

# INTERIOR WEST FOREST INVENTORY & ANALYSIS P2 FIELD PROCEDURES



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(V5.00)



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**FOREST INVENTORY AND ANALYSIS  
NATIONAL CORE FIELD GUIDE  
(With Interior West Regional Additions)**

**VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS**

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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.

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.

### **RM Program Purpose**

The information obtained through the inventory is used to estimate forest land area, wood fiber, tree volume, growth, mortality, understory composition, recreation opportunities, wildlife habitat, and other related resources. This information provides annual and periodic analysis of renewable resource

situations, including current conditions, use trends, and the potential production of forest resources of the Rocky Mountain Area States (Arizona, Colorado, Idaho, New Mexico, Montana, Nevada, Utah, and Wyoming). Findings of the inventories are published and available to resource planners, managers, and the public.

### **RM Field Organization**

Field work is conducted by Interior West Forest Inventory and Analysis (FIA) and contract crews. The Interior West is divided up into geographic sections where an equal number (approximate) of crews are assigned to an Area Leader. An Area Leader is responsible for coordinating the field effort for the crews in their area, administrative duties including timesheets, travel, and performance evaluations, training, and Quality Control/Assurance.

One-to-four person field crews conduct fieldwork. The crew leader directs the work of the field crew, but all crew members are responsible for accurate and efficient work, and for ensuring that the field crew has the proper equipment, maps, aerial photographs, field forms, and supplies before beginning each day's work.

### **RM Quality Assurance**

The goal of the quality assurance program is to ensure that all resource inventory data are scientifically sound, of known quality, and thoroughly documented. Measurement quality objectives (MQO) are established as standards to define data quality and are specified with each data item throughout this manual.

The role of quality control is to determine if the measured data meet the quality standards and to correct measurement or procedure errors. Because each plot sample represents approximately 6,200 acres of land, it is critical that crews exercise necessary care and effort to maintain the standards of accuracy in their work. Individual measurements will be expanded to describe and classify land and vegetation; because of the importance of these data, quality is critical. In addition, because of the effort and cost associated with extensive inventories, data collection efficiency is also critical.

Quality control crews conduct periodic on-site inspections of plots to ensure that the field work is being performed with the required accuracy and precision. Field checking is also conducted for the following reasons:

1. To obtain uniform and consistent interpretation and application of field instructions among all field crews.
2. To hold technique errors to a minimum.
3. To check the performance of each individual crew member.
4. To reveal inadequacies in the instructions and in the training program.
5. To assess and document the quality (accuracy, precision, completeness) of field data.

## **RM Personal Conduct and Safety**

While establishing plots, there will be frequent opportunities for contacts with National Forest personnel, private landowners, and others interested in the work conducted by field crews. Field crew members, as representatives of the USDA Forest Service, are expected to act courteously and diplomatically in all their contacts with the public and other agencies. Field crews are expected to project a professional image; this includes general cleanliness and a neat appearance (t-shirts with alcohol ads, torn or "ratty" field clothing, etc., are unacceptable).

It is required prior to access that field crews obtain permission to enter or pass through private land. Be careful to not trespass or cause any property damage, respect private property rights, and leave all gates as they are found.

Field personnel are subject to many hazards in the course of their work. Each person is expected to use care, common sense, and judgment in their work to avoid injuries to themselves and fellow workers.

### **SAFETY IS EVERYONE'S FIRST PRIORITY.**

Read and study carefully the applicable sections of the Forest Service Health and Safety Code Handbook and the Driver-Operator Handbook, and observe the precautions given.

Regulation hard hats must be worn on all field plots and while hiking to and from field plots when overhead hazards exist. Appropriate footwear, such as all-leather boots, and other protective clothing must be worn while on the job - NO EXCEPTIONS.

Immediately report all injuries to the Area Leader or COR.

## **RM Equipment and Supplies**

Each individual will be issued the necessary field equipment and supplies. Individuals will be responsible for the use and care of equipment assigned to them.

## **RM Everyday Considerations**

The goal of the inventory is to collect the best quality data possible, in a safe and efficient manner. All field personnel must consider their actions with regard to what is safe, efficient, and proper. If it is not safe -- don't do it.

Follow these suggestions:

1. Before leaving the motel, duty station, or campsite, plan the travel route to the plot. Always take two or more extra plots each day.
2. If the plot is located far from a road, plan to camp out if necessary.
3. Forest Service employees only: Record the plot destination(s) in the Field Crew Check-in program on the laptop before the required time given by the Area Leader every morning. If unable to complete the Field Crew

Check-in or if plans change after check-in, notify the Ogden office. Be sure to check-in once safely back to the final destination by completing the "Done for the Day" procedure on the laptop or call the Answering Service if there is no computer access.

4. Check to make sure you have all your equipment before leaving the duty station, campsite or motel: field gear, plot packets, data recorder, GPS, satellite phone, first aid kit, metal stakes, nails, lunch, water, rain gear, etc.
5. Check to make sure you have all the equipment needed to conduct the field inventory when you leave your truck.
6. Perform a thorough plot edit before you leave the location. Check for missing data items as well as field gear.
7. Do not travel through the woods after dark. If you are lost, do not panic, but settle down some place and try to make radio/satellite phone contact with the Area Leader or with another agency. Know how to use the radio/satellite phone!
8. Bring your first aid kit, keep it supplied, and know how to use it.

## 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
8	Phase 2 Vegetation Profile (core optional)
9	Invasive Plants
10	<b>RM</b> Accounting Procedures
11	<b>RM</b> P2 Down Woody Material Procedures
12	<b>RM</b> Field Location Reference

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. Data elements labeled with "**RM**" refer to Rocky Mountain Area (Interior West FIA) regional variables. These are only collected in the **RM** area. 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., +/- 0.2 inches); 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 that 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 ENGLISH units as the measurement system.

Plot Dimensions:

Macroplot:

Radius= 58.9 feet

Area = 10,899 square feet or 0.25 acre (ac) or 1/4 acre

Subplot:

Radius= 24.0 feet

Area= 1,809.56 square feet or approximately 0.04 acre or approximately 1/24 acre

Microplot:

Radius= 6.8 feet

Area= 145.27 square feet or approximately 0.003 acre or approximately 1/300 acre

Annular:

Radius= from 24.0 feet to 58.9 feet

Area= 9088.4 square feet or approximately 0.21 acre or 5/24 acre

The distance between subplot centers is 120.0 feet horizontal.

The minimum area needed to qualify as accessible forest land is 1.0 acre.

The minimum width to qualify as accessible forest land is 120.0 ft

**Tree Limiting Dimensions:**

breast height	4.5 ft
stump height	1.0 ft
cubic merchantable top	4.0 in DOB*
board foot merchantable top softwoods	7.0 in DOB
board foot merchantable top hardwoods	9 in DOB
merchantable top for woodland	1.5 in DOB*
minimum conifer seedling length	0.5 ft
minimum hardwood seedling length	1.0 ft
seedling/sapling DBH/DRC break	1.0 in DOB*
sapling/tree DBH/DRC break	5.0 in DOB*

\*DOB refers to Diameter Outside Bark

**0.0**

**GENERAL DESCRIPTION**

The CORE field plot consists of four subplots approximately 1/24 acre in size with a radius of 24.0 feet. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 feet horizontal (+/- 7 feet) at azimuths of 360, 120, and 240 degrees from the center of subplot 1, respectively (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 ¼ acre in size with a radius of 58.9 feet; 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 5.0 inches or greater. If the macroplots are installed, then subplots are used to collect data on trees from a diameter 5.0 inches 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 1/300 acre in size with a radius of 6.8 feet. The center of the microplot is offset 90 degrees and 12.0 feet horizontal (+/- 1 foot) from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH/DRC of 1.0 inch through 4.9 inches) and seedlings (DBH/DRC less than 1.0 inch in diameter and greater than 0.5 foot in length [conifers] or greater than 1.0 foot in length [hardwoods]).

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 such as collecting 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.

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. (RM Boundaries occurring on subplots, microplots, or macroplots (when macroplots are being established) must be distinct and abrupt.)
Tree	Data describing saplings with a diameter 1.0 inch through 4.9 inches, and trees with diameter greater than or equal to 5.0 inches
Seedling	Data describing trees with a diameter less than 1.0 inch and greater than or equal to 0.5 foot in length (conifers) or greater than or equal to 1.0 foot in length (hardwoods).
Site Tree	Data describing site index trees.

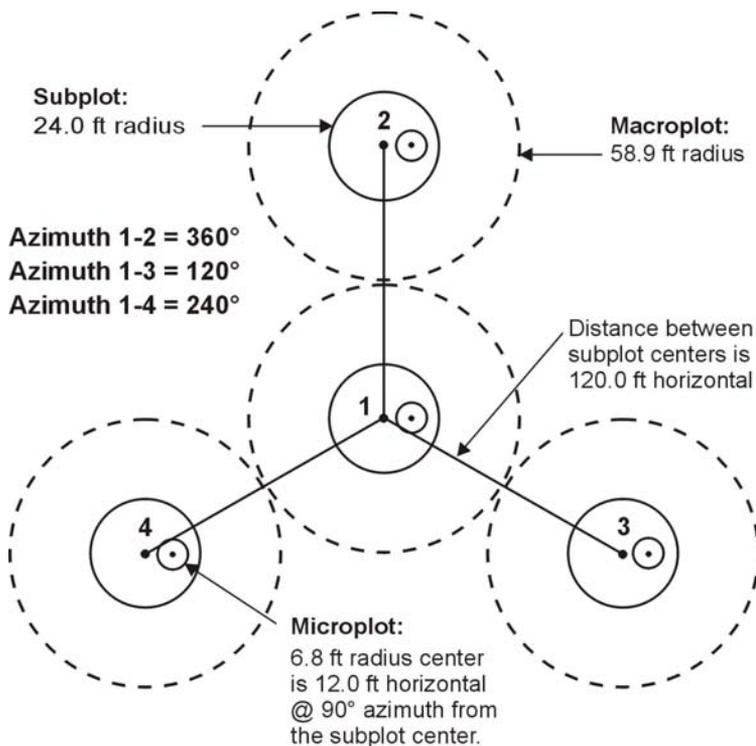


Figure 1. FIA Phase 2 plot diagram. See individual Phase 3 chapters for Phase 3 plot figures.

### 0.1 PLOT SETUP

Plots will be established according to the regional guidelines of each FIA unit. 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.

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

From Subplot	To Subplot	Azimuth (degrees)	Back Azimuth (degrees)	Distance (feet)
2	3	150	330	207.8
3	4	270	90	207.8
4	2	30	210	207.8

If a subplot was installed incorrectly (**RM** out of the 8 foot tolerance) at the previous visit, the current crew should remeasure the subplot in its present location and contact the field supervisor. (**RM** Obtaining trend data is better than replacing the subplot. In this situation, contact the Area Leader and make a plot level note). 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 (**RM** - trees listed in the historic file) (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.

#### 0.1.0**RM** Finding the Plot Center

This section provides instructions for finding the Plot Center (PC) which is designated as subplot center 1 of the field sample. The PC is based on the intersection of map grid lines and is located in the field using past inventory location reference information, global positioning system receivers, and/or photo baseline techniques.

#### 0.1.1**RM** Land Owner/Management Agency Verification

Prior to the establishment of any plot, the ownership or managing agency of the plot must be verified. All plots except National Forest and Bureau of Land Management require written permission. If you are not sure about the permission status for a plot check the Ownership database or call your Area Leader or prefield person to verify that permission has been granted. Prior to the field season, the Area Leader will designate a field crew to verify the managing agency and to obtain private land ownership information (name, address, phone number). First, check to see which counties in a state have an on-line data base. The County Courthouses of counties without on-line database must be visited to verify the managing agency and to obtain private land ownership information. Land management agencies must be contacted to obtain lessee information. Record all land ownership information on the Private Land Ownership form and in the Ownership database. Also record private land ownership on the Field Location Description record but not in the PDR.

It is required that field crews contact private land owners or lessees to obtain permission to enter or pass through private land. Information about best travel route, locked gates, etc., may also be obtained. **If the crew is unable to make contact (no permission letter received, unable to reach owner by phone or by visiting ranch house, etc.), the location will be classified as “access denied”.**

#### 0.1.2**RM** Planning Travel to the Vicinity of the Plot Center

As an aid in planning travel and in finding a plot, field crews are supplied with forest and highway maps, a GPS Receiver, and a plot packet. Each packet contains a USGS 7.5 minute topographic map. On the topographic map, the

PC of a plot is indicated by the intersection of designated map grid lines. Each packet also contains current aerial photographs or a Digital Orthoquad (DOQ). For new plot locations, one of the photos has a circle around the area in which the PC should be located. Remeasurement locations also have photos (with the PC pinpricked), a copy of the previous plot data, and road directions used in the previous inventory. Do not exclusively rely on previous travel directions for previously established plots. Roads change, roadless areas can be established, and crews can make errors.

### 0.1.3RM Finding the Plot Center - New Locations

It is the responsibility of the field crew to physically locate the PC on the ground. The following procedure describes how to find the PC.

Provide a description and record reference point (RP) traverse information (described below) on the Field Location Reference form under "Reference Point Description and Traverse Info. to PC". Record traverse information on the back of the aerial photograph containing the PC pinprick. **Use a ball-point pen for all photo work** (do not use pencil or felt-tip pen), and use a ruler or other straight edge for drawing lines (protractor edges are not necessarily straight)

Note: See 0.1.5.5RM PC Verification for plot placement tolerances.

#### 0.1.3.1RM Establishing PC with the Garmin GPS Receiver

See **Appendix C** for detailed instructions on the Garmin use.

Use the GPS Receiver to help establish new locations whenever possible. Use Ground-Photo and Map-Photo baseline techniques if accurate readings from the Garmin cannot be obtained (e.g. malfunctioning GPS, heavy canopy cover, dead batteries, poor satellite reception, etc.). Proper planning and knowledge of basic functions will allow use of the GPS in almost any situation encountered by crews.

1. Verify GPS Settings  
The proper initial GPS settings are critical for positioning and navigational accuracy. Once the GPS settings are selected, they become the default value each time the GPS is turned on. Refer to Appendix C.
2. Select a Suitable RP
  - Designate a reference point (RP) readily identifiable on both the ground and the photograph/DOQ. The RP should be close to the plot center, but at least 100 feet from the PC, if possible. Select a landmark such as a prominent tree or large boulder, a sharp bend in a road or drainage ditch, a fence corner, etc. When selecting a tree, choose one not likely to die or be removed within the next 10-15 years (Note: do not select an RP next to features that may affect GPS or compass readings such as metal objects like barbed-wire fences or high power transmission lines.)
  - The **RP selection is critical**. The more unique and obvious the RP

on both the photos and the ground, the better the chance crews will be able to relocate the plot in the future should significant change occur over time. If possible, choose an RP with a view of the southern sky to allow for optimum satellite reception. Elevate the GPS receiver off of the ground and remove all obstructions that may block reception and use the external antenna if necessary.

- Pinprick the RP on the aerial photograph with the PC pinprick, circle and label the pinpricked RP on the back of the photograph, and provide a detailed description of it on the Field Location Reference form. Refer to section 12 - Field Location Reference for instructions on tagging the RP.
3. Find the Position of the RP  
**Tolerance: EHE  $\leq$  70 feet.**  
Use the "Averaging" option in the GPS to provide coordinates for the position of the RP using Latitude and Longitude. Refer to Appendix C Section 2.0.1RM or 2.0.2RM. If the 180 hit averaged estimated error is > 70 feet, check map datum, GPS settings, and battery life, then try again.
  4. Traversing from the RP to the PC  
Record the distance and azimuth from the RP to the PC waypoint obtained from the GPS. Use a chaining tape and compass for chaining from the RP to PC and correct for slope when chaining. Refer to Appendix C.
  5. PC Verification  
**Tolerance:  $\pm$ 6 feet per 100 feet chained.  $\pm$  30 foot maximum error.**  
Upon arrival at the PC, put a stake in the ground and use the **Average** function of the GPS to collect the latitude and longitude for the PC. For correct placement of the PC, chaining error should be no more than  $\pm$ 6 feet per 100 feet of chaining distance up to  $\pm$  30 feet. See 0.1.5.5RM for GPS plot placement tolerances.  
Check photos and the averaged GPS coordinates to verify the PC Position. If the PC pinprick and GPS placement disagree by more than 0.1 inches, re-pinprick the photo, and begin referencing the plot. Use the "Moving the Pinprick" procedures described in Section 0.1.5.6RM.

#### 0.1.4RM

##### Photo Work

Upon verification of the PC, carefully draw a line with a ball point pen on the back of the photo, using the RP and PC as guides for your ruler. Do not draw through the pinpricks. Put an arrow at the end of the line indicating the azimuth direction and write the azimuth next to the arrow. Label and circle both the PC and RP. Record the azimuth, horizontal distance, and slope distance from the RP to PC in the lower left or right hand corner of the photo.

#### 0.1.5RM

##### Finding the Plot Center - Remeasurement Locations

A reference point (RP) and witness trees were established in the previous inventory to aid in relocating the plot .

Find the previously established RP using directions and GPS coordinates recorded on the old Field Location Record sheet. The RP is a landmark (usually a tree) that is identifiable on both the ground and the plot photo, and

should be indicated by a pinprick on the old photos. Trees used as RPs were marked with aluminum tags: one tag nailed below stump height (1 foot) facing in the direction of the plot center, and two other tags nailed approximately 6 feet above the ground on opposite sides of the tree.

If the RP is suitable for the current inventory, and visible on the new photograph, it may be re-used. If new photography is used for the location, pinprick the RP and label it on the back of the new photo. A tree that is re-used as an RP must be re-tagged if necessary.

Run the traverse from the RP to the PC using the azimuth and horizontal distance recorded under "Course to Sample Location" on the old Field Location Record sheet and/or old photos. Horizontal distances must be adjusted for slope (determine the slope correction factor, SCF, using a clinometer with a SCF option).

Two witness trees (designated "X" and "Y" trees) were established near the PC. The "X" tree was either scribed with an X or tagged above DBH/DRC (facing the PC) and should generally be near an extension of the course followed from the RP. The "Y" tree was generally located at a right angle to this azimuth. An aluminum tag was nailed below stump height facing the PC stake on both witness trees. Azimuth and slope distance from the PC stake to each witness tree, plus species and diameter, were recorded under "Witness Trees" on the old Field Location Record sheet.

The crew should arrive in the vicinity of the plot center by following the RP to PC course. Toward the end of the course, begin looking for the "X" tree. In addition to the "X" tree, look for old flagging, old plot stakes, and nails in trees at DBH/DRC. Place a new stake at the PC, at the location of the old stake if the old stake marking the PC is missing. If the old stake is missing, the new stake can be correctly placed by triangulation of the witness trees. If the witness trees are missing (cut), use tally trees to triangulate.

The following discussion and instructions cover some of the situations that may occur when searching for the plot center. In all situations where a new RP or RP-PC course is established, record the appropriate new information on the new Field Location Reference form, and on both the old and new photographs. Pinprick and label the new RP on the old and new photos.

Note: See 0.1.5.5RM PC Verification for plot placement tolerances

#### **0.1.5.1RM RP Not Found**

Due to incorrect directions, inaccurate plot center placement, or disturbance at the location area (clearcut, new roads, etc.), the RP may not be found on the ground. Find the PC by using one of the following methods:

- Use GPS coordinates for the previously established PC and re-establish. Select a new RP if PC is found.
- If PC cannot be found using previous coordinates, follow the procedures described under "Finding the Plot Center - New Plot" (0.1.3RM).

#### 0.1.5.2RM RP Found But Not Usable

The RP may be found and used for relocating the plot, but it is no longer suitable for re-use (e.g., dying, dead, or cut). A new RP must be established.

Use the previous azimuth and distance and locate the previous PC. Select a new RP and compute a new RP to PC course. This can be accomplished by one of the following methods:

1. Choose an RP that can be seen from the location center and is **identifiable on the aerial photos**. Take the azimuth and distance directly.
2. Locate a new RP that is discernible on both the old and new photos. Using the GPS, a new course from the RP to PC can be computed (see Appendix C Section 3.0.3RM or 3.0.4RM)

#### 0.1.5.3RM Plot Center Incorrectly Placed or Not Found

Thoroughly search the area at the end of the RP-PC chain; circumstances dictate the actual amount of time to spend (e.g., stand density, site disturbance). Factors that might explain why a plot center cannot be found include the following: azimuth and/or distance incorrectly calculated, compass not set at 0° declination, compass not used properly, or corrections for slope were not made while chaining.

Plots that cannot be found due to disturbance (clearcut, fire, land clearing, etc) should be considered as found and located at the end of the RP-PC chain, and the previous trees will need to be reconciled due to the disturbance. Establish a new plot center if the plot cannot be found or the Plot Center is >3,281 feet (1000 meters) and is outside the hex boundary (you will need to check with Ogden office) from the theoretical coordinates listed on the plot packet label. Also, establish a new plot center if the old plot was a "shifted woodland" plot. In past inventories, some fixed-radius plots were "shifted" away from nonforest land, moving the entire sample plot into accessible forest land.

If a plot center is incorrectly placed (>3,281 feet off from the theoretical coordinates or a "shifted" woodland) or cannot be found, establish a replacement plot at the correct theoretical coordinates using the GPS and close out the old plot file. Also, do the following:

1. Contact the I data management person in Ogden for a new location number. No Historic file exists for replacement plots so a new file must be created.
2. On the outside of the plot center packet write "old plot center not found" or "old plot center incorrectly placed" and give a brief explanation. Note if a new plot center was established.
3. Cross out preprinted data forms, make an appropriate note, and leave the forms in the plot packet.

#### 0.1.5.4RM Traversing to the PC

Using a compass and tape, run a traverse from the RP to the PC along the calculated azimuth and horizontal ground distance. Make distance corrections

for slope. Use a clinometer to determine the appropriate slope correction for each distance segment traversed. Place a stake at the end of the traverse.

#### **0.1.5.5RM PC Verification**

Upon arrival at the end of the traverse, determine if the plot center is in tolerance with the provided GPS coordinates.

##### **Tolerances:**

- For plots being established for the first time, the averaged GPS coordinates at the plot center must be  $\leq 500$  feet from the theoretical coordinates.
- For remeasurement plots, the averaged GPS coordinates at the plot center must be  $\leq 3,281$  feet from the theoretical coordinates and be inside the hex boundary.

If it is found the coordinates are out of tolerance on a plot being established for the first time, return to the RP, reaverage the RP coordinates, calculate a new distance and azimuth using the route function on the GPS, and traverse to the PC from the RP with the new distance and azimuth.

If it is found the coordinates are out of tolerance on a remeasurement location, close out the old plot, establish a replacement plot at the correct theoretical coordinates, and open a new file in MIDAS. You will need to get a new location number for the replacement plot from the Ogden office.

#### **0.1.5.6RM Moving the Pinprick**

If it is determined that the ground point and the PC pinprick are not in agreement due to the PC pinprick being in the wrong location, use the following rules to move the pinprick to the correct location:

Tolerance: No errors 100% of the time.

1. Verify that the topographic map is plotted correctly (using the coordinates on the plot packet) and also verify photo pinprick matches topographic map.
2. If GPS is used to establish PC and pinprick is off:
  - (a) Leave pinprick where it is if you cannot verify EXACTLY where you are on the photograph due to canopy, topography, etc.
  - (b) Move pinprick if you can verify exactly where you are on the photograph and the pinprick is off by  $\geq 1/10$  inch on the photo.

#### **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 to determine tree age, growth, 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 on any subplot:

- Boring and scribing some specific tree species (such as aspen) that are known to be negatively affected (e.g., 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.

### 0.3.0RM Field Procedure Overview

This section provides a general overview of the field procedures required to conduct the inventory, depending on the plot situation and condition classes present. Section 0.3.1RM discusses several situations where the crew may not be able to conduct the inventory; Section 0.3.2RM describes the basic parts (data forms) of the inventory to be completed; and Section 0.3.4RM discusses remeasurement, P3 field plots, and reserved lands.

For this inventory, a portion of the plots measured during previous inventories may be revisited. In addition to the current location layout and sampling procedures for sampling trees, previously tallied trees on these locations will be remeasured using the original location layout and sampling procedures. The plot center (PC) will be the same point for both samples.

If the plot center was established < 3,281 feet (1,000 meters) from the theoretical coordinates and is outside the hex boundary, follow the procedures outlined in section 0.1.5.3RM.

If a previously established subplot was not established in the correct location see Section 3.0 (Subplot Description Items).

### 0.3.1RM Circumstances Precluding Plot Establishment

#### 1. Potential Situations

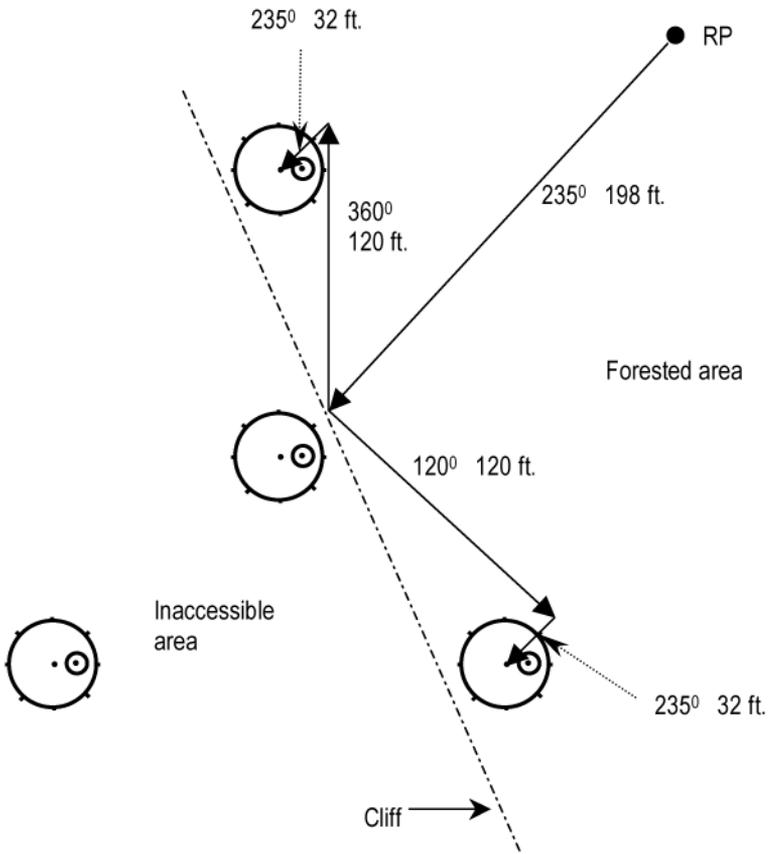
The following circumstances may preclude the establishment of any plot :

- **Plot currently being logged.** If the plot is currently being logged, determine when the logging will be completed (ask the foreman), and establish and measure the location only after logging is complete.
- **Denied access.** The landowner denies access to the entire plot

on private property, or obtaining permission from the owner is not possible. Denied access can also occur when a landowner denies access across their property to reach the plot. This form of denied access is only coded when there are no other reasonable means of access to the plot. **Promptly leave the property!**

- **Hazardous.** The crew cannot reach or measure any of the subplot centers because of permanent physical conditions (e.g., cliffs) restricting access. Crews are required to establish all accessible subplots. (RM Figure 1a).
- **Not in Sample Area.** The PC falls outside the area currently being inventoried.

Figure 1a depicts a situation where the plot center is inaccessible (hazardous due to cliffs) but subplots 2 and 3 are in accessible forest land. All of subplots 1 and 4 are classified as condition status = 5 (Area too hazardous to visit). Subplots 2 and 3 must be established since they are in accessible forest land.



RM Figure 1a. Establishing Subplots When the Plot Center is Inaccessible

Procedure: The course from RP to the plot center is 235° for 230 feet. The cliff is encountered at 198 feet, 32 feet short of the plot center. To establish subplot 2, proceed 360° for 120 feet, then proceed on the original azimuth (235°) for the remaining 32 feet (230- 198 feet) to the center of subplot 2. To establish subplot 3, start where the original course from RP to the plot center ended, go 120° for 120 feet, then go 235° for 32 feet to the center of subplot 3.

2. Procedures

When a plot is denied access, entirely too hazardous to visit, or not in the sample area, complete the following inventory sections (it will be provided on the data recorder, or use the appropriate field form). However, if the location can be seen clearly enough to classify as nonforest, treat it as a nonforest.

- (a) The **Field Location Reference Form and Plot Monumentation Record** data (Section 12).
- (b) The **Plot Level Data** data (Section 1).
- (c) On the **outside of the plot packet** record the appropriate Condition Status code.

**0.3.2RM**

**Plots with Accessible Forest Land Present**

**Core Optional: Plots with Accessible Nonforest Land Present (when doing nonforest land inventory)**

Establish and measure a plot if any portion of one of the four subplots or macroplot (if establishing macroplots) occurs within an **accessible forest land** condition class. The plot layout consists of 4 subplots where the PC is the center point of subplot 1. Refer to Section 0 for plot layout and tree sampling procedures. Establish these locations using current inventory procedures.

For previously established locations using another sample design, re-establish the PC where it was placed before if it meets the requirements described in Section 0.1.5.3RM, and sample the location using current inventory procedures. In addition, account for the previously tallied trees (**TIMBER PLOTS ONLY, DO NOT ACCOUNT FOR TREES ON PREVIOUSLY ESTABLISHED WOODLAND PLOTS**) from the previous inventory as described in Section 10.

For all locations with accessible forest land present, complete the following inventory sections (these will be provided on the data recorder, or use the appropriate field forms). Refer to Appendix A for data forms and for specific items to record:

1. The **Field Location Reference Form and Plot Monumentation Record data** (Section 12).
2. The **Plot Level Data** (Section 1).
3. The **Condition Class Description** data (Section 2) for the condition containing the PC and for any additional conditions occurring on the

subplots.

4. The **Condition Class** and **Boundary References** data (Sections 2 and 4).
5. The **Subplot Information** data (Section 3) for each of the four subplots.
6. The **Tree and Sapling Data** (Section 5); record all tally trees present within accessible forest land conditions. If only a portion of a subplot occurs in accessible forest land, only tally the trees within that portion. Refer to Appendix 3 for tally tree selection.
7. The **Vegetation Profile** data (Section 8) and **Invasive Plants** (Section 9) for each subplot center that occurs in an accessible forest land condition.
8. If necessary, the **Accounting Tree** data (Section 10)
9. On the outside of the plot packet, record the following information:
  - Date plot completed
  - Crew Number and first initial and last name
  - Condition Status

### 0.3.3RM Plots with No Accessible Forest Land Present (Nonforest Land and/or Water Only)

Do not establish and measure a plot if the subplot (or Macroplot, if establishing Macroplots) layout is located completely within conditions classified as nonforest land (unless doing a nonforest inventory), census water, and/or noncensus water.

For locations where FUTURE FOREST POTENTIAL = 1, place a plot stake in the ground at the PC. For all nonforested locations do the following. Refer to Appendix A for data forms for specific items to record:

1. The **Field Location Reference Form and Plot Monumentation Record** data (Section 12) only the appropriate information is required (including photographing the location).
2. The **Plot Level Data** (Section 1). Include in the General Comments a brief description of why the plot does not meet the accessible forest land criteria (e.g., this area has been chained and currently has less than 5 percent tree cover and no regeneration).
3. The **Condition Class Description** data (Section 2).
4. The **Subplot Description** data (Section 3) for each of the four subplots.
5. On the outside of the plot packet, record the following information:
  - Date plot completed
  - Crew Number and First Initial and last name
  - Condition Status

### 0.3.4RM Remeasurement, P3, and Accounting Plots

During the course of this field inventory, crews will occasionally revisit previously established plots. Within the Rocky Mountain Area States, numerous field plots have been established to obtain information on forest resources and forest health. Throughout this field manual, subsections referencing remeasurement, P3, and accounting plots provide additional guidelines for conducting the inventory.

**Remeasurement plots** are resource inventory plots of the same design that were previously established at a location: crews will relocate the field plot, remeasure the trees from the previous inventory, and tally any new trees on the plot. Remeasurement plots use the same basic layout as the current inventory (refer to Section 0), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to Section 5.0). The microplot, however, was located at the subplot center for these plots prior to 2001, so crews will need to establish new offset microplots in this inventory. Old reference and witness trees can be reused if appropriate.

**P3 plots** are a subset (1/16) of the P2 plots where additional forest health variables are collected. These plots were initially established on a 5-year cycle, but were switched to a 10-year cycle in 2006. Because of the differing cycle lengths and how P3 has been added to the annual inventory, these plots will have a variety of establishment procedures. Some will be regional remeasurement plots, where a periodic Rocky Mountain 4-subplot design was installed; some will be established where a previous P3 plot was installed on the 5-year cycle (these off-cycle P3 plots are being considered 1<sup>st</sup> time visits; however, crews will have previous data and will re-use tree numbers); some will be established where a previous variable radius plot timberland or fixed plot woodland design was installed (these plots will have a co-located point 1, as long as the requirements are met described in Section 0.1.5.3RM); and some will be established for the first time in a location never before visited by IWFA.

**Accounting plots** are old design timber plots (do not account for trees on old woodland design plots), usually located at the same point on the ground as the current plot, but only portions of the old tree data are collected. In addition to accounting for the old tree data, a new current design plot will be established.

### 0.3.5RM Reserved Lands/Wilderness Areas

Because of the legal and social aspects regarding reserved lands (National Parks, NFS and BLM Wilderness areas, etc.), crews are required to take extra precautions in monumenting plots as not to disturb the area and "advertise" the presence of the plot. Throughout this manual, several references to reserved lands instruct crews to remove flagging, paint tree tags gray or brown, and avoid monumenting trees near roads and trails.

However, because it is necessary to relocate field plots wherever they exist, reference trees, plot stakes, tree nails, etc., are still required for reserved plots. On occasion a particular Park, Monument, or Wilderness may require adjustments to these guidelines, but crews should follow the procedures in this manual unless specific instructions are included with the plot packet information. Refer to the special provisions section and the index for various reserved land/wilderness area topics.

**Special Provisions:** The following are provided as minimum guidelines for conducting FIA inventories in Wilderness areas on NFS lands (based on Service wide Memorandum of Understanding 00-SU-11130150-011 between NFS and FIA, dated 12/20/1999). These will also be used for all other reserved

lands unless specific written instructions are provided to the FIA program by the managing agency.

**Location Monumentation:** It is important to be able to relocate plots, subplots, and trees measured during the inventory. In Wilderness areas, less visible markings are always appropriate. Detailed, concise sketches and notes will also make subsequent relocation easier.

1. Identifying tags/nails – Paint tags/nails an approved color, and face away from obvious trails and roads. Tags/nails may only be used at the base of the tree. Use marking tags/nails minimally.
2. Flagging – Remove any flagging used to facilitate entry and exit from the plot area upon completion of the plot measurements.
3. Painting/Scribing – Do not paint or scribe any trees. This includes trees used to monument the plot and witness trees. Do not paint or scribe to mark breast height.

### Sample Plot Monumentation

1. Reference point trees – Do not paint or scribe Reference Point trees. Nail a tag marked with “RP” to the base of the tree facing the direction of plot center. Describe the reference point on the plot sheet notes and include reference landmarks.
2. Subplot center – Witness subplot centers with a metal wire/rod in the ground as a marker (not to protrude from the ground more than 1 inch). Do not attach flagging to the marker.
3. Subplot witness trees – Do not paint or scribe witness trees. Nail a tag to the base of the tree facing subplot center with the appropriate letter (X or Y) and the plot location number inscribed on it.
4. Sample trees – Do not paint or scribe sample trees. Mark each sample tree 5.0” DBH and larger with a tag/nail at ground level either facing subplot center or on the uphill side of the tree if there is a slope. If the sample tree is in view of a known path or trail, place the tag/nail away from the path or trail and note in the field tally. If only saplings are on the subplot mark a couple of them with nails at ground level and note which are so marked. Measure DBH at exactly 4.5 feet above the nail. If diameter needs to be taken at a location other than breast height, measure the distance (to the nearest inch) from the nail to the place of diameter measurement, and record in LENGTH TO DIAMETER MEASUREMENT POINT.

**Site Condition:** All refuse associated with field operations shall be removed from Wilderness lands and the site of any data collection or encampment shall be returned to the condition in which it was found, except as authorized by the project work plan.

Temporary markers, such as flagging, may not remain in place for more than one week when study teams are not present on a site. Paint, or similar semi-permanent markers, may not be applied to rocks, plants, or other natural

surfaces.

**NOTE: Specimen Collection:** No personal flora or fauna collection is permitted on Wilderness lands. Collections are for scientific or educational purposes only, dedicated to public benefit, and may not be used for personal or commercial profit. All collections for scientific purposes must be approved by the Wilderness Manager.

No archeological or vertebrate paleontological materials may be collected. Upon location of any historical or archeological remains field work will cease and the site shall be reported immediately to the local Recreation Heritage and Wilderness Resource (RHWR) Wilderness Manager. No disturbance of such a site is permitted.

#### **Wildlife Interaction**

Problem encounters with wildlife, including any experienced or observed incidents of wildlife obtaining food or garbage from humans, shall be reported promptly to the RHWR Wilderness Manager. All food and garbage will be stored in a sealed containers approved by the local RHWR Wilderness Manager. Field personnel will make all reasonable efforts to prevent wildlife from obtaining food or garbage from humans.

### **0.4RM**

#### **Tree Sampling Procedures**

The following is a list of important terms/terminology that will be used throughout the manual in reference to different situations crews may encounter. Notice that not all scenarios apply in all states.

**National 4-point offset micro:** Current National 4-subplot plot design with an "offset" microplot located 12 feet horizontal at 90 degrees from subplot center (phase 2, formerly known as FIA - see Figure 1).

