 1 digit
 Tolerance: No errors
 MQO: At least 90% of the time
 Values:

<u>Class/Code</u>	<u>Definition</u>
1	Saplings must have an UNCOMPACTED LIVE CROWN RATIO of 35 or higher, have less than 5 percent DIEBACK (deer/rabbit browse is not considered as dieback but is considered missing foliage) and 80 percent or more of the foliage present is normal or at least 50 percent of each leaf is not damaged or missing. Twigs and branches that are dead because of normal shading are not included.
2	Saplings do not meet Class 1 or 3 criteria. They may have any UNCOMPACTED LIVE CROWN RATIO, may or may not have DIEBACK and may have between 21 and 100 percent of the foliage classified as normal.
3	Saplings may have any UNCOMPACTED LIVE CROWN RATIO and have 1 to 20 percent normal foliage or the percent of foliage missing combined with the percent of leaves that are over 50 percent damaged or missing should equal 80 percent or more of the live crown. Twigs and branches that are dead because of normal shading are not included. Code is also used for saplings that have no crown by definition.

12.9 CROWN DENSITY

CROWN DENSITY estimates crown condition in relation to a typical tree for the site where it is found. CROWN DENSITY also serves as an indicator of expected growth in the near future. CROWN DENSITY is the amount of crown branches, foliage and reproductive structures that blocks light visibility through the crown. Each tree species has a normal crown that varies with the site, genetics, tree damage, etc.

To determine the crown shape, select the crown base on the stem used for UNCOMPACTED LIVE CROWN RATIO. Project a full "mirror image" crown based on that tree's shape. Include missing or dead tops. Project half-sided trees as full crowns by using the "mirror image" of the existing half of the crown. Foliage below the crown base is not included (Figure 12-1). Include CROWN DIEBACK and open areas in this outline (Figures 12-11 and 12-12).

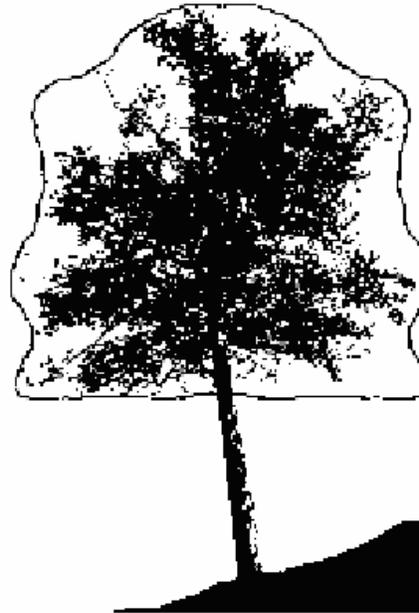
After determining the crown shape, each person should use the crown density - foliage transparency card (Figure 12-2). Along the line of sight, estimate what percentage of the outlined area is blocking sunlight. In cases where portions of the tree may be missing, i.e., half-sided trees, it may be easier to determine the percent of the crown shape missing and the actual density of the tree's remaining portion. Then use the table on the back of the crown density - foliage transparency card to arrive at the final CROWN DENSITY. When two individuals disagree with their estimates, follow the guidelines listed at the end of section 12.1 *Overview*. The estimate is placed into one of 21 percentage classes.



Figure 12-11. CROWN DENSITY rating outline examples.



Density = 55%



Density = 65%

Figure 12-12. Crown density outline and rating examples

When collected: All live trees ≥ 125 mm in DBH/DRC

Field width: 2 digits

Tolerance: +/- 10% (2 classes)

MQO: At least 90% of the time

Values:

Code	Definition	Code	Definition	Code	Definition
00	No crown	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc

12.9a EPIPHYTES AND VINES

For each pole size tree and larger, record the presence of epiphytes and vines as relates to crown density. Measure and record the vegetation type, primary location and the % coverage of the vegetative structures that block light visibility through the crown.

12.9a.1 VEGETATION TYPE

When collected: All live trees \geq 5.0 in DBH/DRC

Field width: 1 digits

Tolerance: None

MQO: At least 90% of the time

Values:

0	None present
1	Vines
2	Epiphytes
3	Both vines and epiphytes

12.9a.2 PRIMARY LOCATION

When collected: All live trees \geq 5.0 in DBH/DRC

Field width: 1 digits

Tolerance: None

MQO: At least 90% of the time

Values:

0	None
1	Crown
2	Stem
3	Both crown and stem

12.9a.3 PERCENT (%) COVERAGE

When collected: All live trees \geq 5.0 in DBH/DRC

Field width: 2 digits

Tolerance: +/- 10% (2 classes)

MQO: At least 90% of the time

Values:

00	None
01	Trace
05	1 – 5%
10	6 – 10%
*	* *
*	* *
95	91 – 95%
99	96 – 100%

12.10 CROWN DIEBACK

CROWN DIEBACK estimates reflect the severity of recent stresses on a tree. Estimate CROWN DIEBACK as a percentage of the live crown area, including the dieback area. The crown base should be the same as that used for the UNCOMPACTED LIVE CROWN RATIO estimate. Assume the perimeter of the crown is a two-dimensional outline from branch-tip to branch-tip, excluding snag branches and large holes or gaps in the crown (Figures 12-13 and 12-14).

Project a two-dimensional crown outline, block in the dieback and estimate the dieback area. When two individuals disagree with their estimates, follow the guidelines listed at the end of section 12.1 *Overview*. The estimate is placed into one of 21 percentage classes.

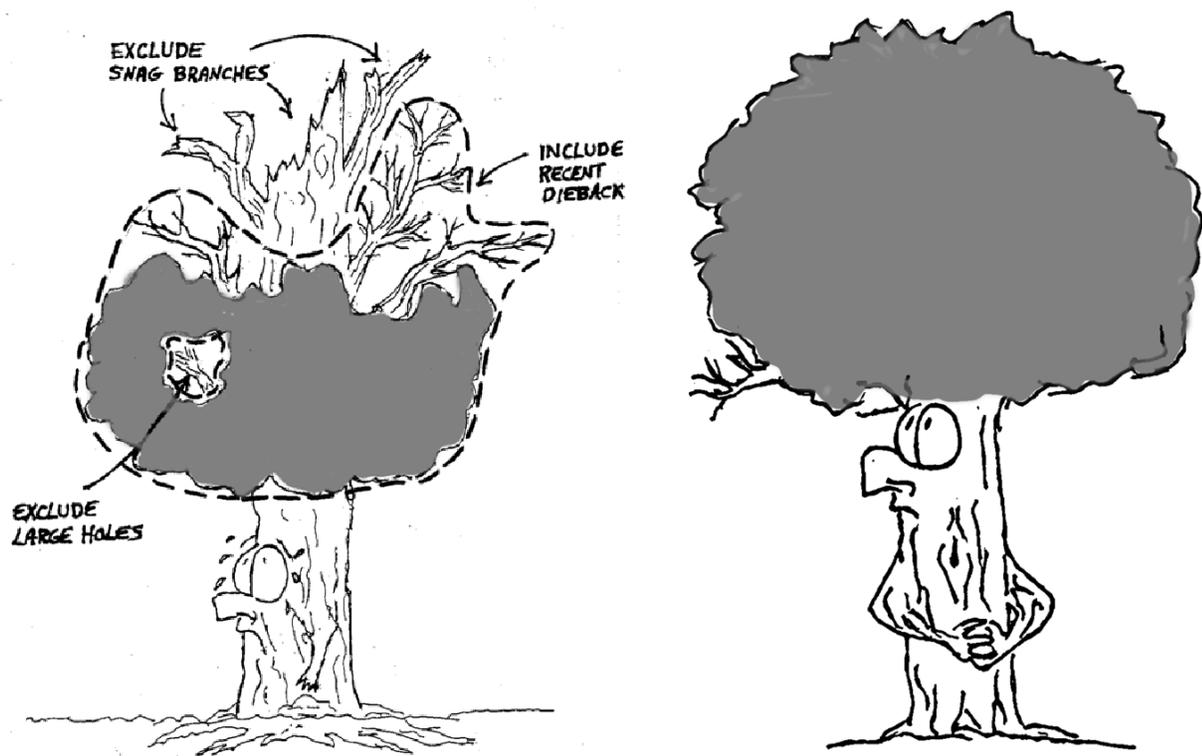


Figure 12-13. CROWN DIEBACK rating outline examples.

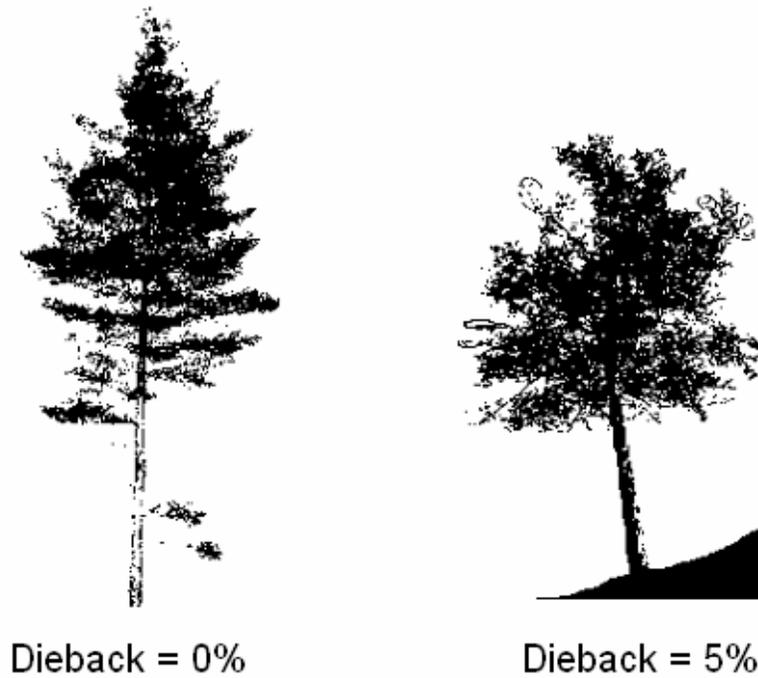


Figure 12-14. Dieback outline and rating examples.