**National 4-point offset micro (P3):** Current National 4-subplot plot design with an "offset" microplot located 12 feet horizontal at 90 degrees from subplot center (phase 3, formerly known as FHM - see Figure 1). This is the same plot design as National 4-point offset. However, additional forest health data are collected on these locations.

**National 4-point nonforest:** Current National 4-subplot plot design with no accessible forest land on any of the 4 subplots.

**Rocky Mountain 4-point center micro:** Previous Rocky Mountain 4-subplot plot design with a "centered" microplot located at the subplot center.

**Rocky Mountain 4-point offset micro:** Current Rocky Mountain 4-subplot plot design with an "offset" microplot located 12 feet horizontal at 90 degrees from subplot center. This plot design was used in states that conducted the "periodic inventory". This is the same plot design as National 4-point offset. However, data collected on these locations differ slightly from the current "National Core".

**Rocky Mountain 4-point nonforest:** Current and previous Rocky Mountain 4-subplot plot design with no accessible forest land on any of the 4 subplots.

**Previous variable-radius plot:** Previous "timberland" 5, 7, or 10-point plot design. These variable-radius points each have a fixed radius microplot at the center. Previous tree data may be accounted for on these plots. A new National 4-point offset plot will be established using the previously established PC and the previous variable radius points 5 -10 dismantled.

**Previous fixed-radius plot:** Previous "woodland" plot design consisting of a 1/5, 1/10, or 1/20 acre fixed radius plot used to sample woodland species. Previous tree data will NOT be remeasured or accounted for on these plots. A new National 4-point offset plot will be established using the previously established PC, when appropriate, and the previous woodland plot dismantled and nails removed.

**Previous other tree land plot:** Previously established Rocky Mountain 4-point center location, where non tally tree species occurred. No tree data was collected; only understory vegetation data was collected. Understory vegetation data will NOT be remeasured or accounted for. A new National 4-point offset will be established using the previously established PC when appropriate.

**National Remeasurement Plots:** Current National 4-point offset collocated with a previously established National 4-point offset. The initial National 4-point offset must have been installed as part of the annualized inventory of a state. Any other visit of a 4-point design will be either regional remeasurement or off-cycle P3.

**Regional Remeasurement Plots:** Current National 4-point offset co-located with a previously established Rocky Mountain 4-point center or a Rocky Mountain 4-point offset. A portion of the plots measured during previous inventories will be revisited during the current inventory. For remeasurement locations that cannot be found, or are mislocated, refer to Section 0 for instructions. Remeasurement locations will be sampled and remeasured using current inventory procedures, including accounting for the previously established center microplots. New offset microplots will be established for the current inventory. Remeasurement locations will have past data downloaded to the Data Recorder. In addition, preprinted field forms will be included with the field packets.

In Wyoming and New Mexico, most plots on National Forest and reserved land will be considered remeasure or replacement locations (REGIONAL SAMPLE KIND 2 or 3) regardless of past CONDITION STATUS. For example, a plot was all nonforest during the previous inventory (Rocky Mountain 4-point nonforest) but now there is some accessible forest land on the plot (National 4-point offset). Even though this may be the first time trees are being tallied at the location, the REGIONAL SAMPLE KIND = 2. Plots falling outside of National

Forest or reserved land that were nonforest during the previous inventory will be considered initial establishments (SAMPLE KIND 1).

**P3:** A portion of the plots are designated as P3 plots. In CO, ID, and NV, P3 plots will be co-located with previously established P3 plots. However, these plots will be considered SAMPLE KIND 1 (new plots), NOT remeasurement locations. All subplot tally trees and microplot seedling and saplings will reuse past tree numbers where applicable, but all trees (live and dead) will be considered new trees. Location reference data and some past tree data will be provided to aid in plot relocation. The new P3 plot will be measured on the same plot layout as the previous P3 plot. In MT, the P3 plots will be initial establishments.

**Accounting Plots:** A portion of the plots measured during previous inventories using the previous variable-radius plot (timberland plot) design will be revisited during the current inventory. On these locations past tree data will be accounted for using the previous location layout and sampling procedures and the location will be sampled using the current location layout sampling procedures. Accounting locations will have previous tree data downloaded to the Data Recorder, and will have a separate set of preprinted field forms included with the field packet; refer to Section 10 for accounting plot layout and accounting procedures. For accounting locations that cannot be found, or are mislocated, refer to Section 0 for instructions.

**New plots:** A portion of the plots will be installed for the first time using current inventory procedures. Some plots that are considered "new" may be co-located with previously established "woodland" fixed-radius plots, "other tree land" plots, or old P3 plots. In these situations DO NOT remeasure or account for any trees from the previous inventory (do reuse past tree numbers on previously established P3 plots). Sample the location using current inventory procedures.

Possible current design vs. previous design combinations for the current inventory.

Plot Type	State	Current Design	Previous Design
National Remeasure	AZ, UT	P2/P3 offset	P2/P3 offset
Regional Remeasure	CO, ID, NM, MT, WY	P2/P3 offset	P2 center P2 offset
Accounting	MT, NV, ID,	P2/P3 offset	Variable-radius
New	AZ, UT, CO, ID, NM, MT, NV, WY	P2/P3 offset	No past sample/ or woodland fixed- radius/ or other tree land

**0.4.1RM Sampling Procedures**

For accessible forest land condition classes, inventory all macroplots, subplots, and microplots as described below.

**0.4.2RM Subplot Tree Tally**

**1. Procedure**

The subplot is approximately 1/24-acre fixed-radius plot (24-foot radius) centered on the stake. At each subplot, stand directly over the center (stake), and starting at 1° azimuth, rotate clockwise and tally qualifying trees that fall within the subplot. Include only those trees within accessible forest land condition classes; do not tally and measure trees in nonforest land condition classes (unless doing a nonforest inventory). For a qualifying tree to be tallied, the horizontal distance from the subplot center stake to the geographic center of the stem(s) or the center of the bole (pith) at the base of the tree must be 24 feet or less. Trees are tallied and numbered clockwise from the subplot center outward. Numbering is continued in the same fashion on the microplot once the subplot is complete.

**2. Qualifying trees.**

1. Live timber species trees (refer to the tally tree species list in Appendix 3) 5.0-inches in diameter at breast height (DBH) or larger. Live timber species trees will be classified as sound, rough, or rotten:

The merchantable bole on a timber species is defined as: cubic volume - the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter; board foot softwoods - the portion of a tree, 9.0-inches DBH or larger, between a 1-foot stump and a 7.0-inch top diameter; board foot hardwoods - the portion of a tree, 11.0-inches or larger DBH, between a 1-foot stump and a 9.0-inch top diameter.

- (a) A sound live timber species has at least 1/3 of the merchantable volume in live and solid wood, and contains at least one solid 8-foot section now or prospectively, reasonably free of form defect.
  - (b) A rough live timber species has less than 1/3 of the board foot merchantable volume live and solid, with more than half of the unsound wood due to solid dead wood volume or severe form defect; or, a live tree that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the bole.
  - (c) A rotten live timber species has less than 1/3 of the cubic volume live and solid, with more than half of the unsound wood due to rotten and/or missing volume.
2. Live woodland trees (refer to the tally tree species list in Appendix 3) with a single stem of at least 5.0-inches diameter at root collar

(DRC) or a cumulative (calculated) DRC of at least 5.0-inches. For multistemmed trees, stems must be at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point to qualify for measurement.

**Note (regarding woodland trees):** Treat all woodland species (except maple and deciduous oak) that have several stems **clumped together, with a unified crown, and appearing to be from the same root origin, as a single tree.** Treat maple and deciduous oak species that fork underground as individual trees.

3. Standing dead timber species 5.0-inches DBH and larger. To qualify as a standing timber species, the main tree stem/bole must be at least 4.5 feet tall (i.e., a standing timber species cannot be broken below 4.5 feet) and must be standing (STANDING DEAD = 1). Trees supported by other trees or by their own branches are considered standing when their lean angle is < 45 degrees from vertical.
4. Standing dead woodland trees with a single stem of at least 5.0-inches DRC or a cumulative (calculated) DRC of at least 5.0-inches. For a single stem to qualify as standing dead, the stem must be at least 4.5 feet tall, and standing (STANDING DEAD = 1). For multistemmed trees at least one stem must be 1.0-inch DRC or larger, and at least 1/3 of the volume must be attached and upright; do not consider cut and removed volume. Trees supported by other trees or by their own branches are considered standing.
5. Down mortality timber species 5.0-inches DBH and larger. Trees must have died within the past 5 years for new or replacement plots; or since the previous inventory for remeasurement plots and are currently down (STANDING DEAD = 0).
6. Down mortality woodland trees with a single stem of at least 5.0-inches DRC or a cumulative (calculated) DRC of at least 5.0-inches. Trees must have died within the past 5 years for new or replacement plots; or since the previous inventory for remeasurement plots and are currently down (STANDING DEAD = 0).

To determine if a downed tree is within the subplot, visually upright the tree at its origin (e.g., base of broken tree stem or bole, root system depression) and determine if the center of the tree at its base would fall within the maximum subplot distance for tally. If point of origin for a downed tree cannot be determined, use the center of its base where it lies for a measurement point.

**Standing dead trees are classified as either hard or soft:**

- (a) A hard dead tree has a minimum of 33 percent of the original merchantable cubic foot volume in solid wood (less than 67 percent rotten and/or missing).
- (b) A soft dead tree has less than 33 percent of the original merchantable cubic volume in solid wood (more than 67 percent rotten and/or missing).

### 0.4.3RM Microplot Sapling Tally.

#### 1. Procedure

The microplot is approximately 1/300-acre fixed-radius plot (6.8-foot radius) located 12 feet horizontal at an azimuth of 90 degrees from the subplot center. At each microplot, stand directly over the center (stake), and starting at 1° azimuth, rotate clockwise and tally qualifying trees that fall within the microplot. Include only those trees within accessible forest land condition classes (unless doing a nonforest inventory). For a qualifying tree to be tallied, the horizontal distance from the subplot center stake to the geographic center of the stem(s) at the base of the tree must be 6.8 feet or less.

#### 2. Qualifying trees

- (a) Live timber species 1.0- to 4.9-inches DBH. Live timber species saplings are classified as either sound or rough; examine these trees from a 1-foot stump to a 1.0-inch top diameter.
  1. A sound live timber species sapling is one that is expected to become a sound tree 5.0-inches DBH or larger by rotation age.
  2. A rough live timber species sapling is one that is precluded from becoming a sound tree, 5.0-inches DBH or larger by rotation age due to suppression or damage.
- (b) Live woodland species, with a single stem between 1.0 and 4.9-inches DRC or a cumulative DRC of 1.0- to 4.9-inches. For multistemmed trees, at least one stem must be 1.0-inch DRC or larger.

### 0.4.4RM Seedling Counts.

Within the 6.8 foot radius microplot, record the number of live tally tree seedlings, by species and condition class. Count up to 5 individuals by species; estimate the total count if there are more than 5 individuals of any given species in any given condition class. A suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiplying by 4 (given that there is only one condition class on the microplot). Repeat for each species.

**Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for counting.**

**Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for counting.**

For woodland species, each stem on a single tree must be less than 1.0 inch at DRC.

Multiple "suckers" of aspen that originate from the same location will be considered 1 seedling.

Do not tally or count fir “layers” (und detached branches partially or completely covered by soil, usually at the base) as seedlings. Once a stem within a fir layer meets sapling tree qualifications, then tally the stem as a sapling.

## 1.0 PLOT LEVEL DATA

All variables listed in Section 1.0 are collected on plots with at least one accessible forest land condition (PLOT STATUS = 1) and all NONFOREST/NONSAMPLED plots (PLOT STATUS = 2 or PLOT STATUS = 3). 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 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. (See Appendix A.3 for the FIELD LOCATION REFERENCE FORM and PLOT MONUMENTATION RECORDS)

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. 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.

### 1.1 STATE

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

When collected: All plots  
Field width: 2 digits  
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.

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. If SAMPLE KIND = 3, the plot number will be assigned by the National Information Management System (NIMS).

When collected: SAMPLE KIND = 1 or SAMPLE KIND = 2  
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 - possibility of forest land

#### 1.5 NONFOREST SAMPLING STATUS

Record whether this plot is part of a nonforest inventory. If NONFOREST SAMPLING STATUS = 1, then the entire suite of attributes that are measured on the forest lands will be measured and only those suites of attributes that are measured on forest lands can be measured on nonforest lands.

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

- 0 Nonforest plots / conditions are not inventoried
- 1 Nonforest plots / conditions are inventoried

#### 1.6 NONFOREST PLOT STATUS

Record the code that describes the sampling status of the other-than-forest plot, i.e., PLOT STATUS = 2. In cases where the plot is inaccessible, but obviously contains no nonforest land, i.e., plot is either noncensus water or census water, record NONFOREST PLOT STATUS = 2.

When collected: When PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 0 or 1  
Field width: 1 digit  
Tolerance: no errors  
MQO: At least 99% of the time  
Values:

- 1 Sampled – at least one accessible nonforest land condition present on the plot
- 2 Sampled – no nonforest land condition present on plot, i.e., plot is either census and/or noncensus water
- 3 Nonsampled nonforest

## 1.7

### 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 – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only.
- 06 Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required. The plot that is lost is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 6. The replacement plot is assigned SAMPLE KIND = 3.
- 07 Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required. The plot being relocated is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 7. Its replacement plot is assigned SAMPLE KIND = 3.
- 08 Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.
- 09 Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.
- 10 Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.
- 11 Ocean - Plot falls in ocean water below mean high tide line.

### 1.7.1RM CONDITION CLASS CHANGE

Record the code that describes the change, if any, in the CONDITION CLASS from the previous inventory

When collected: All SAMPLE KIND 2 plots.

Field width: 1 digit.

Tolerance: No errors.

Values

- 0 There have been no condition class changes from the previous inventory. Copy condition class defining (mapping) variables from computer-generated printouts included in the plot packet.
- 1 True change has taken place since the last inventory. At least one condition class defining (mapping) variable has changed on any condition. Include changes in CONDITION STATUS such as: previous CONDITION STATUS was accessible forest land, now some portion or all of the condition is not accessible forest land (condition is now nonforest land, noncensus water, census water, denied access, area too hazardous to visit, area that is not in the sample, or not sampled/out of time), or vice versa.
- 2 There are no true condition changes. The previous crew mapped or failed to map a condition(s) in obvious error. Explain error in notes.
- 3 There are no true condition changes. Change is due to procedural or definition changes.

### 1.8 NONFOREST PLOT NONSAMPLED REASON

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

When collected: When PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 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.
- 08 Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.

- 09 Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.
- 10 Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

### 1.9 SUBPLOTS EXAMINED

Record the number of subplots examined. By default, PLOT STATUS = 1 plots have all 4 subplots examined.

When collected: When PLOT STATUS = 2 or 3

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 1 Only subplot 1 center condition examined and all other subplots assumed (inferred) to be the same
- 4 All four subplots fully described (no assumptions/inferences)

### 1.10 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.
- 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.

### 1.10.1RM REGIONAL 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 annual plot that was sampled at the previous inventory or remeasurement of a previously established “Rocky Mtn. 4-point center micro” or “National 4-point offset micro” (see Section 0.4 for definitions). If the previously established plot is a design other than those mentioned above, the SAMPLE KIND will equal 1.
- 3 Replacement plot - a replacement plot for a previously established national design annual plot. Assign SAMPLE KIND = 3 if a plot is installed at a location other than the previous location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the previous plot. Replaced plots are assigned PLOT STATUS = 3, SAMPLE KIND = 2, and the appropriate NONSAMPLED REASON code. The plot number for the replacement plot is assigned by NIMS or replacement of a previously established “Rocky Mtn. 4-point center micro” or “National 4-point offset micro” (see Section 0.4 for definitions). Includes a plot that was replaced with a new plot because the original plot was established in the wrong location (see Section 0.3, Field Procedure Overview).

### 1.11 PREVIOUS PLOT NUMBER

Record the identification number for the plot that is being replaced.

When collected: When SAMPLE KIND = 3

Field width: 5 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 00001 to 99999

### 1.12 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: 5.0

**1.13 CURRENT DATE**

Record the year, month, and day that the current plot visit was completed as described in 1.13.1 – 1.13.3.

**1.13.1 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: ≥ 2009

**1.13.2 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

**1.13.3 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

**1.14 DECLINATION (CORE OPTIONAL)**  
 (Not used by RM)

**1.15 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 either one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

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

#### 1.16

##### WATER ON PLOT

Record the water source that has the greatest impact on the area within the accessible forest/nonforest 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 either at least one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST 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/nonforest land CONDITION 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

## 1.17

**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
- 3 Reference plot (off grid)
- 4 Training/practice plot (off grid)
- 5 Botched plot file (disregard during data processing)
- 6 Blind check
- 7 Hot check (production plot)

## 1.18

**CREW NUMBER**

Record up to 5 crew numbers as assigned to the field crew; always record the crew leader first. The first 2 digits are for the responsible unit's station number (NRS- 24xxxx, SRS - 33xxxx, RMRS - 22xxxx, and PNW - 26xxxx).

When collected: All plots  
 Field Width: 6 digits  
 Tolerance: No errors  
 MQO: At least 99% of the time  
 Values:

NRS	240001 - 249999
SRS	330001 - 339999
RMRS	220001 - 229999
PNW	260001 - 269999

## 1.18.1RM

**ADDITIONAL OWNER CONTACT**

All owners and land management agencies are contacted prior to field location access. Some owners and land management agencies request additional contact prior to visiting the field location. Indicate whether additional contact (i.e. call first, pick up key, get a permit, etc.) with the land owner or land management agency was necessary to gain access to the field location.

When collected: All plots  
 Field width: 1 letter  
 Tolerance: No errors  
 Values: "Y" for yes and "N" for no

## 1.18.2RM

**4 X 4**

Record if it was necessary to use 4 wheel drive to access the location.

When collected: All plots

Field width: 1 letter  
 Tolerance: No errors  
 Values: "Y" for yes and "N" for no

**1.18.3RM ATV**

Record if ATV's are recommended (not necessarily used) to access the location.

When collected: All plots  
 Field width: 1 letter  
 Tolerance: No errors  
 Values: "Y" for yes and "N" for no

**1.18.4RM LOCKED GATE**

Record if it was necessary to go through a locked gate to access the location. This includes locked gates that you have the key for.

When collected: All plots  
 Field width: 1 letter  
 Tolerance: No errors  
 Values "Y" for yes and "N" for no

**1.18.5RM PREVIOUS NUMBER OF POINTS MEASURED**

See Section 10 Accounting procedures item 10.2.5RM

**1.18.6RM POINTS ACCOUNTED**

See Section 10 Accounting procedures item 10.2.6RM

**1.18.7RM PREVIOUS NUMBER OF MICROPLOTS MEASURED**

See Section 10 Accounting procedures item 10.2.8RM

**1.18.8RM MICROPLOTS ACCOUNTED**

See Section 10 Accounting procedures item 10.2.9RM

**1.18.9RM ACCOUNTING LAND USE**

See Section 10 Accounting procedures item 10.2.10RM

**1.19 GPS Coordinates**

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field-visited plot locations even if GPS has been used to locate the plot in the past.

**1.19.1 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 use the NAD83 Datum to collect coordinates. (RM Before 2011 NAD27 was used. Be sure to follow the GPS setup instruction found in Appendix C.)

Each FIA unit will 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.

### 1.19.2 Collecting Readings

Collect at least 180 GPS readings (**RM Sample Confidence reaches 100%**) 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 < 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 (**RM Sample Confidence reaches 100%**) at error  $\leq$  to 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 200 feet of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. Record the azimuth and horizontal distance as described in Sections 1.19.14 and 1.19.15.

Coordinates may be collected further away than 200 feet from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Record the azimuth and horizontal distance as described in Sections 1.19.14 and 1.19.15.

In all cases try to obtain at least 180 positions before recording the coordinates. Coordinates not collected by automatic means shall be manually double-entered into the data recorder.

### 1.19.3 GPS UNIT (**RM GPS TYPE**)

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

When collected: All field visited plots

Field width: 1 digit

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

### 1.19.4 GPS SERIAL NUMBER

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

When collected: When GPS UNIT > 0

Field width: 6 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 000001 to 999999

#### 1.19.5 GPS ENTRY METHOD

Identify the method used to record GPS data. If GPS data are manually entered, record 0. If GPS data are transferred electronically from the GPS receiver to the data recorder, record 1.

Upon entering a 1 the following variables are automatically populated in accordance with the GPS receiver setup in 1.19.1 (coordinates LATITUDE, LONGITUDE or UTM, GPS ELEVATION, GPS ERROR, and NUMBER OF READINGS). All other GPS variables must be populated via manual key-entry.

When Collected: GPS UNIT > 0  
Field width: 1 digit  
Tolerance: No errors  
MQO: at least 99% of the time  
Values:

0 GPS data manually entered  
1 GPS data electronically transferred

#### 1.19.6 GPS DATUM

Record the acronym indicating the map datum that the GPS coordinates are collected in (i.e., the map datum selected on the GPS unit to display the coordinates).

When collected: When GPS UNIT >0  
Field width: 5 characters (cccn)  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:

NAD83 North American Datum of 1983

#### 1.19.7 COORDINATE SYSTEM

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

When collected: When GPS UNIT > 0  
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:

1 Geographic coordinate system  
2 UTM coordinate system

1.19.8

**Latitude**

Record the latitude of the plot center to the nearest hundredth second, as determined by GPS.

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 feet.

1.19.8.1

**LATITUDE DEGREES**

Record the latitude degrees of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

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

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 0-90

1.19.8.2

**LATITUDE MINUTES**

Record the latitude minutes of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

Field width: 2 digits

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 0 – 59

1.19.8.3

**LATITUDE SECONDS**

Record the latitude decimal seconds of the plot center to the nearest hundredth place as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

Field width: 4 digits

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 0.00 - 59.99

1.19.9

**Longitude**

Record the longitude of the plot center, to the nearest hundredth second, as determined by GPS.

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 feet.

**1.19.9.1 LONGITUDE DEGREES**

Record the longitude degrees of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

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

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 1-180

**1.19.9.2 LONGITUDE MINUTES**

Record the longitude minutes of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

Field width: 2 digits

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 0 – 59

**1.19.9.3 LONGITUDE SECONDS**

Record the longitude decimal seconds of the plot center to the nearest hundredth place as determined by GPS.

When collected: When COORDINATE SYSTEM = 1

Field width: 4 digits

Tolerance: When GPS ENTRY METHOD = 0, No errors in data entry

When GPS ENTRY METHOD = 1, not applicable

MQO: When GPS ENTRY METHOD = 0, at least 99% of the time

When GPS ENTRY METHOD = 1, not applicable

Values: 0.00 – 59.99

**1.19.10 UTM ZONE**

(Not used by RM)

**1.19.11 EASTING (X) UTM**

(Not used by RM)

**1.19.12 NORTHING (Y) UTM**

(Not used by RM)

**1.19.13 Correction For “Offset” Location**

As described in Section 1.19.2, coordinates may be collected at a location

other than the plot center (an "offset" location). If the GPS unit is capable of calculating plot center coordinates then AZIMUTH TO PLOT CENTER and DISTANCE TO PLOT CENTER both equal 000.

**1.19.14 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 or are corrected in the field to plot center, record 000.

When collected: When GPS UNIT = 1, 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

**1.19.15 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 or are corrected in the field to plot center, record 000. As described in Section 1.19.2, 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 200 feet.

When collected: When GPS UNIT = 1, 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

**1.19.16 GPS ELEVATION**

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

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

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

Tolerance: No errors

MQO: At least 99% of the time

Values: -00100 to +20000

**1.19.17 GPS ERROR**

Record the error as shown on the GPS unit to the nearest foot. As described in Section 1.19.2, 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 999

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

#### 1.19.18 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

#### 1.19.19 GPS FILENAME (CORE OPTIONAL)

Record the filename containing the GPS positions collected on the plot.

When collected: When GPS UNIT = 3

Field width: 15 characters

Tolerance: No errors

MQO: At least 99% of the time

Values: English words, phrases and numbers

#### 1.20 MACROPLOT BREAKPOINT DIAMETER (CORE OPTIONAL)

When the macroplot core option is being utilized, record the value selected for breakpoint diameter for that particular plot. If macroplots are not being installed, this item will be left blank. A macroplot breakpoint diameter is the diameter (either DBH or DRC) above which trees are measured on the plot extending from 0.01 to 58.9 feet horizontal distance from the center of each subplot. Examples of different breakpoint diameters used by western FIA units are 24 inches or 30 inches (Pacific Northwest), or 21 inches (Rocky Mountain Region). Installation of macroplots is core optional and is used to have a larger plot size in order to more adequately sample large trees.

When collected: All plots

Field width: 2 digits (xx)

Tolerance: No errors

MQO: At least 99% of the time

Values: 21, 24, and 30

#### 1.20.1RM FUTURE FOREST POTENTIAL

Indicate if the location requires a prefield examination at the time of the next inventory (10-20 years).

When collected: When no accessible forest land condition class is present on the location.

Field width: 1 digit.

Tolerance: No errors.

Values

- 0 No, there is no chance this plot will meet the forest definition at the next cycle. It meets one or more of the following criteria:
  - Located more than ½ mile from the nearest forest land, and there are no trees present on or near the location. No disturbance evident (e.g. large fires, clearcut, etc.)
  - Located in a large reservoir.
  - Located in a developed urban area (on a house, building, parking lot), but the plot does not fall in a park, undeveloped yard, etc. that may revert to natural forest.
  - Located on barren rock, sand dunes, etc.
- 1 Yes, there is some chance that this plot could become forested in the next cycle; there are trees present, or forest land is present within ½ mile.
- 2 There are no forest tree species (Appendix 3 - Tree Species Codes) on the site, but other woody species not currently defined as forest species occupy the site (such as palo verde, ironwood, big sage). Where code 2 is selected, note the dominant tree or shrub species on the site in the Condition Notes.

## 1.21

### PLOT 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

**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).

**2.0.1RM CONDITION CLASS INTRODUCTION**

After the plot center has been established, identify all condition(s) present on the plot (encompassing the 4 subplots). A condition is defined as an area of relatively uniform ground cover, such as a homogeneous vegetation cover; a condition class is a categorization by several defining attributes (refer to 2.1.1). A contrasting condition class is one that is different from the previously assigned condition class based on the defining attributes.

**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 - possibility of forest land

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

At time of re-inventory, one additional attribute, PRESENT NONFOREST LAND USE, is used to define new condition classes if the sampled area on a plot has changed from accessible forest land to nonforest land (NOTE: see Section 2.5.24). This allows tracking of land use changes without requiring mapping of all nonforest land condition classes on all plots.

**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. (RM a condition is 10% stocked if it has 5% crown cover or 40 established seedlings per acre of any tally tree species (Appendix 3). See Section 2.2.1RM for procedures to calculate 5% crown cover over the acre).
- (b) in several 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. (RM a condition is 10% stocked if it has 5% crown cover or 40 established seedlings per acre of any tally tree species (Appendix 3)).

To qualify as forest land, the prospective condition must be at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outer-most edge. Forested strips must be 120.0 feet wide for a continuous length of at least 363.0 feet 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 land condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. This may cause difficulties determining exactly where the forested area meets the minimum stocking criteria. 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

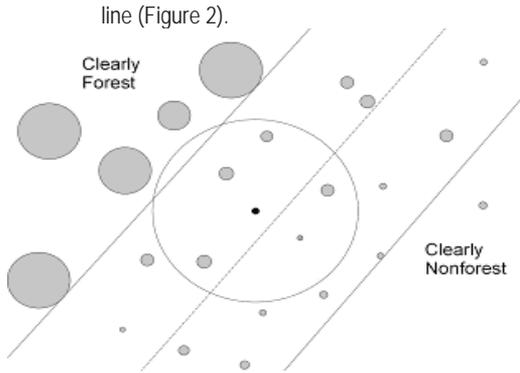


Figure 2. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest land 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 (120.0 feet) 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.

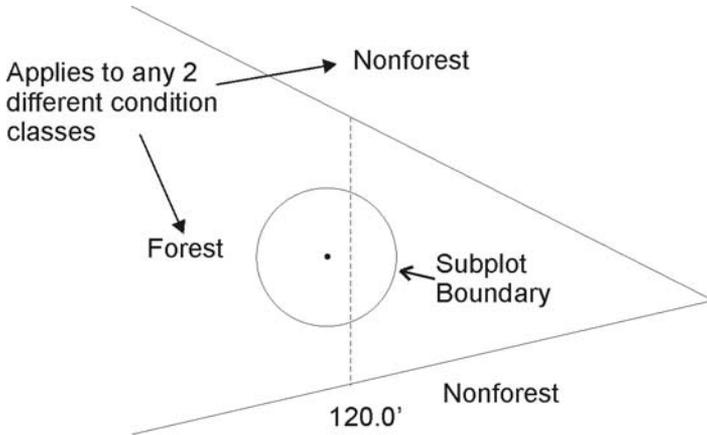


Figure 3. Forest condition narrows within a nonforest land condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

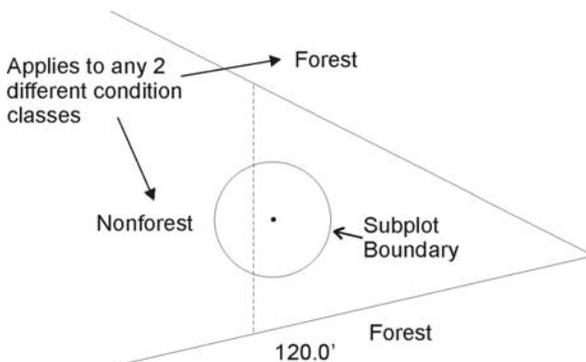


Figure 4. Nonforest land condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

## 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 numbers 3 and 4 in Section 2.2. To qualify, the area must be at least 1.0 acre in size and 120.0 feet 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 1.0 acre to 4.5 acres in size. Rivers, streams, canals, etc., 30.0 feet to 200 feet wide.
4. Census Water  
Lakes, reservoirs, ponds, and similar bodies of water 4.5 acres in size and larger; and rivers, streams, canals, etc., more than 200 feet wide (1990 U.S. Census definition).
5. Nonsampled  
See section 2.4.3 CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled. In cases where a condition is access-denied or hazardous land use, but obviously contains no forest land, record CONDITION CLASS STATUS = 2, 3 or 4. In cases where a condition is access-denied or hazardous land use and has the possibility of forest, record CONDITION CLASS STATUS = 5.

## 2.2.1RM PERCENT CROWN COVER CALCULATION

If a plot is close to 5% crown cover, and the crown cover transect (see 2.5.25.1RM) may not represent the true cover, the following method provides another estimate of the total tree crown area within the 1-acre surrounding the plot center: The forest crown cover definition may change to 10%, so crews should measure the entire acre of crown cover when cover is <12%

Given:

1. The area of an acre is 43,560 ft<sup>2</sup>.
2. A 1-acre circle has a radius of 117.75 ft.
3. 5% of 1-acre is 2,178 ft<sup>2</sup>.

and assuming the canopies to be ellipses:

1. Measure the approximate canopy diameters (d) of the long axis and short axis for each tree on the acre.
2. Calculate the canopy area for each tree as  $\text{Canopy Area} = \pi \cdot ((\text{long axis } d)/2 \cdot (\text{short axis } d/2))$ .
3. Add up the Canopy Areas, and divide by 435.6 (1% of an acre) to obtain percent cover (truncate)

## 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:

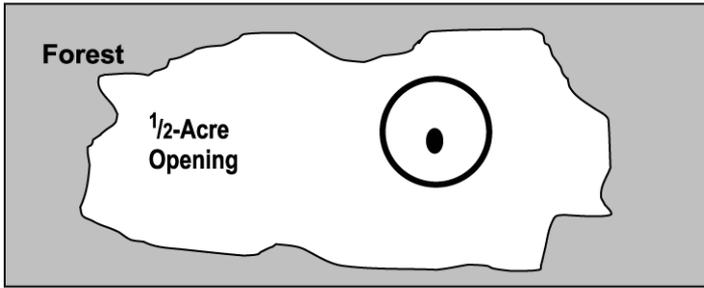
- |            |   |   |   |
|------------|---|---|---|
| 2.5.1      | RESERVED STATUS   | } | Attributes where a change causes a separate condition class |
| 2.5.2      | OWNER GROUP   |   |   |
| 2.5.3      | FOREST TYPE   |   |   |
| 2.5.4      | STAND SIZE CLASS  |   |   |
| 2.5.5      | REGENERATION STATUS   |   |   |
| 2.5.6      | TREE DENSITY  |   |   |
| 2.5.7      | OWNER CLASS   | } | Ancillary - changes do not delineate a new condition class  |
| 2.5.8      | PRIVATE OWNER INDUSTRIAL STATUS   |   |   |
| 2.5.9      | ARTIFICIAL REGENERATION SPECIES   |   |   |
| 2.5.10     | STAND AGE   |   |   |
| 2.5.10.1RM | CONDITION HABITAT TYPE  |   |   |
| 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   |   |   |
| 2.5.24.1RM | LAND USE  |   |   |
| 2.5.24.2RM | PERCENT BARE GROUND   |   |   |
| 2.5.25     | CANOPY COVER SAMPLE METHOD  |   |   |
| 2.5.25.1RM | CROWN COVER   |   |   |
| 2.5.26     | LIVE CANOPY COVER   |   |   |
| 2.5.27     | LIVE PLUS MISSING CANOPY COVER  |   |   |
| 2.5.28     | TOTAL STEMS   |   |   |
| 2.5.24     | PRESENT NONFOREST LAND USE (for area converted from accessible forest land condition class to nonforest land since last inventory). |   |   |

**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 1.0 acre in size, and each is at least 120.0 feet in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 acre in size and less than 120.0 feet in width are considered forest land and are not delineated and classified as a separate nonforest land condition class (RM Figure 4.1)

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



RM Figure 4.1. The subplot falls in an opening less than 1 acre in size; the opening does not meet the definition for nonforest land (1-acre in size, 120-foot wide). Therefore, this subplot occurs in an ACCESSIBLE FOREST LAND condition class.

Five exceptions to these size and width requirements apply:

1. Developed nonforest land condition: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 acre in size and 120.0 feet in width and are surrounded by forest land. There are three kinds of developed nonforest land conditions that do not have to meet area or width requirements (Figures 5, 5.1, and 5.2).

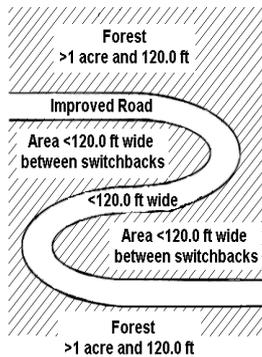
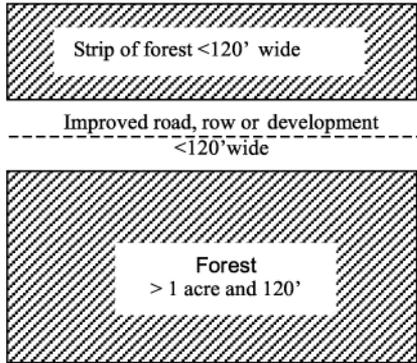
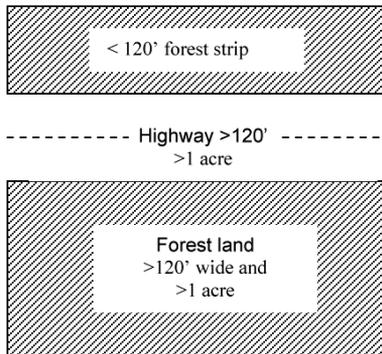


Figure 5. Example of a switchback road. All the cross-hatched area is forest and the improved road is a nonforest condition.

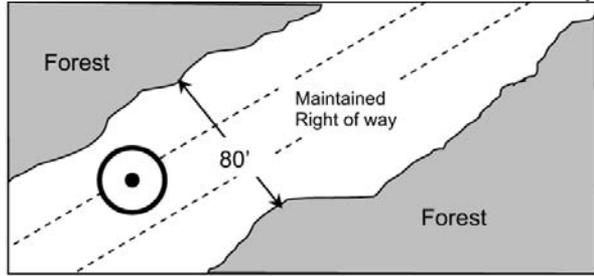


RM Figure 5.1. Example of a nonforest strip <120' wide. Area above road, while <120' wide, is still forest.

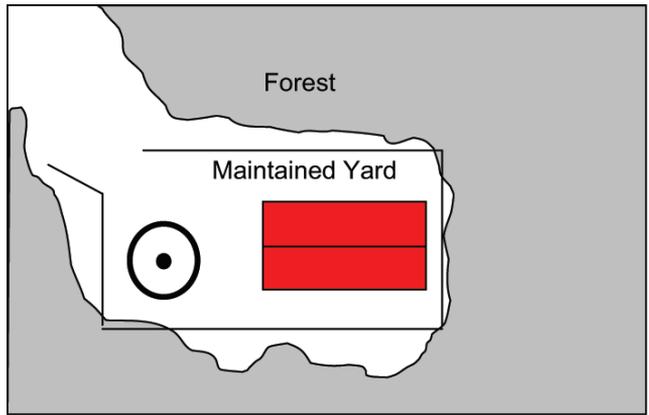


RM Figure 5.2. Example of a nonforest strip >120' wide. Area of forest above highway is not forest land

- (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. (RM Figure 5.3)
- (c) Developments: structures and the maintained area next to a structure, all less than 1.0 acre 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. (RM Figure 5.4)

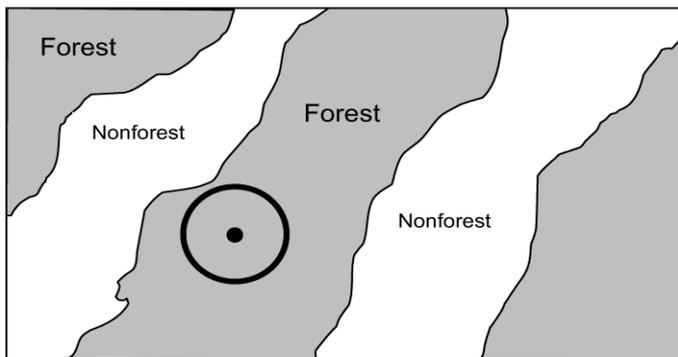


RM Figure 5.3. The subplot falls in a power line right-of-way. Although the right-of-way is less than 120-foot wide, maintained roads and rights-of-way are exemptions to the size rule and are considered NONFOREST LAND regardless of width.