When collected: All live trees \geq 125 mm in DBH/DRC
 Field width: 2 digits
 Tolerance: +/- 10% (2 classes)
 MQO: At least 90% of the time
 Values:

Code	Definition	Code	Definition	Code	Definition
00	0%	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

12.11 FOLIAGE TRANSPARENCY

Foliage transparency is the amount of skylight visible through the live, normally foliated portion (where you see foliage, normal or damaged, or remnants of its recent presence) of the crown. A recently defoliated tree except for one or two live leaves should have a transparency rating of 99 not 0!! Check with binoculars to assess which branches are alive and should have foliage.

Different tree species have a normal range of foliage transparency, which may be more or less than that of other species. Changes in foliage transparency can also occur because of current defoliation or stresses during the current or preceding years.

Estimate FOLIAGE TRANSPARENCY using the crown density - foliage transparency card (Figure 12-2). Exclude vine foliage from the transparency estimate as best you can. Dead branches in the lower live crown, snag branches, crown dieback and missing branches or areas where foliage is expected to be missing are deleted from the estimate (Figure 12-15).

When defoliation is severe, branches alone will screen the light, but you should exclude the branches from the foliage outline and rate the area as if the light was penetrating those branches. For example, an almost completely defoliated dense spruce may have less than 20 percent skylight coming through the crown, but it will be rated as highly transparent because of the missing foliage. Old trees and some hardwood species, have crowns with densely foliated branches that are widely spaced. These spaces between branches should not be included in the FOLIAGE TRANSPARENCY rating. When FOLIAGE TRANSPARENCY in one part of the crown differs from another part, the average FOLIAGE TRANSPARENCY is estimated.

Project a two-dimensional crown outline. Determine the foliated area within the crown outline and estimate the transparency of the normally foliated area.

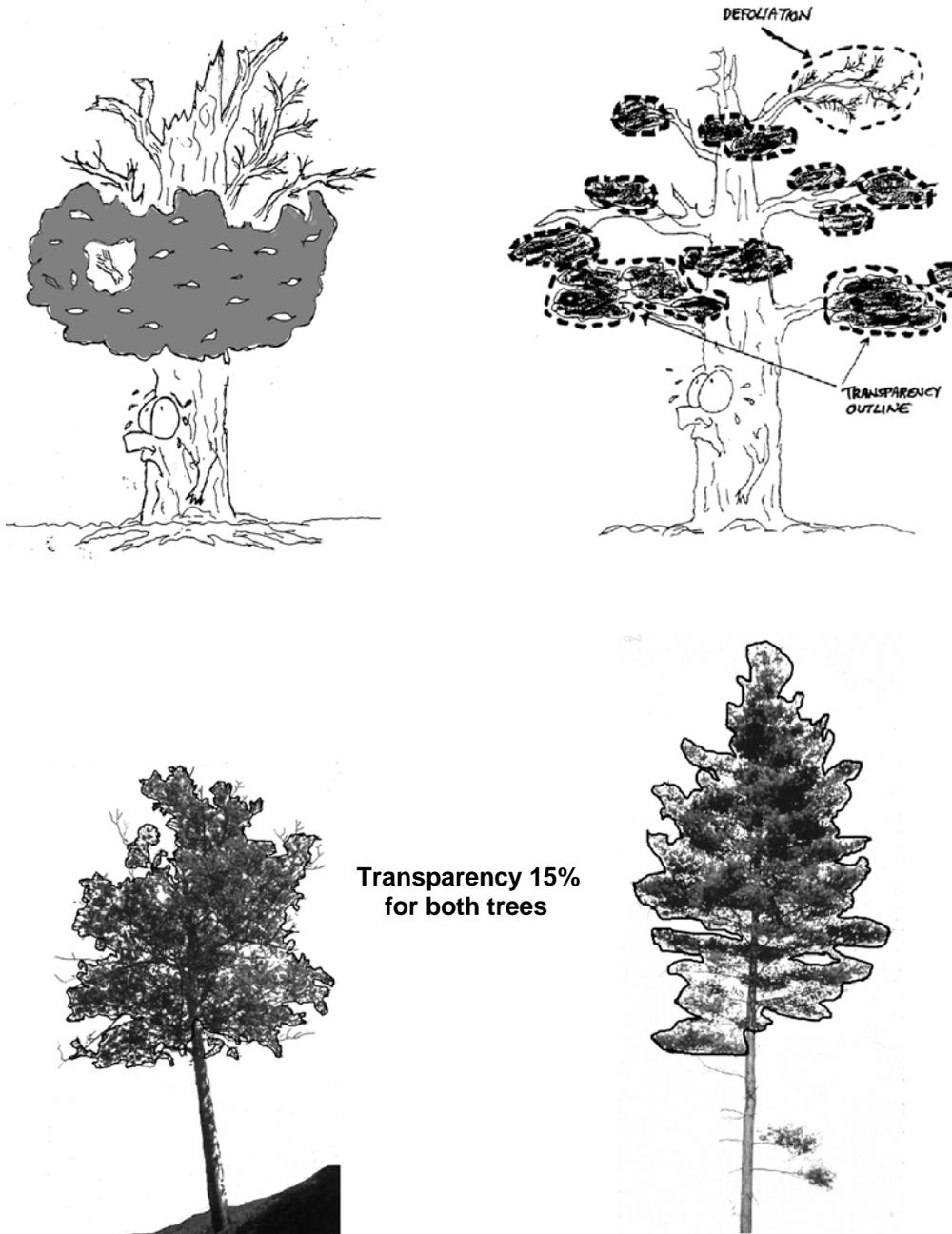


Figure 12-15. FOLIAGE TRANSPARENCY rating outline examples.

When collected: All live trees \geq 125 mm in DBH/DRC

Field width: 2 digits

Tolerance: +/- 10% (2 classes)

MQO: At least 90% of the time

Values:

Code	Definition	Code	Definition	Code	Definition
00	0%	35	31-35%	70	66-70%
05	1-5%	40	36-40%	75	71-75%
10	6-10%	45	41-45%	80	76-80%
15	11-15%	50	46-50%	85	81-85%
20	16-20%	55	51-55%	90	86-90%
25	21-25%	60	56-60%	95	91-95%
30	26-30%	65	61-65%	99	96-100%

Note: Class code is the percentage of the upper limits of the class, i.e., Code 10 is 6% to 10%, etc.

12.12 ACKNOWLEDGEMENTS

Contact information for the National Advisor for this indicator is: Michael Schomaker, 5400 Vardon Way, Fort Collins, CO 80528-9114 or email mschomak@lamar.colostate.edu .

Section 14. Down Woody Materials

14.0 INTRODUCTION

Down woody materials (DWM) are important components of forest ecosystems across the country. DWM is dead material on the ground in various stages of decay. Wildlife biologists, ecologists, mycologists, foresters, and fuels specialists are some of the people interested in DWM because it helps describe the:

- Quality and status of wildlife habitats.
- Structural diversity within a forest.
- Fuel loading and fire behavior.
- Carbon sequestration – the amount of carbon tied up in dead wood.
- Storage and cycling of nutrients and water – important for site productivity.

Down woody components and fuels estimated by the FIA programs are: coarse woody, fine woody, litter, herb/shrubs, slash, duff, and fuelbed depth. Any crew member can learn to collect down woody materials data. If untrained members of the crew are available to help, they can locate, measure, and flag transect lines and record the condition class information for the transect segments.

DWM is only sampled in accessible forest conditions intersected by the transect. If a transect crosses a nonforest condition, the boundaries of the condition are recorded (see section 14.3) but no DWM or fuels measurements are taken along this portion of the transect. The majority of DWM in the inventory is sampled using the line intersect sampling method (also called planar intercept method). In this method, transects are established, and individual pieces of CWD or FWD are tallied if the central axis of the piece is intersected by the plane of the transect. In addition, each piece must meet specified dimensions and other criteria before being selected for tally. Special procedures apply when a CWD piece lays across a condition class boundary (section 14.2). Transects will always be used to sample FWD. Transects will be used to sample CWD when crews are able to see and measure individual pieces.

The line intersect method is not practical for sampling CWD when it is part of machine-piled windrows or slash piles, or part of log "jumbles" at the bottom of steep-sided ravines. In these situations, individual pieces are impractical to tally separately and are labeled as "residue piles". A different sampling method is used to tally and measure CWD residue piles (see section 14.8, Sampling Residue Piles).

Note: This indicator is CORE OPTIONAL on all phase 2 plots.

14.1 DEFINITION OF DOWN WOODY MATERIALS

CWD – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth and on the ground. CWD also includes dead trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical. Also included are non-machine processed round wood such as fence posts and cabin logs. For multi-stemmed woodland trees such as juniper, only tally stems that are dead, detached, and on the ground; or dead and leaning > 45 degrees from vertical.

CWD does not include:

1. Woody pieces < 7.6 cm (3.0 inches) in diameter at the point of intersection with the transect.
2. Dead trees leaning 0 to 45 degrees from vertical.
3. Dead shrubs, self-supported by their roots.
4. Trees showing any sign of life.
5. Stumps that are rooted in the ground (i.e., not uprooted).
6. Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
7. Roots or main bole below the root collar.

FWD – In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 1.8 m (6 feet) above the ground to be counted.

FWD does not include:

- 1) Woody pieces ≥ 7.6 cm (3.0 inches) in diameter at the point of intersection with the transect.
- 2) Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
- 3) Dead foliage (i.e., pine or fir needles, or leaf petioles).
- 4) Bark fragments or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
- 5) Small pieces of decomposed wood (i.e., chunks of cubical rot)

14.2 LOCATING AND ESTABLISHING LINE TRANSECTS

Transects are established on each subplot if the subplot center is accessible (i.e., not census water, access denied, or hazardous), and there is at least one forest land condition class mapped within the 7.32 m (24.0 feet) radius subplot (CONDITION CLASS STATUS = 1). Transects begin at the subplot center and extend 7.32 M (24.0 feet) to the edge of the subplot. The location of condition class boundaries are recorded along the transect. It is extremely important to lay out the transect in a straight line to avoid biasing the selection of pieces and to allow the remeasurement of transect lines and tally pieces for future change detection.