RM Figure 5.4. The subplot falls in a maintained yard next to a house; the area of the yard and house is less than 1-acre. However, the yard and house are cultural developments; these are considered nonforest land regardless of size. Therefore, the subplot occurs in NONFOREST LAND.

2. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is less than 1.0 acre in size and less than 120.0 feet 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 land conditions that are not listed under number 1, e.g., improved roads, maintained rights-of-way, and developments. (RM Figure 6.1) Figure. 6 not used in IWFA.



**RM** Figure 6.1. The subplot falls in an area of alternating strips of forest and nonforest, none of which meet the 120-foot wide criteria. Examine the overall area, and classify the land according to whatever cover occupies the most area. In this example, there is more forest, so the subplot occurs in ACCESSIBLE FOREST.

- (a) Many small intermingled strips: Determine the total area that the intermingled strips occupy, and classify according to the **CONDITION CLASS STATUS** (forest land or nonforest land) that occupies the greater area. If the area of intermingled strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.
- (b) Two alternating strips: 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 land 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. Again, this exception applies only to nonforest land conditions that are not listed under number 1, e.g., improved roads, maintained rights-of-way, and developments.

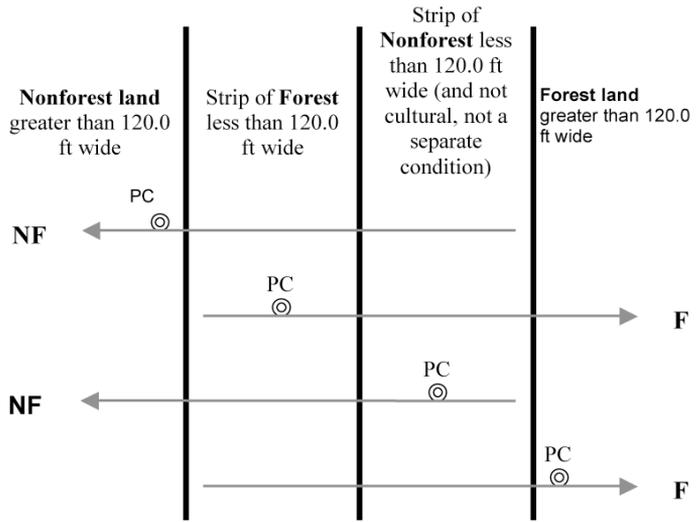


Figure 7. Example of alternating strips of forested and nonforested conditions. PC is the Plot Center (center of subplot 1).

3. The 120.0-foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 8).

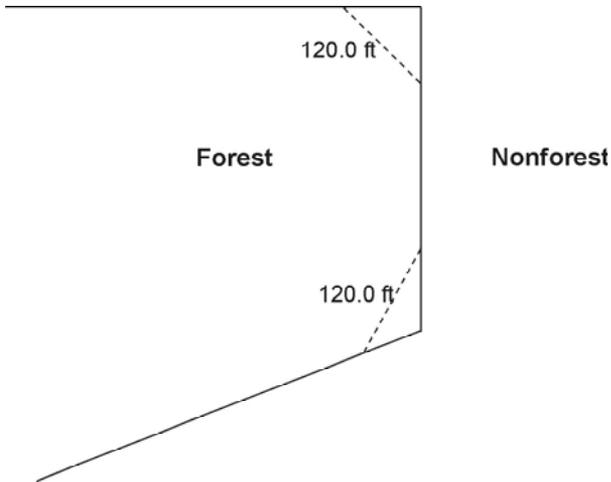
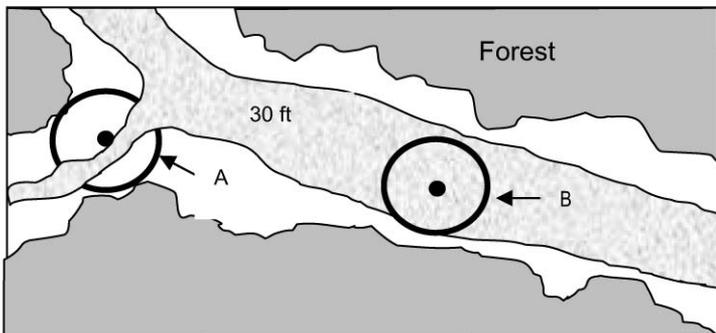


Figure 8. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest land conditions.

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a

linear water feature must be at least 30.0 feet wide and cover at least 1.0 acre. 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 1.0 acre requirement; use professional judgment and common sense on any linear water feature. (RM Figure 8.1)

5. Nonsampled conditions within accessible forest land are delineated, regardless of size, as a separate condition.



RM Figure 8.1. Subplot A falls in a stream less than 30-feet wide, and within tree land. Subplot A occurs in a FOREST LAND condition class. Subplot B falls in a stream at least 30-feet wide; subplot B occurs in WATER.

#### 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. In situations where a condition

is denied access or hazardous, but obviously contains no forest land, record CONDITION CLASS STATUS = 2, 3 or 4. In cases where a condition is access-denied or hazardous land use and has the possibility of forest, record CONDITION CLASS STATUS = 5.

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 – possibility of forest land

#### 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:

- 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.
- 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.
- 10 Other – This code is used whenever a 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 Ocean – Condition falls in ocean water below mean high tide line.

#### 2.4.4 NONFOREST CONDITION CLASS STATUS

Record the code that describes the sampling status of the condition class (see the nonforest nonsampled reasons below for additional information).

When collected: When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

2 Accessible nonforest land

5 Nonsampled nonforest

#### 2.4.5 NONFOREST CONDITION NONSAMPLED REASON

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

When collected: When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST CONDITION STATUS = 5

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

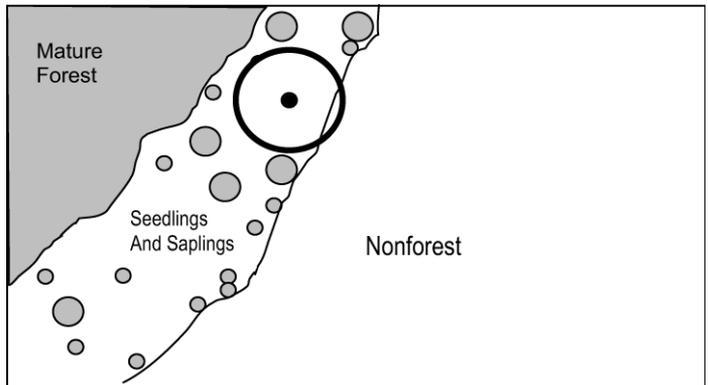
- 02 Denied access – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access 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.
- 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.
- 10 Other – This code is used whenever a 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.

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 1.0 acre in size and at least 120.0 feet 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. (RM Figure 8.2)



RM Figure 8.2 Combining conditions that do not meet minimum size criteria.

The subplot falls in a strip of seedling/sapling cover less than 120-feet wide. Although the strip meets the definition of forest by crown cover or stocking, this strip is too narrow to be its own condition. However, the strip is adjacent to a larger area of forest land that does meet the minimum forest land size criteria. Therefore, the strip is combined with the mature forest, and the subplot occurs in ACCESSIBLE FOREST LAND.

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 a 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 120.0 feet wide, and 1.0 acre 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 120.0 feet and 150.0 feet and the width of the riparian forest is at least 30.0 feet wide, the rules for identifying the non-riparian forest (at least 30.0 feet but less than 120.0 feet) need to be modified. The non-riparian forest can be between 30.0 feet and 120.0 feet 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.

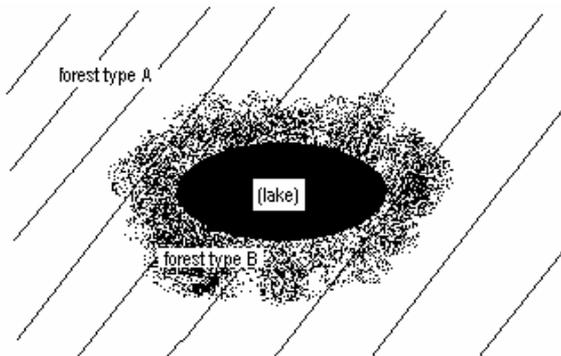


Figure 9. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

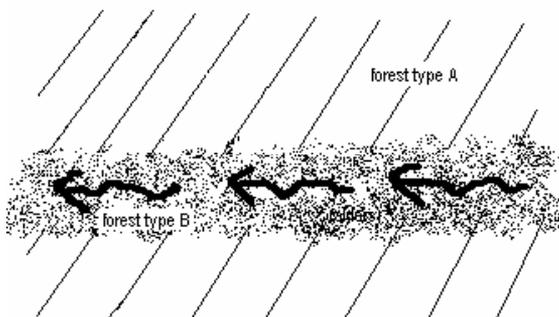


Figure 10. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

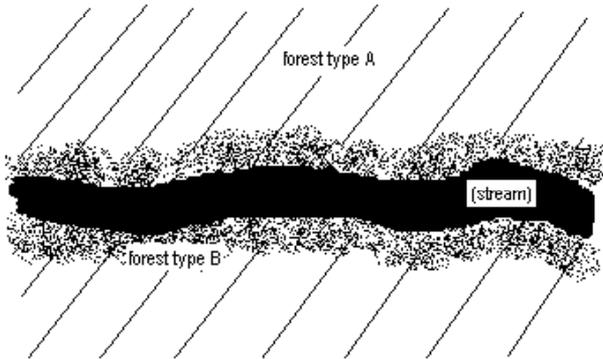


Figure 11. If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands, including the stream falls between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

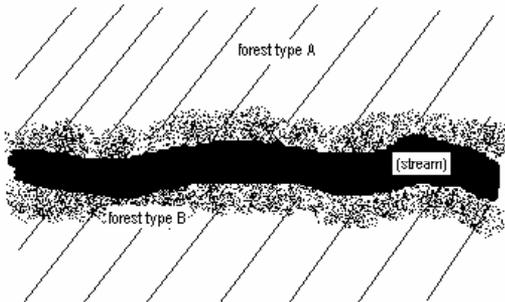


Figure 12. If the stream is > 30.0 feet wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands between 30.0 feet and 120.0 feet wide and is > 1.0 acre in size.

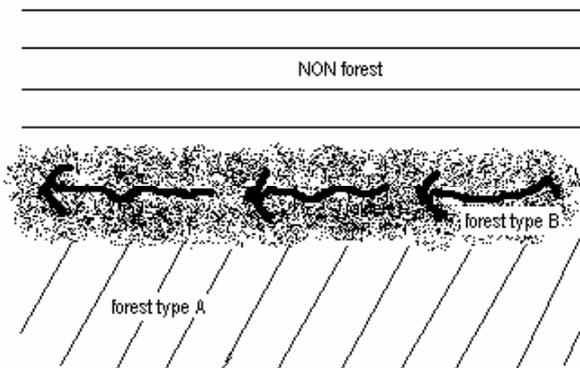


Figure 13. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

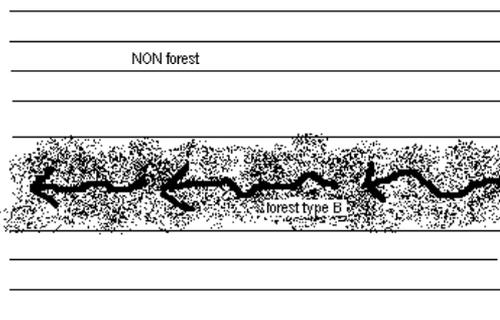


Figure 14. In a nonforested area, a band of forest type B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.

### 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 forest land condition classes (CONDITION CLASS STATUS = 1)

CORE OPTIONAL: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) and nonforest land 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)

CORE OPTIONAL: All accessible forest land condition classes (CONDITION

CLASS STATUS = 1) and nonforest 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

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

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: See Appendix 2

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, and not classified as cover trees (see code 6), or
  - (b) for several woodland species where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.
- 1  $\leq 4.9$  inches (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 5.0 inches DBH/DRC.
- 2 5.0 – 8.9 inches (softwoods) / 5.0 – 10.9 inches (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  $\geq 5.0$  inches DBH/DRC and the plurality of the crown cover is in softwoods between 5.0 – 8.9 inches diameter and/or hardwoods between 5.0 – 10.9 inches DBH, and/or woodland trees 5.0 – 8.9 inches DRC.
- 3 9.0 – 19.9 inches (softwoods) / 11.0 – 19.9 inches (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  $\geq 5.0$  inches DBH/DRC and the plurality of the crown cover is in softwoods between 9.0 – 19.9 inches diameter and/or hardwoods between 11.0 – 19.9 inches DBH, and for woodland trees 9.0 – 19.9 inches DRC.
- 4 20.0 – 39.9 inches  
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  $\geq 5.0$  inches DBH/DRC and the plurality of the crown cover is in trees between 20.0 – 39.9 inches DBH.
- 5 40.0 + inches  
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  $\geq 5.0$  inches DBH/DRC and the plurality of the crown cover is in trees  $\geq 40.0$  inches 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 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, 20-acre stand has many trees killed by a bark beetle outbreak,
- one portion of a stand is partially cut over (with 40 ft<sup>2</sup> basal area per acre) while the other portion is undisturbed (with 100 ft<sup>2</sup> basal area per acre).

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

Record the OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will **NOT** be delineated based on changes in owner class. If

multiple owner classes within a group occur on a single condition class, record the owner class closest to the plot center.

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

CORE OPTIONAL: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) and nonforest land condition classes (CONDITION CLASS STATUS > 1)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

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

- 11 National Forest
- 12 National Grassland
- 13 Other Forest Service

Owner Classes within Other Federal Lands (Owner Group 20)

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

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

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

Owner Classes within Private lands (Owner Group 40)

- 41 Corporate
- 42 Non Governmental Conservation / Natural Resources  
Organization- examples: Nature Conservancy, National Trust for Private  
Lands, Pacific Forest Trust, Boy Scouts of America, etc.
- 43 Unincorporated Partnerships / Associations / Clubs – examples: Hunting  
Clubs that **own, not lease** property, recreation associations, 4H, etc.
- 44 Native American (Indian) – within reservation  
boundaries
- 45 Individual

### 2.5.8

#### PRIVATE OWNER INDUSTRIAL STATUS

Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, "mom & pop" home-operated businesses, etc., should not be considered as industrial plants. If

any doubt exists with the determination by the field crew about the owner's industrial status due to name, commercial plant size, type plant, etc., choose code 0.

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

When collected: CORE: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) when the owner group is private (OWNER GROUP 40)

CORE OPTIONAL: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) when the owner group is private (OWNER GROUP 40) and nonforest land condition classes (CONDITION CLASS STATUS > 1) when the owner group is private (OWNER GROUP 40)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0 Land is not owned by industrial owner with a wood processing plant

1 Land is owned by industrial owner with wood processing plant

### 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

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for nonstocked stands. (RM When the AGE and RADIAL requirements are satisfied for each tallied tree SPECIES and STAND SIZE CLASS encountered on the plot, STAND AGE is automatically calculated when entered in the PDR.)

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Unlike the procedure for site tree age (TREE AGE AT DIAMETER), estimates of STAND

AGE should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

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

$$(34 \times 0.25) + (62 \times 0.60) + (59 \times 0.15) = 55 \text{ years.}$$

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

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

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

If tree cores are not counted in the field, but are collected and sent to the office for the counting of rings, record 999. Note on the core the percent of stand that type of core represents so that STAND AGE can be calculated later. (RM Cores are counted in the field. If an AGE or RADIAL is estimated, record "1" for RADIAL GROWTH AND TREE AGE CHECK (see Section 5.25.7RM). STAND AGE is automatically populated in the PDR after all appropriate RADIAL GROWTH and TREE AGES are entered).

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

Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 95% of the time

Values: 000 to 997, 998, 999

### 2.5.10.1RM CONDITION HABITAT TYPE

Record the 7-digit code for the primary and secondary Habitat Types that best represent the condition class. Examine the area surrounding each subplot within a condition class; if several types within a condition class are evident on the subplots, record the type that is most abundant as primary. If only one habitat type is present on the condition, record the same habitat type code for the secondary habitat type.

For conditions that have had a severe or recent disturbance (e.g., burn or cut), estimate the type from a nearby similar site or use a series level type code and explain in the general comments or notes. Refer to the local Habitat Type key and manual(s).

For condition classes that do not have a defined type or series in the Habitat Type manuals, record 9999999.

When collected: Condition Class Status = 1

Field width: 7 digits.

Tolerance: Series - no errors

MQO: - no errors.

### 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 1.0 acre in size. Record up to three different disturbances per condition class from most important to least important. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

**For initial plot establishment (SAMPLE KIND =1 or 3), the disturbance must be within the last 5 years. For remeasured plots, recognize only those disturbances that have occurred since the previous inventory.**

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 land and/or vegetation, but initially may not affect vegetation 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) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

Code	Definition
00	None - no observable disturbance
10	Insect damage
11	insect damage to understory vegetation
12	insect damage to trees, including seedlings and saplings
20	Disease damage
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
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
51	ice
52	wind (includes hurricane, tornado)
53	flooding (weather induced)
54	drought
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.
90	Geologic disturbances
91	landslide
92	avalanche track
93	volcanic blast zone
94	other geologic event
95	earth movement/avalanches

#### 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; 9999

- 2.5.13      **DISTURBANCE 2**  
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**  
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 1.0 acre 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 plot establishment (plotsSAMPLE KIND = 1 or 3), 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) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- |    |  |
|----|--|
| 00 | None - No observable treatment.  |
| 10 | Cutting - The removal of one or more trees from a stand.   |
| 20 | Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration. |
| 30 | Artificial regeneration - 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 Natural regeneration - 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 Other silvicultural treatment - 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 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**

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) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits

Tolerance: No errors

MQO: At least 80% of the time

Values:

- Xeric** Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.
- 11 Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.
  - 12 Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.
  - 13 Deep Sands - Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams, and many deserts.
  - 19 Other Xeric - All dry physiographic sites not already described.
- Mesic** Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.
- 21 Flatwoods - Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.
  - 22 Rolling Uplands - Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated flood plains.
  - 23 Moist Slopes and Coves - Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.
  - 24 Narrow Flood plains/Bottomlands - Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs.
  - 25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces. Excludes swamps, sloughs, and bogs with year-round water problems.
  - 29 Other Mesic - All moderately moist physiographic sites not already described.
- Hydric** Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where

- excess water seriously limits both growth and species occurrence.
- 31 Swamps / Bogs - Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.
  - 32 Small Drains - Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.
  - 33 Bays and wet pocosins - Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include the Carolina bays in the southeast US.
  - 34 Beaver ponds
  - 35 Cypress ponds
  - 39 Other hydric - All other hydric physiographic sites.

#### 2.5.24 PRESENT NONFOREST LAND USE

Record this attribute for all nonforest condition classes. For areas that were sampled and classified at last inventory as accessible forest land and are now nonforest land, the area that has changed is a new, separate condition class. It should not be considered part of any nonforest land condition class(es) sampled during the previous inventory that may still be present. Instructions in Sections 2.1 and 2.4 apply. Select the classification for the new nonforest condition that, within sampled area, indicates what the majority of this changed area is now if more than one nonforest classes are present.

When collected: CORE: SAMPLE KIND = 2, current CONDITION CLASS STATUS = 2,  
CORE OPTIONAL: SAMPLE KIND = 1, 2, or 3; current CONDITION CLASS STATUS = 2  
Field width: 2 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:

- 10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width). 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 opening
  - 17 Windbreak/Shelterbelt

- 20 Rangeland - 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 1.0 acre in size and 120.0 feet wide.
- 30 Developed - 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 (industrial/commercial), 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 - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. Use the 40 code only for cases not better described by one of the following:
  - 41 Nonvegetated
  - 42 Wetland
  - 43 Beach
  - 45 Nonforest-Chaparral

#### 2.5.24.1RM LAND USE

For each condition, record the current land use.

When collected: All accessible forest land and nonforest condition classes (CONDITION CLASS STATUS = 1 and 2)

Field width: 3 digits

Tolerance: no errors

MQO: At least 90% of the time

Values: 001 - 004

- 001 Condition is not being manipulated by human activities such as regular mowing, intensive grazing, or recreation activities.
- 002 Condition is being manipulated by human activities that prevent normal regeneration and succession such as regular mowing, intensive grazing, or recreation activities.
- 003 Condition has been chained in the past.
- 004 An inclusion that would generally be recognized as a separate condition, except that it is not large enough to qualify (<1 acre or <120 feet wide) , regardless of live plus missing crown cover percent.

### 2.5.24.2RM PERCENT BARE GROUND

Estimate bare ground on the subplot by forested condition, to the nearest percent, using one of the methods described below.

Bare ground is exposed soil and rock fragments smaller than  $\frac{3}{4}$  inch (longest dimension). Do not include rocks protruding through the soil or cryptobiotic crusts as bare ground.

If the plot includes non-forested areas, estimate the percent bare ground in only the forested condition (i.e. if the subplot is half forested and 25% of the forested portion is bare ground, then the Percent Bare Ground is recorded on the Crown/Ground Supplemental Data Form as 25).

For estimating purposes:

1% is an area 4.25 feet X 4.25 feet

The microplot is approximately 8% of the area of the subplot

#### Method 1

Visually estimate the percent bare ground on each subplot by forested condition and record on the Crown/Ground Cover Supplemental Data Form (appendix A.9). Add the percent bare ground estimates and divide by the number of subplots sampled. Where more than one forested condition class occurs on the location, separate and record (PDR) the estimate by condition class.

Record the percent using a three-digit code (e.g. record 5 percent as "005", 21 percent as "021").

#### Method 2 (optional)

As the amount of bare ground increases on a subplot it may become difficult to estimate the Percent Bare Ground. If a crew is having difficulty or is "calibrating" their eyes, to reduce subjectivity, Ground Cover Transects can be used to obtain the same information as Method 1. Follow the procedures below:

On each subplot, use the transect layout shown to sample bare ground. Using a cloth tape or carpenter's tape, lay out the 25-foot transects in the appropriate cardinal directions from the subplot center. Beginning at the 1-foot mark, place the tip of a plot stake or sharply pointed staff on the ground along the transects (against the side of the tape) at each 1-foot mark, and count each point that is bare ground (defined above). Record the number of points on the Crown/Ground Cover Supplemental Data form (appendix A.8) and calculate percent by dividing the number of bare ground points by the total number of points in each condition.

Where more than one condition class occurs on the location, separate and record the point samples by condition class.

After all 8 transects (2 per subplot) have been sampled, record (PDR) the percent of bare ground sampled on the condition. Where transects are extremely difficult to sample (e.g., within a cholla cactus clump), provide a best estimate of bare ground.

When collected: Condition Class Status = 1  
Field width: 3 digits.  
Tolerance:  $\pm 10\%$ .

## 2.5.25

### CANOPY COVER SAMPLE METHOD

Record the CANOPY COVER SAMPLE METHOD used to determine LIVE CANOPY COVER, LIVE PLUS MISSING CANOPY COVER, and TOTAL STEMS for the condition. If the Ocular method is not used, the appropriate plot-based method should be selected according to the condition's dimensions and shape. (RM In RMRS, the Subplot and Sub-acre methods are not used.)

When collected: CONDITION CLASS STATUS = 1 or 2  
Field width: 1 digit  
Tolerance: None  
MQO: At least 90% of the time  
Values:

- 1 Ocular method
- 2 Subplot method (RM not a valid code for RMRS)
- 3 Acre method
- 4 Sub-acre method (RM not a valid code for RMRS)

**Ocular method** - The Ocular method is only used in areas that are obviously 0 % LIVE PLUS MISSING CANOPY COVER or obviously greater than 10% LIVE PLUS MISSING CANOPY COVER. In addition to visual inspections of what is on the ground, crews can also use various types of aerial imagery to help determine LIVE CANOPY COVER and LIVE PLUS MISSING CANOPY COVER values using this method. The Ocular method may also be used on condition status 2 plots where access to the nonforest landcover area may be limited or the nonforest condition is a developed non-forest land use. Note that when the Ocular method is used, it is likely to be easier for the observer to ignore subplot boundaries and assess the percentage of tree canopy cover over the condition in question, without regard to the locations of the stems supporting the canopy over the plot.

**Subplot method** - (RM not used in RMRS) The Subplot method is used when the Ocular method is not appropriate and in cases where the terrain, vegetation, and dimensions of a condition or the size of the field crew DO NOT allow a safe or practical sample using the Acre method

1. To estimate cover using the Subplot method, the crew measures the crowns of all live trees, seedlings, and saplings on each of the four 1/24 acre subplots. To estimate total stems per acre, stems >5.0 inches diameter are counted on the subplots and stems <5.0 inches diameter are counted only on the four 1/300 acre microplots located 90 degrees and 12.0 feet from the subplot centers. The sample may consist of any combination of regular subplots and/or phantom subplots, provided all subplots fall entirely in the questionable condition.

2. Install phantom subplots as necessary to yield four 1/24-acre sample areas that fall entirely within the questionable condition. Record the location of these phantom or temporary subplots on your four point plot sketch and monument. Establish phantom plots using the following protocol (Figure 15):
  - (a) Begin by locating the phantom subplots using the "highest" numbered regular subplot that falls in the questionable condition (e.g., 4 is the highest numbered regular subplot, next 3 and then 2). The phantom subplots are located in the following fashion: 1) 120.0 feet at 360 degrees, 2) 120.0 feet at 120 degrees, then 3) 120.0 feet at 240 degrees.
  - (b) If this fails to yield 4 subplots that fall entirely within the questionable condition, install the remaining phantom subplots off the next highest numbered regular subplot that falls in the questionable condition.
  - (c) If this fails to produce a suitable location, rotate the phantom subplot off the other phantom subplots in the attempted order of installation until 4 subplots have been located in the questionable condition.

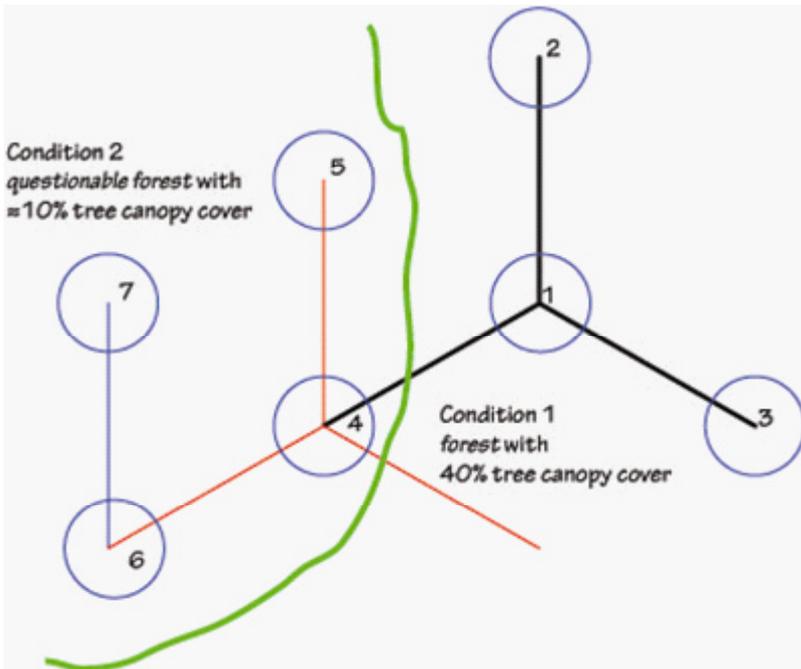


Figure 15. Example of the subplot method phantom subplots.

3. The Subplot method uses a 1/6-acre sample, so it would require a total of 726 ft<sup>2</sup> of LIVE PLUS MISSING CANOPY COVER to reach 10% threshold and be sampled as accessible forestland. If the sample of

the subplot method does not reach the 10% threshold for LIVE PLUS MISSING CANOPY COVER, the stem counts are used to determine if there are 200 live stems per acre.

The sum of the stem counts on the subplots and microplots have to meet the following tally combinations to be sampled as accessible forestland (assuming 4 subplots and microplots are used):

Microplot Count (<5.0 inch DBH/DRC)	Subplot Count (>5.0 inch DBH/DRC)	Estimated Stems per Acre
3	0	225
2	9	204
1	21	201
0	34	204

**Acre method** - The Acre method is used when the Ocular method is not appropriate and when it is safe and practical to sample on the entire acre.

1. To determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached (4356 ft<sup>2</sup>), the crew samples all live, dead, and missing tree canopies on the one-acre sample plot (117.75 foot radius) as described in LIVE PLUS MISSING CANOPY COVER.
2. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is met and there is additional LIVE PLUS MISSING CANOPY COVER on the acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the Ocular method (**RM** In RMRS, if the Acre method is used, do not estimate once the 10% LIVE PLUS MISSING CANOPY COVER threshold has been met. The whole acre must be sampled.)
3. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is not met, a sample of all live seedlings, saplings, and trees that are within the acre plot (117.75 foot) radius is required. If the one-acre plot tree count reaches the sum of 200 stems of any combination of trees, seedlings and saplings, the condition will be sampled as accessible forestland.
4. As with the Subplot method, the sample acre (117.75 foot radius plot) must fall entirely in the questionable condition.

#### Percent Canopy Cover Calculation for Acre method:

If a condition is close to 10% canopy cover, and other methods may not accurately represent tree canopy cover due to irregular spatial distribution of tree canopies (e.g., clumpiness), the Acre method provides another estimate of the total tree canopy area within the radius of a 1-acre plot located within the condition in question.

Given:

1. The area of an acre is 43,560 ft<sup>2</sup>.
2. A 1-acre circle has a radius of 117.75 ft.
3. 10% of 1-acre is 4,356 ft<sup>2</sup>.

and assuming the canopies to be ellipses:

1. Measure the approximate canopy diameters (d) of the long axis and short axis for each tree on the acre.
2. Calculate the canopy area for each tree as  $\text{Canopy Area} = \pi * ((\text{long axis } d) / 2 * (\text{short axis } d / 2))$ .
3. Add up the Canopy Areas, and divide by 435.6 (1% of an acre) to obtain percent cover (truncate)

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. This may cause difficulties determining exactly where the forested area meets the minimum canopy cover or stem count criteria. For these cases, determine where the land clearly meets the minimum requirements, and where it clearly is less than required. 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.

If the Acre plot falls on or very near a transition, the Acre plot should be moved into the condition identified at plot center (Figure 16).

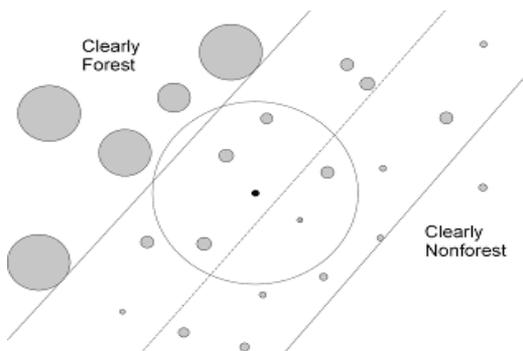


Figure 16. Example of classifying the condition class of the subplot in a transition zone with forest/Nonforest encroachment.

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 meets cover / stem count criteria 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 does not clearly meet cover / stem count criteria where it meets the nonforest, determine where the land clearly meets the minimum requirements, and where it clearly is less than required. Divide the zone between these points in half, and classify the entire subplot based on which side of the line the subplot center falls.

**Sub-acre method - (RM not used in RMRS)** The Sub-Acre method is only used when the Ocular method is not appropriate and only when the Acre or Subplot methods can not be established due to the condition's shape, dimensions or accessibility.

1. Ensure that the canopy cover sample area is representative of the condition in question.
2. Determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached. The crew samples all live, dead, and missing tree canopies on the canopy cover sample plot as described above in LIVE PLUS MISSING CANOPY COVER. The 10% threshold is dependent on the sample plot size and respective area in square feet.
3. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is met and there is additional LIVE PLUS MISSING CANOPY COVER on the sub-acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the ocular method.
4. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is not met, the estimate of all live seedlings, saplings, and trees (stem count x appropriate stem count multiplier) must be 200 or greater for the condition to qualify as accessible forest land.
5. As with the Acre and Subplot method, the sub-acre sample plot(s) must fall entirely in the questionable condition.
6. Potential circular plot sizes and appropriate scaling factors:

Acre Fraction	Radius (ft)	Area (ft <sup>2</sup> )	10% Cover (ft <sup>2</sup> )	Stem Count Multiplied
1	117.7	43,560	4356	x1
1/2	83.3	21,780	2178	x2
1/3	67.6	14,520	1452	x3
1/4	58.9	10,890	1089	x4
1/5	52.7	8,712	872	x5
1/6	49.0	7,260	726	x6

#### 2.5.25.1RM CROWN COVER

Use the following line transect method to determine the percentage of crown cover when Canopy Cover Sample Method = 1 (Ocular Estimate). Establish four 25-foot transects at each subplot, in the cardinal directions from subplot center. Each transect begins 1 foot from the subplot stake; measure the length

of live tally tree species crown intercepted (above or below) by the 4 transects at each subplot.

If a condition class boundary crosses the transect line, keep both the length of transect and the intercepted crown cover separated by condition class.

For each condition class, divide the total live tree crown length measured by the total length of transect (400-feet for single-condition class locations).

Note: If the slope of the transects is greater than 10 percent, measure both the transect and the crown length intercept along the slope; correct both the length of crown and the length of the transect for slope before adding to the other transects.

For example, the following crown length was intercepted for the 4 subplots:

Subplot	Condition 1		Condition 2		
	length (feet)	intercept (feet)	length (feet)	intercept (feet)	
1	100	32			
2	75	22	25	19	(total length =100 feet)
3	100	38			
4	45	16	55	40	(total length =100 feet)
<b>TOTAL</b>	<b>320</b>	<b>108</b>	<b>80</b>	<b>59</b>	

Dividing the total crown intercept by the total length of transect for each condition gives 34 percent ( $108/320 = .34$ ) crown cover for condition class 1 and 74 percent ( $59/80 = .74$ ) crown cover for condition class 2.

If a condition contains less than 400 feet of transect (most multi-condition class plots), or if the transects do not represent the apparent crown cover of the condition class, record the calculated crown cover for this variable and record an estimate of cover in the condition class comments along with an explanation. For macroplots that do not have an accessible forested condition on the subplot, ocularly estimate the crown cover for the forested condition occurring in the macroplot.

When Canopy Cover Sample Method = 3 (Acre method) use the actual calculated cover and do not do transects.

When collected: Condition Class Status = 1 and Canopy Cover Sample Method = 1 (Ocular Estimate)

Field width: 3 digits.

Tolerance:  $\pm 10\%$ .

Record the percentage of crown cover, to the nearest 1 percent, of all established tally seedlings, saplings, and trees (refer to the tally tree species

list in Appendix 3). Crown cover is the percentage of ground surface area covered by a vertical projection of the live crowns.

### 2.5.26 LIVE CANOPY COVER

Record the percentage of LIVE CANOPY COVER for the condition. Include live tally trees, saplings, and seedlings that cover the sample area. For conditions where the LIVE CANOPY COVER is low and there is a question whether it meets 10 percent LIVE CANOPY COVER, the crew will measure every crown width within the canopy cover sample area. When the 10% threshold is determined by measuring crown widths, the crew can use the ocular method to determine the total LIVE CANOPY COVER value.

Canopy widths are measured using the ellipse formula for calculation of canopy area. This requires two measurements. The first measurement is the long axis diameter. The second measurement is made at 90 degrees to the first measurement at the widest point of the crown (Figure 17). Canopy area =  $\pi * ((\text{long axis diameter}/2) * (\text{90 degrees axis diameter}/2))$ .

- Do not include the crown portion of trees, saplings, or seedlings that are vertically overtopped by other trees, saplings or seedlings.
- Only include tree canopy measurements from trees with stems that originate within the sample area, although canopy measurements can extend outside the sample area.
- Occasionally, a branch may protrude abnormally, but the lateral crown line is drawn across the portion of the branch which includes the "normal outline" of the tree.
- For leaning trees, ocularly upright the trees and measure crowns as if the trees were upright.

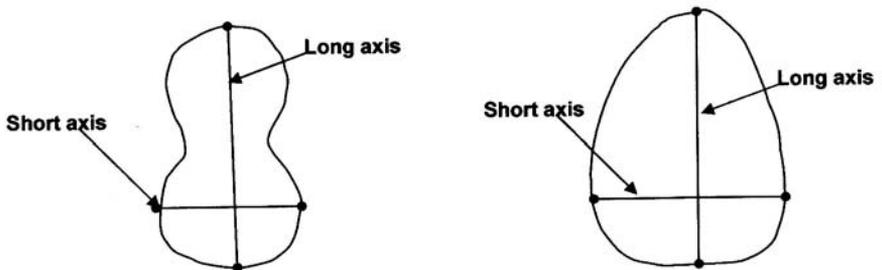


Figure 17. Examples of where to measure canopy widths.

LIVE CANOPY COVER can be based on an ocular estimate when the condition in question is certain to contain greater than 10% LIVE PLUS MISSING CANOPY COVER or TOTAL STEMS greater than 200.

When collected: All CONDITION CLASS STATUS = 1 or 2

Field width: 2 digits

Tolerance: 0 – 12% - No errors

13 – 20% - 10% error

21 – 100 - 25% error

MQO: At least 99% of the time

Values: 00 – 99 (where 99=99-100 %)

**2.5.27 LIVE PLUS MISSING CANOPY COVER**

Record the percentage of LIVE PLUS MISSING CANOPY COVER for the condition by adding the LIVE CANOPY COVER plus the estimated missing canopy cover that existed prior to disturbance (harvesting, fire, chaining, etc). Include live and dead and removed tally trees, saplings, and seedlings. Base the estimate on field observations, aerial photos, historical aerial imagery, and similar evidence of undisturbed conditions. The total of the LIVE PLUS MISSING CANOPY COVER cannot exceed 100%.