Transect lines should be marked with a pin or small piece of flagging at the end of the line (7.32 M (24.0 feet), horizontal distance) to help the QA staff identify the path of the transect during the check-plot procedure. Because the tolerance for the transect azimuth is ± 2 degrees, the line might have been laid down in a slightly different direction from the check-plot crew. This could affect the location of diameter measurements for CWD pieces as well as identifying whether a CWD piece is a valid tally piece. It is also helpful to mark the point where the FWD transect begins (4.3 m (14 feet), slope distance).

14.2.1 CWD transects

Three transects are established that originate at the subplot center and extend out 7.32 M (24.0 feet) horizontal distance (the radius of the subplot) at azimuths of 30, 150, 270 degrees (Figure 14-1). This transect configuration was chosen to avoid sampling bias on sloped land, where it is possible that CWD may be oriented in one direction. This configuration of transects should pick up CWD logs that are lying parallel to the slope, perpendicular to the slope, and across slope.

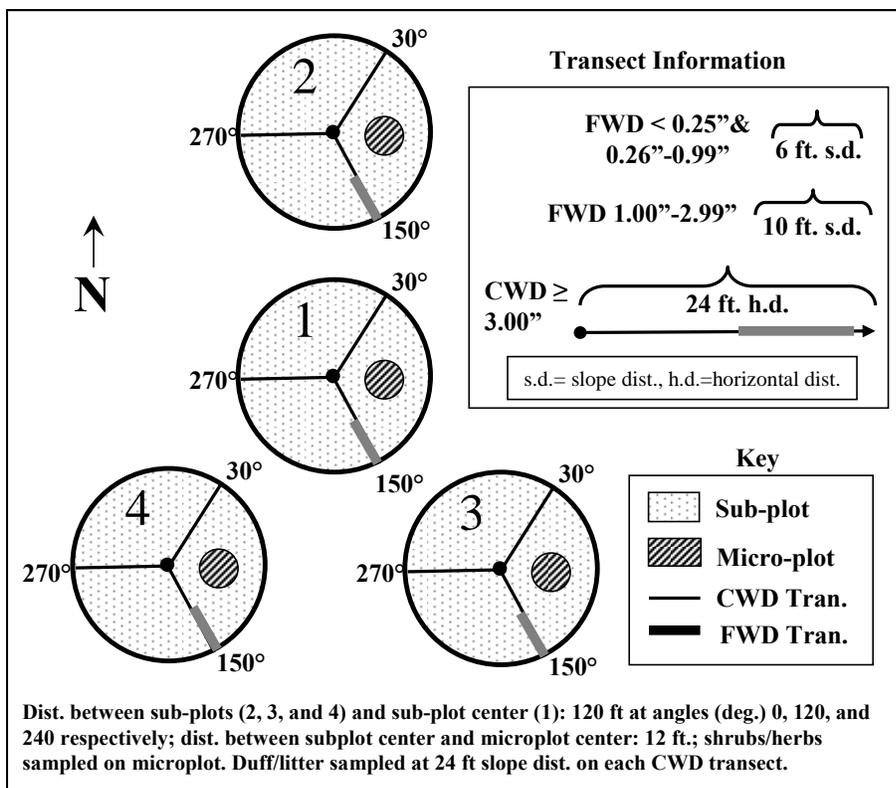


Figure 14-1. Plot layout for sampling CWD, FWD, and fuels.

14.2.2 FWD transects

One transect is established on each subplot, along the 150 degree azimuth. FWD is tallied within 3 size classes. Because FWD is generally present in higher densities, a shorter transect will pick up an acceptable amount of tally. The transect begins at 4.3 m (14 feet) (slope distance) from the subplot center and extends out either 1.8 or 3.0 m (6 or 10 feet) (slope distance) depending on the FWD size class, as follows:

Category of FWD	Size Class	Diameter range	Transect length (slope distance)	Transect location (slope distance)
Small FWD	1	0 to 0.6 cm (0 to 0.25")	1.8 m (6 ')	4.3 to 6.1 m (14 to 20 ')
Medium FWD	2	0.6 to 2.4 cm (0.25 to 0.9")	1.8 m (6 ')	4.3 to 6.1 m (14 to 20 ')
Large FWD	3	2.5 to 7.4 cm (1.0 to 2.9")	3.0 m (10 ')	4.3 to 6.1 m (14 to 20 ')

Note that the FWD transects are slope distance not horizontal distance. The formulas used to estimate biomass from the data contain an adjustment for slope. It is helpful to have a size gauge available until your eye is 'trained' to recognize the 3 size classes. Examples include a plastic or cardboard card with 3 notches cut for each size class, or a set of 3 dowels representing each size class.

14.3 TRANSECT LINE SEGMENTING

Transect lines are segmented to determine the length of transect that occurs within each mapped condition class intersecting the line. A segment is a length of transect that is in one condition. Segments are identified by recording the BEGINNING DISTANCE and ENDING DISTANCE of the slope from subplot center out to the end of the subplot. In the office, the segmenting data will be combined with CWD distances to determine which condition class each piece falls in (condition classes are not assigned to CWD pieces in the field). If more than one condition is found on the FWD transects, the segmenting information recorded here will provide the length of transect in each condition.

Starting at the subplot center and working towards the fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record. On each record, the BEGINNING DISTANCE and ENDING DISTANCE of the slope are recorded for each condition class encountered. The first record for each transect will have a BEGINNING DISTANCE of 0 meters. If only one condition class occurs on the transect line, only one segment is recorded. The transect must extend a total of 7.32 M (24.0 feet) horizontal distance. If the entire 7.32 M (24.0 feet) subplot is nonforest, enter codes for SUBPLOT NUMBER, TRANSECT, CONDITION CLASS NUMBER, followed by zeros in the remaining fields.

On subplots where a transect intersects a boundary between condition classes, the transect continues across the boundary into the adjacent class (Figure 14-2). Although DWM is only sampled in accessible forest conditions, all CONDITION CLASS BOUNDARIES (BEGINNING DISTANCE and ENDING DISTANCE) are recorded on each transect.

Individual pieces of DWM intersected by a transect are tallied or counted if they meet the tally rules for CWD or FWD specified in the sections that follow. It is expected that the majority of FWD transects will be in one condition, but if the condition class changes along the transect, a count is recorded for each condition. Again, the segmenting data recorded here will identify which condition class is associated with each count.

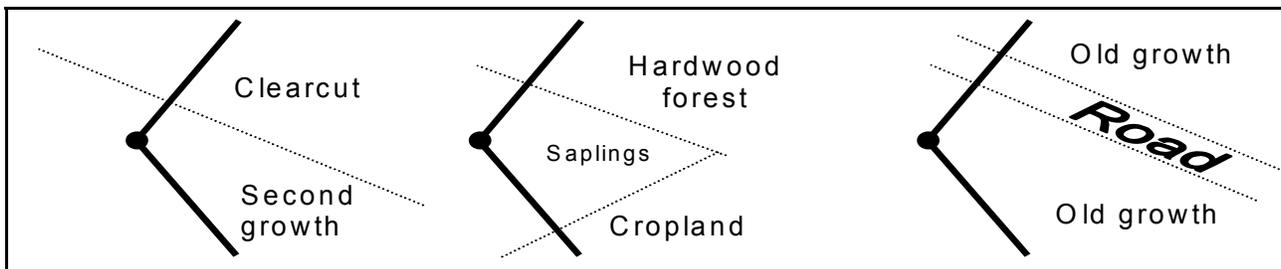


Figure 14-2. Transects are installed across condition class boundaries.

14.3.1 SUBPLOT NUMBER

Record the code indicating the subplot center from which the transect originates.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

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

14.3.2 TRANSECT

Record the code indicating the transect on which a condition class is being delineated. The three transects used are 30 degrees, 150 degrees, and 270 degrees. These transects, when being installed, have a tolerance of +/- 2 degrees.

When Collected: All tally segments

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 030 Transect extends 30 degrees from subplot center
- 150 Transect extends 150 degrees from subplot center
- 270 Transect extends 270 degrees from subplot center

14.3.3 CONDITION CLASS NUMBER

Record the code indicating the number of the condition class for the transect segment. Use the same code assigned to the condition class on the subplot or elsewhere on the plot. The first segment recorded for each transect will have the same CONDITION CLASS NUMBER as assigned to the subplot center.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

14.3.4 BEGINNING DISTANCE

Record the location (using slope distance) on the transect line where the transect intersects the boundary with the adjacent condition class nearer to the subplot center. The first record for each transect will have a BEGINNING DISTANCE of 0000 cm. Each subsequent record will have a BEGINNING DISTANCE equal to the ENDING DISTANCE of the previous record. Measure to the nearest centimeter.

When collected: All tally segments

Field width: 4 digits

Tolerance: +/- 30 cm (1.0 feet)

MQO: At least 95% of the time

Values: 0000 to 1350

14.3.5 SLOPE PERCENT

Record the code indicating the average slope percent along the transect within the condition class being segmented. When only one condition class is present on a transect, slope percent is the average slope percent along the entire transect. Measure to the nearest 5%.

When collected: All tally segments

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 005 to 155

14.3.6 ENDING DISTANCE

Record the location (using slope distance) on the transect line where the transect exits the condition class being delineated and intersects the boundary with a different condition class further away from the subplot center. If no other condition classes are encountered, record the location (using slope distance) of the end of the transect line. Measure to the nearest centimeter.

When collected: All tally segments
 Field width: 4 digits
 Tolerance: +/- 30 cm (1.0 feet)
 MQO: At least 95% of the time
 Values: 0000 to 1350

14.4 SAMPLING Methods for COARSE WOODY DEBRIS (CWD)

14.4.1 Tally Rules for Coarse Woody Debris (CWD)

1. Coarse woody debris (CWD) is sampled in accessible forest land conditions only. Tally a piece if its central longitudinal axis intersects the transect, and the condition class is accessible forest land at the point of intersection (Figure 14-3). The entire piece is assigned to this condition.