When collected: CONDITION CLASS STATUS = 1 or 2

Field width: 2 digits

Tolerance: 0 – 12% - No errors

13 – 20% - 10% error

21 – 100 - 25% error

MQO: At least 80% of the time

Values: 00 – 99 (where 99=99-100 %)

**2.5.28 TOTAL STEMS**

Record the estimated number of live stems per acre of the condition. Base the estimate on actual stem count of tally tree species within the sample area. When using the subplot method, use the appropriate expansion factor according to tree and plot size to obtain an estimate of the number of live stems per acre. Using microplots (i.e., the subplot method) to estimate stems <5.0 inches diameter in conditions with wide spacing or 'clumping' is discouraged. RM note: See Section 2.5.25 for additional sampling options.

When collected: CONDITION CLASS STATUS = 1 or 2

Field width: 5 digits

Tolerance: 10%

MQO: At least 90% of the time

Values: 00000 - 99999

**2.6RM CONDITION STATUS CHANGE**

Record the code that describes the type of Condition Class Change that has occurred since the previous inventory.

When collected: SAMPLE KIND 2; Condition Class Change =1.

Field width: 1 digit.

Tolerance: No errors

Code	Present	Past
------	---------	------

1	Accessible forest land (CONDITION STATUS = 1)	Previously all accessible forest land (1)
2	Not accessible forest land (2, 3, 4, 5)	Previously all not accessible forest land (2, 3, 4, 5)
3	Accessible forest land (1)	Some portion of this condition was not accessible forestland (2, 3, 4, 5)
4	Not accessible forest land (2, 3, 4, 5)	Some portion of this condition was accessible forest land (1)

Note: If a condition class has changed since the previous inventory, the past  
CONDITION CLASS NUMBER stays with the condition class that it most  
resembles.

### 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.

Tolerance on newly established plots:

Subplot:  $\pm 8$  feet

Microplot:  $\pm 1$  foot

#### 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 forest land condition class. In regions measuring the CORE OPTIONAL macroplot, indicate whether or not this macroplot currently has at least one forested condition class. In situations where a subplot/macroplot is denied access or hazardous, but obviously contains no forest land, record SUBPLOT/MACROPLOT STATUS = 2. In cases where a subplot/macroplot is access-denied or hazardous and has the possibility of forest, record SUBPLOT/MACROPLOT STATUS = 3.

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
- 2 Sampled – no accessible forest land condition present on subplot
- 3 Nonsampled – possibility of forest land
- 4 Sampled – QA crew did not measure trees, saplings, or seedlings. QA crew did measure all other data items (condition, boundary, and subplot-level data). For use only on check plots (QA STATUS = 2 - 6). Not a legal entry on production plots (QA STATUS = 1 or 7).

### 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.
- 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.
- 04 Time limitation – This code applies to full subplots that cannot be sampled due to a time restriction. This code is reserved for areas with limited access, and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous). Use of this code requires notification to the field supervisor. This code should not be used for an entire plot (use code 8 (skipped visit) when an entire plot is skipped; see Section 1.5).
- 05 Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.
- 10 Other – This code is used whenever a condition class is not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.
- 11 Ocean – Subplot falls in ocean water below mean high tide line. (RM Not a valid IWFA code.)

### 3.4

#### NONFOREST SUBPLOT/MACROPLOT STATUS

Record the code that describes the sampling status of the other-than-forest subplot, i.e., SUBPLOT/MACROPLOT STATUS = 2. In cases where subplot is denied access or hazardous, but obviously contains no nonforest land,

i.e., subplot is either noncensus water or census water, record NONFOREST  
SUBPLOT/MACROPLOT STATUS = 2.

When collected: When NONFOREST SAMPLING STATUS = 1 and SUBPLOT/  
MACROPLOT STATUS = 2

Field width: 1 digit

Tolerance: no errors

MQO: At least 99% of the time

Values:

- 1 Sampled – at least one accessible nonforest land condition present on the subplot.
- 2 Sampled – no nonforest land condition present on subplot, i.e., subplot is either census and/or noncensus water.
- 3 Nonsampled nonforest

### 3.5 NONFOREST SUBPLOT/MACROPLOT NONSAMPLED REASON

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

When collected: When NONFOREST SAMPLING STATUS = 1 and SUBPLOT/  
MACROPLOT STATUS = 2 and NONFOREST SUBPLOT/MACROPLOT  
STATUS = 3

Field width: 2 digits

Tolerance: no errors

MQO: At least 99% of the time

Values:

- 02 Denied access – A subplot/macroplot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. Because a denied-access subplot 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 situation – A subplot/macroplot 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.
- 04 Time limitation – This code applies to a full subplot/macroplot that cannot be sampled due to a time restriction. This code is reserved for areas with limited access, and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous). Use of this code requires notification to the field supervisor.
- 10 Other – This code is used whenever a subplot/macroplot is not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

### 3.6 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

### 3.7 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

### 3.8 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 all subplots with at least one one accessible nonforest condition class present on subplot when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT/MACROPLOT STATUS = 2 and NONFOREST SUBPLOT/MACROPLOT STATUS = 1)Field width: 3 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 000, 005 to 155

### 3.9 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 all subplots with at least one one accessible nonforest condition class present on subplot when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT/MACROPLOT STATUS = 2 and NONFOREST SUBPLOT/MACROPLOT STATUS = 1)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

### 3.10 SNOW/WATER DEPTH

Record to the nearest 0.1 foot 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, Vegetation Profile data) 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/MACROPLOT STATUS = 1) or all subplots with at least one accessible nonforest condition class present on subplot when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT/MACROPLOT STATUS = 2 and NONFOREST SUBPLOT/MACROPLOT STATUS = 1)

Field width: 2 digits (x.y)

Tolerance: +/- 0.5 ft

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

Values: 0.0 to 9.9

### 3.10.1RM VEGETATION SAMPLE STATUS

Record whether Understory Vegetation is to be sampled on the subplot. If snow or water inhibits accurate data collection, do not collect any Understory Vegetation data.

When Collected: SUBPLOT STATUS = 1 and subplot center condition is forested or SUBPLOT STATUS = 2, nonforest SUBPLOT STATUS = 1 and subplot center condition is nonforest

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 1 Vegetation sampled
- 2 Vegetation not sampled

### 3.10.2RM VEGETATION NOT SAMPLED REASON

Record a reason that Understory Vegetation cannot be sampled on the subplot.

When collected: When VEGETATION SAMPLING STATUS = 2

Field Width: 2 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 04 Time limitation
- 10 Other (snow or water covering vegetation)

### 3.11 SUBPLOT/MACROPLOT CONDITION LIST

This is a listing of all condition classes located within the 24.0-foot radius around the subplot center. In regions measuring the CORE OPTIONAL macroplot, this is a listing of all condition classes located within the 58.9-foot 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 plots

Field width: 4 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1000 to 9876

### 3.11.1RM ROOT DISEASE SEVERITY RATING (Collected only in Region 1 in ID and MT)

For each subplot, record a root disease severity rating for the subplot area. Apply the severity rating on the basis of the percentage of the subplot area affected by root disease; use either canopy reduction or estimate ground area of the plot impacted. Consider the total impact, not just since the last inventory. The ground area impacted is estimated by projecting the drip line of the overstory crowns onto the ground and estimating the percentage of the area occupied by symptomatic or dead trees. A more direct method is to visualize the root system of infected trees, and then estimate the total root area of the subplot affected.

Generally, the tree species most susceptible to root disease are Douglas-fir, white fir, and subalpine fir. The most tolerant are pine species, though in some areas ponderosa pine is the preferred host species for annosum root disease. It is important to determine the most susceptible species in an area in order to properly rate plots for root disease severity. When evaluating the severity of root disease for the subplot area, consider what is happening on a broader scale, such as at the stand level. Some species are susceptible at a young age, but develop tolerance with age, which needs to be considered when determining the most susceptible species in an area. A good example of this is with *Armillaria* root disease. All conifer species are susceptible to *Armillaria* at a young age, but western larch and the pines develop a tolerance to the disease at about 25 to 30 years of age.

When collected: Subplot/Macroplot Status = 1

Field width: 1 digit.

Tolerance:  $\pm 1$  class.

Values:

- 0 No evidence of root disease visible within 50 feet of the subplot perimeter.
- 1 Root disease present within 50 feet of the subplot perimeter, but no evidence of root disease on subplot.
- 2 Minor evidence of root disease evident on the subplot -- suppressed tree killed by root disease, or minor part of overstory showing symptoms of infection. Little or no reduction in canopy closure or volume.
- 3 Up to 20 percent canopy reduction evident -- as a result of the death of one codominant tree on an otherwise fully stocked site. In the absence of mortality, numerous trees showing symptoms of root disease infection.
- 4 20 to 30 percent canopy reduction -- as a result of root disease-caused mortality. The presence of snags and downed dead trees as a result of disease, leaving gaps in the tree canopy, as well as live trees with advanced symptoms of disease.
- 5 30 to 50 percent canopy reduction -- as a result of root disease. Almost half of ground area of subplot considered infested with evidence of root disease-killed trees. Note: Subplots representing mature stands with

half of their volume in root disease-tolerant species usually don't go much above severity 5 because of the ameliorating effect of the disease tolerant trees.

- 6 50 to 75 percent canopy reduction -- most of the ground area considered infested as evidenced by symptomatic trees. Much of the canopy variation in this category results from disease-tolerant species occupying infested ground.
- 7 75 percent or more canopy reduction -- subplots with this severity level usually were occupied by only the most susceptible species. Very few of the original overstory trees remain, although the infested ground area is often densely stocked with regeneration of the susceptible species.
- 8 Entire subplot falls within a definite root disease patch with only one or very few susceptible overstory trees present (standing/live) within the canopy.
- 9 The entire subplot falls within a definite root disease patch with no overstory trees of the susceptible species present within the canopy.

## 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

Within the sampled area on each microplot, subplot, and macroplot, reference 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 18 and 19). 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.

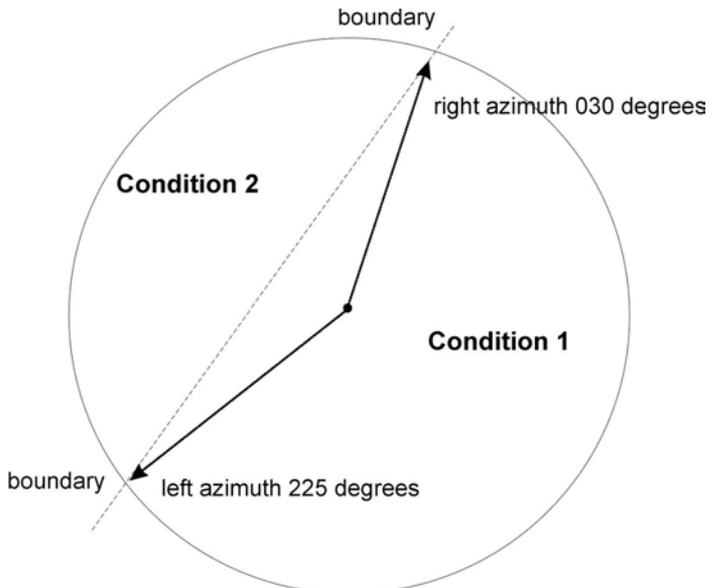


Figure 18. How to measure a straight boundary on a microplot, subplot, or macroplot.

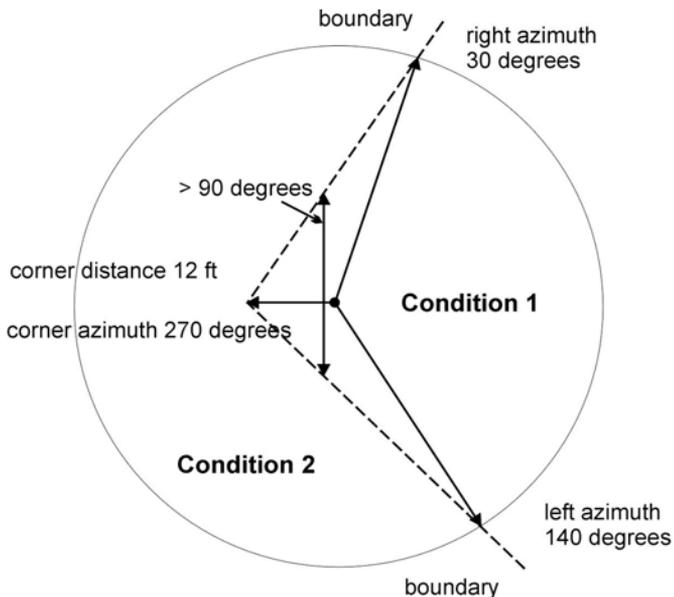


Figure 19. How to measure a boundary with a corner on a subplot and macroplot.

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 of the inclusion relative to subplot center.
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. (RM Map only when the delineation between two conditions are distinct, obvious, and repeatable).

## 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 Hectare plot boundary (coded from subplot 1 only)

### 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.
- 1 New boundary, or boundary data has been changed to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded.
- 2 Boundary has been changed to correct an error from previous crew.
- 3 Boundary has been changed to reflect a change in variable definition.

#### 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: +/- 10 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: +/- 10 degrees

MQO: At least 90% of the time

Values: 000 to 360

#### 4.2.7 CORNER DISTANCE

Record the horizontal distance, to the nearest 1 foot, 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: +/- 1 ft

MQO: At least 90% of the time

Values:

microplot 001 to 007 ft (actual limiting distance is 6.8 ft)

subplot 001 to 024 ft

macroplot 001 to 059 ft (actual limiting distance is 58.9 ft)

hectare 001 to 185 ft

#### 4.2.8 RIGHT AZIMUTH

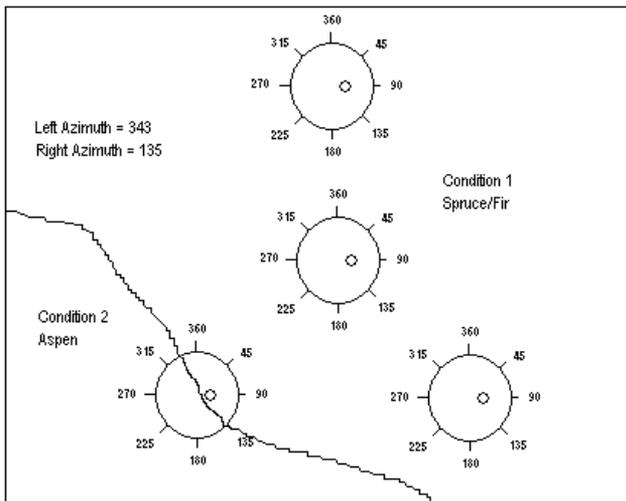
Record the azimuth from subplot, microplot, or macroplot center to the farthest right point (facing the contrasting condition) where the boundary intersects the subplot, microplot, or macroplot circumference.

When collected: All boundaries

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time



RM Figure 16.1. Condition Boundary Map Example:

## 5.0

### TREE AND SAPLING DATA

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

RM Tally trees also include down mortality trees  $\geq 5.0$  inches in diameter or were at least 5.0 inches in diameter within the last 5 years on SAMPLE KIND 1 (initial plot establishment) and SAMPLE KIND 3 (replacement plot) visits.

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

For multi-stemmed 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 5.0 inches 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.

For non-woodland species (Appendix 3) to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet.

The portion of a bole on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and may qualify as Down Woody Material (DWM). See DWM procedures for tally criteria.

For 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 woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical as measured from the base of the tree to 1.0 foot

above point of DRC measurement..

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/DRC qualify as tally trees, provided they meet the size requirement.

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, give one of the tree data lines a PRESENT TREE STATUS = 0, RECONCILE = 7 or 8, and a TREE NOTE. The remaining tree data line receives PRESENT TREE STATUS = 1 or 2 with DIAMETER CHECK = 2, and a TREE NOTE.
- 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 missed tree. Use the existing tree data line to represent one of the stems. PRESENT TREE STATUS = 1 or 2, DIAMETER CHECK = 2, and a TREE NOTE. The second stem would get PRESENT TREE STATUS = 1 or 2, RECONCILE 3 or 4, and a TREE NOTE.

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( if macroplots are being sampled).

## 5.1 SUBPLOT NUMBER

Record the subplot number where the tree occurs.

**When Collected:** All live tally trees  $\geq 1.0$  inches DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

**RM When Collected:** Record for every line of data.

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. Missed trees, ingrowth trees (trees that either grew over the 1.0-inch threshold on the microplot or grew onto the subplot), and throughgrowth trees (trees on the microplot that were less than 1.0 inch diameter at the previous inventory and are now 5.0-inches diameter or larger) 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.

If TREE RECORD NUMBERS are not assigned in the field, record 000. (RM Non-tally site trees are assigned TREE RECORD NUMBER 000 if referenced to a subplot.)

#### **RM Remeasure and P3 plots**

If the previous plot was a P3 plot, or a remeasurement location on the same plot layout, number all resampled trees using the past tree numbers listed on the old data. Number new trees by beginning where the highest numbered re-sampled tree left off ("next available tree number" on preprinted data sheet). For example, if the highest tree number on an old subplot/microplot was 11, the first new tree will be 12. Be sure to check microplot sapling numbers from the previous plot before continuing with new subplot tree numbers.

#### **RM Subplot tally**

Standing over the subplot center stake, start at 001° azimuth and rotate clockwise numbering sequentially all tally trees 5.0-inches and greater, beginning with TREE RECORD NUMBER 001. For example, the first tally tree is coded 001, the second tree is 002, and so on. If a tree tallied on the microplot during the previous inventory has grown to 5.0 inches DBH/DRC, it will be tallied on subplot this inventory. On remeasurement plots with a subplot center microplot, account for the old saplings listed in the historic file. If any saplings have grown to be  $\geq 5.0$  inches in diameter, the tree must be tallied on the subplot and assigned the next available tree number. Do not reuse the previously assigned tree number.

#### **RM Microplot tally**

Next, standing over the microplot center stake, begin at 001° azimuth and rotate clockwise to number the live tallied saplings; begin numbering where the subplot tally tree numbers left off.

#### **RM Nontallied Site trees**

Assign nontallied site trees to the nearest subplot and tree number of "0" (see Section 7.1.2RM for more information).

When Collected: All live tally trees  $\geq 1.0$  inch DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

RM When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot. 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 20).

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

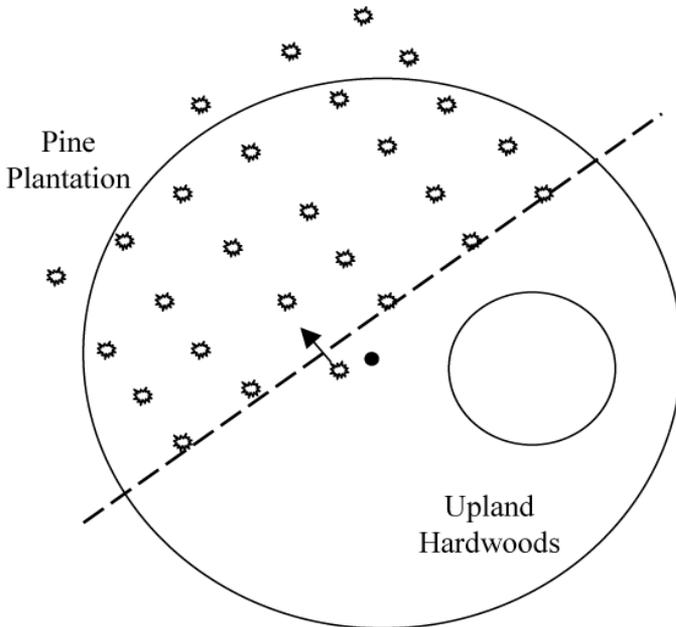


Figure 20. Ragged **CONDITION CLASS** boundary and tree condition class designation.

### 5.4 AZIMUTH

Record the **AZIMUTH** from the subplot center (for trees greater than or equal to 5.0 inches DBH/DRC) or the microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH/DRC), sight the center of the base of each tree with a compass. Sight to the geographic center for multi-stemmed 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.

**RM** Downed live and downed mortality trees - Azimuth taken to the point of origin (e.g. center of the base of tree stem or bole, root system depression).

**RM** Nontallied site trees – Azimuth taken using procedures described above from the nearest subplot center stake.

**RM** Remeasure and P3 plots: use the same azimuths as previously recorded. If the previous crew made an obvious error, record the correct azimuth and make a note on the preprinted form.

When Collected: All live tally trees  $\geq 1.0$  inch DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

**RM** When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot.

Field width: 3 digits

Tolerance: +/- 10 degrees

MQO: At least 90% of the time

Values: 001 to 360

## 5.5

### HORIZONTAL DISTANCE

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center (for trees greater than or equal to 5.0 inches DBH/DRC) or microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH/DRC) to the pith of the tree at the base. For all multi-stemmed woodland trees (woodland species indicated in Appendix 3), the HORIZONTAL DISTANCE is measured from subplot or microplot center to the "geographic center" of the tree. The geographic center is a point of equal distance between all tallied stems for a given woodland tree.

**RM** Downed live and mortality trees - Horizontal distance taken to the point of origin (e.g. center of the base of tree stem or bole, root system depression).

**RM** Nontallied site trees – Horizontal distance measured using the procedures described above from the nearest subplot center stake.

**RM** Remeasure and P3 plots: use the same distances as previously recorded. If the previous crew made an obvious error (i.e. recorded 1.0' instead of 10.0'), record the distance and make a note on the preprinted form.

When Collected: All live tally trees  $\geq 1.0$  inch DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

**RM** When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot.

Field width: 3 digits (xx.y)

Tolerance: Microplot: +/- 0.2 feet

Microplot woodland species: +/- 0.4 feet

Subplot: +/- 1.0 ft; **RM** +/- .1 foot for  $\geq 23.0$  feet

Subplot woodland species: +/- 2.0 feet

Annular plot: +/- 3.0 feet  
Annular plot woodland species: +/- 6.0 feet  
MQO: At least 90% of the time  
Values: Microplot: 00.1 to 06.8  
Subplot: 00.1 to 24.0  
Annular plot: 24.1 to 58.9

## 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 the tree's volume to the proper component of volume change.

When collected: On remeasurement plots (SAMPLE KIND = 2), all previously tallied trees  $\geq 1.0$  inch 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 the tree's volume to the proper component of volume change.

When Collected: All new live tally trees  $\geq 1.0$  inch DBH/DRC  
All new dead tally trees  $\geq 5.0$  inches  
On remeasurement plots, all previously tallied trees  
**RM** When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot.  
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 95% of the time  
Values:

- 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. 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 (removed).

**RM** This also includes down mortality trees.

- 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  $\geq 1.0$  inch DBH/DRC (PRESENT TREE STATUS = 1 and no PREVIOUS TREE STATUS), all new dead tally trees  $\geq 5.0$  inches (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 – 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 5.0 inches DBH/DRC and larger, within the microplot, which was not missed at the previous inventory. **RM** Tree would have been a seedling or not existing at the previous inventory and grown to 5.0 inches or more.
- 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.
- 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 5.0 inch 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 5.0 inch threshold on the subplot and is currently greater than or equal to 1.0 inch 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 or not a tree qualifies as standing dead. For non-woodland species (Appendix 3) trees to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the base of the tree to 4.5 feet. See Figures 21-23 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 4.5 feet), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

For 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 woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical as measured from the base of the tree to 1.0 feet above DRC measurement point..

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 only: All dead tally trees  
(PRESENT TREE STATUS = 2)

RM When collected: All dead tally trees.

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.

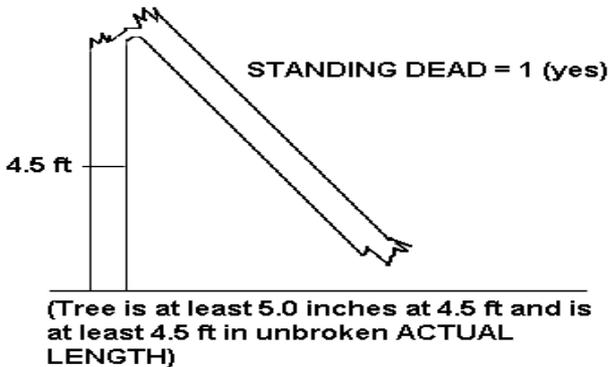


Figure 21. Example of an unbroken bole to 4.5 feet.

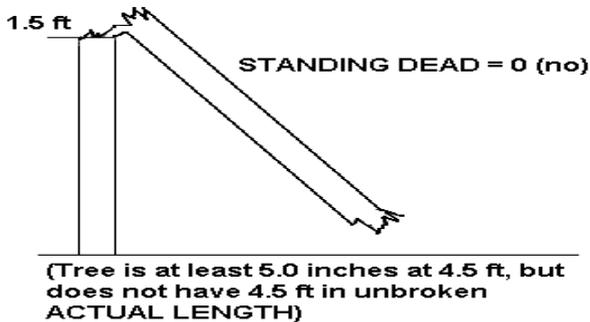


Figure 22. Example of an unbroken length of < 1.5 feet.

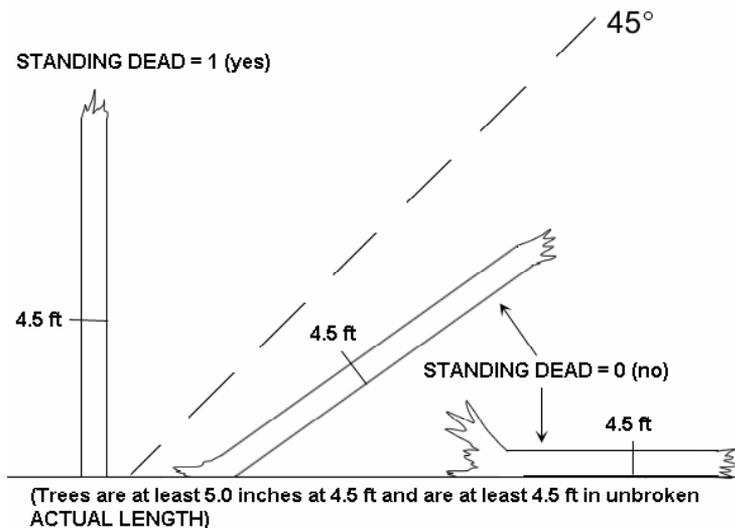


Figure 23. Other examples of dead trees.

### 5.7.3

#### MORTALITY (CORE OPTIONAL)

(Also see MORTALITY YEAR - Section 5.22)

Record a mortality code for any tree that was live within the past five years but has died, regardless of cause of death. This information is needed to correctly assign the tree's volume to the proper component of volume change.

When Collected: All standing dead trees 5.0 inches DBH/DRC and larger that were live within the past 5 years if no previous inventory (PRESENT TREE STATUS = 2 on SAMPLE KIND = 1 or 3 plots).

RM When collected: All dead tally trees  $\geq 5.0$  inches DBH/DRC that were live at the previous inventory or within the past 5 years if no previous inventory.

RM When collected NM only: All dead tally trees  $\geq 5.0$  inches DBH/DRC that were live at the previous inventory or within the past 10 years if no previous inventory.

Field width: 1 digit

Tolerance: No errors

MQO: At least 85% of the time

Values:

0 No - tree does not qualify as mortality.

1 Yes - tree does qualify as mortality

RM - Refer to the following as a guide for time-since-death for various tree species:

- 5-needle pines: Within past 5 years - some foliage remaining, >75% twigs and >30% branches left; bark intact.  
More than 5 years - no foliage remaining, <75% of twigs left, many large limbs gone, much bark sloughing (except small trees).
- Ponderosa pine: Within past 5 years - some foliage remaining, >50% twigs and most branches left; most bark intact.  
More than 5 years - no foliage remaining, <50% of twigs left or branches left, most large limbs gone, much bark sloughing (except small trees).
- Spruce: Within past 5 years - some foliage remaining, >30% twigs and >50% of branches left; little bark sloughing.  
More than 5 years - no foliage remaining, <30% of twigs left or >50% branches left, most large limbs gone, bark sloughing (except small trees).
- Lodgepole pine: Within past 5 years - some foliage remaining, >75% twigs and most branches left.  
More than 5 years - no foliage remaining, <75% of twigs left or branches left, bark sloughing.
- Douglas-fir: Within past 5 years - some foliage remaining, >50% twigs and >75% of branches left; bark intact.  
More than 5 years - no foliage remaining, <50% of twigs and 75% or less branches left, most large limbs gone, bark sloughing.
- True firs: Within past 5 years - some foliage remaining, >50% twigs and >70% of branches left; bark unbroken, not curled away from bole.  
More than 5 years - no foliage remaining, <50% of twigs and <75% branches left, most large limbs gone, bark heavily checked and curled, much sloughing.
- Aspen: Within past 5 years - >50% of bark attached to some degree.  
More than 5 years - no foliage remaining, bark <50% attached.
- Pinyon Within past 5 years - some foliage remaining,  
More than 5 years - no foliage remaining.

In all cases, the presence of sporophore of sapwood rotting fungi such as *Polyporus volvatus*, *Fomes pinicola*, etc., is accepted as evidence that the tree has been dead more than 5 years.

## 5.8

### SPECIES

Record the appropriate SPECIES code from the list in Appendix 3. If a species is encountered that is not listed in Appendix 3 and it is not clear if it should be tallied as a tree, consult the Field Supervisor (RM Area Leader). If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to the supervisor (RM Area Leader or Local Botanist) for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES

code later. Use code 0299 for unknown dead conifer, 0998 for unknown dead hardwood when the genus or species codes cannot be used, and 0999 for other or unknown live tree. (RM In situations where tree species and shrub species hybridize (such as *Juniperus scopularum* and *Juniperus horizontalis*) use the species code that best represents the individual plant based upon dominant taxonomic features.) 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. The species code list in Appendix 3 includes all tree species tallied in the Continental U.S. and Alaska. Species designated East/West are commonly found in those regions, although species designated for one region may occasionally be found in another. Species marked as Woodland designate species where DRC is measured instead of DBH. Species that have an "X" in the Core column are tallied in all regions. All other species on the list are "core optional."

When Collected: All live tally trees  $\geq 1.0$  inches DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

RM When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot.

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 1.0- and 4.9-inches are measured on the 6.8-foot radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-foot radius subplots. Macroplot tree diameter thresholds are determined according to regional specifications (see regional field guides for more information).

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 3.0-inches 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 12 inches 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:** All live tally trees  $\geq 1.0$  inches DBH/DRC and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

**RM** When collected: All tally trees and nontallied site trees, including through growth (new trees  $\geq 5.0$  inches DBH/DRC) on the formerly centered microplot and all remeasurement trees.

Field width: 4 digits (xxx.y)

Tolerance: +/- 0.1 inch per 20.0 inch increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2

+/- 1.0 inch per 20.0 inch increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5

For woodland species: +/- 0.2 inch per stem

MQO: At least 95% of the time. For example: a tree with a diameter of 41.0 inches would have a tolerance of plus or minus 0.3 inch. (Note: the MQO for point of measurement is +/- 0.2 inch when the tree is first measured and within 1 ft of the location established by the previous crew when the tree is remeasured.)

Values: 001.0 to 999.9

#### 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. Any change made to this field signifies an error at the time of the previous inventory. DIAMETER CHECK should be set to 2 and an explanation is required in the notes if previous DBH is changed.

**RM** Change the downloaded PREVIOUS DIAMETER AT BREAST HEIGHT if the previous crew made an obvious data entry error by transposing or adding a number to the DBH (i.e. crew entered 17.1 inches DBH last time when it was most likely 7.1 inches DBH).

#### 5.9.2 DIAMETER AT BREAST HEIGHT (DBH)

Unless one of the following special situations is encountered, measure DBH at 4.5 feet above the ground line on the uphill side of the tree. **Round each measurement down to the last 0.1 inch.** For example, a reading of 3.68 inches is recorded as 3.6 inches.

**RM - Measuring DBH.** Tree diameter for non-woodland species, 1.0 inch and larger in diameter, is measured at a point 4.5 feet above ground level (referred to as diameter at breast height or DBH) on the uphill side of the tree. When measuring 4.5 feet above the ground, it is not necessary to remove litter; however, measure below any large woody debris (e.g., down logs or branches) that may be at the base of the tree. For diameter measurement techniques for timber species refer to Appendix B.1.

## RM - Marking timber species.

Avoid extraneous marking of trees on plot with lumber crayon, paint pen, etc. Large numbers (> 2 inches) on tally trees or X's on "out trees" are not acceptable.

1. Standing tally trees. Mark trees 3.0-inches DBH and larger with an aluminum nail at 4.5 feet above the ground on the uphill side of the tree, except aspen or trees with a bole irregularity at breast height (BH). Place the nail first, then measure DBH directly above the nail. Place the nail perpendicular to the tree bole, and etch the tree number in pencil on the nail head. Leave at least 1 inch of the nail exposed to allow for tree growth.  
Mark live aspen and birch 3.0-inches DBH and larger with a paint pen. Put a horizontal line approximately 1 to 2 inches in length at BH. Dead aspen and birch should be marked with an aluminum nail at point of measurement.  
Mark trees with bole irregularities at the point of diameter measurement.
2. Down tally trees. Place a nail on top of the tree bole at the place of diameter measurement; etch the tree number on the head of the nail.
3. Resampled trees. If the old nail is still protruding from the tree  $\frac{3}{4}$  - 1 inch or more, do not re-nail. If the old nail is protruding from the tree  $< \frac{3}{4}$  inch, re-nail next to the old nail and if possible, remove the old nail.

**RM - Reserved locations:** Sample trees (tally trees) will not be painted or scribed. Mark each sample tree  $\geq 5.0$  inches DBH and larger with a tag/nail at ground level either facing subplot center or on the uphill side of the tree if there is a slope. If the sample tree is in view of a known path or trail, place the tag/nail away from the path or trail and note in the field tally. If only saplings are on the subplot mark a couple of them with nails at ground level and note which are so marked. Measure DBH at exactly 4.5 feet above the nail. If diameter needs to be taken at a location other than breast height, measure the distance (to the nearest tenth of a foot) from the nail to the place of diameter measurement, and make a tree note.

**RM - Recording diameter.** Record diameter as a three-digit code to the last whole 0.1 inch. **Always round down.** For example, record a 9.18 inch diameter as 091, and record a 38.23 inch diameter as 382.

For remeasure trees that are currently dead and have a smaller diameter than previously recorded, record the new smaller diameter unless the new diameter is  $< 5.0$  inches for trees that were on the subplot or the new diameter is  $< 1.0$  inch for trees that were on the microplot. If the new smaller diameter is  $< 5.0$  inches (subplot) or  $< 1.0$  inch (microplot), refer to Appendix 8 for the appropriate tree codes.

For downed trees where it is not possible to get a diameter tape around the tree, estimate the diameter to the nearest inch by measuring  $\frac{1}{2}$  the

circumference (with diameter tape) of the tree and multiply by 2.

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 1.0 foot, between 1.0 and 4.5 feet, or above 4.5 feet.
  - **Trees forked below 1.0 foot.** Trees forked below 1.0 foot are treated as distinctly separate trees (Figure 24). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 27 A-C). DBH is measured for each stem at 4.5 feet above the ground. When stems originate from pith intersections below 1 foot, 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 1.0 foot fork again between 1.0 and 4.5 feet (Figure 27-B), the rules in the next paragraph apply.

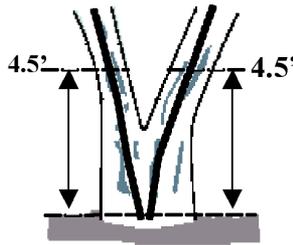


Figure 24. Forked below 1.0 ft.

- **Trees forked between 1.0 foot and 4.5 feet.** Trees forked between 1.0 foot and 4.5 feet are also counted as separate trees (Figure 25), but only one distance and azimuth (to the central stump) is recorded for each stem (Figure 27 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 3.5 feet above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 feet, the limiting distance is the same for all forks--they are either all on, or all off the plot.

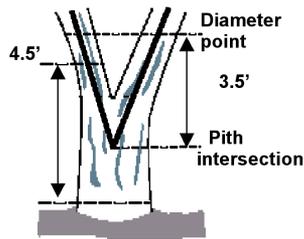


Figure 25. Forked between 1.0-4.5 ft.

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 3.5 feet above the common pith intersection (Figure 27-F).

Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 feet, 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 27-E (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).

- **Trees forked at or above 4.5 feet.** Trees forked at or above 4.5 feet count as one single tree (Figure 26). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH.

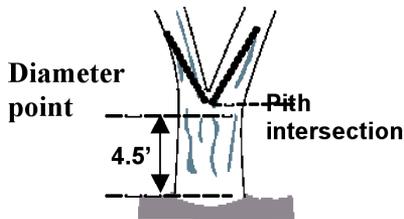


Figure 26. One tree

2. **Stump sprouts:** Stump sprouts originate between ground level and 4.5 feet 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 1.0 foot are measured at 4.5 feet from ground line. Stump sprouts originating between 1.0 foot and 4.5 feet are measured at 3.5 feet above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 1.0 foot. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

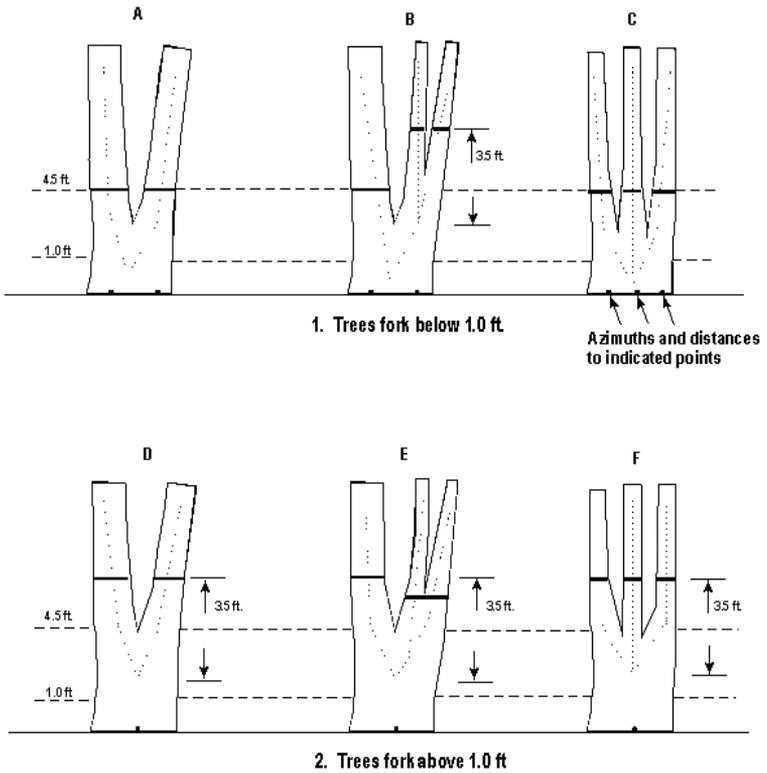


Figure 27. Summary of where to measure DBH, distance, and azimuth on forked trees.

3. Tree with **butt-swell or bottleneck**: Measure these trees 1.5 feet above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 feet or more above the ground (Figure 28).

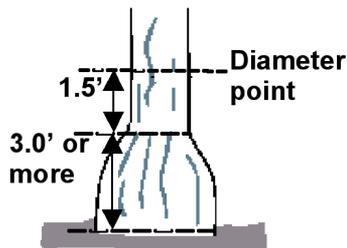


Figure 28. Bottleneck tree

4. **Tree with irregularities at DBH:** On trees with swellings (Figure 29), bumps, depressions, and branches (Figure 30) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

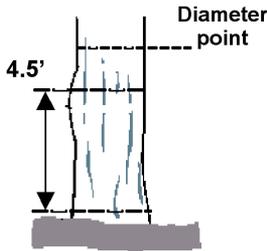


Figure 29. Tree with swelling

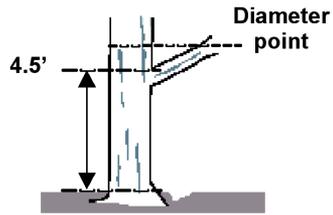


Figure 30. Tree with branch

5. **Tree on slope:** Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 31).

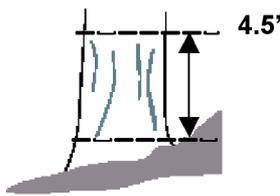


Figure 31. Tree on a slope

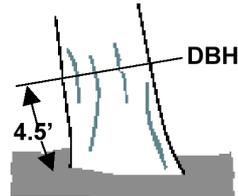


Figure 32. Leaning tree

6. **Leaning tree:** Measure diameter at 4.5 feet from the ground along the bole. The 4.5-foot distance is measured along the underside face of the bole (Figure 32).
7. **Turpentine tree:** On trees with turpentine face extending above 4.5 feet, estimate the diameter at 10.0 feet above the ground and multiply by 1.1 to estimate DBH outside bark. **RM** Turpentine trees are primarily longleaf pine which were scarred/chipped between about 1.5 feet and 8 feet for the collection of sap which was distilled to produce turpentine.
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 0.1 inch, of the wood and bark that is still attached to the tree (Figure 33). 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 29 and 30).

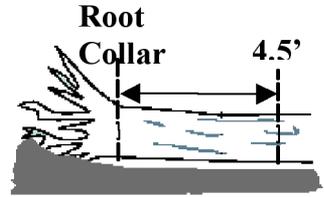
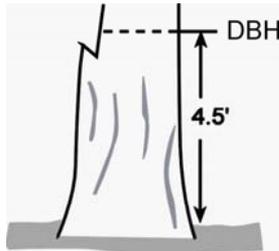


Figure 33. Tree with part of stem missing    Figure 34. Tree on the ground

10. **Live windthrown tree:** Measure from the top of the root collar along the length to 4.5 feet (Figure 34).
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 35).

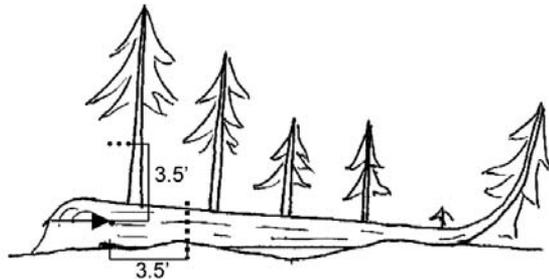


Figure 35. Down tree above duff. (RM Arrow indicates pith center)

- If the pith intersection of the main down bole and vertical tree-like branch occurs below 4.5 feet from the stump along the main bole, treat that branch as a separate tree, and measure DBH 3.5 feet above the pith intersection for both the main bole and the tree-like branch.
- If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet 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 36). 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.

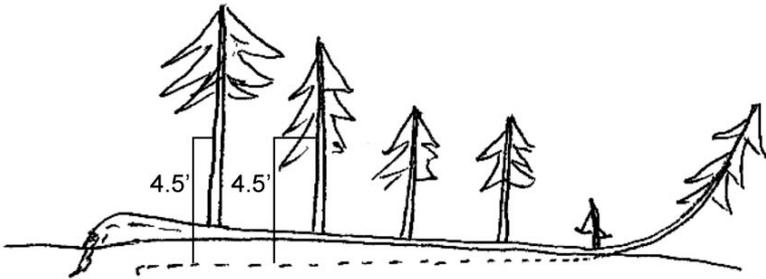


Figure 36. Down tree below duff.

12. **Tree with curved bole (pistol butt tree):** Measure along the bole on the uphill side (upper surface) of the tree (Figure 37).

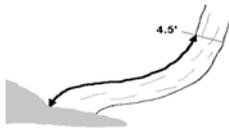


Figure 37. Tree with curved bole (pistol butt tree).

### 5.9.3 PREVIOUS DIAMETER AT ROOT COLLAR

This is the DRC assigned at the previous survey. It has been downloaded from the previous inventory. Any change made to this field signifies a misclassification at the time of the previous inventory. DIAMETER CHECK should be recorded as 2 and an explanation is required in the notes if previous DRC is changed.

**RM** Change the downloaded PREVIOUS DIAMETER AT ROOT COLLAR if the previous crew made an obvious data entry error by transposing or adding a number to the DRC (i.e. crew entered 17.1 inches DRC last time when it was most likely 7.1 inches DRC).

### 5.9.4 DIAMETER AT ROOT COLLAR (DRC)

For species requiring diameter at the root collar (refer to Appendix 3), measure the diameter at the ground line or at the stem root collar, whichever is higher. For these trees, treat clumps of stems having a unified crown and common root stock as a single tree; examples include mesquite, juniper, and mountain mahogany. Treat stems of woodland species such as Gambel oak and bigtooth maple as individual trees if they originate below the ground. For woodland trees, record DRC STEM DIAMETER and DRC STEM STATUS (described below). Then compute and record the DRC value from the individual stem diameter information.

**Measuring woodland stem diameters:** Before measuring DRC, remove the loose material on the ground (e.g., litter) but not mineral soil. Measure just above any swells present, and in a location so that the diameter measurements are a good representation of the volume in the stems (especially when trees are extremely deformed at the base). Stems must be at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point to qualify for measurement. Whenever DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme number of limbs), stems may be estimated and recorded to the nearest 1.0-inch class. Additional instructions for DRC measurements are illustrated in figure 38. For each qualifying stem of the woodland tree, measure and record DRC STEM DIAMETER (5.9.4.1) and indicate the DRC STEM STATUS (5.9.4.2).

**Computing and Recording DRC:** For all tally trees requiring DRC, with at least one stem 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point, DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed DRC tree, the computed DRC is equal to the single diameter measured.

Use the following formula to compute DRC:

$$\text{DRC} = \text{SQRT} [\text{SUM} (\text{stem diameter}^2)]$$

Round the result to the nearest 0.1 inch. For example, a multi-stemmed woodland tree with stems of 12.2, 13.2, 3.8, and 22.1 would be calculated as:  
 $\text{DRC} = \text{SQRT} (12.2^2 + 13.2^2 + 3.8^2 + 22.1^2)$

= SQRT (825.93)  
= 28.74  
= 28.7

**RM** - If a previously tallied woodland tree was completely burned and has re-sprouted at the base, treat the previously tallied tree as dead and the new sprouts (1.0-inch DRC and larger) as part of a new tree.

**RM - Woodland species diameter groupings.**

- **Saplings (microplot)** -- single-stemmed trees between 1.0 inch and 4.9 inches in diameter, and multistemmed trees with a cumulative DRC between 1.0 inch and 4.9 inches in diameter. For multistemmed trees, measure all stems 1.0 inch in diameter and larger, and at least 1 foot in length, to compute DRC.
- **Trees (subplot)** -- single-stemmed trees 5.0 inches in diameter or larger and multistemmed trees with a cumulative DRC of at least 5.0-inches or larger. For multistemmed trees, measure all stems 1.0 inches in diameter and larger, and at least 1 foot in length, to compute DRC (see formula below).

For trees with several small stems, use the following guidelines to help determine possible trees to tally on the subplot:

Stem Size (inches)	Approx. No. Stems Needed to Total 5.0 inches DRC
4	2
3	2-3
2	4-6
1	8-15

**RM - Marking woodland species.** For woodland species 1.0-inch DRC and larger, mark the exact location of stem diameter measurement with a lumber crayon or paint pen. Draw a small line (at least 1.0-inch long and parallel to the diameter tape placement on the stem) on each stem measured for DRC. In addition, for all standing woodland trees, 5.0-inches DRC and larger, place a nail approximately 1 foot from the ground on one stem, preferably the largest or main stem, facing subplot center. Etch the tree number in pencil on the nail head. For down woodland trees, place the nail on top of the largest or main stem. Note: The purpose of the nail is to aid in tree relocation and not to mark the exact location of a stem diameter measurement.

Additional instructions for DRC measurements are illustrated in Figure 38 and 38a.

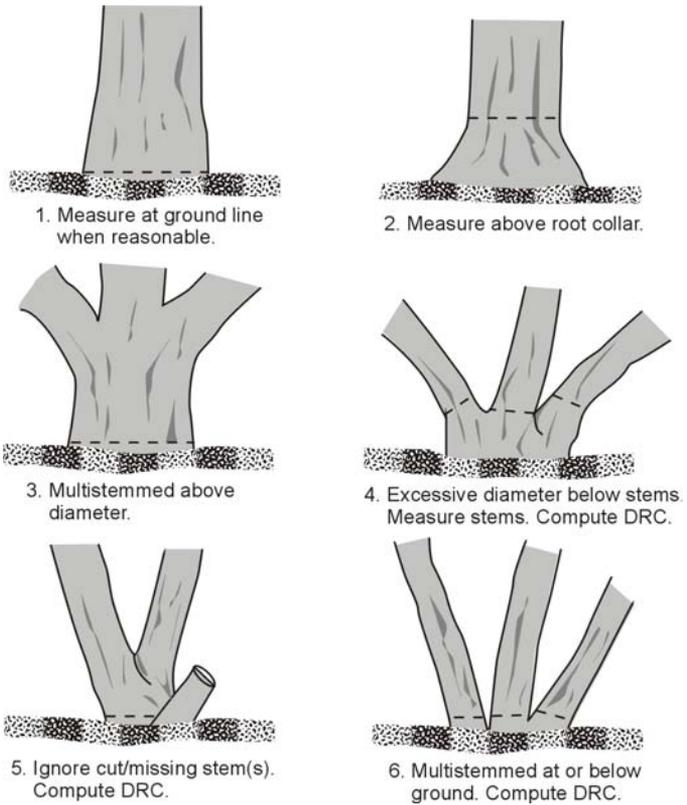
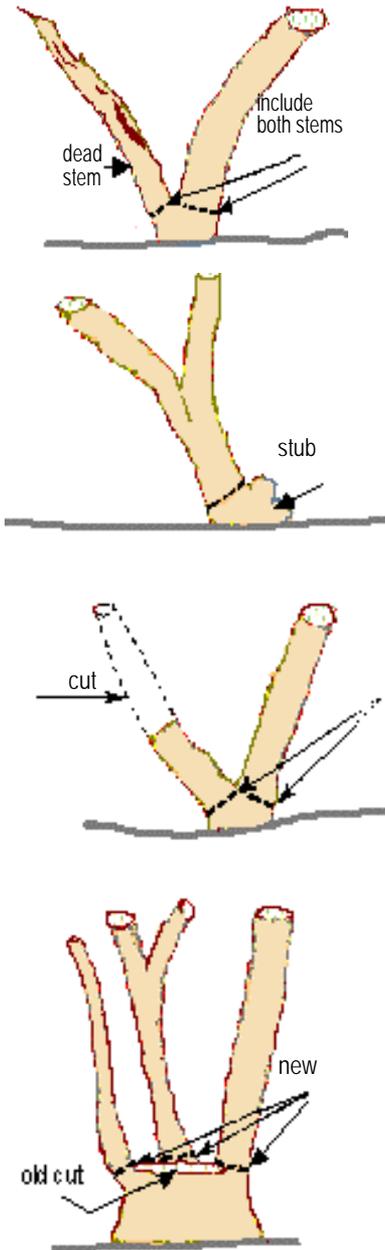


Figure 38. How to measure DRC in a variety of situations.  
RM The cut stem in example number 5 is < 1 foot in length



1. Measure the diameter of a dead stem if it is essentially intact, the volume is sound, and the stem represents a portion of the main tree form. Include the stem diameter in the DRC computation and record the appropriate percent of dead volume.
2. Ignore stem stubs that are deteriorated. Do not deduct missing volume for stems not measured for DRC computation. If cutting or other damage (firescar) on a stem is so old that the tree stem or stub has deteriorated or has been replaced with new growth, do not measure the stem or stub, and do not deduct volume for the original loss.
3. Measure diameter on recently cut stems (>1.0 foot in length and  $\geq 1.0$  inches at one foot) and include them in DRC computation. Record the missing volume. Evidence of a recent cut would be a clean stump, an obvious gap in the crown, and lack of sprouting.
4. When any main stem has been cut and replaced with new growth, measure the stem diameters at the point of new growth; if all stems were cut, measure height from the point of new growth. Measure any uncut stem at the usual point of measurement. If the stem is replaced with new growth, do not deduct missing volume.

RM Figure 38a. How to measure DRC in a variety of situations

**RM - Recording DRC.** Record the calculated DRC as a three-digit code to the last whole 0.1 inch.

If using field forms, record individual stem diameters for multistemmed woodland trees on the "Multistemmed Woodland Species Tally" supplemental form (Appendix A.8). Note: If a multistemmed woodland tree has dead stems, place a "2" on the "Multistemmed Woodland Species Tally" form next to the individual diameter measurement of the dead stem.

#### 5.9.4.1 DRC STEM DIAMETER

Record the diameter of each individual qualifying stem on the woodland tree.

When collected: All stems on woodland tree species that are at least 1 ft in length and at least 1.0 inch in diameter 1 ft up from the stem diameter measurement point

Field width: 4 digits (xxx.y)

Tolerance: +/- 0.2 inch per stem

MQO: At least 95% of the time

Values: 001.0 to 999.9

#### 5.9.4.2 DRC STEM STATUS

Record the status of each individual stem on the woodland tally tree.

When collected: All stems on woodland tree species that are at least 1 ft in length and at least 1.0 inch in diameter 1 ft up from the stem diameter measurement point

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

- 1 live stem
- 2 dead stem

#### 5.10 PAST NUMBER OF STEMS

If the PAST NUMBER OF STEMS does not equal the CURRENT NUMBER OF STEMS, **do not** change the preprinted value. Make a note in TREE NOTES suggesting the possible reason for the difference.

When collected: Value is preprinted for SAMPLE KIND = 2 locations

Field width: 2 digits

Tolerance: No errors

MQO: At least 90% of the time

Values: 1 to 99

#### 5.11 CURRENT NUMBER OF STEMS

Record the total number of stems that were measured for DRC (e.g., record 1 stem as 01; record 12 stems as 12). Count only the number of qualifying stems used to calculate DRC. Qualifying stems are those that are at least 1.0 foot in length and at least 1.0 inch in diameter, 1 foot up from the measurement

point.

When collected: For tallied **woodland** species with at least one stem 1.0 inch in diameter or larger; includes woodland species tallied on the microplot

Field width: 2 digits

Tolerance: No errors

MQO: At least 90% of the time

Values: 1 to 99

## 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.

**RM** - When the diameter of a timber species is taken accurately but not measured at 4.5 feet due to an abnormality, branches, scars, etc., use code "0" and record in **LENGTH TO DIAMETER MEASUREMENT POINT**.

When Collected: All live tally trees  $\geq$  1.0 inch DBH/DRC and standing dead tally trees  $\geq$  5.0 inch DBH/DRC

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 (CORE OPTIONAL)

Record the percent **ROTTEN** or **MISSING** cubic-foot cull for all live tally trees greater than or equal to 5.0 inches DBH/DRC (**CORE**) and all standing dead tally trees greater than or equal to 5.0 inches DBH/DRC.

Record the percentage of **ROTTEN** and **MISSING** cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-foot stump to a 4-inch top **DOB**. Do not include any cull estimate above **ACTUAL LENGTH**. For woodland species, the merchantable portion is between the point of **DRC** measurement to a 1.5-inch **DOB** top.

**RM** - The merchantable portion of a woodland species is defined as the portion of a tree, up to a minimum top diameter of 1.5-inches, and includes all merchantable segments above the place(s) of diameter measurement; do not include sections below the place(s) of diameter measurement. Merchantable segments are stems or branches that are a minimum of 1.0 foot in length

and at least 1.5 inches in diameter (at the top). Branches and stems smaller than 1.5 inches in diameter (or portions of branches and stems smaller than 1.5 inches in diameter, such as tips of branches) are not included when determining volume loss.

ROTTEN and MISSING volume loss is often difficult to estimate. Refer to supplemental disease and insect pests field guides (RM - see below) 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 imbedded in the wood.

Use the following guidelines to estimate tree cull:

1. Timber species, 5.0-inches DBH and larger. Refer to Appendix B.4 (Defect Chart) and supplemental guidelines to compute volume loss.

Regard with suspicion all trees exhibiting any of the defect indicators listed above. As a general rule, when boring trees for age and radial growth data, note the presence of any yellow, yellowish brown, or light brown rot on the increment core; this may indicate the presence of butt or stem rot.

2. Woodland species,  $\geq 5.0$ -inches DRC
  - (a) Rotten volume may be identified by visual evidence of cubical rot, or indirectly detected by a dull hollow sound when the segment is struck by the flat side of a hatchet. Also, if a tree segment is suspected of containing rot, bore into the segment (but only far enough to detect rot), and check the core for punky wood.
  - (b) MISSING volume includes the merchantable portion of the tree that has been cut (e.g., for posts or firewood) or is broken off. If cutting or other damage (fire scar) on a stem is so old that the tree stem or stub has deteriorated or has been replaced with new growth, do not deduct volume for the original loss.

When Collected: CORE: All live tally trees  $\geq 5.0$  inches DBH/DRC

CORE OPTIONAL: All live and standing dead tally trees  $\geq 5.0$  inches DBH/DRC

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 1.0 foot 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: All live tally trees  $\geq 5.0$  inches DBH/DRC  
Phase 2 CORE OPTIONAL: All live tally trees  $\geq 1.0$  inch DBH/DRC and all standing dead tally trees  $\geq 5.0$  inches DBH/DRC  
Phase 3 CORE OPTIONAL: All live tally trees  $\geq 1.0$  inch DBH/DRC, and all standing dead tally trees  $\geq 5.0$  inches DBH/DRC

RM When collected: All tally trees  $\geq 1.0$  inch DBH/DRC.  
Phase 3 CORE: All live tally trees  $\geq 1.0$  inch DBH/DRC  
Field width: 3 digits  
Tolerance: +/- 10 % of true length  
MQO: At least 90% of the time  
Values: 005 to 400

RM - For a standing tree with a missing top, measure the length of the standing portion and add on the estimated length of the missing top (i.e., record the total estimated height). For estimating the length of the missing top, measure any portions of the top that may be on the ground or base the estimate on similar trees nearby.

RM - For all standing trees that lean, go out perpendicular to the lean to determine tree length. For standing trees with excessive lean (more than 15° from vertical, or 27 percent), go out perpendicular to the lean, and visually "up-right" the tree to a vertical position before determining length with a clinometer; also, in the comments column, note that tree length was estimated due to lean.

RM - For live downed tree, measure total tree length directly along the ground, or if necessary, estimate the previous total length. If total length is estimated, record a note in the comments column.

RM - If a tree bole or stem(s) is growing on an old tree stump, measure tree height from the point of new growth to the top of the tree.

#### 5.14.1RM PAST TOTAL TREE LENGTH

This is the TOTAL TREE LENGTH assigned at the previous inventory. It has been downloaded from the previous inventory. If the PAST TOTAL TREE LENGTH is obviously wrong (length recorded as 031 instead of 013), record a new PAST TOTAL LENGTH estimate.

When collected: Verify for remeasure trees  $\geq 1.0$  inch DBH/DRC.  
Field width: 3 digits.  
Tolerance: No errors.

#### 5.15 ACTUAL LENGTH

Record 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 1.0 foot 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: All live and standing dead tally trees (with broken or missing tops)  $\geq$  5.0 inches DBH/DRC

Phase 2 CORE OPTIONAL: All live tally trees (with broken or missing tops)  $\geq$  1.0 inch DBH/DRC and standing dead tally trees (with broken or missing tops)  $\geq$  5.0 inches DBH/DRC

Phase 3 CORE: All live tally trees (with broken or missing tops)  $\geq$  1.0 inch DBH/DRC and standing dead tally trees (with broken or missing tops)  $\geq$  5.0 inches DBH/DRC

RM When collected: All tally trees  $\geq$  1.0 inch DBH/DRC.

Field width: 3 digits

Tolerance: +/- 10 % of true length

MQO: At least 90% of the time

Values: 005 to 400

#### 5.15.1RM PAST ACTUAL TREE LENGTH

This is the ACTUAL TREE LENGTH assigned at the previous inventory. It has been downloaded from the previous inventory. If the Past Actual Tree Length is obviously wrong (length recorded as 31 instead of 13), record a new PAST ACTUAL TREE LENGTH estimate.

When collected: Verify for remeasure trees  $\geq$  1.0 inch DBH/DRC.

Field width: 3 digits.

Tolerance:  $\pm$ 10% of true length.

#### 5.16 LENGTH METHOD

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

When Collected: Phase 2 CORE: All live tally trees  $\geq$  5.0 inches DBH/DRC

Phase 2 CORE OPTIONAL: All live tally trees  $\geq$  1.0 inch DBH/DRC and all standing dead tally trees  $\geq$  5.0 inches DBH/DRC

Phase 3 CORE: All live tally trees  $\geq$  1.0 inches DBH/DRC

Phase 3 CORE OPTIONAL: All live tally trees  $\geq$  1.0 inches DBH/DRC and all standing dead tally trees  $\geq$  5.0 inches DBH/DRC

RM When collected: All tally trees  $\geq$  1.0 inch DBH/DRC.

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, laser).
- 2 Total length is visually estimated, actual length is measured with an instrument
- 3 Total and actual lengths are visually estimated.

## 5.17

### CROWN CLASS

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 39). 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  $\geq 1.0$  inch DBH/DRC

RM When collected: All live tally trees  $\geq 1.0$  inch DBH/DRC, and nontallied site trees.

Field width: 1 digit

Tolerance: No errors

MQO: At least 85% of the time

Values:

- 1 Open Grown – trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.
- 2 Dominant – trees with crown extending above the general level of the crown 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.

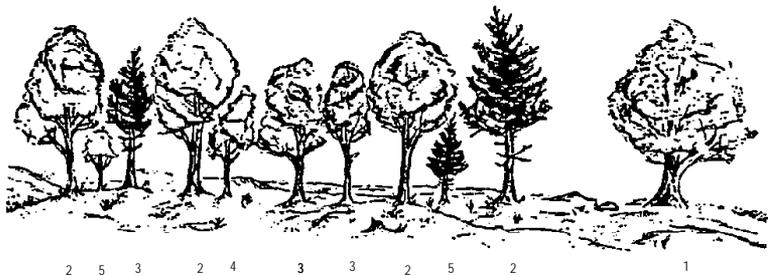


Figure 39. Examples of CROWN CLASS code definitions (numbers are the CROWN CLASS codes).

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 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 LENGTH (Figure 40). 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 1 inch and are within 5 feet 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.

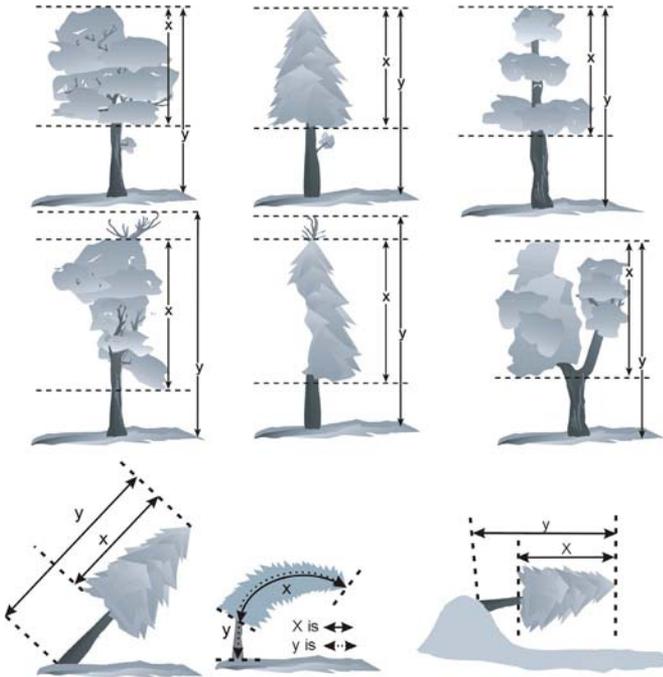


Figure 40. UNCOMPACTED LIVE CROWN RATIO examples.

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by ACTUAL 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 5.0 inches DBH/DRC and larger; the 1-inch/5-foot rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 41).

**RM Note:** See the definitions for sprig and twig in the glossary.

When collected: Phase 2 CORE OPTIONAL: All live tally trees  $\geq 5.0$  inch DBH/DRC

Phase 3 CORE: All live tally trees  $\geq 1.0$  inch DBH/DRC

Phase 3 (CORE): All live tally trees  $\geq 1.0$  inch DBH/DRC

Field width: 2 digits

Tolerance: +/- 10%

MQO: At least 90% of the time

Values: 00 to 99 percent

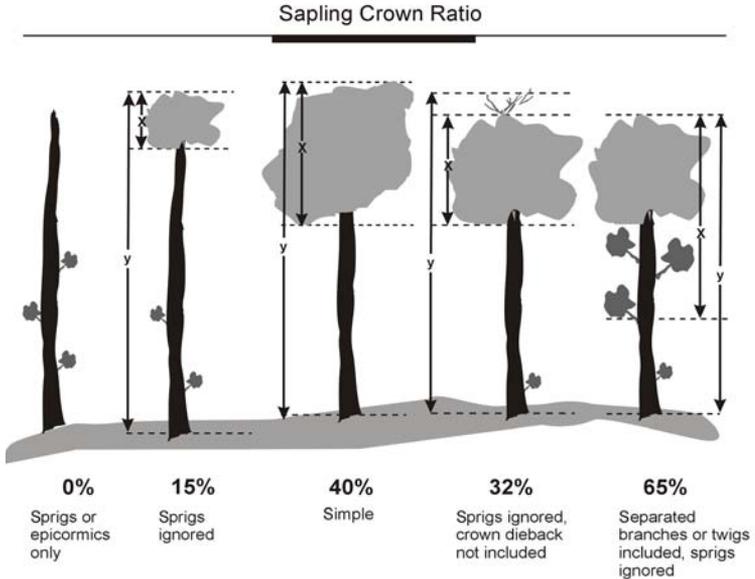


Figure 41. Sapling ratio determination examples.

5.19

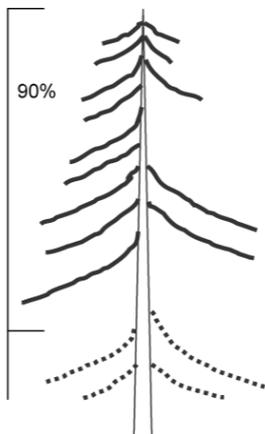
**COMPACTED CROWN RATIO**

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 inch 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.

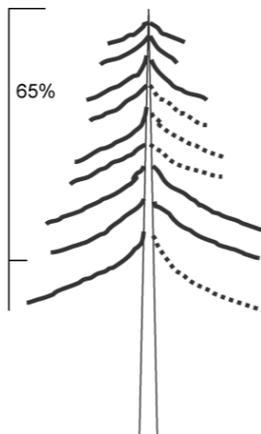
Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2 feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 42). Figure 43 shows an example of COMPACTED CROWN RATIO on a leaning tree.

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

Uncompacted:

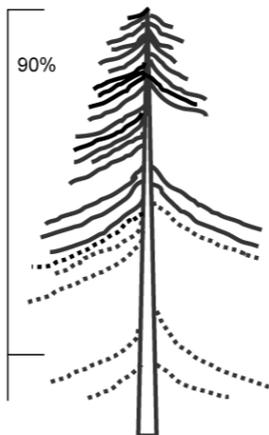


Compacted:



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

Uncompacted:



Compacted:

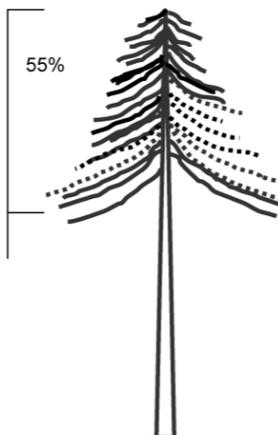


Figure 42. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of conifers.

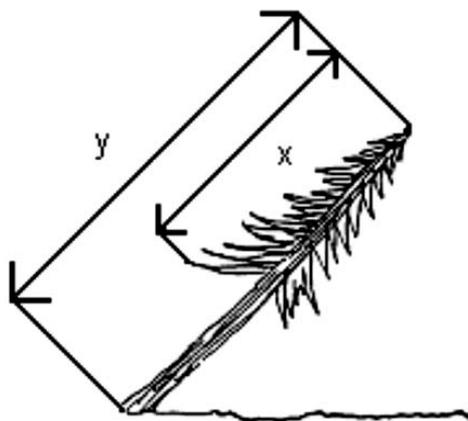


Figure 43. COMPACTED CROWN RATIO on a leaning tree.  
CROWN RATIO =  $(x/y)100$ .

For multi-stemmed woodland species, ocularly transfer lower live foliage to fill large holes on all stems and form an even crown across the tree (Figure 44).

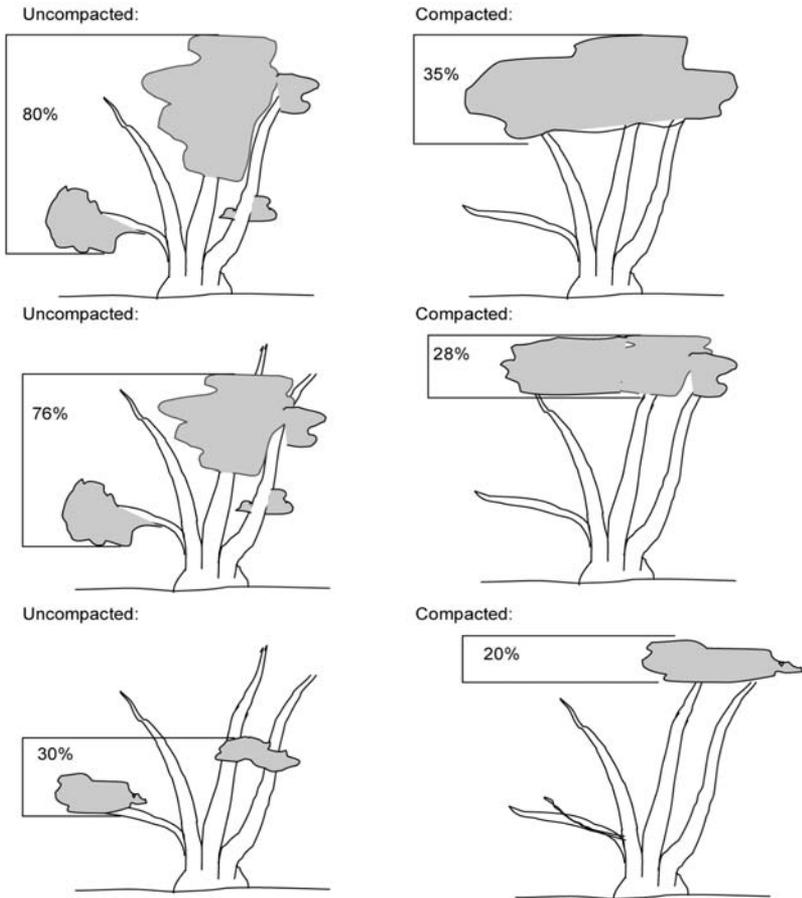


Figure 44. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of woodland species.

When Collected: All live tally trees  $\geq 1.0$  inch DBH/DRC

Field width: 2 digits

Tolerance: +/- 10 %

MQO: At least 80% of the time

Values: 0

## 5.20

### TREE DAMAGE - (CORE OPTIONAL)

(Not used in RM)

Note: Figures 45 -55 are not used

- 5.20.1      **DAMAGE LOCATION 1 (CORE OPTIONAL)**  
(Not used in RM)
- 5.20.2      **DAMAGE TYPE 1 (CORE OPTIONAL)**  
(Not used in RM)
- 5.20.3      **DAMAGE SEVERITY 1 (CORE OPTIONAL)**  
(Not used in RM)
- 5.20.4      **DAMAGE LOCATION 2 (CORE OPTIONAL)**  
(Not used in RM)
- 5.20.5      **DAMAGE TYPE 2 (CORE OPTIONAL)**  
(Not used in RM)
- 5.20.6      **DAMAGE SEVERITY 2 (CORE OPTIONAL)**  
(Not used in RM)

- 5.20.7RM      DAMAGE AGENT 1,2,3**  
Record a primary, secondary, and tertiary damage code for all live tally trees, 5.0 inches DBH/DRC and larger, and nontallied site trees. Only trees with serious damage, insect, or pathogen activity are to be given damage codes other than 00.

For each tally tree and nontallied site tree, select the most significant damages present. Record the most significant damage as the primary, the next as secondary, etc. Avoid selecting one of the "other, unidentified, or unknown" categories unless a more specific category cannot be determined. For insect and disease damage, base the ordering of most significant, second most significant, etc.

A general rule is to only code a damage category when something is affecting the tree that will cause one of the following:

- Prevent it from living to maturity, or surviving 10 more years, if already mature.
- Prevent it from producing marketable products. For example, code any damage preventing a timber species from having a minimum of one merchantable bolt.
- Reduce (or has seriously reduced) the quality of the tree's products (e.g., potentially resulting from lightning strike, excessive lean, tree rot).

Examine each tree carefully as serious internal tree damage can only be determined based on external indicators (e.g., small conks on the main bole can indicate serious volume loss that may affect the tree's chance of survival). On the other hand, a minor defect, such as a small fire scar that results in some cull would not be serious enough to qualify as damage.

It is not necessary to code damage or typical form defects common to a

particular tree species (such as forking on a cottonwood or juniper tree).

Note: General symptoms listed in the damage descriptions below (such as discolored foliage, dead branches or tops, or galls) may be indicative of several **damaging agents**. Refer to insect pest and disease field guides for **damaging insect/disease agent identification and tree damage potential**.

Damage Agent	Code	Damage
	00	No serious damage
Insects:	10	Other and unidentified insects
	11	Bark beetles
	12	Defoliators
	14	Terminal weevils
	15	Mountain pine beetle
	16	Ips engraver beetle
Diseases:	20	Other and unidentified diseases
	21	Stem rusts
	22	Stem and butt rots (conks)
	23	Cankers
	24	True mistletoe
	26	Dwarf mistletoe -- rating of 4 to 6
	27	Broom rusts
	28	Root diseases
	29	Foliage diseases
Fire:	31	Fire
Animals:	40	Unidentified animal
	41	Domestic animal
	42	Porcupine girdling
	43	Other wildlife
	44	Big game
	47	Pocket gophers
	48	Sapsuckers
Atmosphere:	50	Unidentified weather
	51	Wind
	52	Lightning
	53	Snow break or bend
	54	Frost crack
	55	Drought
	56	Sun scald
	57	Winter drying or burn -- red belt
	58	Air pollution
	59	Flooding
Misc:	61	Suppression
	70	Unidentified/unknown
	71	Excessive lean -- more than 15° from vertical
	72	Forked below merchantable top; timber spp.
	73	Broken top

	74	Dead top
	75	Wolf tree: excessively limby timber spp.
	76	Unhealthy foliage
	77	Heartwood scar on bole
	78	Forked above merchantable top; timber species, under rotation age
	79	Excessive crook, sweep, or taper -- timber
Human:	80	Other human
	81	Logging
	82	Timber stand improvement (TSI)
	83	Land clearing
	84	Woodland cutting
	85	Chemical

Definitions for Damage codes are described as follows:

**No Serious Damage (code 00).** Record this code when serious tree damage is not evident. Some minor damage may be evident, but it will not seriously reduce tree quality or prevent the tree from living to maturity.

**Insect Damage (codes 10-12, 14-16).** Record only serious insect damage. Nearly any tree in the woods will have insects on it at one time or another, but this presence does not necessarily indicate serious tree damage. Serious insect damaging agents are described below.