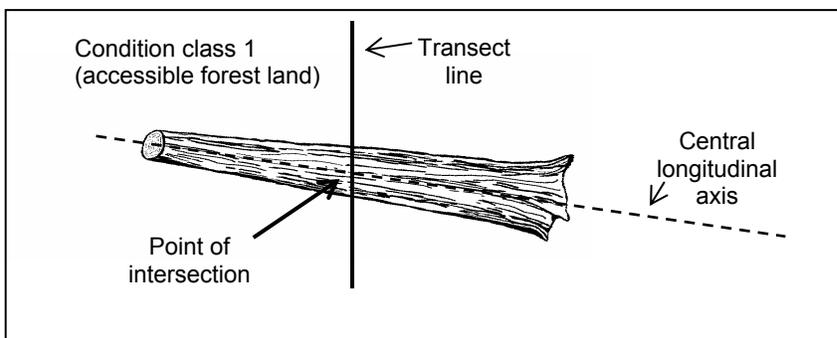


Figure 14-3. Tally rules for CWD.

2. Tally dead trees and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees and stumps that are still upright and leaning < 45 degrees from vertical. Follow the same rules for down trees as outlined in section 5.0 'Tree and Sapling Data' from the P2 field guide. Most CWD will be laying on the ground.
3. The minimum length of any tally piece is 91 cm (3.0 feet). When CWD pieces are close to 91 cm (3.0 ft) total length measure the length carefully to determine if it is ≥ 91 cm (3.0 feet). CWD TOTAL LENGTH (14.4.3.7) is the length of the piece that lies between the piece's recorded DIAMETER AT THE SMALL END AND DIAMETER AT THE LARGE END (14.4.3.6.2 & 14.4.3.6.3),
4. Decay class of the piece determines whether or not the piece is tallied (see section 14.4.3.4).

For decay classes 1 to 4: tally a piece if it is ≥ 7.6 cm (3.0 inches) in diameter at the point of intersection with the transect. The piece must be ≥ 91 cm (3.0 feet) in length and ≥ 7.6 cm (3.0 inches) or more in diameter along that length. If the intersect diameter is close to 7.6 cm (3.0 inches), measure the diameter to the nearest millimeter (0.1 inch) to determine if the piece qualifies (Figure 14-4).

For decay class 5: tally a piece if it is ≥ 12.5 cm (5.0 inches) in diameter at the point of intersection and ≥ 12.5 cm (5.0 inches) high from the ground. The piece must be ≥ 91 cm (3.0 feet) in length and ≥ 12.5 cm (5.0 inches) or more in diameter along that length. The reason for treating decay class 5 pieces differently is because they are difficult to identify, especially when heavily decomposed. Only

pieces that still have some shape and log form are tallied—humps of decomposed wood that are becoming part of the duff layer are not tallied.

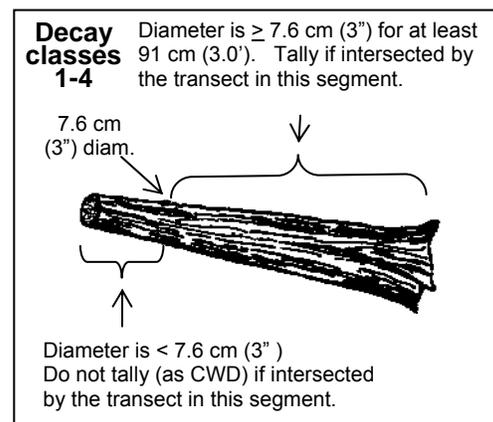


Figure 14-4. CWD tally rules for decay classes 1-4.

5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine-piled. Do not record pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" at the bottom of a steep-sided ravine in which individual pieces are impractical to tally separately. Instead, sample these piles according to instructions in section 14.8 'Sampling Residue Piles'. A slash pile or windrow consists of broken logs, limbs, and other vegetative debris.
6. Tally a piece only if the point of intersection occurs above the ground. If one end of a piece is buried in the litter, duff, or mineral soil, the piece ends at the point where it is no longer visible. Measure the diameter and length at this point.
7. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see Figure 14-5).

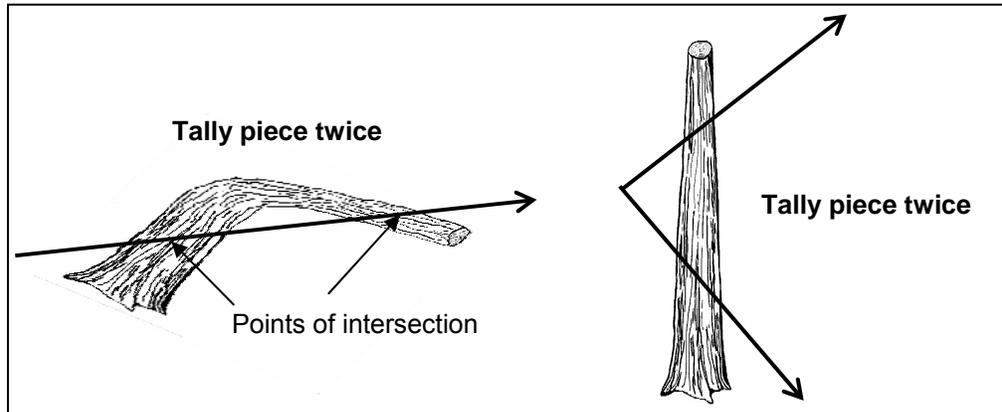


Figure 14-5. CWD tally rules: intersections.

8. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece. Tally the piece on the 30 degree transect and record the CWD Distance as 001.
9. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.
10. Do not tally a piece if it intersects the transect on the root side of the root collar. Do not tally roots.
11. When the transect crosses a forked down tree bole or large branch connected to a down tree, tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements.
12. In the case of forked trees, consider the "main bole" to be the piece with the largest diameter at the fork. Variables for this fork such as TOTAL LENGTH and DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (see Figure 14-6).
13. If a transect intersects a nonforest condition (e.g., a road), no CWD is tallied.

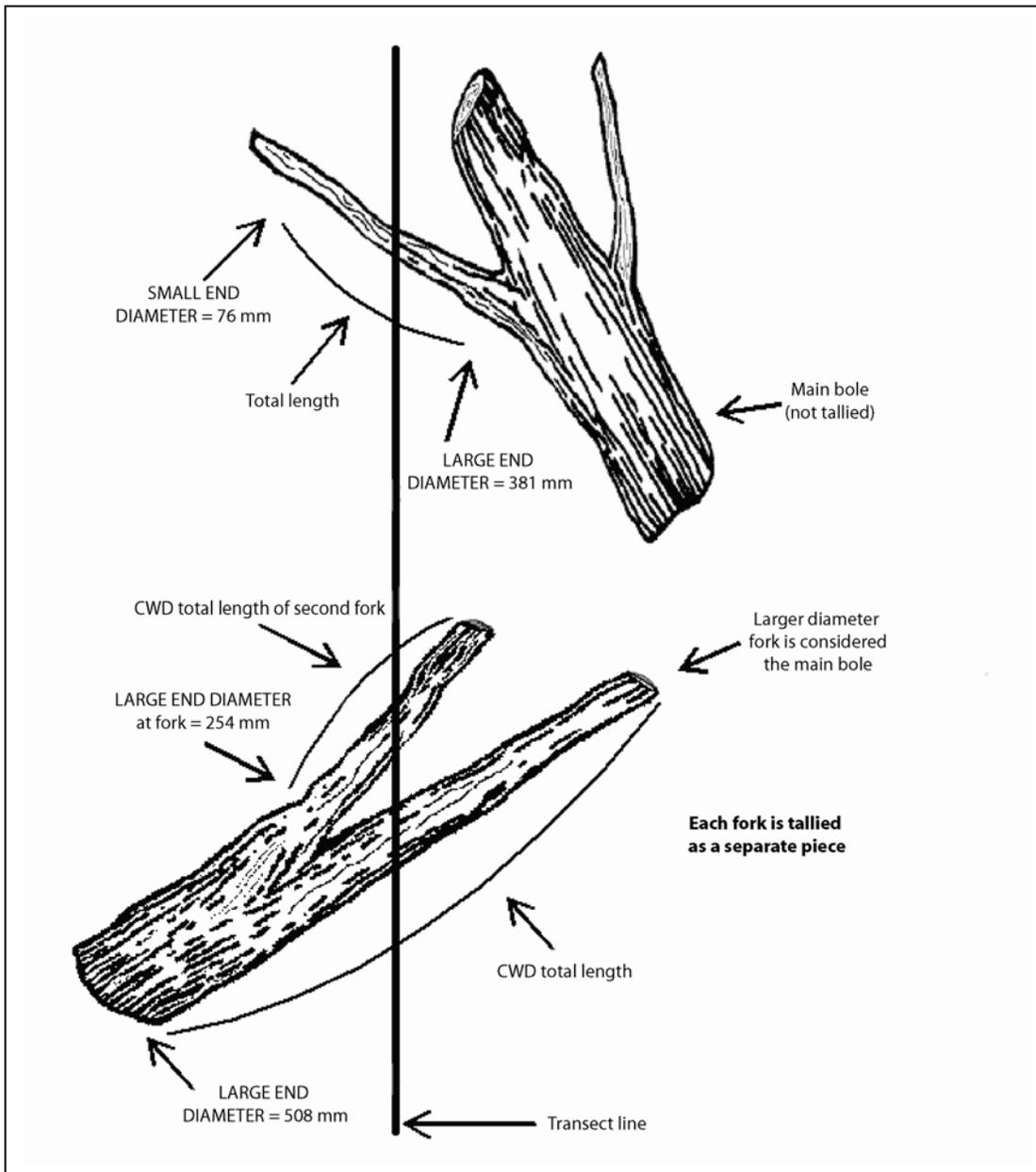


Figure 14-6. CWD tally rules for forked trees.

14.4.2 Marking CWD

Marking CWD is optional. Marked CWD is an aid to future crews returning to the plot for a QA check or to re-measure the plot at the next re-measurement period. Nails can be used to mark the location of the point of intersection, if the piece is in decay class 1, 2, or 3. Position the nail on top of the piece, and if possible, drive the nail into the piece so that about 2.5 cm (1 inch) of the nail is left exposed. Stop driving the nail if the next blow means breaking the piece or seriously disturbing the location of the piece. Please see section 14.3 Transect Line Segmenting, for information on the required marking of the transect line.