**Other and Unidentified Insects (code 10):** Use this code only for unidentified insect damage or for insect damage not specified in one of the categories below (e.g., wood borers). Describe in the comments column the damage and the type of insect causing the damage, if known.

**Bark Beetles (codes 11, 15, 16):** These are phloem-feeding insects that bore through the bark and create extensive galleries between the bark and the wood. Symptoms of beetle damage include fading or discolored tree crown (yellow or red), pitch tubes or pitch streaks on the bark, extensive egg galleries in the phloem, boring dust in the bark crevices or at the base of the tree. Bark chipping by woodpeckers may be conspicuous. Examples of tree damaging bark beetles include species of the genera *Dendroctonus*, *Scolytus*, and *Phloeosinus* (in juniper), such as mountain pine beetle (code 15), Ips engraver beetle (code 16), and others (code 11) such as western pine beetle, Douglas-fir beetle, spruce beetle, and cedar bark beetles.

**Defoliators (code 12):** These are foliage-feeding insects that may reduce growth and weaken the tree causing it to be more susceptible to other damaging agents. General symptoms of defoliation damage include large amounts of missing foliage (greater than 75 percent defoliated in top 10 feet or 50 percent defoliated over the entire tree), browning foliage, extensive branch mortality, or dead tree tops. Examples include spruce budworm, pine sawflies, Douglas-fir tussock moth, and gypsy moth.

**Terminal Weevils (code 14):** These are insects that feed on the meristematic portion of the tree (tips, terminal and lateral branches). Damage includes reduced tree growth, forking, and deformed crowns. Symptoms include orange to red colored or dead terminal leaders, stunted or drooping terminal or lateral branches, or galls on branches. Examples are the western pine shoot borer, and the white pine and lodgepole pine terminal weevils.

**Disease Damage (codes 20-24, 26-29).** Record only serious disease damage. Serious disease damaging agents are described below.

**Other and Unidentified Diseases (code 20):** Use this code only for unidentified disease damage or for disease damage not specified in one of the categories below. Describe in the comments column the damage and the type of disease causing the damage, if known.

**Stem Rusts (code 21):** A stem rust is a disease caused by fungi that kill or deform all or a portion of the stem or branches of a tree. Sometimes yellow or reddish-orange spores are present giving a "rusty" appearance. Damage occurs when the disease attacks the cambium of the host, girdling and eventually killing the stem above the attack. Symptoms of rusts include galls (an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems) and cankers (a sunken lesion on the stem caused by death of the cambium which often results in the death of tree tops and branches). Examples of stem rusts include western gall rust and comandra blister rust (causing cankers and galls on lodgepole and ponderosa pines), and white pine blister rust on five-needle pines.

**Stem and Butt Rots (code 22):** A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the effected wood. First, the wood stains and discolors, then it begins to lose its structural strength, and finally the wood starts to break down, forming cavities in the stem. Even early stages of wood decay can cause cull due to losses in wood strength and staining of the wood. Damage includes mortality, cull, increased susceptibility to other agents (such as insects), and wind throw and stem breakage. Any conk (a fruiting body of the causal fungus), or discoloration and decay in more than 1/2 the stem (examine increment core), is serious enough to code. Examples include Indian paint fungus on true firs (characterized by large conks with a rust colored interior), red belt fungus (characterized by a brown cubical decay and a conk-like shelf with a distinctive red band), and white trunk rot of aspen (characterized by a hoof-shaped conk).

**Cankers (code 23):** A canker -- a sunken lesion on the stem caused by the death of cambium -- may cause tree breakage or kill the portion of the tree above the canker. If cankers occur on the lower 1/2 of the tree bole, the tree will likely be killed. Examples include Atropellis canker in lodgepole pine and ponderosa pine (characterized by a blue-black stain in the wood), *Cytospora* canker in spruce, fir, and aspen, *Ceratocystis*

canker in aspen (forming highly irregular and blackened callous ridges around the canker), and sooty bark canker in aspen (which kills trees rapidly and causes the underside of dead bark to be blackened and "sooty"). Note: Record code 21 for cankers resulting from a stem rust.

**True Mistletoe (code 24):** This is a parasitic plant (*Phoradendron* spp.) that grows on tree branches or stems of host trees. When it occurs in large amounts on a single tree, true mistletoe can reduce tree growth, deform the tree, and increase the tree's susceptibility to other damaging agents. True mistletoes are green plants with or without well-developed leaves. Host plants include juniper, oak, mesquite, and poplars (cottonwood, etc.). Code true mistletoe as a damage only when it is present on numerous stems or branches.

**Dwarf Mistletoe (code 26):** This is a parasitic plant (*Arceuthobium* spp.) that grows on tree branches or stems of host trees and can substantially reduce tree growth, deform the tree, and increase the tree's susceptibility to other damaging agents. Dwarf mistletoe occurs on larch, Douglas-fir, and pines (rarely on true fir and spruce). A mistletoe class rating of 4 to 6 is considered damaging. Signs and symptoms include witches brooms (a massed dense clump of branches, typically with live foliage), the visual presence of the mistletoe plant (simple or branched shoots, approximately 1 to 4 inches in length), and swellings on the tree stem or branches.

Note: If any dwarf mistletoe occurs on the tree, whether it is coded as a damage or not, enter an appropriate code for Mistletoe Class

**Broom Rusts (code 27):** Broom rusts are diseases that attack the foliage of true firs and spruce. These diseases form spores on the foliage, and also induce the plant to form growth hormones which distort the growth of the tree and form witches brooms (massed dense clumps of tree branches) often containing dead and diseased branches and needles. Code broom rust as a damage only when numerous brooms occur or when the tree has been deformed by the disease.

**Root Diseases (code 28):** Root disease kills all or a portion of a tree's roots. Quite often, the pathogenic fungus girdles the tree at the root collar. Tree damage includes mortality (often occurring in groups or "centers"), reduced tree growth, and increased susceptibility to other agents (especially bark beetles). General symptoms include resin at the root collar, thin, chlorotic (faded) foliage, and decay of roots. Examples include Armillaria root disease in all tree species (characterized by white mycelial fans - mats of the fungus - between the bark and wood at the base of the tree), Annosus root disease, primarily on true firs but also infecting pines (characterized by white spongy root rot containing black specks and fruiting bodies of the fungus)

**Foliage Diseases (code 29):** Foliage diseases are caused by fungi and result in needle shed, growth loss, and, potentially, tree mortality. This category includes needle casts, blights, and needle rusts. Examples include *Rhabdocline needle cast* in Douglas-fir (characterized by numerous brown bands on needles and shed needles causing thinned tree foliage), and snow mold on pines, fir, spruce, and juniper (characterized by gray or black thickly matted needles, killing branches or small trees).

**Fire Damage (code 31).** Fires may cause scarring to a tree stem or bole or may kill foliage in the lower crown without seriously damaging a tree. Record damage for basal scars due to fire only if the cambium on half or more of the bole circumference has been killed. Also code if fire-killed foliage reaches into the upper one-third of the crown.

**Animal Damage (codes 40-48).** Record one of the following codes for damage by either wild or domestic animals. Code only when half or more of the bole circumference has been girdled or stripped, or when browsing or trampling prevent a tree from living to maturity, prevent it from producing marketable products, or reduce the quality of the tree's products (trees 5.0 inches DBH/DRC and larger).

**Unidentified Animal (code 40):** Record this item only if the type of animal (domestic or wild) that caused the damage cannot be determined.

**Domestic Animal (code 41):** Record for damage (e.g., trampling, browsing) that can be attributed to domestic animals (e.g., cows, sheep, horses).

**Porcupine Girdling (code 42):** Record for porcupine damage where one-half or more of the bole diameter has been girdled.

**Other Wildlife Damage (code 43):** Record for damage by wildlife other than big game or small rabbits and rodents. This includes damage by beavers, etc.

**Big Game (code 44):** Record for serious browse damage (i.e., feeding on foliage or bark), trampling, or scraping by elk, moose, deer, or bear.

**Pocket Gophers (code 47):** Record for root damage to small trees caused by gophers. Gophers often invade openings or cut-over areas and create a network of feeding tunnels just below the ground surface (these tunnels appear as channels of loosened, raised soil).

**Sapsuckers (code 48):** Sapsuckers are birds that feed on tree sap. Damage is characterized by small wounds in both horizontal and vertical rows, often with oozing resin, on the stem of live trees. Record for damage that occurs over more than 1/2 of the circumference of the stem.

**Atmosphere Damage (codes 50-59).** Record the appropriate code for weather- or pollution-related damage.

**Unidentified Weather (code 50):** Record if serious damage can be attributed to a weather problem but the specific type cannot be identified. Describe in the comments column the damage present and the cause of the weather damage, if known.

**Wind (code 51):** Wind may cause serious damage to a tree by breaking numerous branches or the stem/bole, or uprooting the whole tree. Do not code wind damage if another damage (e.g., root rot) was the primary factor affecting or weakening the tree.

**Lightning (code 52):** Lightning damage often appears as long splits, cracks, or spiral scars down the tree bole; this damage may also cause top sections of the tree to be broken off.

**Snow Break or Bend (code 53):** Record for snow damage, such as severe bending (primarily small trees) or breakage to the stem/bole or numerous limbs, resulting from avalanches or from the weight of snow on tree limbs.

**Frost Crack (code 54):** Frost cracks are long vertical splits on the surface of the tree stem, caused by the cooling and contracting of wood. Frost cracks indicate a structure defect in the wood beneath the crack.

**Drought (code 55):** Drought damage is difficult to determine, but may be identified by widespread foliage damage (wilting, discoloration of new foliage) indicated by yellowing and needle loss.

**Sun Scald (code 56):** Sun scald is the death of a portion of the tree bark caused by exposure to the sun during the winter. Sun scald occurs on young trees and on trees newly exposed to direct sun after an opening occurs in the canopy.

**Winter Drying or Burn (code 57):** Winter burn damage on a tree is caused by adverse weather conditions (an extreme drop in temperature) and is characterized by red and green (new needles) foliage above snow-line and green foliage below snow-line.

**Air Pollution (code 58):** Air pollution results in damage to large numbers of trees in the same location. Typically these areas will be in a down-wind location from large industrial sites.

**Flooding (code 59):** Flooding damage may occur near reservoir sites, washes, streams, or rivers and might be identified by features such as water marks or lines on tree boles, exposed roots (due to soil erosion), or uprooted trees.

**Miscellaneous Damage (codes 61, 70-79).** Record one of the following codes for miscellaneous damage.

**Suppression (code 61):** Suppressed trees are characterized by short or nonexistent internodes, gnarled stems, flat crowns, or sparse foliage. For shade-intolerant species such as lodgepole pine, code any indication of suppression. For shade-tolerant species such as spruce, do not code unless the tree is extremely deformed or has no live terminal leader.

**Unidentified/Unknown (code 70):** Record only if there is serious damage that cannot be identified; describe in the comments column the damage present.

**Excessive Lean (code 71):** Record for trees leaning more than 15° (27 percent) from vertical. Do not record if a more serious damage is present.

**Forked Below Merchantable Top (Code 72):** Record only for timber species, 5.0-inches DBH and larger, with multiple forks below the merchantable top (4.0-inch diameter top, DOB).

**Broken Top (code 73):** Record for timber species broken above 6.0 feet and woodland species with a broken top on the main stem.

**Dead Top (code 74):** Record for trees with a dead terminal leader.

**Wolf Tree (code 75):** A wolf tree is a vigorous timber species with poor growth form, usually larger in diameter than the average tree in the stand, with many large and dead limbs forming a rounded crown not typical of a conifer. Wolf trees are often open grown.

**Unhealthy Foliage (code 76):** Record if a tree has unhealthy foliage or chlorosis (an abnormal yellowing of foliage) and the causal agent (e.g., disease, insect, drought) cannot be identified.

**Heartwood Scar on Bole (code 77):** Record for any scar on the bole that has penetrated the heartwood, if the actual causal agent cannot be determined.

**Forked Above Merchantable Top (code 78):** Record only for under-rotation age timber species, 5.0-inches DBH or larger. Code major forks or multiple stems above merchantable height (4.0-inch diameter top, DOB). Do not use this code for trees that are over-rotation age. Rotation age is 80 years for aspen and paper birch, and 120 years for all other timber species.

**Excessive Crook, Sweep, or Taper (code 79):** Record for timber species trees 5.0-inches DBH and larger that have abnormal diameter to height ratios, or severe sweeps and crooks that will significantly reduce

the tree's quality or affect its marketable products.

**Human Damage (codes 80-85).** Record this code to indicate any tree damage due to logging operations (or related activity) or other human activity.

**Other Human (code 80):** Record this code for damage caused by a human activity not listed under another code. If this code is used, describe in the comments column the damage present.

**Logging (code 81):** Logging is the felling and extraction of timber. Record this code for severe damage such as partial uprooting, cutting, extensive breakage, or damage to half or more of the bole circumference due to logging activities.

**TSI (code 82):** Timber stand improvement (TSI) is a term comprising all intermediate cuttings or treatments made to improve the composition, health, and growth of the remaining trees in the stand. Trees removed are often smaller than the minimum sawtimber size. Record for damage caused by TSI activities.

**Land Clearing (code 83):** Land clearing refers to areas where tree land has been converted to non-tree land (e.g., tree land was cleared for homes or pasture). Record for damage caused by land clearing activities such as road building. Damage may be similar to logging.

**Woodland Cutting (code 84):** Record this code for woodland species that have had cutting to stems or branches for use as fuelwood, fence posts, etc.

**Chemical (code 85):** Chemical damage may result from factors such as the use of salts on roadways, drift from herbicide usage, or spillage from large amounts of fertilizer or other chemicals. Use this code cautiously as it is difficult to determine.

When collected: All live tally trees  $\geq$  5.0 inch DBH/DRC

Field Width: 2 digits

Tolerance: No errors

MQO: No errors 2 of 3 agents, 80% of the time.

**5.20.8RM DAMAGE AGENT 2**

Used the procedures described for DAMAGE AGENT 1.

**5.20.9RM DAMAGE AGENT 3**

Used the procedures described for DAMAGE AGENT 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; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3

CORE OPTIONAL: SAMPLE KIND = 1 plots; all MORTALITY = 1

**RM** When collected: All dead tally trees when MORTALITY = 1

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)

## 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.

When Collected: Plots where SAMPLE KIND = 2: all PREVIOUS TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3.

**RM** When collected: All dead tally trees when MORTALITY = 1

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: 1994 or higher

## 5.23

### DECAY CLASS

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

When Collected: All standing dead tally trees  $\geq 5.0$  inches DBH/DRC

Field width: 1 digit

Tolerance: +/- 1 class

MQO: At least 90% of the time

Values: Use the following table for guidelines:

Table 1: Decay Class Table

Decay class stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition <sup>*</sup>	Heartwood condition <sup>*</sup>
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 4.5 feet above the ground, leave this item blank. If the diameter is not measured at 4.5 feet, record the actual length from the ground, to the nearest 0.1 foot, at which the diameter was measured for each tally tree, 1.0 inch DBH and larger. Leave this item blank for woodland species measured for diameter at root collar.

When Collected: CORE OPTIONAL:

All live and dead tally trees (except woodland species)  $\geq$  1.0 inch DBH

Field width: 3 digits

Tolerance: +/- 0.2 ft

MQO: At least 90% of the time

Values: 00.1 – 15.0

#### 5.24.1RM PERCENT VOLUME MISSING TOP

Record the percent volume of the missing merchantable top. Do not include any portion of the missing top that is <4.0 inches DOB in the volume estimate. Many broken topped trees will have 0% volume missing top because no merchantable volume was lost.

For multistemmed woodland trees, record 0.

When Collected: All tally trees  $\geq 5.0$  inches in diameter, missing a portion of the merchantable top (i.e. missing a portion of the top with a DOB  $\geq 4.0$  inches).

Field width: 2 digits.

Tolerance:  $\pm 5\%$  for total deductions <20%, 90% of the time, and  $\pm 10\%$  for total deductions >20%, 90% of the time.

#### 5.25 ROUGH CULL (CORE OPTIONAL)

(Not used by RM)

#### 5.25.1RM SOUND DEAD

For each tally tree 5.0 inches DBH/DRC and larger, record the total percentage of cubic-foot volume that is cull due to SOUND DEAD material. Record to the nearest 1 percent. When estimating volume loss (tree cull) for SOUND DEAD, only consider the cull on the merchantable bole/portion of the tree, from a 1-foot stump to a 4-inch top. Do not include any cull estimate above ACTUAL LENGTH.

The merchantable portion of a woodland species is defined as the portion of a tree, up to a minimum top diameter of 1.5-inches, and includes all merchantable segments above the place(s) of diameter measurement; do not include sections below the place(s) of diameter measurement. Merchantable segments are stems or branches that are a minimum of 1.0 foot in length and at least 1.5 inch in diameter (at the top). Branches and stems smaller than 1.5 inches in diameter (or portions of branches and stems smaller than 1.5 inches in diameter, such as tips of branches) are not included when determining volume loss.

Use the following guidelines to estimate tree cull:

1. Timber species,  $\geq 5.0$ -inches DBH. Refer to Appendix B.4 (Defect Chart) and supplemental guidelines to compute volume loss. SOUND DEAD volume loss can be detected by cutting into a tree with a hatchet and examining the soundness of the wood. Sound dead wood can be caused by insect or animal girdling, lightning or fire damage, etc.
2. Woodland species tally trees  $\geq 5.0$  inches DRC. SOUND DEAD volume includes dead volume only in the merchantable portion; dead ends of branches and stems less than 1.5 inches in diameter are not part of the merchantable portion of the tree, and therefore are not included in determining percent dead volume. Be careful not to overestimate dead volume for trees with numerous dead branch tips.

When Collected: All tally trees  $\geq 5.0$  inches diameter

Field width: 2 digits.

Tolerance:  $\pm 5\%$  for total deductions  $< 20\%$ , and  $\pm 10\%$  for total deductions  $> 20\%$  for standing trees.

$\pm 20\%$  for down dead trees.

Tolerance:  $\pm 10\%$

MQO: At least 90% of the time

Values: 00 to 99

#### 5.25.2RM FORM DEFECT

For each live timber species  $\geq 9.0$  inches diameter softwoods and  $\geq 11.0$  inches diameter hardwoods, record the total percentage of cubic-foot volume that is cull due to FORM DEFECT. Record to the nearest 1 percent. When estimating FORM DEFECT only consider the sawlog portion of the tree from a 1-foot stump to a 7.0 inch DOB for softwoods and a 9.0 inch DOB hardwoods. Do not include any cull estimate above ACTUAL LENGTH.

Refer to local defect guidelines (**RM** - Seen Defect Guidelines) as an aid in determining cull volume for various damages such as crook, fork, sweep, pistol butt, etc.

To estimate tree cull due to FORM DEFECT, only consider the form defects (e.g., crooks, sweep, forks) serious enough to reduce the usable merchantable volume of the tree, or prevent the tree from now or prospectively having an 8-foot (straight and reasonably free of defect) section.

When Collected: All live tally timber species  $\geq 9.0$  inches diameter softwoods and  $\geq 11.0$  inches diameter hardwoods. FORM DEFECT is not recorded on woodland species.

Field width: 2 digits

Tolerance:  $\pm 5\%$  for total deductions  $< 20\%$ , and  $\pm 10\%$  for total deductions  $> 20\%$  for standing trees

$\pm 20\%$  for down dead trees

Tolerance:  $\pm 10\%$

MQO: At least 90% of the time

Values: 00 to 99

#### 5.25.3RM PAST TREE CLASS

This is the TREE CLASS assigned at the previous inventory. It has been downloaded from the previous inventory. If the PAST TREE CLASS is obviously wrong (past recorded as 6 and tree is still alive), record a new PAST TREE CLASS.

When collected: Verify for remeasure trees  $\geq 1.0$  inch DBH/DRC.

Field width: 1 digit.

Tolerance: No errors.

### 5.25.4RM CURRENT TREE CLASS

Assign each tally tree  $\geq 1.0$  inch in diameter a TREE CLASS code based on the information collected in 5.25, 5.25.1, and 5.25.2

When collected: All tally trees  $\geq 1.0$  inch and nontallied site trees, including new trees  $\geq 1.0$  in DBH/DRC on the formerly centered microplot.

Field width: 1 digit.

Tolerance: No errors 90% of the time.

Values:

- 1 Sound (live) - timber species
  - a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor.
  - a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.
- 2 All live woodland species
- 3 Rough (live) - timber species
  - a live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a sound tree of good form, 5.0-inches DBH or larger.
  - a live tree, 9.0-inches DBH or larger softwoods and 11.0 inches DBH or larger hardwoods, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
  - a live tree, 5.0 to 8.9 inches DBH softwoods and 5.0 to 10.9 inches DBH hardwoods, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.
- 4 Rotten (live) - timber species
  - a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.
- 5 Hard dead
  - a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
- 6 Soft dead
  - a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

### 5.25.5RM RADIAL GROWTH and 5.25.6RM TREE AGE

Collect Tree Age and Radial Growth information for specified tally trees, and timber species site trees. In addition, collect age information for timber species seedling counts.

**Accounting plots:**

**RADIAL GROWTH** – If there is an accounting tree that is the same species and diameter class as a new tally tree, use the formula below to estimate RADIAL GROWTH for the new tally tree (instead of boring the new tally tree). The accounting tree does not have to fall on a new subplot. Based on diameter of remeasure tree:

$$\text{Number of 1/20ths} = \frac{100 \times (\text{Current dia.} - \text{Past dia.})}{\# \text{ years since last inventory}}$$

**TREE AGE** – If there is an accounting tree that is the same species and diameter class as a new tally tree, estimate TREE AGE for the new tally tree as follows: Use the previously recorded age of the accounting tree and adjust for the years since the previous inventory (pre-printed forms will specify the past inventory year).

If an accounting tree is used to determine RADIAL GROWTH or TREE AGE for a new tally tree, use code 2 for "RADIAL GROWTH AND TREE AGE CHECK". Note: For QA/QC purposes, be sure to make note of which previously inventoried tree is used (tree number) to determine RADIAL GROWTH or Tree Age.

**1. Radial growth and age tree selection**

**a. Timber species**

Radial growth information is required for a minimum of two trees in each diameter class (starting with the 4-inch class) for each species.

Age information is required for a minimum of one tree in each diameter class and species, and for one timber species seedling count per species (i.e., one count for each group for the entire condition class).

For both RADIAL GROWTH and AGE, if rough or rotten trees are bored, select additional sound trees if tallied. Ranges of diameters for each diameter class are as follows:

Stand Size Class	Softwoods	Hardwoods
	Size Class Range (DBH, inches)	Size Class Range
1	0 - .9" (count whorls/scars): age only	0 - .9"
	1 – 2.9" (age at base): age only	1 – 2.9"
	3 – 4.9" (age at BH): age and radial	3 – 4.9"
2	5 – 8.9"	5 – 8.9"
		9 – 10.9"
3	9 – 12.9"	11 – 12.9"
	13 – 16.9"	13 – 16.9"
	17 – 20.9"	17 – 20.9"
	etc.	etc.

1. **Select the first timber species tallied by diameter class and species type across the subplots.** Obtain age for all trees selected, and radial growth for trees in the 4-inch diameter class and larger. For the seedling class, select the first seedling group counted in each species on the location and obtain AGE only.
2. For trees in the 4-inch diameter class and larger, also select the second timber species tallied across the subplots, by diameter class and species type, and obtain RADIAL GROWTH only. To help distribute trees, always select the radial growth tree from a different subplot than the age/growth tree selected in (a) above. Note: If a second tree is not tallied on a different subplot, the second RADIAL GROWTH measurement is not required. (Table 2)

**NOTE:**

When you encounter a new diameter class or species, you must obtain both age and radial information.

In this example, the trees indicated with an "X" are selected to bore for AGE/RADIAL GROWTH. After measuring two subplots, all of the requirements are met for the seedling, 4, 8, and 12-inch Douglas-fir class and the seedling, 4, 8 and 10-inch, aspen classes. However, given the types of species and diameter classes tallied so far, one more live sound Douglas-fir in the 20-inch class, and an oak in the in the 8-inch class, if tallied on subplots 3 or 4, need to be bored for RADIAL GROWTH.

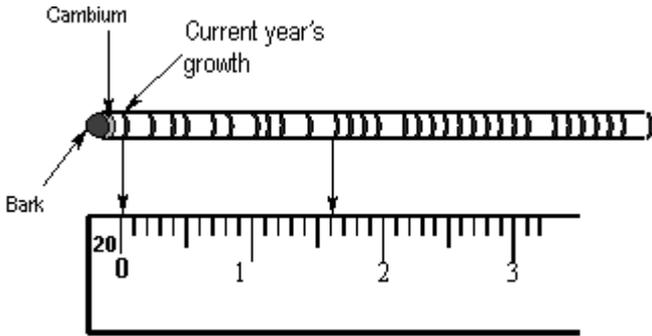
- b. **Woodland species.** For each woodland genus group tallied across the subplots, select one representative live tally tree within each size class tallied (refer to the Stand Size Class table above). Core the largest stem near the base to obtain the age and radial.
2. **Radial-growth measurement** (timber species, 4-inch diameter class and larger). Measure the last 10 years of RADIAL GROWTH from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. To reduce bias, bore on the side of the tree facing the subplot center, where reasonable. Using a ruler with a 1/20-inch scale, measure the length of the core from the inner edge of the last (most recent) complete summer wood ring to the inner edge of the summer wood ring 10 years previous (figure 55a).

Table 2: Age and Radial coding guide

Subplot 1:	DBH	Species	Diameter	Bore for:	
			Class	Age	Radial
SOFTWOODS		Doug fir	Seedling	X	
	3.2	Doug fir	4"	X	X
	4.1	Doug fir	4"		
	5.2	Doug fir	7"	X	X
	9.4	Doug fir	11"	X	X
	13.1	Doug fir	15"	X	X
HARDWOODS		Aspen	Seedling	X	
	3.9	Aspen	4"	X	X
	2.1	Aspen	2"	X	
	5.5	Aspen	8"	X	X
	8.7	Aspen	8"		
	9.3	Aspen	10"	X	X
11.3	Aspen	12"	X	X	

NOTE: Softwoods do not have a 10" size class.

Subplot 2:	DBH	Species	Diameter	Bore for:	
			Class	Age	Radial
SOFTWOODS		Doug fir	Seedling		
	3.0	Doug fir	4"		X
	4.1	Doug fir	4"		
	5.8	Doug fir	8"		X
	9.9	Doug fir	11"		X
	17.7	Doug fir	19"	X	X
HARDWOODS		Aspen	Seedling		
	3.5	Aspen	4"		X
	2.9	Aspen	2"		
	8.9	Aspen	8"		X
	9.3	Aspen	10"		X
	5.2	Oak	8"	X	X



RM Figure 55a. Radial growth measurement. Use the 20ths scale on the 6" ruler. Each graduation = 1/20th inches. In this figure, the radial = 16.

3. Age tree measurement (timber species).

- **Seedling age group:** For the first timber species seedling group counted (by species) on the location, record an average total age. It is not necessary to age seedlings species groups for each condition class. Use the same methods for determining total tree age as for small saplings; however, do not bore seedlings.
- **2-inch diameter class (1.0- to 2.9-inches DBH) age trees:** Measure and record total tree age. Use the following methods:

For small coniferous saplings, determine total age by counting the terminal bud scars or the whorls of branches. The terminal bud scars are those that completely encircle the stem of the tree. The scar is left on the stem where the terminal bud lay dormant during the winter.

For larger coniferous saplings, or if an accurate tree age cannot be determined for smaller saplings by counting whorls, bore the tree as close to the base as possible to obtain total age. Be careful not to bore all the way through the tree. Count the growth rings on the increment core from the bark end to the pith (center of the tree).

For **aspen and cottonwood saplings**, determine tree age by counting the intervals between scars left on the stem by the terminal bud.

If age cannot be accurately determined by the above methods, estimate total age and note in the comments column.

- **4-inch diameter class and larger age trees (3.0 to 4.9 inches DBH):** Measure and record breast height (BH) age. Count the growth rings from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. Bore on the side of the tree facing the subplot center, where

reasonable. Count every growth ring from the bark end to the pith (center of the tree). If the age is difficult to determine (e.g., due to indistinct rings, presence of rot), or if the pith was not reached (e.g., diameter too big to bore to center) estimate the age and note in the comments column.

4. **Radial-growth and age tree coding.**
  - a. Radial growth. Record the radial-growth measurement as a two-digit code; for example, record 6/20 as 06, and record 23/20 as 23.
  - b. Age tree coding. Record Tree Age as a three-digit number. For example, record 29 years as 029, and record 195 years as 195.

When collected: All tally trees where RADIAL GROWTH and/or TREE AGE is collected.

Field width: Radial growth: 2 digits.

Tree age: 3 digits

Tolerance: Radial growth:  $\pm 1$

Tree age:  $\pm 10\%$

#### 5.25.7RM RADIAL GROWTH AND TREE AGE CHECK

When collected: All tally trees where RADIAL GROWTH and/or TREE AGE is collected.

Field width: 1 digit.

Tolerance: No errors.

Values:

- 0 Age/radial growth measured directly from core.  
Age/radial growth calculated from remeasurement data (same tree).
- 1 Age/radial growth was estimated due to rot.  
Age/radial growth was estimated because rings were difficult to count (old suppressed trees).  
Age was estimated because the increment bore could not reach to tree center.
- 2 Age/radial growth was calculated from a similar remeasure tree (same species and diameter class).  
Age/radial growth was based on a similar tree off the subplot.

#### 5.26 DWARF MISTLETOE CLASS (CORE OPTIONAL)

Rate all live conifer species, except juniper species, greater than or equal to 1.0 inch diameter for dwarf mistletoe (*Arceuthobium* spp.) infection. Use the Hawksworth six-class rating system: divide the live crown into thirds, and rate each third using the following scale (Figure 56):

- 0 No visible infection
- 1 Light infection -- <50 percent of the total branches infected
- 2 Heavy infection -- >50 percent of the total branches infected

Sum the three individual ratings to obtain and record a total mistletoe class (0 to 6) for the tree.

When Collected: CORE OPTIONAL: All live conifer (except juniper) tally trees  $\geq 1.0$  in DBH/DRC  
Field width: 1 digit  
Tolerance: +/- 1 class  
MQO: At least 90% of the time  
Values: 0 to 6

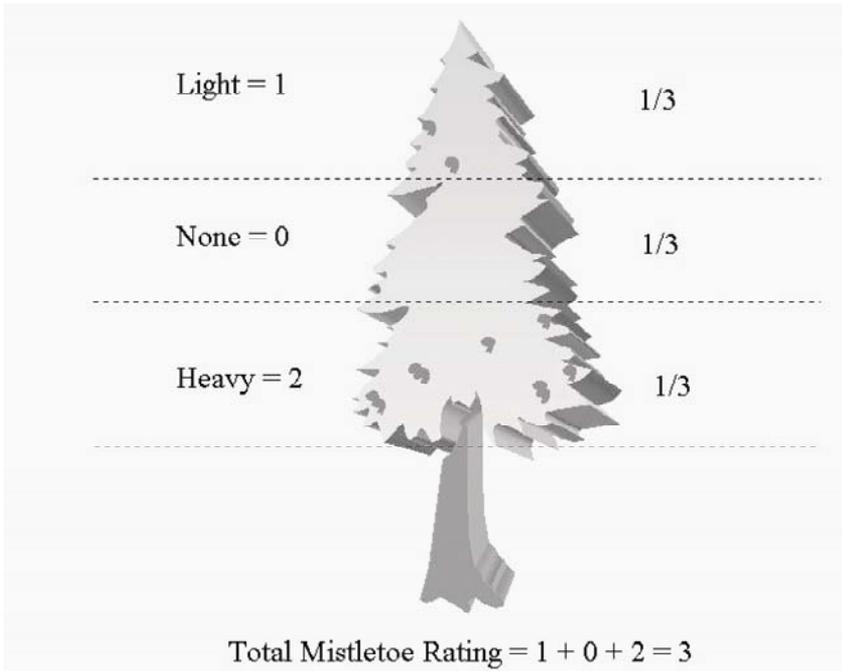


Figure 56. Example of the Hawksworth six class rating system

## 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

## 6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting live seedlings within the 6.8-foot radius microplot located 90 degrees and 12.0 feet from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. For woodland species, each stem on a single tree must be less than 1.0 inch in DRC. Seedlings are counted in groups by species and condition class, up to five individuals per species. Counts beyond five estimated. Only count seedlings occurring in accessible forest land condition classes.

### 6.1 SUBPLOT NUMBER

Use the same procedures described in Section 3.1.

When Collected: All counts of seedlings

### 6.2 SPECIES

Use the same procedures described 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 same procedures described 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 6.0 inches in length and less than 1.0 inch at DBH to qualify for counting. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting.

For woodland species, each stem on a single tree must be less than 1.0 inch 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

**RM** When Collected: Each accessible forest land condition class on each microplot, not required for formerly centered 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

#### 6.4.1RM COUNT CHECK

Record this code for seedling counts that are estimated.

When collected: Any time seedlings recorded

Field width: 1 digit.

Tolerance: No errors.

MQO: At least 90% of the time

Values:

0 seedlings counted accurately.

1 seedling count estimated.

#### 6.4.2RM SEEDLING AGE

Record this code to identify which seedlings were aged.

When collected: All seedling count records.

Field width: 1 digit.

Tolerance: No errors.

MQO: At least 90% of the time

Values:

0 Do not collect age information for this Seedling count.

1 Collect total age information for this seedling count.

#### 6.4.3RM TOTAL SEEDLING AGE

For the first species seedling group counted (by species) on the plot, record an average total age. It is not necessary to age seedlings species groups for each condition class. Use the same methods for determining total tree age as for small saplings (see Section 5.25.6); however, **do not bore seedlings**.

When collected: When SEEDLING AGE = 1

Field width: 3 digits

Tolerance:  $\pm 5\%$

MQO: At least 90% of the time.

Values: 1 to 999

## 7.0 SITE TREE INFORMATION

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

### 7.1 SITE TREE SELECTION

Select at least one (RM - Select at least 2 that represent the species of the condition class FOREST TYPE) site tree(s) for each accessible forest land condition class where no previous site tree data exist. The absence of site tree data may occur because:

- This is the first visit to the site
- On the previous visit no suitable site tree could be found for the condition
- Since the last visit there has been a change in condition class that renders the previous data incompatible with the current conditions

If a site tree is needed; select tree from a species common to the condition class being sampled, based on the criteria listed in Appendix 4. Select trees off the subplot where possible. (RM Select trees off the subplot if necessary to find an appropriate specimen.) Use only trees that have remained in a dominant or co-dominant crown position throughout their entire life span. If possible, trees should be 5.0 inches in diameter, or larger, and at least 20 years old. Trees that are visibly damaged, trees with ring patterns that exhibit signs of suppression, and trees with rotten cores should be rejected. If there are no acceptable site trees, record that in the plot notes and leave this section blank.

#### 7.1.1RM Site Tree Requirements

1. Suitable site trees:
  - live sound tree;
  - 5.0-inches DBH or larger;
  - open grown, dominant, or codominant throughout most of its life;
  - minimum of 35 years (DBH age) for softwoods or minimum of 45 years (DBH age) for hardwoods;
  - under rotation age (80 years for aspen and paper birch, 120 years for all other timber species);
  - undamaged top (not dead or broken);
  - vigorous, having an uncompacted crown ratio of at least 50 percent, if possible, and have the best height/age ratio of all the trees on the site.
2. Unsuitable site trees

- relicts;
- over rotation age but less than 200 years (DBH age);
- rough trees.

### 7.1.2RM Site Tree Selection

Select a minimum of two site trees that represent the species of the condition class FOREST TYPE. If extra site trees were measured at a previous inventory under different sampling protocols, it is not necessary to remeasure those trees. Obtain the necessary site tree data under the current sampling protocol and delete the extra records in the historic file.

If not enough suitable trees can be selected from the subplot tally, then select nontallied suitable site trees off the subplots from a nearby site of similar slope, aspect, elevation, and soils. Obtain only suitable site trees where possible; however, if no suitable site trees are present within a reasonable distance (e.g. < 200 feet) of the subplot, select an unsuitable site tree.

Assign each nontallied site tree selected to the nearest subplot. Nontallied site trees that are referenced to a particular subplot must be recorded with TREE RECORD NUMBER 0. All other tree data is entered normally, but the maximum HORIZONTAL DISTANCE for a nontallied site tree that is referenced to a subplot is 200.0 feet. Nontallied site trees that are not referenced to a subplot can also be entered. If the trees HORIZONTAL DISTANCE is greater than 200 feet, leave the SUBPLOT NUMBER, HORIZONTAL DISTANCE, and AZIMUTH blank and enter all other data for the site tree normally. These non-referenced site trees require a note of where the tree is located which could include AZIMUTH and HORIZONTAL DISTANCE, GPS coordinates or some other description of where the tree maybe located.

For burned or cut stands, go to an adjacent stand to obtain site trees representing the Forest Type if possible.

Note: Do not select aspen or birch site trees from the subplot tally; instead, when these are required site trees, select nontallied site trees.

## 7.2 SITE TREE DATA VARIABLES

### 7.2.0RM TREE RECORD NUMBER

See procedures detailed in Section 5.2 for tallied site trees. For nontallied site trees, assign "0" as the TREE RECORD NUMBER.

When collected: All site trees.

### 7.2.1 CONDITION CLASS LIST

List all CONDITION CLASSES that the site index data from this tree represents. (RM If a site tree is selected from one condition class, and can be used for additional condition classes, list these additional classes in the Site Tree Condition List on the data recorder.)

When Collected: All site trees  
Field width: 4 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 1000 to 9876

### 7.2.2 SPECIES

Use the same procedures described in Section 5.8 (Appendix 4 lists preferred site tree species by region).

When Collected: All site trees  
Values: See Appendix 4

### 7.2.3 DIAMETER

Use the same procedures described in Section 5.9.

When Collected: All site trees  
Field width: 4 digits (xxx.y)  
Tolerance: +/-0.1 inch per 20.0 inch increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2  
+/-1.0 inch per 20.0 inch increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5  
For woodland species: +/-0.2 inch per stem  
MQO: At least 95% of the time. For example: a tree with a diameter of 41.0 inch would have a tolerance of plus or minus 0.3 inch. (Note: the MQO for point of measurement is +/-0.2 inch when the tree is first measured and within 1 foot of the location established by the previous crew when the tree is remeasured.)  
Values: 001.0 to 999.9

### 7.2.4 SITE TREE LENGTH

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

When Collected: All site trees  
Field width: 3 digits  
Tolerance: +/-10% of true length  
MQO: At least 90% of the time  
Values: 005 to 999

#### 7.2.4.1RM SITE TREE

Refer to the characteristics listed in Section 7.1 to determine whether each site tree is considered Suitable or Unsuitable. If no Suitable site trees exist, an Unsuitable site tree may be selected. Collect and record site tree data only for those species listed as timber species trees (refer to the tally tree species list in this chapter). Site trees are selected as indicators of site productivity.

Record one of the following codes for each live tally tree 5.0 inches DBH and larger:

When collected: All site trees.  
Field width: 1 digit.  
Tolerance: No errors  
MQO: At least 90% of the time.  
Values:

- 1 Suitable site tree
- 2 Unsuitable site tree

#### **7.2.4.2RM RADIAL GROWTH AND TREE AGE CHECK**

See procedures in section **RM 5.25.7**

When collected: All site trees.

#### **7.2.5 TREE AGE AT DIAMETER**

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

When Collected: All site trees  
Field width: 3 digits  
Tolerance: +/-5 years  
MQO: At least 95% of the time  
Values: 001 to 999

#### **7.2.6 SITE TREE NOTES**

Record notes pertaining to an individual site tree.

When collected: All site trees as necessary  
Field width: alphanumeric character field  
Tolerance: N/A  
MQO: N/A  
Values: English language words, phrases and numbers

#### **7.2.7 SUBPLOT NUMBER (CORE OPTIONAL)**

Record the subplot number to which the site tree is referenced.

When Collected: All site trees  
**RM** When Collected: All suitable and unsuitable site trees with a HORIZONTAL DISTANCE of <200.0 feet  
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

#### 7.2.8 AZIMUTH (CORE OPTIONAL)

Record the AZIMUTH from the subplot center by sighting the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

When Collected: All site trees

**RM** When Collected: All suitable and unsuitable site trees with a HORIZONTAL DISTANCE of <200.0 feet

Field width: 3 digits

Tolerance: +/-10 degrees

MQO: At least 90% of the time

Values: 001 to 360

#### 7.2.9 HORIZONTAL DISTANCE (CORE OPTIONAL)

Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center to the pith of the tree at the base.

When Collected: All site trees

**RM** When Collected: All suitable and unsuitable site trees with a HORIZONTAL DISTANCE of <200.0 feet

Field width: 4 digits (xxx.y)

Tolerance: +/-5 feet

MQO: At least 90% of the time

Values: 0001 to 2000

## 8.0 PHASE 2 (P2) VEGETATION PROFILE (CORE OPTIONAL)

The Phase 2 (P2) vegetation data are collected to provide vegetation structure and dominant species composition for vascular plants. The data collected provide a horizontal and vertical estimation of vegetation located within the sample area and provide information for the most abundant species found on the subplot. Information on the abundance, structure, and species composition of understory plant communities has many uses. It can be used to assess wildlife habitat, biomass, forage availability, grazing potential, vegetation competition with tree growth, fuel loadings from understory vegetation, and potential site productivity. The most abundant species provide information to classify plant community types into plant associations and to predict associated forest stand characteristics. Accurately representing the species present on a site and their change in abundance in response to forest development, disturbance, or management is therefore important to a wide variety of users. This information is also used to augment forest ecosystem health assessments from P3 plots, in terms of vegetation structure and rates of change of community vascular plant composition.

The P2 Vegetation protocols are core-optional. Each FIA unit determines whether to collect the P2 vegetation information and several levels of options must be determined by each unit prior to data collection. Options declared prior to field data collections include **Vegetation sampling status and level of detail**. Vegetation sampling status determines if P2 vegetation is to be collected, and, if so, what lands are included; the unit may choose to collect only on forested conditions or on all accessible conditions found on the plot. The level of detail determines if data are collected on structure by growth habit only; or if the most abundant species are recorded; and whether trees greater than or equal to 5 inches DBH (DRC for woodland species) are included in species records. FIA units collecting species data record information on (up to) the four most dominant species per growth habit that have a cover of at least 3 percent on the subplot. Most trees greater than or equal to 5 inches DBH/DRC are already measured during tree tally, but some units may choose to also record visual estimates of cover for them. Regardless of the level of detail, the protocols found in this section will be implemented in such a way that basic structure and species data can be compared across the nation.

### 8.1 Vegetation Sampling Design

The core optional Phase 2 Vegetation Profile includes measurements of vegetation structure – cover by layer and total aerial cover of each growth habit – with additional options to collect data on the most abundant species in each growth habit.

Sampling of vegetation is focused on accessible condition classes within the 24.0-foot radius subplot. Inventory units implementing the vegetation profile determine if they will include accessible forested lands, or any accessible land (P2 Vegetation Sampling Status). If the area of an accessible condition class is less than 100 percent on a subplot, vegetation measurements are done only on the portion that accessible. If multiple accessible condition classes are present

on the subplot, separate estimates are made for each condition class area on the subplot. Prior to implementation, inventory units must also determine the LEVEL of DETAIL they will collect, so that regional field guides and PDR programs can be customized to ensure quality data is collected in the most efficient manner possible. All units implementing Vegetation Profile will collect Level of Detail = 1, vegetation structure as cover by growth habit by layer and total aerial cover. Level of Detail = 2 and 3 include species composition data.

Vegetation is best recorded when all plant species are fully leafed out. However, crews may end up visiting plots early in the season before leaves are fully expanded or late in the season when plants are beginning to senesce. Canopy cover is vertically projected from the outline of the foliage as they see it at the time of plot visit. Notes can be added to subplot records indicating unusual phenological conditions. Crews should not collect vegetation data in leaf off condition or when snow covers the plot (see Section 8.4.2 P2 VEG SUBPLOT SAMPLE STATUS).

## 8.2 General definitions

**Canopy Cover** – Canopy cover is defined as the area of ground surface covered by a vertical projection of the canopy of a vascular plant. The canopy is described by a polygon surrounding the outer edges of the foliage (Figure 57), without subtracting any normal spaces occurring between the leaves of plants (Daubenmire 1959). Overlapping crowns within a species or growth habit are not double-counted; the maximum possible cover is 100 percent. All estimates on the cover of vegetation are focused on plants or plant parts that are located within the sampled condition class within the subplot perimeter (24.0-foot radius, horizontal distance) and any foliar parts overhanging the sampled condition class within the subplot. Canopy cover is collected by height layer or as a total (aerial view) cover across all layers for all growth habits in Vegetation Structure (8.5). Total aerial cover is collected for recorded species in Species Composition (8.6). Cover is estimated to the nearest 1 percent. See tabulation below for cover to area relationships for a 1/24 acre subplot and Figures 58 and 59 for additional visual calibrations. Group practice in the field is a mandatory training exercise.

<sup>1</sup>Daubenmire. R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

Cover	Area (ft <sup>2</sup> )	Square length on side (ft)	Circle Radius (ft)
1%	18	4.3	2.4
3%	54	7.4	4.2
5%	90	9.5	5.4
10%	181	13.4	7.6
15%	271	16.5	9.3
20%	362	19.0	10.7
25%	452	21.3	12.0
50%	905	30.1	17.0

**Cover estimates on FIA subplot**

- A: 1%
- B: 25%
- C: 6%
- D: 2%
- E: 1%

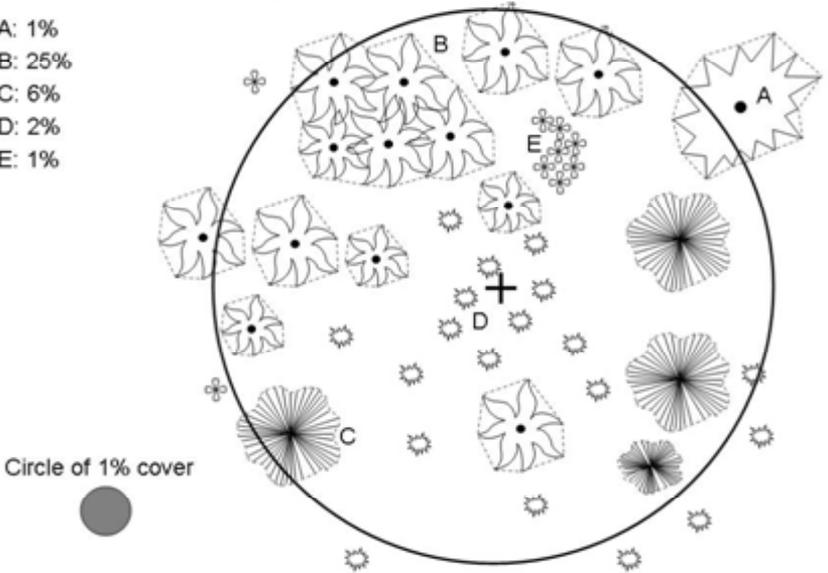


Figure 57. Assessing canopy cover. See individual variable text for more detail.

**Growth Habits** – P2 Vegetation data is collected by growth habits at each level of detail. In general, growth habits for vascular plants include trees, shrubs and woody vines, forbs, and grass-like plants (graminoids). However, depending on the level of detail, trees are grouped in different ways. See Sections 8.5 and 8.6 for more detail.

**Layer Codes** – Growth Habit groups are assessed by layers in Vegetation Structure (Section 8.5), and one of the following layer codes (Section 8.6.5) will be assigned to individual plant species in Species Composition (Section 8.6).

**NRCS PLANTS database** – The Natural Resource Conservation Service (NRCS) PLANTS Database provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the U.S. and its territories. It includes names, plant symbols, checklists, distributional data, species abstracts, characteristics, images, crop information, automated tools, onward Web links, and references.

USDA, NRCS. 2000. The PLANTS Database (<http://plants.usda.gov>, 1 January 2000). National Plant Data Center, Baton Rouge, LA 70874-4490 USA. FIA currently uses a stable codeset downloaded in January of 2000.

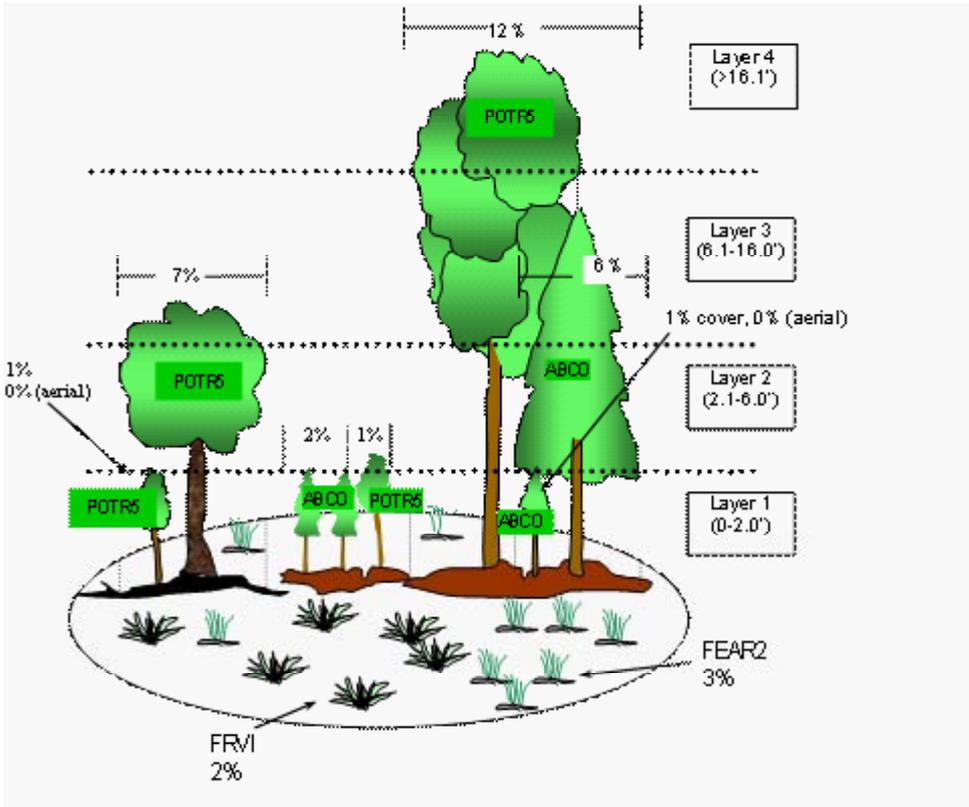


Figure 58. Example of growth habit by layer and species composition.

Table 1-Estimation of canopy cover by layer and aerial view of each growth habit in Figure 58

Vegetation Structure Growth Habit	Layer 1 (0-2.0')	Layer 2 (2.1'-6.0')	Layer 3 (6.1'-16.0')	Layer 4 (>16.1')	Aerial
	Percent canopy cover				
Tally tree sp (TT)	005	013	019	008	022
Non-tally tree sp (NT)	000	000	000	000	000
Shrub & Vine (SH)	000	000	000	000	000
Forb (FB)	002	000	000	000	002
Graminoid (GR)	003	000	000	000	003

Table 2-Estimation of canopy cover by species in figure 58

Level of Detail	Species Growth Habit	Species Code	Cover	Layer
2	GR	FEAR2	003	1
2	SD	ABCO	003	1
2	SD	POTR5	008	3
3	LT	POTR5	008	4
3	LT	ABCO	006	3

Note: FRVI, estimated at 2%, was not recorded, and ABCO and POTR5 are present as two different growth habits (seedling/sapling (SD) and large tree (LT)) with at least 3% cover.

### 8.3 Vegetation Sampling Options – Plot-Level Variables

The following options are set by the inventory unit prior to field season and are not set by field crews upon arriving at a plot. Therefore, each unit can customize the PDR program to automatically fill these variables. These variables are included to aid data management and allow various units to be compared appropriately.

#### 8.3.1 P2 VEGETATION SAMPLING STATUS

This plot-level variable determines whether vegetation data will be recorded on the plot and the land class(es) on which it will be recorded. The code used will be determined by regional needs. If P2 VEGETATION SAMPLING STATUS = 0, no further data collection is required within this field guide section.

When collected: All plots  
Field width: 1 digit

MQO: No errors

Tolerances: At least 99% of the time

Values:

- 0 Not sampling vegetation
- 1 Vegetation data collected only on accessible forest land conditions (CONDITION CLASS STATUS = 1 and NONFOREST SAMPLING STATUS = 0)
- 2 Vegetation data collected on all accessible land conditions (CONDITION CLASS STATUS=1 or 2, NONFOREST SAMPLING STATUS =1 and NONFOREST PLOT STATUS=1)

### 8.3.2

#### LEVEL OF DETAIL

This plot-level variable determines whether data are collected for vegetation structure growth habits only or for individual species (that qualify as most abundant) as well. If LEVEL OF DETAIL = 3, then a tree species could be recorded twice, but it would have two different species growth habits (see Section 8.6.1). (RM LEVEL OF DETAIL = 2 on all plots where P2 vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2))

When collected: on all plots where P2 vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)

Field width: 1 digit

MQO: No errors

Tolerances: At least 99% of the time

Values:

- 1 Collect data for vegetation structure only; total aerial cover and cover by layer for tally tree species (all sizes), non-tally tree species (all sizes), shrubs, forbs, and graminoids.
- 2 Collect vegetation structure data (Level of Detail = 1) plus understory species composition data including up to four species of: seedlings and saplings of any tree species (tally or non-tally) <5 inches DBH (DRC for woodland species), shrubs (including woody vines), forbs, and grasses.
- 3 Collect vegetation structure data, understory species composition data (Level of Detail = 2), plus up to four trees species (tally or non-tally) ≥5 inches DBH (DRC for woodland species)

### 8.4

#### Vegetation Data Collection Location – Subplot-Level Variables

#### 8.4.1

##### SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: On all plots where P2 vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)

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

#### 8.4.2 P2 VEG SUBPLOT SAMPLE STATUS

Record the code to indicate if the subplot was sampled for P2 vegetation. A condition may be sampled but not have any vascular plants present. If all the vegetation measurements cannot be completed on the subplot (for example, deep snow or water, hazardous weather, time limitation), enter code 2 and do not record any vegetation measurements.

When collected: On all subplots where P2 vegetation is being sampled on accessible forest land (P2 VEGETATION SAMPLING STATUS=1 and SUBPLOT STATUS = 1) or is being sampled on accessible forest land or nonforest land and at least one accessible nonforest land condition is present on the plot (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST SUBPLOT STATUS=1)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Subplot sampled
- 2 Subplot not sampled

#### 8.4.3 VEGETATION NONSAMPLED REASON

Record the reason why vegetation on a subplot cannot be sampled.

When collected: On all subplots where P2 vegetation is being sampled on all accessible land conditions (P2 VEG SUBPLOT SAMPLE STATUS = 2)

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 04 Time limitation
- 05 Lost data (for office use only)
- 10 Other (for example, snow or water covering vegetation that is supposed to be sampled)

#### 8.4.4 CONDITION CLASS NUMBER

Record the number for the sampled condition class in which the vegetation is found. If multiple sampled conditions occur on the same subplot, data will be collected for each condition separately.

When collected: Any accessible condition class when P2 vegetation is being sampled on accessible forest land conditions (P2 VEGETATION SAMPLING

STATUS =1)  
Field width: 1 digit  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 1 to 9

#### 8.4.5 VEGETATION SUBPLOT NOTES

Use this field to record notes pertaining to the subplot, and any unusual conditions encountered.

When collected: VEGETATION NONSAMPLED REASON = 10 or as needed  
Field width: 2000 alphanumeric characters  
Tolerance: N/A  
MQO: N/A  
Values: English language words, phrases, and numbers

#### 8.5 Vegetation Structure

In this section, use ocular methods to estimate canopy cover by layer and aerial view coverage for each growth habit, and record to the nearest percent.

Canopy cover by layer:

Estimate the canopy cover for each of the four layers. Include growth habits present on the condition and any foliar parts overhanging the condition. For each layer cover, examine the canopy cover of each growth habit as if the other growth habits do not exist. Do not double count overlapping layers within a growth habit; visualize the cover layer collapsed into a 2-dimensional space. If a growth habit group does not have foliage in a layer, enter 0 (do not count tree boles as cover).

Aerial View Coverage:

Determine the total canopy cover by growth habit (trees, shrubs, forbs, and graminoids). Examine each growth habit individually as if the other growth habits do not exist. Do not double count overlapping layers within a growth habit (maximum cover=100%). To determine, estimate the area of ground surface covered by a vertically-projected polygon, described by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959) for the particular growth habit (Figure 57).

Cover is estimated for each sampled condition of the subplot. If multiple sampled conditions occur on a subplot, treat the condition boundary as a vertical wall on the plot: plant foliage is included in the condition it is hanging over, even if the plant is rooted in a different condition. However, the foliage cover value is always estimated as a percent of an entire subplot. That is, if the cover of a growth habit within the condition is about equal to a circle with a radius of 5.3 feet, the cover estimate will always be 5 percent, even if only 30 percent of the subplot is in the condition on which the species is being measured.

The total cover for a specific growth habit must be equal to or greater than the

highest cover recorded for an individual layer in that growth habit, but cannot be greater than the sum of the covers recorded for all the layers in that growth habit.

Vegetation Structure Growth Habits:

Apply the definitions that follow based on the species and appearance of the plants on the subplot-condition (i.e. do not put the same species in multiple growth habits on the same subplot-condition). If a tree species has been selected as a tally tree by the particular FIA unit, always record that species in the tally tree species growth habit (TT), even if it grows as a shrub in some environments. Woody plants not on the unit's tally tree list may have a tree growth habit in some environments, and these should be recorded as non-tally tree species (NT). If the growth habit is shrub in another environment, record that species as a shrub (SH). The definitions (adapted from NRCS PLANTS) are:

- TT Tally Tree Species (TT): All core tree species and any core-optional tree species selected by a particular FIA unit. Any plant of that species is included, regardless of its shape and regardless of whether it was tallied on the subplot or microplot during tree tally (plants with canopy hanging into the subplot). Seedlings, saplings, and mature plants are included.
- NT Non-tally Tree Species (NT): Tree species not on a particular FIA unit's tree tally list that are woody plants with a single stem, not supported by other vegetation or structures (not vines), and which are, or are expected to become, greater than 13 feet in height. Seedlings, saplings, and mature plants are included.
- SH Shrubs/Woody Vines (SH): Woody, multiple-stemmed plants of any size, and vines. Most cacti are included in this category.
- FB Forbs (FB): Herbaceous, broad-leaved plants; includes non-woody-vines, and ferns (does not include mosses and cryptobiotic crusts).
- GR Graminoids (GR): Grasses and grass-like plants (includes rushes and sedges).

#### 8.5.1

##### TALLY TREE SPECIES COVER LAYER 1

Record a total canopy coverage for all tally tree species in layer 1 (0-2.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC.

When Collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)

Field Width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time  
Values: 000-100

**8.5.2 TALLY TREE SPECIES COVER LAYER 2**

Record a total canopy coverage for all tally tree species in layer 2 (2.1- 6.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

**8.5.3 TALLY TREE SPECIES COVER LAYER 3**

Record a total canopy cover for all tally tree species in layer 3 (6.1- 16.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

**8.5.4 TALLY TREE SPECIES COVER LAYER 4**

Record a total canopy cover for all tally tree species in layer 4 (16.1 feet and above) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

**8.5.5 TALLY TREE SPECIES COVER – AERIAL VIEW**

Record the total canopy cover for all tally tree species over all layers. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1, but include all layers.

**8.5.6 NON-TALLY TREE SPECIES COVER LAYER 1**

Record a total canopy coverage for species not on the tally tree species list with tree growth habit in layer 1 (0-2.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC.

When Collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)

Field Width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time

Values: 000-100

**8.5.7 NON-TALLY TREE SPECIES COVER LAYER 2**

Record a total canopy coverage for species not on the tally tree species list with tree growth form in layer 2 (2.1- 6.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

- 8.5.8 NON-TALLY TREE SPECIES COVER LAYER 3**  
Record a total canopy cover for species not on the tally tree species list with tree growth habit in layer 3 (6.1- 16.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.
- 8.5.9 NON-TALLY TREE SPECIES COVER LAYER 4**  
Record a total canopy cover for species not on the tally tree species list with tree growth habit in layer 4 (16.1 feet and above) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.
- 8.5.10 NON-TALLY TREE SPECIES COVER – AERIAL VIEW**  
Record the total canopy cover for species not on the tally tree species list with tree growth habit over all layers. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1, but include all layers.
- 8.5.11 SHRUB AND WOODY VINE COVER LAYER 1**  
Record a total canopy coverage for shrub/woody vine growth habit in layer 1 (0-2.0 feet) to the nearest percent.
- When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)  
Field width: 3 digits  
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%  
MQO: at least 90% of the time  
Values: 000-100
- 8.5.12 SHRUB AND WOODY VINE COVER LAYER 2**  
Record a total canopy coverage for shrub/woody vine growth habit in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.
- 8.5.13 SHRUB AND WOODY VINE COVER LAYER 3**  
Record a total canopy coverage for shrub/woody vine growth habit in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.
- 8.5.14 SHRUB AND WOODY VINE COVER LAYER 4**  
Record a total canopy coverage for shrub/woody vine growth habit in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.
- 8.5.15 SHRUB AND WOODY VINE COVER—AERIAL VIEW**  
Record the total canopy cover for the shrub/woody vine growth habit over

all layers. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1, but include all layers.

**8.5.16 FORB COVER LAYER 1**

Record a total canopy coverage for forbs in layer 1 (0-2.0 feet) to the nearest percent.

When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)

Field width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time

Values: 000-100

**8.5.17 FORB COVER LAYER 2**

Record a total canopy coverage for forbs in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

**8.5.18 FORB COVER LAYER 3**

Record a total canopy coverage for forbs in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

**8.5.19 FORB COVER LAYER 4**

Record a total canopy coverage for forbs in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

**8.5.20 FORB COVER—AERIAL VIEW**

Record the total canopy cover for the forb growth habit over all layers. Follow the same procedures as for FORB COVER LAYER 1, but include all layers.

**8.5.21 GRAMINOID COVER LAYER 1**

Record a total canopy coverage for graminoids in layer 1 (0-2.0 feet) to the nearest percent.

When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)

Field width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time

Values: 000-100

**8.5.22 GRAMINOID COVER LAYER 2**

Record a total canopy coverage for graminoids in layer 2 (2.1-6.0 feet) to the

nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

**8.5.23 GRAMINOID COVER LAYER 3**

Record a total canopy coverage for graminoids in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

**8.5.24 GRAMINOID COVER LAYER 4**

Record a total canopy coverage for graminoids in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

**8.5.25 GRAMINOID COVER—AERIAL VIEW**

Record the total canopy cover for the graminoid growth habit over all layers. Follow the same procedures as for GRAMINOID COVER LAYER 1, but include all layers.

**8.6 Species Composition**

Species are recorded when LEVEL OF DETAIL = 2 or 3. Identify the four most abundant species within each growth habit group (tree seedlings and saplings, shrubs/woody vines, forbs, graminoids, and overstory trees) that occupy 3 percent or greater canopy cover on the subplot. Although up to four species with cover of at least 3 percent per growth habit can be recorded, crews should not spend more than 5 minutes searching for additional species when less than four species are not readily observable. The methods described assume that **only one field crew member per plot is entering vegetation profile data**. Other crew members may assist with assessments, but data entry by only one person is highly recommended.

When there are multiple conditions within a subplot, the species must be present at 3 percent or more cover on the full 24-foot radius subplot in order to be recorded. If part of the subplot is a non-sampled condition (e.g., nonforest or inaccessible), estimate cover for the full subplot if possible; otherwise assume the species density is the same on the non-sampled portion. If a species is present at 3 percent cover or more on the full subplot, record species and cover separately for each condition, by only including cover within a vertical projection of the condition boundary within a subplot. Cover percentages are **always fixed on the full subplot area, regardless of condition proportion**. For example, on a subplot with two sampled conditions, a species occurs with a cover equal to a circle with a radius of 7.6 feet on the full subplot, or 10 percent cover, so it is recorded. On condition class #1, it covers an area equal to a circle of 2.4-foot radius and is recorded as 1 percent cover. The remainder, 9 percent cover, is recorded for condition #2. Cover values less than 3 percent for a condition that occupies part of a subplot are valid as long as the cover of the species on the full subplot is at least 3 percent. See Figure 59 for an example.

**Cover estimates on FIA subplot with multiple conditions**

- Condition 1 covers 65% of subplot
- Condition 2 covers 35% of subplot

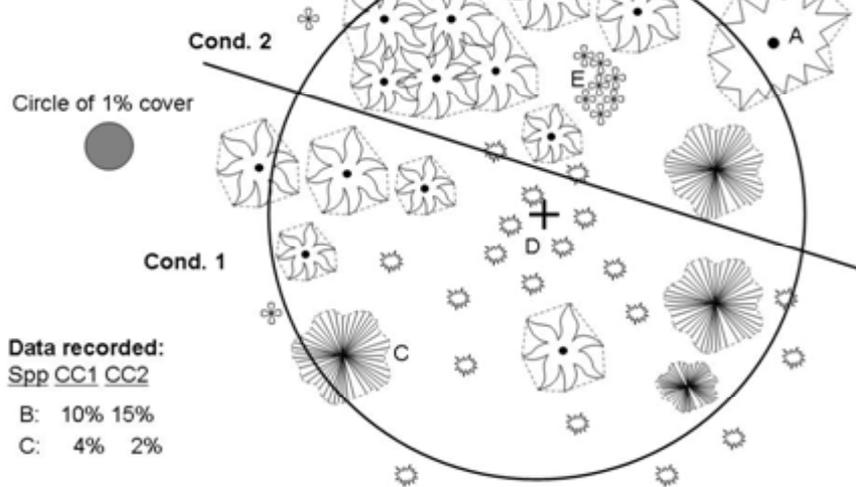


Figure 59. Example of species cover estimation on a subplot with 2 conditions. See Figure 57 for total cover across the subplot. In Figure 57, species A, D, and E would be included in estimates of vegetation structure by growth habit, but not recorded for species composition. Note that species with subplot cover <3% are not recorded, but that cover recorded on a condition can be less than 3%.

**8.6.1 SPECIES GROWTH HABIT**

Record the growth habit of the species. Tally tree species are always recorded as trees, even when they exhibit a shrub-like growth habit. However, because many species can exhibit various growth habits, it is important to note which growth habit each recorded species is demonstrating on the current condition. If a species has more than one growth habit on a condition in a subplot, record the one which is most prevalent; however, both tree habits (SD and LT) can be coded for the same species if LEVEL OF DETAIL=3 and the species is found in both size classes. A species may be recorded with a different growth habit on a different subplot-condition on the same plot.

When collected: LEVEL OF DETAIL = 2 or 3, and for each species recorded below.

Field width: 2 alphanumeric characters

Tolerance: No errors

MQO: At least 95% of the time

Values:

- SD** Seedlings Saplings: Small trees less than 5 inches DBH or DRC, including tally and non-tally tree species. Up to four species are included if individual species total cover is at least 3% of subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.
- SH** Shrubs:/Woody Vines: Woody, multiple-stemmed plants of any size, and vines. Most cacti are included in this category. Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.
- FB** Forbs: Herbaceous, broad-leaved plants; includes non-woody-vines, and ferns (does not include mosses and cryptobiotic crusts). Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.
- GR** Graminoids: Grasses and grass-like plants (includes rushes and sedges). Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.
- LT** Large Trees: Up to four species of large trees (DBH or DRC at least 5 inches) are recorded if individual species cover is at least 3% of the subplot area, including both tally and non-tally tree species, when LEVEL Of DETAIL = 3.

## 8.6.2

### SPECIES CODE

Record a code for each sampled vascular plant species found rooted in or overhanging the sampled condition of the subplot at any height. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database (currently January 2000 version). Identification to species only is expected. However, if subspecies information is known, enter the appropriate NRCS code. For graminoids, genus and unknown codes are acceptable, but do not lump species of the same genera or unknown code. For example, if several unknown CAREX species are present, only record the individual species present with cover of at least 3 percent.

If a plant cannot be identified quickly and confidently, assign a NRCS PLANTS genus or unknown code appropriate to the species. Collect a specimen away from the subplot unless the species is locally sparse or another SPECIMEN NOT COLLECTED REASON CODE (Section 8.6.6) applies. A species is "locally sparse" if 5 or fewer plants are present in the entire plot (4 subplots) and immediate surrounding area. A species may be sparse and still meet the criteria for inclusion in species composition, but this will be rare.

Acceptable unknown codes

Code	Common Name
2FERN	Fern or Fern Ally
2FORB	Forb (herbaceous, not grass nor grasslike)
2FD	Forb, dicot
2FM	Forb, monocot
2GRAM	Graminoid (grass or grasslike)
2GA	Grass, annual
2GP	Grass, perennial
2GL	Grass-like, (sedges and rushes)
2PLANT	Plant
2SHRUB	Shrub (>.5m)
2SUBS	Subshrub (<.5m)
2TREE	Tree
2VH	Vine, herbaceous
2VW	Vine, woody

When collected: LEVEL OF DETAIL = 2 or 3 and species canopy cover on the full subplot is 3% or greater.

Field width: 8 alpha-numeric characters

Tolerance: No errors

MQO: At least 80% of the time

Values: Accepted NRCS species code when the species is known, or an accepted NRCS genus or unknown code when the species is not known

### 8.6.3 UNIQUE SPECIES NUMBER

When any code is entered for the first time on a plot, it is assigned UNIQUE SPECIES NUMBER = 1. If more than one unidentified species is discovered that is described by the same genus or unknown code, the next sequential number is assigned. If a recorded unidentified species is encountered again elsewhere on the plot, the field crew records the species with the same genus or unknown code with the same unique species number.

When collected: All species recorded

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-99, assigned in sequential numbers

### 8.6.4 SPECIES CANOPY COVER

For each species recorded, estimate and record the canopy cover present on the subplot-condition to the nearest 1 percent (Note: cover is always recorded as a percent of the full subplot area, even if the condition being assessed does not cover the full subplot—see example in Section 8.6). Canopy cover

is identified as the area of ground surface covered by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959) by the canopy of each plant species (Figure. 57). Do not count overlapping crowns within a species. When recording cover for seedlings and saplings (SPECIES GROWTH HABIT=SD), do not include any canopy from trees greater than or equal to 5 inches DBH (DRC for woodland species), regardless of how close to the ground the canopy extends. When LEVEL OF DETAIL=3, a separate estimate is made for the canopy of trees  $\geq$  5 inches DBH/DRC.

When collected: For each plant species present on the subplot with canopy cover greater than or equal to 3%. A plant species is defined as a unique SPECIES CODE and UNIQUE SPECIES NUMBER pair.

Field width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: at least 90% of the time

Values: 001-100

#### 8.6.5 SPECIES VEGETATION LAYER

For each individual species recorded, assign one of the vegetation layers. These layers illustrate the vertical diversity of the predominant species found on the subplot.

Assign each plant species record to only one of the vegetation layers. If a plant species in a growth habit is found in more than one layer, assign the entire plant to the layer where most of the cover occurs. If a species occupies multiple layers equally, assign the highest of the equally occupied layers. If a plant has a seed head that grows much taller than the rest of the plant, record the layer that the main part of the plant is in, not the top of the seed head.

When collected: For each species recorded.

Field width: 1 digits

Tolerance: No errors

MQO: At least 90% of the time

Values: 1-4

- 1 0 to 2.0 feet
- 2 2.1 to 6.0 feet
- 3 6.1 to 16.0 feet
- 4 Greater than 16 feet

#### 8.6.6 SPECIMEN OFFICIALLY COLLECTED

Record if a specimen was collected or not for each species, genus or unknown code entered as a new unique species. (RM See Appendix 10 for information on where to send unknown samples.)

When collected: All species recorded

Field width: 1 digit

Tolerance: No errors  
MQO: At least 99% of the time  
Values

- 0 No, a specimen was not collected
- 1 Yes, a specimen was collected

#### 8.6.7 SPECIMEN LABEL NUMBER

Record the label number for the collected specimen. Pre-numbered labels are provided to each crew by the regional coordinator.

When collected: SPECIMEN OFFICIALLY COLLECTED = 1  
Field width: 5 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 1 to 99999, as pre-printed and assigned by region

#### 8.6.8 P2 SPECIMEN NOT COLLECTED REASON CODE

Record the code that describes why a specimen has not been collected.

When collected: An unknown code or genus code is entered and SPECIMEN OFFICIALLY COLLECTED = 0  
Field width: 2 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values:

- 01 Species is locally sparse (fewer than 5 individual plants in area of the plot)
- 02 Species has no mature foliage or reproductive parts present, so is unlikely to be identifiable if collected.
- 03 Hazardous situation
- 04 Time limitation
- 05 Wilderness or reserved land where plant collections are not allowed
- 06 Specimen collected for immediate/local identification
- 07 Not required by inventory unit
- 10 Other (explain in notes)

#### 8.6.9 VEGETATION SPECIES NOTES

Notes may be entered for any species encountered, but are required for each new species that is not identified. Enter text that describes the species. This text may be used in the specimen label and unknown report.

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

## 9.0

### INVASIVE PLANTS

The objectives of the Phase 2 (P2) invasive plants protocol are to document abundance and monitor changes in abundance of selected species over time. Combined with other plot data and other datasets, this data can be used to predict the future spread of selected species. Invasive plant species are having tremendous economic and ecological impacts on our nation's forests, and the impacts are increasing over time. Providing accurate, statistically valid estimates of the distribution and abundance of some of the most damaging species will give managers and policy-makers a better understanding of the problem than they would otherwise have.

Each FIA unit, in collaboration with vegetation experts, has developed lists of the most important invasive species to monitor on forested lands. Depending on local needs or forest conditions, there may be different lists of species for individual states or portions of states. Changes to the species on these lists are managed by the individual FIA units using local change procedures. However, **when an FIA unit samples invasive species, they will use the field protocols contained in this chapter.**

Data will be collected by crew members who have been trained and certified in the Invasive plants protocol methods. These crew members are expected to have field guides that allow for unambiguous identification of the plant species on the list they are to use, and training in field identification and cover estimation of those species under different conditions.

**Note: Avoid becoming part of the problem!** There is a risk that field crews walking into plot locations could pick up seeds along roadsides or other patches of invasive plants and spread them through the forest and on to the plot. Be aware of the vegetation you are traveling through and consider stopping and removing seeds from boots and clothing before entering uninvaded lands, particularly remote areas that are rarely visited.

## 9.1

### Invasive species sample design

Phase 2 sampling of invasive species is most often focused on accessible forest condition classes within the 24.0-foot radius subplot. If the total area of all accessible forest land condition classes is less than 100 percent on a subplot, invasive species measurements are done only on the portion that is in accessible forest land condition classes. If multiple accessible forested condition classes are present on the subplot, separate estimates are made for each condition class on the subplot. Canopy cover estimates are only made for the area within accessible forest condition(s)—for example, vegetation cover over-hanging a nonforest road condition is not included in the estimate. However, each FIA unit has the option to also sample invasive species on accessible nonforest land conditions (CONDITION STATUS 2), where desired or funded by specific landowners (e.g., on some National Forests in the West). Where this is done, estimates of invasive species abundance are maintained separately on forest and nonforest conditions.