14.4.3 Recording Procedures for CWD

The tolerance for the total number of pieces (≥ 7.6 cm (3 inches), transect diameter) tallied across all transects on the plot is: ± 2 pieces or $\pm 5\%$, whichever is greater for the plot. Note: always round up to a whole piece count when using the 5% option.

14.4.3.1 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally pieces
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 4

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

14.4.3.2 TRANSECT

Record the code indicating the azimuth of the transect on which the piece is sampled.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 030 Transect extends 30 degrees from subplot center
- 150 Transect extends 150 degrees from subplot center
- 270 Transect extends 270 degrees from subplot center

14.4.3.3 CWD SLOPE DISTANCE

Record the code indicating the slope distance from the subplot center to the point where the transect intersects the longitudinal center of the piece. If two or more pieces have the same slope distances, record the top piece first. Measure and record to the nearest 3.0 cm (0.1 feet). CWD SLOPE DISTANCE is an important item because it will be used to assign the CWD piece to a condition class by comparing the recorded distance to the piece with the recorded BEGINNING DISTANCE and ENDING DISTANCE to the condition class boundary. CWD SLOPE DISTANCE is also used to locate the piece for QA and remeasurement in future inventories.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: +/- 30.5 cm (1.0 feet)
MQO: At least 90% of the time
Values: 0001 to 1350

14.4.3.4 CWD DECAY CLASS

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the recorded CWD TOTAL LENGTH (14.4.3.7) of the piece. Use the guide below to determine CWD DECAY CLASS.

When Collected: All tally pieces
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values:

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound, freshly fallen, intact logs	Intact, no rot; conks of stem decay absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports its own weight	Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent	Reddish-brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten; piece does not support its own weight, but maintains its shape	Soft, small blocky pieces; a metal pin can be pushed into heartwood	Reddish or light brown	Through-out	Branch stubs pull out
5	None, piece no longer maintains its shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Through-out	Branch stubs and pitch pockets have usually rotted down

Note: CWD DECAY CLASS 5 pieces can be difficult to identify because they often blend into the duff and litter layers. They must still resemble a log, therefore, the first tally rule is that they must be > 12.7 cm (5.0 inches) in diameter, > 12.7 cm (5.0 inches) from the surface of the ground, and at least 91 cm (3.0 feet) long. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

CWD DECAY CLASS: The chart above was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other charts available to use to describe decay classes for other species or locations. Concentrate on the structural integrity and texture when estimating a decay class for CWD logs.

If a log is case hardened (hard, intact outer sapwood shell) but the heartwood is rotten, code this log as a CWD DECAY CLASS 2 with a HOLLOW PIECE code of 1. CWD DECAY CLASS 1 should be reserved for 'freshly fallen' logs that are completely intact (i.e., recent windfalls, or harvest).

14.4.3.5 SPECIES

Record the code indicating the species of the piece. Species codes are the same as those used in P2 (see Appendix 3 of the P2 field guide). Because CWD includes the tally of large shrub boles and woody vines, enter a code of '0001' for SPECIES if the tally piece is a shrub or vine.

Species identification may be uncertain for some pieces. The piece's bark (either attached or sloughed and laying beside the piece), branching pattern (if the branches are still present), or heartwood smell (particularly if cedars, Douglas-fir, or western hemlock) may provide clues. On remeasurement plots, see what tree species were tallied in past inventories. One way to distinguish hardwoods from softwoods is by the type of decay present. Hardwoods usually have a white or grayish stringy rot, while softwoods usually have a reddish-brown blocky rot. If it is not possible to identify the species, attempt to estimate if it is softwood or hardwood. Enter code 9998 for unknown species.

When Collected: CWD DECAY CLASS = 1 to 4
 Field width: 4 digits
 Tolerance: No errors
 MQO: At least 80% of the time
 Values: See species codes in Appendix 3 of the P2 field guide.

14.4.3.6 Diameters

The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length (Figure 14-7). It is useful to carry a steel carpenters retracting tape to measure diameters. Other methods include wrapping a tape around the bole if possible, holding a straight-edge ruler above the piece, or using calipers.

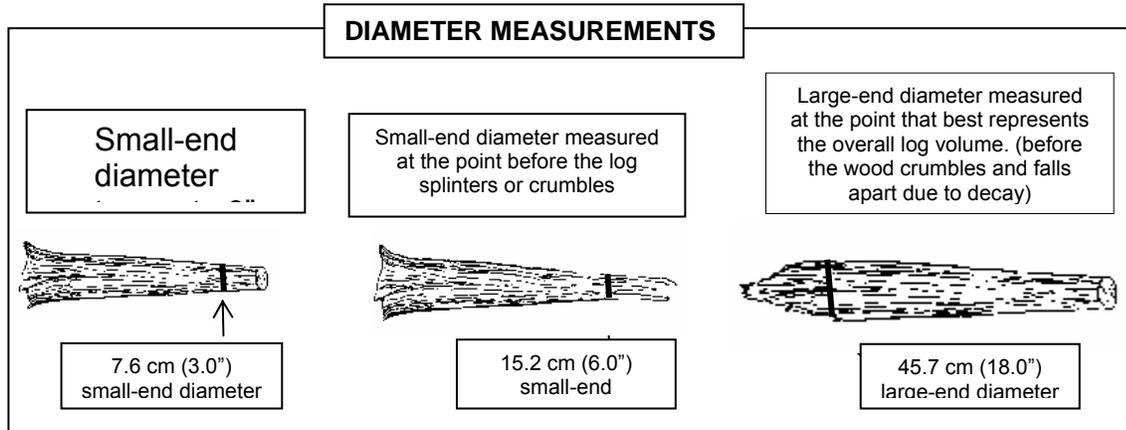


Figure 14-7. Diameter measurements

For pieces that are not round in cross-section because of missing chunks of wood or "settling" due to decay, measure the diameter in two directions and take an average. Estimate the longest and shortest axis of the cross-section ("A" and "B" in Figure 14-8), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

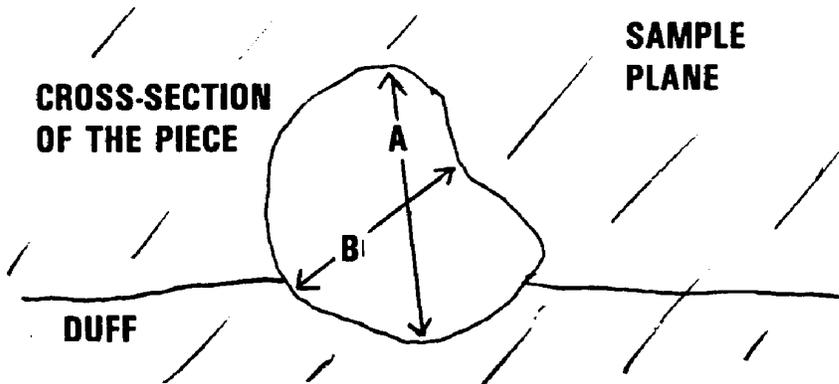


Figure 14-8. Estimating the diameter of pieces that are not round in cross-section

If the transect intersects the log at the decayed or splintered end (Figure 14-9) (i.e., the portion where we do not consider it part of the log because it is falling apart), record the diameter at this location as the intersect diameter, but record the large end and small end diameter according to our established rules (i.e., at the points where they best represent the log volume). If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – in this situation treat it as one log and take a diameter around the end (take two measurements if it is odd shaped). Length would be measured between the large and small end diameters.

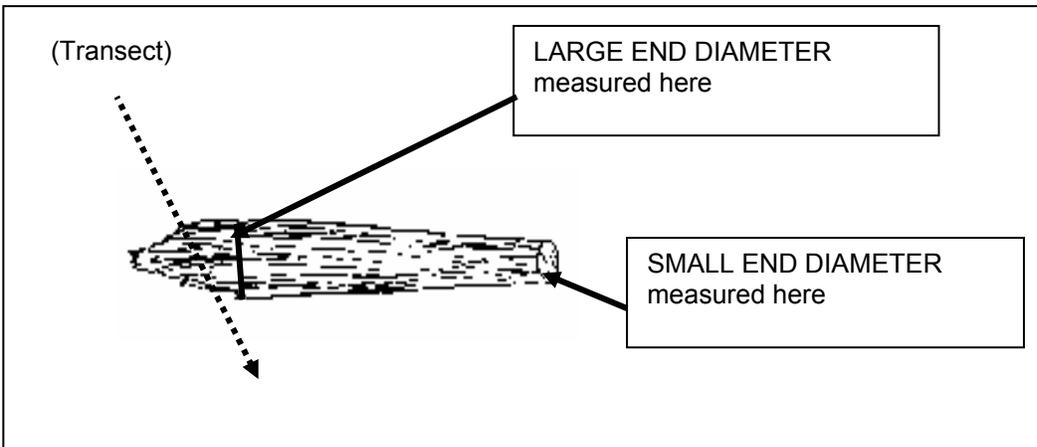


Figure 14-9. Example of decayed end intersecting the transect

14.4.3.6.1 DIAMETER AT POINT OF INTERSECTION

Record the code indicating the piece's diameter at the point where the transect intersects the longitudinal center of the piece. If the diameter is close to 7.6 cm (3 inches), measure the diameter to the nearest 0.25 cm (0.1 inch) to determine if the piece is actually ≥ 7.6 cm (3.0 inches) and a valid tally piece. The diameter is recorded to the nearest centimeter.

When Collected: All tally pieces

Field width: 3 digits

Tolerance: Pieces < 50.8 cm (20.0 inches) diameter: +/- 7.6 cm (3 inches)

Pieces > 50.8 cm (20.0 inches) diameter: +/- 20%

MQO: At least 90% of the time

Values: 007 to 508

14.4.3.6.2 DIAMETER AT THE SMALL END

Record the code indicating the diameter at the piece's small end. The diameter is recorded to the nearest inch. The DIAMETER AT THE SMALL END occurs either at (1) the actual end of the piece, if the end has a diameter ≥ 7.6 cm (3.0 inches), or (2) at the point where the piece tapers down to 7.6 cm (3.0 inches) in diameter. If the end is splintered or decomposing (sloughing off), measure the diameter at the point where it best represents the overall log volume. Use the same measuring procedures described in 14.4.3.6.1 (see Figure 14-7).

When Collected: CWD DECAY CLASS = 1 to 4

Field width: 3 digits

Tolerance Pieces < 50.8 cm (20.0 inches) diameter: +/- 5.1 cm (2 inches)

Pieces > 50.8 cm (20.0 inches) diameter: +/- 10%

MQO: At least 90% of the time

Values: 007 to 508

14.4.3.6.3 DIAMETER AT THE LARGE END

Record the code indicating the diameter at the piece's large end. The diameter is recorded to the nearest inch. The large end will occur either at a broken or sawn end, at a fracture, or at the root collar. If the end is splintered or decomposing (sloughing off), measure the diameter at the point where it best represents the overall log volume. Use the same measuring procedures used for 14.4.3.6.1.

When Collected: CWD DECAY CLASS = 1 to 4

Field width: 3 digits

Tolerance: Pieces < 20.0 in diameter: +/- 2 in

Pieces > 20.0 in diameter: +/- 15%

MQO: At least 90% of the time

Values: 007 to 508

14.4.3.7 CWD TOTAL LENGTH

Record the code indicating the total length of the piece. CWD TOTAL LENGTH is the length of the piece that lies between the piece's recorded DIAMETER AT THE SMALL END AND DIAMETER AT THE LARGE END (14.4.3.6.2 & 14.4.3.6.3). For DECAY CLASS = 5, DIAMETER AT THE SMALL END AND DIAMETER AT THE LARGE END are not recorded for a log, therefore the length is measured between the two physical ends of the log. For curved logs, measure along the curve. The minimum log length is 91 cm (3.0 feet) before it is a valid tally log. When the length is close to 91 cm (3.0 feet), measure the length to determine if the piece is actually ≥ 91 cm (3.0 feet). CWD TOTAL LENGTH is recorded to the nearest tenth meter (decimeter).

When Collected: All tally pieces

Field width: 3 digits

Tolerance: +/- 20%

MQO: At least 90% of the time

Values: 009 to 302

14.4.3.8 IS THE PIECE HOLLOW?

Record the code indicating whether or not the piece is hollow (see Figure 14-10).

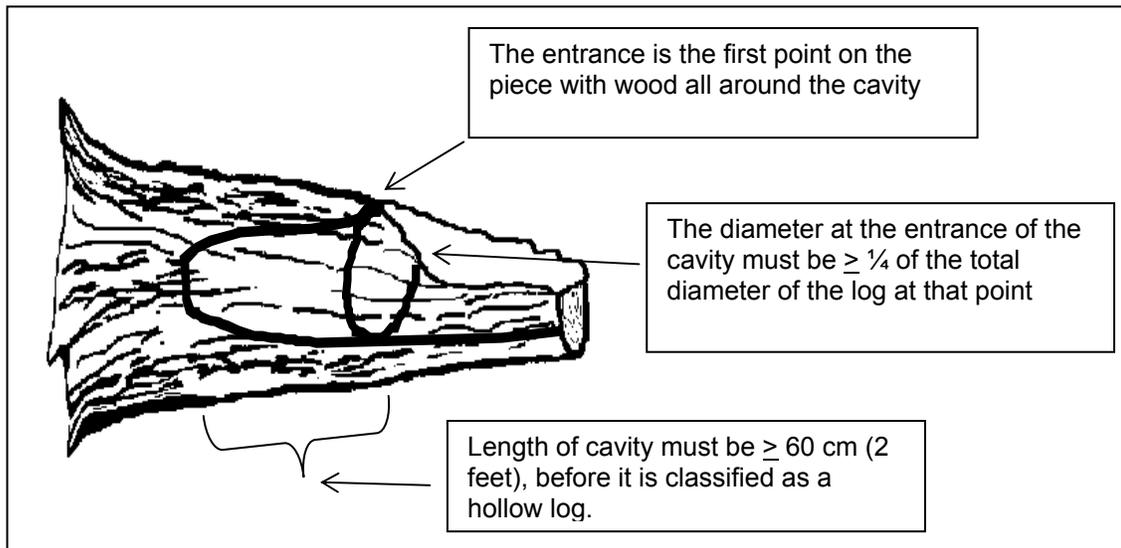


Figure 14-10. Determining if the piece is hollow

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

- Y A piece is considered hollow if a cavity extends at least 60 cm (2 feet) along the central longitudinal axis of the piece, and the diameter of the entrance to the cavity is at least 1/4 of the diameter of the piece where the entrance occurs. The entrance occurs at the point where the circumference of the cavity is whole -- the point where wood is present completely around the circumference of the cavity. The length of the cavity begins at this point.
- N Does not meet criteria for being a hollow log

14.4.3.9 CWD HISTORY

Record the code that indicates whether or not the piece of CWD is on the ground as a result of harvesting operations or as a result of natural circumstances. One objective of this item is to identify those pieces that are considered logging residue. If the piece appears to have fallen to the ground as a result of natural causes such as decomposition or windfall, enter a code of 1. This category would include blown out tops, snapped off boles, wind-fallen trees on clearcut edges, and trees that basically collapsed and fell over due to decomposition.

If the piece is on the ground as a result of recent (since last annual remeasurement; if the plot is new, the time between the panel remeasurements) harvesting activity, either because the tree was cut down with a chainsaw (or other device) or pushed over by harvesting equipment (bulldozer), enter a code of 2. A code of 2 would be considered logging residue (usually you are in the middle of a recent clearcut).

If the piece is on the ground as a result of older (more than 15 years) harvesting activity, enter a code of 3. This would be a situation where you tally an old decomposing log that has a sawn end – if it appears that the log was cut and left on site, then enter a code of “3”.

If a piece is on the ground as a result of incidental harvest (such as a standing tree was cut for firewood or small clearing), enter a code of “4”. Incidental harvest involves a few trees and is not a part of a major organized harvesting operation.

If the crew cannot decide the history of the CWD log, classify it as “unknown”, and give it a code of “5”.

When Collected: CWD DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

- 1 CWD piece is on the ground as a result of natural causes
- 2 CWD piece is on the ground as a result of major recent harvest activity (<= 15 yrs old)
- 3 CWD piece is on the ground as a result of older harvest activity (> 15 yrs old)
- 4 CWD piece is on the ground as a result of an incidental harvest (such as firewood cutting)
- 5 Exact Reason Unknown

14.5 SAMPLING METHODS FOR FINE WOODY DEBRIS (FWD)

1. Fine Woody Debris (FWD) is sampled in accessible forest land conditions. The length of FWD transects are measured in slope distance--no correction is applied to obtain a horizontal distance. The FWD transects start at 427 cm (14 feet) slope distance and extends for 1.8 or 3.0 m (6.0 or 10.0 feet) slope distance. Estimates of FWD biomass calculated in the office, will include a slope correction factor obtained from the transect segmenting data on the subplot.
2. Only sample FWD that intersects a plane from the ground to a height of 1.8 m (6 feet).

3. FWD is sampled in three size classes, on the 150 degree azimuth transect. Two of the FWD size classes (0 to 6 mm (0.01 to 0.24 inches) and 7 to 24 mm (0.25 to 0.9 inches)) are counted on a 180 cm (6 feet) transect, from 427 to 610 cm (14 to 20 feet). Pieces in the third size class (25 to 74 mm (1.0 to 2.9 inches)) are counted on a 3.0 m (10 feet) transect, from 427 cm to 732 cm (14 to 24 feet) (see section 14.2 for details on transects). These transects overlap. Note: individual diameters are not recorded for FWD.
4. Count a piece of FWD if it intersects the transect, and the condition class is accessible forest land at the point of intersection. Only count a piece if the twig, branch, wood fragment, or shrub/tree bole are woody. Do not count pine or fir needles or non-woody parts of a tree or shrub.
5. Accumulate the number of pieces counted within each size class and enter the total count on one record for the subplot (unless there are >1 condition classes). If there is no tally on a transect, enter zeros for the count.
6. Accurate counts of FWD can be conducted efficiently up to about 50 pieces for small and medium size classes, and up to 20 pieces for the large size class. After that, crews can begin estimating counts in a systematic fashion. Transects that fall on very dense FWD where counting is nearly impossible, can be subsampled and calculated. For example, an accurate count can be conducted on a 60 cm (2.0 feet) section of the transect and then multiplied by 3 to provide an estimate for the 180 cm (6 feet) transect, as long as the crew feels that the remaining transect has a similar density of FWD pieces.
7. If a transect intersects a large pile of material such as a wood rat's nest or a recently fallen tree (with many attached fine branches), crews should estimate a count based on #6 above, but also enter a code indicating that this is an unusual situation (see section 14.5.6).
8. If rocks, logs, or other obstructions are present along the transect (427 cm to 732 cm (14 to 24 feet) section) include any FWD that is present on top of these obstructions in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.
9. If a residue pile intersects the FWD transect at any point along the 427 cm to 732 cm (14 to 24 feet) section, do not measure FWD on this transect. It is too subjective determining exact boundaries of the pile, and how they relate to the exact point on the transect line. To identify this situation, code 1 in RESIDUE PILE ON TRANSECT which indicates that a residue pile has intersected the transect line.
10. If a transect crosses a condition class boundary, record the CONDITION CLASS NUMBER and enter a count for each condition on separate records. Transect lengths within each condition class will be obtained from the transect segmenting data entered for the subplot.

14.5.1 SUBPLOT NUMBER

Record the code indicating the subplot center from which the transect originates.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

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

14.5.2 CONDITION CLASS NUMBER

Record the code indicating the number of the condition class that pertains to the FWD count.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

14.5.3 SMALL FWD COUNT

Record the number of pieces counted in this size class (0 – 6 mm [0.01 to 0.24-inch] diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see 14.5, #6)

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: 0 to 50 = +/- 20% of the total count for the transect

51 to 100 = +/- 25% of the total count for the transect

100 + = +/- 50% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 999

14.5.4 MEDIUM FWD COUNT

Record the number of pieces counted in this size class (7 – 24 mm [0.25 to 0.9-inch] diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see 14.5, #6)

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 20% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 999

14.5.5 LARGE FWD COUNT

Record the number of pieces counted in this size class (25 – 74 mm [1.0 to 2.9 inch] diameter) along the transect segment. An accurate count should be conducted up to 20 pieces. If the count exceeds 20, the transect can be subsampled to estimate a total count for the transect segment (see section 14.5, #6).

When collected: On the 150 degree transect in CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 20% of the total count for the transect

MQO: At least 90% of the time

Values: 000 to 500

14.5.6 HIGH COUNT REASON

Enter a code that applies to the situation encountered on the transect. Enter a code if any of the counts on a transect are greater than 100 pieces.

When Collected: When any count on the transect ≥ 100

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 0 FWD is not unusually high
- 1 High count is due to an overall high density of FWD across the transect
- 2 Wood Rat's nest located on transect
- 3 Tree or shrub laying across transect
- 4 Other reason

14.5.7 RESIDUE PILE ON TRANSECT

Enter a code that indicates whether a residue pile intersects the FWD transect segment. The default is always 0; crews will enter a 1 if the situation is encountered on the transect.

When Collected: On all FWD transects (between 14 and 24 ft)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

0	No
1	Yes

14.6 DUFF, LITTER, AND FUELBED DEPTH MEASUREMENTS

Depth measurements are sampled in accessible forest land conditions. The depth of the duff layer, litter layer, and overall fuelbed are important components of fire models used to estimate fire behavior, fire spread, fire effects, and smoke production. These measurements are taken at the 7.32 M location on each transect. An average depth will be calculated in the office and stored with other information about the condition class on the plot. If a residue pile, log, rock, or other obstruction intersects the transect at the 7.32 M location, do not measure the duff or litter depth. But, do measure the fuelbed depth if the obstruction is a log or residue pile.

14.6.1 Definitions

1. Litter is the layer of freshly fallen leaves, needles, twigs (< 0.63 cm (0.25 inches) in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer.

Litter is flash fuel – so think about it as the loose material that is exposed to the air, capable of igniting quickly and carrying a fire across the surface of the forest floor.

Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e., if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter – fire would burn differently if it hit a pile of rotten punky wood chips, cradled by the unrotted sapwood shell). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer.

Litter does not include animal manure.

Microplot estimates: As you look down on the microplot, litter is the material that you see covering the surface area of the 2.1 m (6.8 feet) radius plot.

2. Duff is the layer just below litter. It consists of decomposing leaves and other organic material. You should see no recognizable plant parts, the duff layer is usually dark decomposed organic matter. When moss is present, the top of the duff layer is just below the green portion of the moss. The bottom of this layer is the point where mineral soil (A horizon) begins.
3. The fuelbed is the accumulated mass of dead, woody material on the surface of the forest floor. It begins at the top of the duff layer, and includes litter, FWD, CWD, and dead woody shrubs. In this definition, the fuelbed does not include dead hanging branches from standing trees.

14.6.2 Overview of Measurements

Depth measurements will be taken at the 7.32 M (24 feet) (slope distance) location on each transect. If a log, rock or other obstruction occurs at the sample location, do not measure duff or litter depth, regardless of what is on top of the obstruction. However, if the obstruction is a log, proceed with the fuelbed depth estimate.

The DUFF, LITTER, AND FUELBED SAMPLE variable has three options for indicating if duff, litter, and/or fuelbed were measured at each sample location. The default value for this variable is 1, indicating that all

three variables were measured (duff, litter, and fuelbed). A value of 0 is entered if duff and litter were not sampled (obstruction), but fuelbed was sampled. A value of 2 is entered if none of the three (duff, litter, and the fuelbed) were sampled (i.e., submerged part of plot).

14.6.2.1 Duff and Litter

The duff layer is the organic material layer between the A-horizon (or uppermost soil mineral horizon) and the litter layer. The duff is a soil layer dominated by organic material derived from the decomposition of plant and animal litter (pine straw, leaves, twigs, etc) and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material (e.g., individual plant parts) can no longer be identified. Litter is defined as undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.). As a general rule, duff depth should rarely exceed a few inches. Crews should be absolutely sure they are measuring deep duff depths, instead of mineral soil layers or parts of the litter layer. Duff can easily weigh more than 6 times that of litter. If unsure of the bottom of the duff layer, crews should feel the texture of the suspect material in their hand. Rub the soil between your fingers. Does it crumble (duff) or feel more like modeling clay (mineral).

Carefully expose a shallow profile of the forest floor by digging out an area at the sample point using a knife, hatchet, or other tool. Estimate the depth of each layer with a ruler to the nearest mm (0.1 inches). If there is a log, rock, or other obstruction on the surface at the sample point, do not measure the litter or duff depth (record DUFF, LITTER, AND FUELBED SAMPLE = 0 or 2, depending if fuelbed can be sampled); a value of 99.9 will be entered by the TALLY program for each depth.

As you dig the hole for this measurement, if you encounter a rock, root, or buried log – stop the depth measurement at this point.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect. Try to preserve the conditions of this location by walking around this point, so the QA staff will measure the same height as the original crew.

14.6.2.2 Fuelbed

Measure the height of the fuelbed from the top of the duff layer (just below the litter) to the highest piece of woody debris found at the transect point. Round to the nearest centimeter (0.1 feet). If a rock or other obstruction (other than a log) occurs at the 7.32 M (24.0 feet) sample location, do not measure fuelbed depth.

14.6.3 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All tally segments

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

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

14.6.4 TRANSECT

Record the code indicating the azimuth of the transect.

When collected: All tally segments

Field width: 3 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 030 Transect extends 30 degrees from subplot center
- 150 Transect extends 150 degrees from subplot center
- 270 Transect extends 270 degrees from subplot center

14.6.5 DUFF, LITTER, AND FUELBED SAMPLE

Record the code indicating if the depth of the duff and litter layer was measured.

When collected: At 7.32 M (24.0 feet) on each transect

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Duff and litter depth not sampled; Fuelbed is sampled
- 1 All sampled: Duff, litter, and fuelbed
- 2 Nothing sampled; Duff, litter, fuelbed are not sampled

14.6.6 DUFF DEPTH

Record the code indicating the depth of the duff layer to the nearest millimeter.

When collected: At 7.32 M (24.0 feet) on each transect

Field width: 3 digits

Tolerance: +/- 1.3 cm (0.5 inches)

MQO: At least 90% of the time

Values: 000 to 999

14.6.7 LITTER DEPTH

Record the code indicating the depth of the litter layer to the nearest millimeter.

When collected: At 7.32 M (24.0 feet) on each transect

Field width: 3 digits

Tolerance: +/- 1.3 cm (0.5 inches)

MQO: At least 90% of the time

Values: 000 to 999

14.6.8 FUELBED DEPTH

Record the code indicating the depth of the fuelbed layer, to the nearest centimeter. If the fuelbed depth is >0 and ≤ 3.0 cm (0.1 feet) enter 3.0 cm (0.1 feet). In this situation finer depth resolution will be obtained from the duff and litter measurements.

When collected: At 7.32 M (24.0 feet) on each transect

Field width: 3 digits

Tolerance: +/- 20%

MQO: At least 90% of the time

Values: 000 to 999

14.7 FUEL LOADING ON THE MICROPLOT

Another component of the total fuel loading on a plot is the biomass of live and dead understory material. The 2.1 m (6.8 feet) radius microplot will be used to estimate the percent cover and height of live and dead shrubs, live and dead herbs (includes grasses) and litter. Fuel loading is estimated in accessible forest land conditions on the microplot. Enter one value for all forested conditions combined.

Shrubs are plants with woody stems, including woody vines. Herbs are non-woody herbaceous plants, but also include ferns, mosses, lichens, sedges, and grasses. Although many forbs and grasses will die by the end of the growing season, an estimate of live and dead biomass on a given date will help fire modelers predict the phenology of herbaceous material during the year, allowing them to estimate fire danger patterns across the landscape.

Percent cover is estimated for each of the five fuel categories (live shrubs, dead shrubs, live herbs, dead herbs, and litter) in 10-percent classes for the accessible forested conditions of the microplot. For live fuels, estimate the percent of the microplot area that is covered by live plant material. Include whole plants that are entirely green (or alive) and the live branches on plants that are a mixture of live and dead plant parts. Include live branches or leaves that extend into the microplot area from a plant that is actually rooted outside of the microplot. Do not include herbaceous material above 1.8 m (6 feet) (i.e., moss, ferns, lichens, epiphytes that are growing in tree branches above 1.8 m (6 feet)).

For dead fuels, estimate the percent cover using the same procedures as live fuels, but include plants that are entirely dead and branches or leaves that are dead but still attached to a live plant. Dead plant material must be clearly visible. Do not include dead material that has fallen to the ground. Cover estimates are made by visualizing an outline around the dead material (with all 'air' space included) and accumulating this across the forested microplot area.

An estimate of the total height of the shrub and herbaceous layers is also needed to calculate biomass and fuel loadings. Record a height estimate for each fuel category, except litter. Height is estimated for the tallest shrub on the microplot.

Microplot Cover Estimation Guide (Hint: 21.6 cm (8.5") x 28.0 cm (11") = about 0.5% coverage)

%	area (sq m)	radius (ft)	square (ft)	area (sq ft)	radius (ft)	square (ft)
1	0.13	0.21	0.37	1.45	0.68	1.20
10	1.35	0.66	1.16	14.52	2.15	3.81
20	2.70	0.93	1.64	29.04	3.04	5.39
30	4.05	1.13	2.01	43.56	3.72	6.60
40	5.40	1.31	2.32	58.08	4.30	7.62
50	6.74	1.47	2.60	72.60	4.81	8.52
60	8.09	1.61	2.84	87.12	5.27	9.33
70	9.44	1.73	3.07	101.64	5.69	10.08
80	10.79	1.85	3.29	116.16	6.08	10.78
90	12.14	1.97	3.48	130.68	6.45	11.43
100	13.49	2.07	3.67	145.20	6.80	12.05

14.7.1 SUBPLOT NUMBER

Record the code indicating the number of the subplot center from which the transect originates.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

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

14.7.2 LIVE SHRUB PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with live shrubs.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.3 LIVE SHRUB HEIGHT

Record the code indicating the height of the tallest shrub to the nearest centimeter (0.1 feet). Measure heights < 1.8 m (6 feet) and estimate heights \geq 1.8 m (6 feet).

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 4 digits

Tolerance: +/- 15.2 cm (0.5 feet)

MQO: At least 90% of the time

Values: 0000 to 3045

14.7.4 DEAD SHRUBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with dead shrubs and dead branches attached to live shrubs if visible from above.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.5 DEAD SHRUB HEIGHT

Record the code indicating the height of the tallest dead shrub to the nearest centimeter (0.1 feet). Measure heights < 1.8 m (6 feet) and estimate heights \geq 1.8 m (6 feet).

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 4 digits

Tolerance: +/- 1.3 cm (0.5 feet)

MQO: At least 90% of the time

Values: 0000 to 3045

14.7.6 LIVE HERBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with live herbaceous plants.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.7 LIVE HERBS HEIGHT

Record the code indicating the height (at the tallest point) of the live herbaceous layer to the nearest centimeter (0.1 feet). Maximum height is 1.8 m (6 feet).

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 0.5 cm (0.2 feet)

MQO: At least 90% of the time

Values: 000 to 183

14.7.8 DEAD HERBS PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with dead herbaceous plants and dead leaves attached to live plants if visible from above.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.7.9 DEAD HERBS HEIGHT

Record the code indicating the height (at the tallest point) of the dead herbaceous layer to the nearest centimeter (0.1 feet). Maximum height is 1.8 m (6 feet).

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 3 digits

Tolerance: +/- 0.5 cm (0.2 feet)

MQO: At least 90% of the time

Values: 000 to 183

14.7.10 LITTER PERCENT COVER

Record the code for the cover class that indicates the percent cover of the forested microplot area covered with litter. Litter is the layer of freshly fallen leaves, twigs, dead moss, dead lichens, and other fine particles of organic matter found on the surface of the forest floor. Decomposition is minimal.

When collected: All microplots with at least one CONDITION CLASS STATUS = 1

Field width: 2 digits

Tolerance: +/- 1 class

MQO: At least 85% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.8 SAMPLING RESIDUE PILES

The line transect method is not practical when sampling CWD within piles and windrows. Piles and windrows will be located and sampled on the subplot plot, regardless of whether they intersect a transect.

Piles and windrows created directly by human activity and log piles at the bottom of steep-sided ravines in which individual pieces are impossible to tally separately, are more efficiently sampled by using the following instructions. However, loose CWD in piles created by wind throw, landslides, fires, and other natural causes should be tallied using line transects unless it is physically impossible to measure the pieces in the natural pile.

For a pile to be tallied on a subplot that contains forest land, all of the following criteria must be met (Figure 14-11):

- The pile's center must be within 7.32 M (24.0 feet) horizontal feet of subplot center,
- The pile's center must be in an accessible forest land condition class, and
- The pile contains pieces of CWD \geq 7.6 cm (3 inches) diameter that would be impossible to tally separately.

Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material \geq 7.6 cm (3 inches). The pile is assigned to the condition class in which the pile center lies.

Apply the following steps to determine the center of a pile or windrow:

1. Determine the longest axis of a pile.
2. Determine the midpoint of this axis.
3. Project a line through this midpoint that is perpendicular to the axis determined in step 1.
4. Determine the midpoint of the segment of this projected line that crosses the pile.
5. This is the center of the pile.

Piles that cross the 7.32 M (24.0 feet) fixed-radius subplot boundary: If the center of a pile is within 7.32 M (24.0 feet) horizontal of subplot center, tally the pile, recording the dimensions of the entire pile even if part of the pile is beyond 7.32 M (24.0 feet). If the center of a pile is more than 7.32 M (24.0 feet) horizontal of subplot center, do not tally the pile or any portion of the pile.

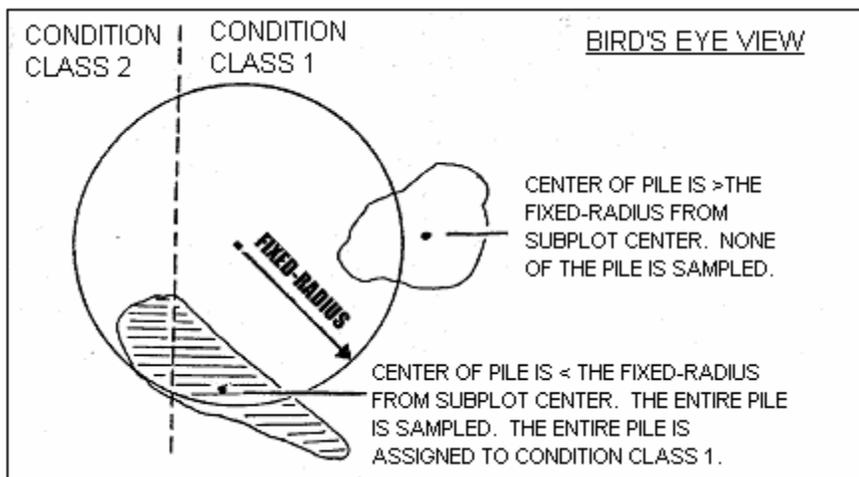


Figure 14-11. Residue pile selection examples.

14.8.1 SUBPLOT NUMBER

Record the code indicating the subplot number.

When collected: Record for all sampled residue piles

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 4

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

14.8.2 CONDITION CLASS

Record the code indicating the number of the condition class to which the pile is assigned.

When collected: Record for all sampled residue piles

Field Width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

14.8.3 PILE AZIMUTH

Record the code indicating the azimuth from the subplot center to the pile. This azimuth centers on the pile so that it can be relocated. Use 360 for north.

When collected: All sampled residue piles

Field width: 3 digits

Tolerance: +/- 10

MQO: At least 90% of the time

Values: 001 to 360

14.8.4 PILE SHAPE

Record the code indicating the shape of the pile. Determine which of the four shapes diagrammed in Figure 14-12 most resembles the pile and record the dimensions. Pile dimensions should be ocularly smoothed out when making estimates. Average the unevenness of protruding pieces.

When collected: All sampled residue piles

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values: 1 to 4

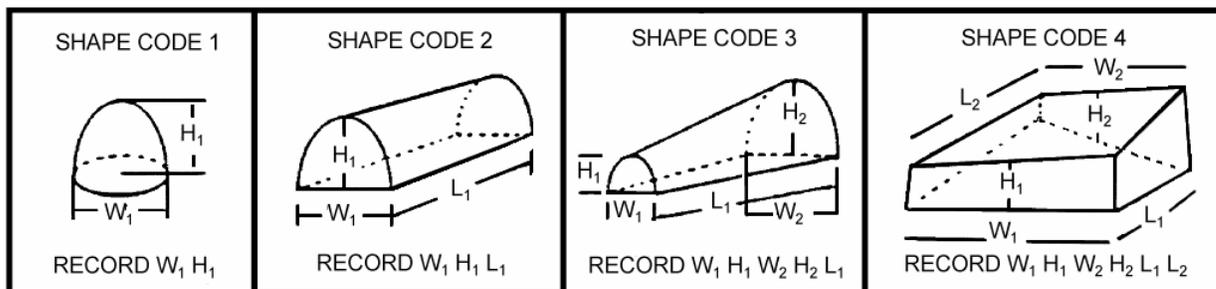


Figure 14-12. PILE SHAPE codes

14.8.5 PILE LENGTH 1

Record the code indicating the length of the sides of the pile. Estimate to the nearest centimeter. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 2, 3, 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

14.8.6 PILE LENGTH 2

Record the code indicating the length of the sides of the pile. Estimate to the nearest centimeter. PILE LENGTH 1 may often equal PILE LENGTH 2.

When collected: All sampled residue piles and PILE SHAPE = 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

Record the code indicating the width of the sides of the pile. Estimate to the nearest centimeters. PILE WIDTH 1 may often equal PILE WIDTH 2.

14.8.7 PILE WIDTH 1

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

14.8.8 PILE WIDTH 2

Record the code indicating the width of the sides of the pile. Estimate to the nearest centimeter. PILE WIDTH 1 may often equal PILE WIDTH 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

14.8.9 PILE HEIGHT 1

Record the code indicating the height of either end of the pile. Estimate to the nearest centimeter. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 1, 2, 3, 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

14.8.10 PILE HEIGHT 2

Record the code indicating the height of either end of the pile. Estimate to the nearest centimeter. PILE HEIGHT 1 may often equal PILE HEIGHT 2.

When collected: All sampled residue piles, and PILE SHAPE = 3, 4

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000 to 302

14.8.11 PILE DENSITY

Record the code estimating the percent of the pile that consists of wood. Use the PILE DENSITY variable to estimate the percent of the pile that contains woody material ≥ 7.6 cm (3 inches). Air, soil, rock, plants, etc, should be factored out of the estimate. Estimate to the nearest 10 percent.

When collected: All sampled residue piles

Field width: 2 digits

Tolerance: +/- 20%

MQO: At least 75% of the time

Values:

00	Absent
01	Trace (< 1% cover)
10	1 – 10%
20	11-20%
30	21-30%
....	
90	81-90%
99	91-100%

14.9 ACKNOWLEDGEMENTS

Contact information for the National Advisor for this indicator is: [Chris Woodall](mailto:CWoodall@fs.fed.us), USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN 55108, cwoodall@fs.fed.us, <http://ncrs2.fs.fed.us/4801/DWM>.

FUELS ASSESSMENT DATA FORM

HEX # _____

DATE ____/____/____

MICROPLOT FUEL LOADING

SUBPLOT	LIVE SHRUB %	LIVE SHRUB HT	DEAD SHRUB %	DEAD SHRUB HT	LIVE HERB %	LIVE HERB HT	DEAD HERB %	DEAD HERB HT	LITTER %
	XX	XXXX	XX	XXXX	XX	XXX	XX	XXX	XX
1									
2									
3									
4									

DUFF, LITTER, FUELBED ASSESSMENT DATA FORM

HEX # _____

DATE ____/____/____

DUFF, LITTER, & FUELBED DEPTHS

SUBPLOT	TRANSECT	DL_SAMP	DUFFLITTER DEPTH	LITTER DEPTH	FUELBED DEPTH
x	xxx	X	xxx	xxx	xxx