Canopy cover is estimated for any listed invasive species present on the

measured condition(s) of a subplot, regardless of abundance (i.e., there is not minimum cover threshold for sampling)(Appendix 9). When crews are not sure about the identification of a plant that might be a listed invasive, they are encouraged to collect specimens for later identification (Appendix 10). Rules and expectations for plant collection and identification are specified by individual FIA units.

## 9.2 Species Records

The invasive plant recorder does a search of each measured condition on the subplot. Only listed species rooted in or overhanging (and rooted out of) this condition are included. For tree species, there are no minimum (or maximum) height limits as are required for seedling counts. All vegetation and plant parts that are or were alive during the current growing season are included in the cover estimates (e.g., brown Canada thistle in late summer is counted, live buds on Russian olive in late fall are used to estimate crown cover). Total cover is estimated on measured conditions on each 24.0-foot radius subplot for every species on the invasive plant list found. If multiple conditions are being sampled on the same subplot, separate cover estimates for every species must be made .

## 9.3 INVASIVE PLANT SAMPLING STATUS (Plot-level variable)

Determine whether invasive plant data will be recorded on the plot and the land class(es) on which it will be recorded.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 Not collecting invasive plant data
- 1 Invasive plant data collected only on accessible forest land conditions (CONDITION CLASS STATUS = 1)
- 2 Invasive plant data collected on all accessible land conditions (CONDITION CLASS STATUS =1 OR NONFOREST CONDITION STATUS=2)

## 9.4 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

When collected: On all subplots where INVASIVE PLANT SAMPLING STATUS = 1 or 2

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

- 9.5 **INVASIVE PLANT SUBPLOT STATUS (Subplot-level variable)**  
Record the code to indicate whether the subplot was sampled for invasive plants. A subplot may be sampled but not have any invasive plants present. If there is any part of an accessible portion of the subplot where other plot measurements are made but invasive plants can't be assessed (e.g., because of snow, water, hazardous weather, time limitation), enter code 3 and do not record any invasive plant measurements.

When collected: On all subplots where (INVASIVE PLANT SAMPLING STATUS=1 and SUBPLOT STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST SUBPLOT STATUS=2)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Subplot sampled, invasive plants present
- 2 Subplot sampled, no invasive plants present
- 3 Subplot not sampled for invasive plants

- 9.6 **INVASIVE PLANT NONSAMPLED REASON (Subplot-level variable)**  
Record the reason why a subplot cannot be sampled for invasive plants.

When collected: On all subplots where INVASIVE PLANT SUBPLOT STATUS = 3

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 4 Time limitation
- 5 Lost data (office use only)
- 10 Other (for example, snow or water covering vegetation that is supposed to be sampled)

- 9.7 **INVASIVE PLANT DATA NOTES**  
Use this field to record any notes about the condition on the subplot, particularly any unusual conditions encountered.

When collected: INVASIVE PLANT NONSAMPLED REASON=10 or as needed

Field width: Unlimited alphanumeric character field

Tolerance: N/A

MQO: N/A

Values: English language words, phrases, and numbers

**9.8 CONDITION CLASS NUMBER**

Record the number for the measured condition class in which the invasive plant(s) is found. If multiple measured conditions occur on the same subplot, data will be collected for each condition separately.

When collected: Any condition class where (INVASIVE PLANT SAMPLING STATUS=1 and CONDITION CLASS STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST CONDITION CLASS STATUS=2).

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-9

**9.9 SPECIES CODE**

Record the code for any species listed in Appendix 9 that is found rooted in or overhanging (and rooted out of) the measured condition within the subplot. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database January 2000 version maintained by the FIA IM group (USDA, NRCS. 2000. The PLANTS database [<http://plants.usda.gov/plants>]. National Plant Data Center, Baton Rouge, LA 70874-4490).

In many of the invasive plant ID guides used by FIA units, some species are grouped together in the ID descriptions, and it may be difficult to distinguish between them with the information provided. In addition, some plants may be hybrids of listed species. Enter the code for the most likely species in the group, or the first one in the group if you are not sure.

If a species is suspected of being a listed invasive but cannot be identified quickly and confidently, and the FIA unit's protocols require specimen collection, assign a NRCS PLANTS unknown code. A subset of acceptable unknown codes that can be used is listed below. Collect a specimen unless the species is "locally sparse". A species is "locally sparse" if five or fewer plants are present in the entire plot (4 subplots) and immediate surrounding area.

Unknown Code	Common Name
2FERN	Fern or Fern Ally
2FORB	Forb (herbaceous, not grass nor grasslike)
2GRAM	Graminoid (grass or grasslike)
2PLANT	Plant
2SHRUB	Shrub (>.5m)
2SUBS	Subshrub (<.5m)
2TREE	Tree
2VH	Vine, herbaceous
2VW	Vine, woody

When collected: On all conditions within subplots where INVASIVE PLANT SUBPLOT STATUS=1 and ((INVASIVE PLANT SAMPLING STATUS=1 and CONDITION CLASS STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST CONDITION CLASS STATUS=2)).

Field width: 8 alpha-numeric characters

Tolerance: No errors

MQO: At least 99% of the time

Values: Accepted NRCS species code from the appropriate list for the unit when the species is known, or a NRCS unknown code when the species is not known.

#### 9.10 UNIQUE SPECIES NUMBER

When any species code is entered for the first time on a plot, the UNIQUE SPECIES NUMBER assigned is "1". If more than one unidentified species is recorded that is described by the same unknown code, the next sequential number is assigned. If a previously-recorded unidentified species is encountered again elsewhere on the plot, the UNIQUE SPECIES NUMBER that corresponds to the earlier encountered specimen must be entered. For example, an unknown thistle and unknown hawkweed would both be given a species code of "2FORB" but would need to be given different UNIQUE SPECIES NUMBERS when measured.

When collected: All species records

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1-99, assigned in sequential numbers

#### 9.11 SPECIES CANOPY COVER

A rapid canopy cover estimate, to the nearest percent cover, is made for each species for all foliage across all layer heights. Canopy cover is based on a vertically-projected polygon described by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959), and ignoring overlap among multiple layers of a species. For each species, cover can never exceed 100 percent. Cover is estimated for each measured condition on the subplot separately. However, the foliage cover is always estimated as a percent of an entire subplot. For example, on a subplot with two sampled conditions, a species occurs with a cover equal to a circle with a radius of 7.6 feet on the full subplot, or 10 percent cover. On condition class #1 it covers an area equal to a circle of 2.4 feet radius and is recorded as 1 percent cover. The remainder, 9 percent cover, is recorded for condition #2. If the species is only present on condition class #1 with an area equal to a circle of 2.4-foot radius it is recorded as 1 percent. The proportion of the subplot in each condition does not matter.

If cover is greater than 0 but less than 1.5 percent, record as 1 percent cover. For species of moderate cover, it may be easiest to divide the subplots into quarters, estimate canopy cover of each quarter separately, and then add them

together. The following area-cover sizes may be useful in developing estimates for an entirely forested subplot:

Subplot radius = 24.0 feet, Subplot area = 1809 ft <sup>2</sup>			
Cover	Area (ft <sup>2</sup> )	Length of a side of a square(ft)	Radius of circular area(ft)
1%	18	4.3	2.4
3%	54	7.4	4.1
5%	90	9.5	5.3
10%	181	13.4	7.6
20%	362	19	10.7

When collected: All species records

Field width: 3 digits

Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%

MQO: At least 90% of the time

Values: 001 to 100

#### 9.12 INVASIVE PLANT SPECIMEN COLLECTION RULE (Plot-level variable)

Downloaded code to indicate if collection of specimens of unknown invasive species is required.

When collected: Downloaded on all plots where INVASIVE PLANT SAMPLING STATUS = 1 or 2

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

0 FIA unit does not require specimen collection for invasive plants

1 FIA unit requires specimen collection for invasive plants

#### 9.13 INVASIVE SPECIMEN COLLECTED

Record if a specimen was collected for each species or unknown code. If the record is an unknown code, your unit requires specimen collection, and a plant specimen is not collected, describe the reason it was not collected, INVASIVE PLANT NOTES (Section 9.15).

When collected: Each record where INVASIVES PLANT SUBPLOT STATUS=1, INVASIVE PLANT SPECIMEN COLLECTION RULE = 1, and an unknown SPECIES CODE was used.

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 0 No, a specimen was not officially collected
- 1 Yes, a specimen was officially collected

**9.14 SPECIMEN LABEL NUMBER**

Record the label number for the collected specimen. Where plant specimen collection is required, numbered labels are provided to each crew.

When collected: Where INVASIVE SPECIMEN COLLECTED=1

Field width: 5 digits

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 99999, as pre-printed and assigned by FIA unit.

**9.15 INVASIVE PLANT NOTES**

Notes are required for each species record with an unknown code. Enter text that describes the species or that explains why it was not collected if collection was required but not done. This text may be used on the specimen label and any spreadsheet used to track specimens.

When collected: Required for each record with an unknown code and SPECIMEN LABEL NUMBER.

Field width: Unlimited alphanumeric character field

Tolerance: N/A

MQO: N/A

Values: English language words, phrases, and numbers

**9.16 References**

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

## **10.0RM ACCOUNTING PROCEDURES**

For this inventory, a portion of the plots measured during previous inventories may be revisited. In addition to the current location layout and sampling procedures for sampling trees, previously tallied trees on these locations will be accounted for using the original location layout and sampling procedures. The location center (PC) will be the same point for both samples. This chapter refers to data collected for RMRS only.

If the plot was not established at the correct map point during the previous inventory (within 2,500 feet of the theoretical coordinates) account for the trees and saplings on the accounting plot and establish the current plot layout in the correct location. Remove the old tags and nails in the trees, and note this re-location in the notes/comments for the current inventory. For further clarification follow the procedures outlined in Section 0.1.5.3RM Plot Center Incorrectly Placed or Not Found.

**Note:** In the first inventory, some fixed-radius plots were “shifted” away from nonforest land, moving the entire sample plot into accessible forest land. For these locations establish the current design in the correct (grid) location. If the old location was established at the correct location, account for the trees and saplings on the old location, remove all tags and nails from old plot design trees not re-tallied in the current inventory, and establish the new plot layout at the old location center.

### **10.0.1RM Plot Layout**

In the previous inventory, the Sampling Factor designated the plot layout and sampling system used. For plots with the Sampling Factor coded as a 20 or 40, a 5-point, 7-point, or 10-point variable radius timberland plot was established. On locations with the Sampling Factor coded as 01, 02, 05, 91, 92, or 95, a fixed-radius woodland plot was established. For these fixed-radius woodland plots DO NOT ACCOUNT FOR TREES OR SAPLINGS. However, the new plot layout will be established at the old location center (if within 2,500 feet of the theoretical coordinates).

### **10.0.2RM Variable-Radius Plots.**

The PC was designated as point 1 of 5, 7, or 10 points on the plot. Points 2 through 5, 7, or 10 were distributed around the PC, and within the condition of the PC, using a triangular grid pattern with 100-foot or 70-foot intervals (Figure 60). The spacing and orientation of the primary point positions was as follows:

5/7-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from PC (1) to	2	60		70/100
	3	120		70/100
	4	300		70/100
	5	240		70/100
	6	180		70/100
	7	360		70/100
<b>10-point layout</b>				
from PC (1) to	2	360		70
from Point 2 to	3	360		70
from Point 3 to	4	120		70
from Point 4 to	5	180		70
from Point 5 to	6	180		70
from Point 6 to	7	240		70
from Point 7 to	8	300		70
from Point 8 to	9	360		70
from Point 9 to	10	360		70

In the previous inventory, when points 2 through 5, 7, or 10 fell into vegetation conditions different than the condition at the PC, those points were redistributed back into the PC condition. Refer to the previous plot map to determine the actual point placement established.

At each of the points, timber species 5.0-inches DBH and larger, and woodland species 3.0-inches DRC and larger, were tallied on a variable-radius main plot; a 20 or 40 basal area factor (BAF) angle gauge, depending on forest type, was used to select tally trees:

Sampling Factor	Basal Area Factor	Forest Types	Limiting Distance to Geographic Center
20	20	Ponderosa Pine	DBH/DRC X 1.945
40	40	All other Conifer	DBH/DRC X 1.375

In addition, saplings were tallied or counted, and seedlings were counted, on a 1/300 acre fixed-radius microplot centered on the point stake.

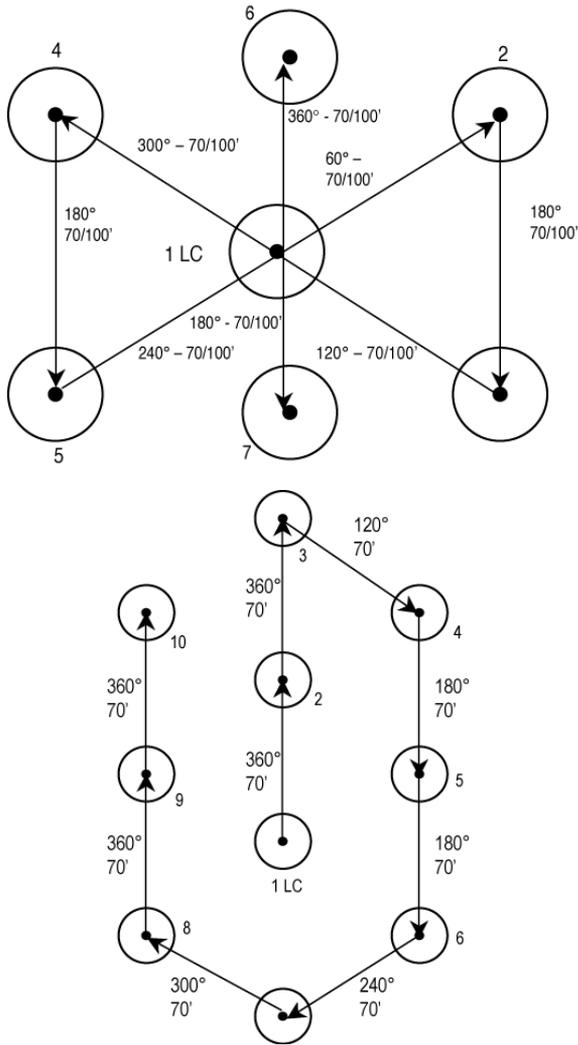


Figure 60. Previous variable-radius plot layouts.

**10.1RM**

**Fixed-radius plots**

Woodland fixed-radius plots will be relocated, but no tree accounting information will be collected.

**10.1.1RM**

**Sampling Methods**

Locate and account for all trees preprinted on the Accounting Tree Data record (Appendix A.10) using the preprinted Sampling Factor code and the plot diagram on the old field form as a reference for the plot layout. Only points 1-5 will be accounted for. If a preprinted tree cannot be relocated and the reason

cannot be determined, code CURRENT TREE STATUS = 0 and make a note in comments.

- On the microplot: Locate and account for all trees preprinted on the Accounting Tree Data record and **measure and record all new live trees  $\geq 5.0$  inches in diameter that were not previously recorded as saplings.**
- With variable-radius sampling (Sampling Factors 20 and 40), the limiting distance values are related to an individual tree's diameter (DBH or DRC) and its horizontal distance from the sample point stake.
- For the microplot, the center of the tree (single-stemmed trees) or the geographic center of the trees stems (multistemmed woodland trees) **must be at or within the fixed horizontal distance of 6.8 feet.**
- Locate individual trees by referencing the preprinted azimuth and distance, or by locating the numbered tree tag.

The following trees were sampled in the previous inventory:

1. Main Plot.
  - a. Live timber species 5.0-inches DBH and larger.
  - b. Live woodland trees 3.0-inches DRC and larger. For multistemmed trees, at least one stem was 3.0-inches DRC or larger.
  - c. Standing dead timber species 5.0-inches DBH and larger.
  - d. Standing dead woodland trees that had at least one standing qualifying stem (3.0-inches DRC or larger, 8.0 feet in length to a 1.5-inches branch diameter).
2. Seedling/Sapling Microplot.  
After trees were tallied on the main plot, the following microplot trees were tallied:
  - a. Timber species saplings (1.0 - 4.9 inches DBH).
  - b. Woodland species saplings (1.0 - 2.9 inches DRC).
  - c. Established seedlings (less than 1.0-inches DRC/DBH) to bring the total tally of main plot and microplot live trees to 4.

## 10.2RM Plot and Tree Data

### 10.2.1RM MONTH

Record the month that the accounting 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

**10.2.3RM DAY**  
Record the day of the month that the accounting 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

**10.2.4RM YEAR**  
Record the year that the accounting plot was completed.  
  
When collected: All plots  
Field width: 4 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: > 2004

**10.2.5RM PREVIOUS NUMBER OF POINTS MEASURED**  
Record the previous number of POINTS measured from the last inventory cycle. Up to 10 points were measured in previous inventories, but only up to a maximum of 5 are being accounted for in the current inventory.

When collected: All accounting plots  
Field width: 2 digits  
Tolerance: No errors  
MQO: At least 99% of the time  
Values: 1-10

- 1 1 point previously measured
- 2 2 points previously measured
- 3 3 points previously measured
- 4 4 points previously measured
- 5 5 points previously measured
- 6 6 points previously measured
- 7 7 points previously measured
- 8 8 points previously measured
- 9 9 points previously measured
- 10 10 points previously measured

**10.2.6RM POINTS ACCOUNTED**  
Record the number of points accounted for, to a maximum of 5.

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

- 1 1 point accounted for

- 2 2 points accounted for
- 3 3 points accounted for
- 4 4 points accounted for
- 5 5 points accounted for

**10.2.7RM NON ACCOUNTED REASON**

Record the reason accounting data was not collected.

When collected: All plots accounting data not obtained (when POINTS ACCOUNTED = 0)

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 Accounting plot not found
- 2 Access denied
- 3 Hazardous
- 4 Ran out of time (when field supervisor determines crew should not return to the location to finish the plot)

**10.2.8RM PREVIOUS NUMBER OF MICROPLOTS MEASURED**

Record the previous number of MICROPLOTS measured from the last inventory cycle. Up to 10 microplots were measured in previous inventories, but only up to a maximum of 5 are being accounted for in the current inventory.

When collected: All accounting plots

Field width: 2 digits

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 1 microplot previously measured
- 2 2 microplots previously measured
- 3 3 microplots previously measured
- 4 4 microplots previously measured
- 5 5 microplots previously measured
- 6 6 microplots previously measured
- 7 7 microplots previously measured
- 8 8 microplots previously measured
- 9 9 microplots previously measured
- 10 10 microplots previously measured

**10.2.9RM MICROPLOTS ACCOUNTED**

Record the number of microplots accounted for, to a maximum of 5.

When collected: All plots

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time  
Values:  
1 1 microplot accounted for  
2 2 microplots accounted for  
3 3 microplots accounted for  
4 4 microplots accounted for  
5 5 microplots accounted for

**10.2.10RM ACCOUNTING LAND USE**

Record the present Land Use code for Point 1.

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

1 Timberland  
2 Woodland  
3 Nonforest

**10.2.11RM CO-LOCATED**

Record whether or not the Accounting plot is co-located with the current plot design.

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

0 No  
1 Yes

**10.2.12RM POINT NUMBER**

For preprinted trees, verify/correct if an obvious error exists. For new trees, record the point number where the tree occurs.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 1 digit.  
Tolerance: No errors.  
Valid codes = 1 to 5

**10.2.13RM TREE RECORD NUMBER**

For preprinted trees, verify/correct if an obvious error exists. Record next available tree number for new tally trees.

When collected: Preprinted for previously tallied trees; record for new tally trees

on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 3 digits.  
Tolerance: No errors.  
Values: 1 to 999

#### 10.2.14RM AZIMUTH

Record azimuth to the nearest degree for new tally trees. Record 360 for due north.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 3 digits.  
Tolerance:  $\geq 10$  degrees.

#### 10.2.15RM DISTANCE

This value is the slope distance from the center stake or microplot stake to the center of single-stemmed trees or to the geographic center of multistemmed trees.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 2 digits.  
Tolerance:  $\pm 1$  foot

#### 10.2.16RM PREVIOUS TREE STATUS

Only live trees are pre-printed. If a tree is not on the pre-printed form (other than through growth) ignore.

When collected: Value is preprinted.  
Field width: 1 digit.  
Tolerance: No errors.  
Values:

1 Live Tree – alive at the previous inventory

#### 10.2.17RM CURRENT TREE STATUS

(Current Tree History)

Record a present TREE STATUS for each preprinted tree and new microplot 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: Record for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 1 digit.  
Tolerance: No errors.  
Values:

0 No status -- tree is not presently in the sample (preprinted trees only).  
Reasons to use this code are as follows: Tree was incorrectly tallied

during previous survey; tree is not tallied due to definitional or procedural change; tree is not tallied due to hazardous situation; tree is not tallied due to denied access; tree is not tallied due to crew running out of time.

- 1 Live tree - any live tree (remeasure or through growth).
- 2 Dead tree - any dead tree (new, remeasured, or ingrowth), regardless of cause of death. Includes down mortality trees, 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.

#### 10.2.18RM RECONCILE

Record a NEW TREE RECONCILE for any new tally tree on the microplot that was not tallied in the previous inventory; this code is used to identify the reason a new tree appeared in the inventory. This information is needed to correctly assign volume information to the proper component of volume change. Codes 1,3, and 4 will not be used for accounting purposes.

When Collected: When CURRENT TREE STATUS = 0 and when New tally trees on microplot  $\geq 5.0$  inches DBH/DRC.

Field width: 1 digit.

Tolerance: No errors.

Values:

- 0 Tree not measured – For Example: Use when hazardous, ran out of time, access denied, or could not find plot.
- 2 Through growth - new tally tree 5 inches DBH/DRC and larger, within the microplot.
- 5 Shrank – live tree that shrank below threshold diameter on microplot/ subplot/macropplot
- 6 Missing – tree was tallied in previous inventory, but is now missing due to natural causes such as landslide, fire, etc.
- 7 Cruiser error – erroneously tallied at previous inventory.
- 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.

#### 10.2.19RM SPECIES

For preprinted trees, verify/correct if an obvious error exists. Record for new tally trees. Refer to Section 9.12 for species list; for preprinted species no longer valid. Assign CURRENT TREE STATUS = 0 and RECONCILE code 8. If preprinted species is incorrect, delete the preprinted code and record the correct species code.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DBH/DRC.

Field width: 4 digits.  
Tolerance: No errors.

**10.2.20RM PAST DBH/DRC**

If the preprinted past diameter appears to be incorrect (e.g., past DBH larger than current DBH, and the tree is still alive and growing) delete the preprinted value and record a past DBH/DRC estimate.

When collected: Value is preprinted.  
Field width: 4 digits (xxx.y).  
Tolerance: No errors.

**10.2.21RM CURRENT DBH/DRC**

Record as directed in Tree Data for each preprinted and new tally tree. If individual stems are nailed, measure the stems at (above) the nail.

When collected: Record only for live previously tallied trees; record for new live tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 4 digits (xxx.y).  
Tolerance: Standing trees  $\pm 0.1$  inch per 20 inches of diameter, down trees  $\pm 1$  inch per 20 inches of diameter. Multi-stemmed Woodland species  $\pm 0.2$  inch per stem.

**10.2.22RM DBH/DRC 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: All tally trees  $\geq 5.0$  inches DBH/DRC.  
Field width: 1 digit.  
Tolerance: No errors.  
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.

**10.2.23RM PAST NUMBER OF STEMS**

If the past number of stems does not equal the current number of stems, do not change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

When collected: Value is preprinted.  
Field width: 2 digits.  
Tolerance: No errors.

**10.2.24RM CURRENT NUMBER OF STEMS**

Record for each preprinted and new tally woodland species with at least one stem 1.0 inch in diameter or larger and 1 foot in length  
When collected: Record for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  inches DRC.

Field width: 2 digits.  
Tolerance: No errors.

**10.2.25RM PAST TOTAL TREE LENGTH**

For preprinted trees, verify/correct if an obvious error exists.

When collected: Value is preprinted.  
Field width: 3 digits.  
Tolerance: No errors.

**10.2.26RM CURRENT TOTAL TREE LENGTH**

Determine Total Tree Length for new tally trees as directed in Section 5.

When collected: New tally trees on microplot  $\geq 5.0$  inches DBH/DRC.  
Field width: 3 digits.  
Tolerance:  $\pm 10\%$  of true length.  
Note: Do not collect CURRENT TOTAL TREE LENGTH for preprinted trees, only for new microplot trees.

**10.2.27RM 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.

When collected: Record for previously tallied trees that have died since the previous inventory and new tally trees  $\geq 5.0$  inches DBH/DRC that grew onto a microplot and died since the previous inventory.

Field width: 2 digits.  
Tolerance: No errors.  
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 land clearing activity (accidental, random, etc.). TREE NOTES required
- 80 Silvicultural or land clearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc, or land clearing activity).

**Note:** If multiple possibilities for cause of death exist, record the lowest

numbered code.

#### 10.2.28RM PAST TREE CLASS

Refer to CURRENT TREE CLASS for codes. For preprinted tees, if the PAST TREE CLASS appears to be incorrect (e.g., tree was coded as rotten in first inventory, but is sound), delete the preprinted code and record an estimate of the correct PAST TREE CLASS.

When collected: Preprinted for previously tallied trees.

Field width: 1 digit.

Tolerance: No errors.

#### 10.2.29RM CURRENT TREE CLASS

Record the CURRENT TREE CLASS for each previously tallied and new tree. When collected: Record for previously tallied trees; record for new tally trees on microplot  $\geq 5.0$  in DBH/DRC.

Field width: 1 digit.

Tolerance: No errors.

Values:

- 1 Sound (live) - timber species
  - a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor.
  - a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.
- 2 All live woodland species
- 3 Rough (live) - timber species
  - a live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a sound tree of good form, 5.0-inches DBH or larger.
  - a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
  - a live tree, 5.0-inches DBH or larger, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.
- 4 Rotten (live) - timber species
  - a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.
- 5 Hard dead
  - a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
- 6 Soft dead
  - a standing dead or mortality tree, 1.0-inch DBH/DRC or larger,

that has less than 33 percent of the original merchantable volume  
sound (more than 67 percent rotten and/or missing).

## **11.0RM DOWN WOODY MATERIAL (DWM)**

### **11.0.1RM Down Woody Material (DWM) Overview**

In 2004 and 2005, DWM Pilot studies were conducted on National Forest System (NFS) lands on Phase 2 (P2) plots in Montana. The transect design implemented in 2004 included a subset of the national Phase 3 (P3) Coarse Woody Debris (CWD) transects, in addition to three 120-foot “traverse” transects between subplots 1 and 2, subplots 1 and 3, and subplots 1 and 4. The purposes of the pilots were threefold: first to maximize total transect length, second to separate fuel-loading estimates by type of transect (P3 vs. traverse) for statistical analysis, and third to identify the most efficient transect design that would meet our needs for P2 National Forest level fuel-loading estimates.

Preliminary analysis of the 2004 data showed that the P3 CWD transects were more time-consuming and had much higher variability in fuel-loading estimates than the “traverse” transects. Efficiency was also gained because “traverse” transects share the same horizontal line used to chain between subplots. As a result, in 2005 it was decided to use only the “traverse” transect design for sampling all DWM components.

Another major time-saving change was the elimination of measuring end-point diameters and lengths of CWD pieces. Even though individual measurement of endpoint diameters and lengths of CWD pieces help improve volume estimates and subsequent fuel loadings, it's expected that longer “traverse” transects will help recover this loss by reducing variability in estimates.

Elimination of the large-end diameters of CWD also compromises information on structural diversity, which is important for assessing wildlife habitat. In 2005, in order to better address wildlife structure related to large-end diameter, Region 1 NFS provided five broad structure-related diameter classes, which field crews assigned to individual CWD pieces. Generally, it is much quicker to assign a class than to measure each piece directly.

### **11.0.2RM Introduction**

Down woody materials are an important component 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.

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 11.2RM) 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 Fine Woody Debris (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 11.1).

### 11.0.3RM 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. CWD also includes dead timber and single-stemmed woodland 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 standing multi-stemmed woodland trees such as juniper, only tally stems that are dead, detached, and on the ground. For all dead multi-stemmed woodland trees that do not qualify as standing dead woodland trees (Section 0.4.3) tally all stems attached or detached that meet the size requirements for CWD pieces. There is no height limit for CWD pieces. If a qualifying piece is, for example, ten feet off the ground in the crown of a tree and the transect intersects its longitudinal axis, estimate the appropriate CWM variables.

#### CWD does not include:

1. Woody pieces < 3.0 inches in diameter at the point of intersection with the transect.
2. Woody pieces < 3.0 feet in length.
3. Dead trees leaning 0 to 45 degrees from vertical.
4. Dead shrubs, self-supported by their roots.
5. Trees showing any sign of life.
6. Stumps that are rooted in the ground (i.e., not uprooted).
7. 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).
8. 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 6 feet above the ground to be counted.

#### FWD does not include:

1. Woody pieces  $\geq$  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)

## 11.1RM Traverse Transect Sampling

### 11.1.1RM Locating and Establishing Line Transects

Traverse transects are established between each of subplots 1 and 2, subplots 1 and 3, and subplots 1 and 4, if accessible forest land is sampled on any of the 24.0-foot radius subplots (CONDITION CLASS STATUS = 1). If so, 360 feet of traverse transect length needs to be accounted for by condition, horizontal distance, and sampled horizontal distance (Figure 61).

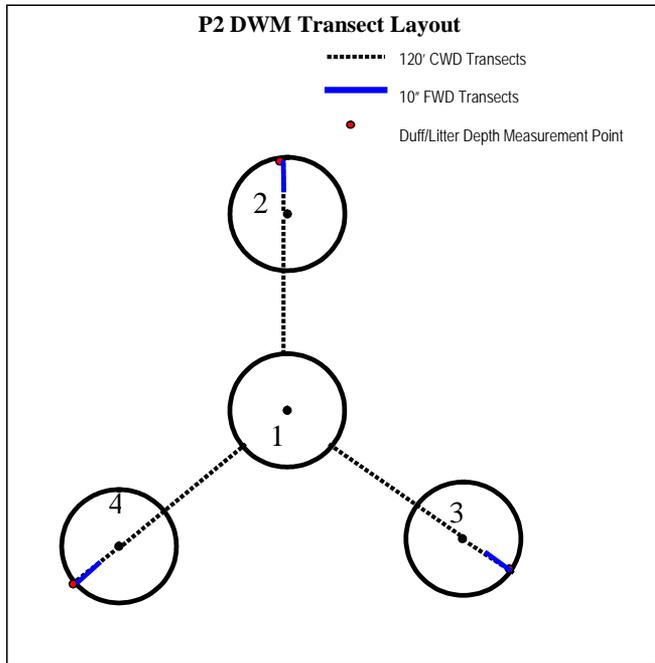


Figure 61. Traverse transect plot layout

### 11.1.2RM CWD transects

Transects begin at the subplot 1 perimeter (24.0 horizontal feet) and extend 120 horizontal feet through the subplot centers to the farther edge of subplots 2, 3, and 4 at 360, 120, and 240 degrees azimuth, respectively (Figure 61).

### 11.2RM Transect Line Segmenting

Any traverse transect that meets the criteria for establishment (see Section 11.1RM) will be segmented by condition class. Transect lines are segmented to determine the length of transect that occurs within each condition class intersecting the line. A segment is a length of transect that is in one condition.

Starting at the subplot 1 perimeter and working towards the other fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record (no more than two conditions per traverse will be segmented—see hierarchical rules below). The transect must extend a total of 120.0 feet horizontal distance. Each time a condition boundary is crossed the segment is recorded (Figure 62)

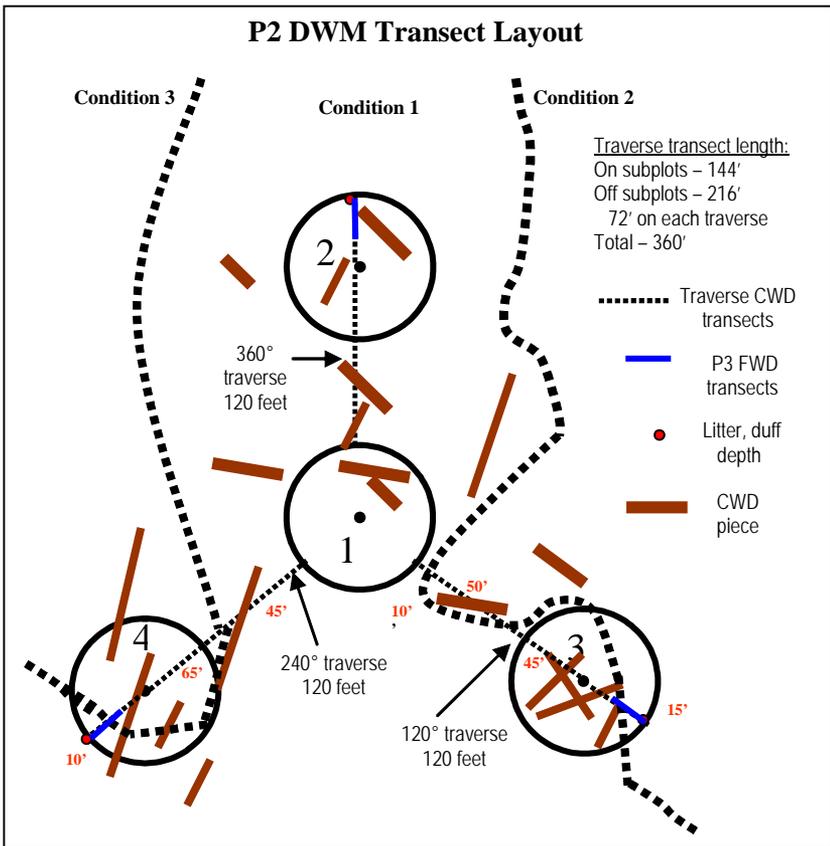


Figure 62. Transect Layout with 3 different conditions.

Application of traverse condition rules for segmentation:

	Condition	H distance	Sampled H distance
Subplot 2	1	120	120
Subplot 3	1	10	10
	2	50	50
	1	45	45
	2	15	15
Subplot 4	1	45	45
	3	65	65
	1	10	10

For remeasurement plots: If the location of subplots 2, 3, and 4 are not obvious from subplot 1 (e.g. dense brush, other obstacles blocking view, etc.) it may be easier to start at subplots 2,3, and 4 and work in reverse direction for tallying DWM components. This will help avoid missing the subplot 2, 3, and 4 stakes, which could cause a break in CWD transects. It could also cause inaccurate sample locations for FWD or duff/litter, which are tied to subplots 2, 3, and 4 stakes.

Note: Regardless of the order of CWD tally, use the same condition numbers assigned on the subplot.

Do not sample DWM on transect segments in conditions that are not accessible forest land (e.g. nonforest, noncensus water, hazardous, etc.). However, all 360.0 horizontal feet of transect length are accounted for by condition, horizontal distance, and sampled horizontal distance regardless of condition status.

Since conditions aren't necessarily mapped or identified between subplots and only two conditions will be segmented per traverse the following hierarchical rules will be used to make traverse transect segmenting more simple and consistent with the core condition and subplot information:

1. Only those conditions identified on the subplots and also recorded on the condition description will be considered legitimate for traverse transect segments. Any other conditions encountered on the traverses between subplots will be ignored. In other words, no new conditions will be considered due to traverse transect sampling.
2. If in doubt about whether a condition should be segmented, do not segment.
3. No more than two conditions per traverse will be considered and segmented. Use hierarchical priority rules (see next two rules) to choose among conditions when more than two conditions are encountered on a traverse. This should rarely occur.
4. Condition boundaries that occur on the subplots have first priority for traverse transect segmenting.

5. Conditions that occur between subplots will have the next priority for traverse transect segmenting (see rule # 8 for exception).
6. Distinct condition boundaries between subplots will be identified and recorded to the nearest horizontal foot by condition.
7. Indistinct condition boundaries (transition zones) between subplots will be split mid way between the subplots at 36 feet. The first condition will be assigned the first 36 feet and the second the next 84 feet.
8. Ignore linear features that are exceptions to the size and width requirements that occur between the subplots (less than 1.0 acre in size and 120 feet wide) like improved roads, maintained rights-of-way, etc. that cross the traverse transects, and assign conditions as though they weren't there.

Note: Do not include portions of transects that cross linear features for total SAMPLED HORIZONTAL DISTANCE (see 11.2.3)

By no means will these rules cover all possible scenarios. Use them with the idea in mind that for most plots a procedure for assigning conditions to traverse transect pieces has been documented and followed to capture most of the condition variability. Please make notes of any different situations encountered.

#### **11.2.1RM 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.

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

#### **11.2.2RM HORIZONTAL DISTANCE**

Starting at the subplot 1 perimeter record the traverse transect length in horizontal feet (nearest foot) segmented by condition class. See Section 11.2RM for specifics on condition segmenting rules.

When collected: All tally segments  
Field width: 3 digits  
Tolerance: +/- 1.0 foot  
MQO: At least 95% of the time  
Values: 001 to 120

#### **11.2.3RM SAMPLED HORIZONTAL DISTANCE**

Record the SAMPLED HORIZONTAL DISTANCE (nearest foot) for each segment. Most of the time this is a repetition of the horizontal distance. However, for conditions other than accessible forest land (see Section 11.2RM for specifics) the SAMPLED HORIZONTAL DISTANCE is recorded as zero. Also, transect segments or portions of segments within accessible forest land

conditions that cannot be accurately sampled due to snow/water or that cross nonforest linear features (see note in Section 11.2 item 8) are not included in SAMPLED HORIZONTAL DISTANCE.

When collected: All tally segments  
Field width: 3 digits  
Tolerance: +/- 1.0 foot  
MQO: At least 95% of the time  
Values: 000 to 120

### 11.3RM Sampling Methods for Coarse Woody Debris (CWD)

#### 11.3.1RM 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 63). The entire piece is assigned to this condition

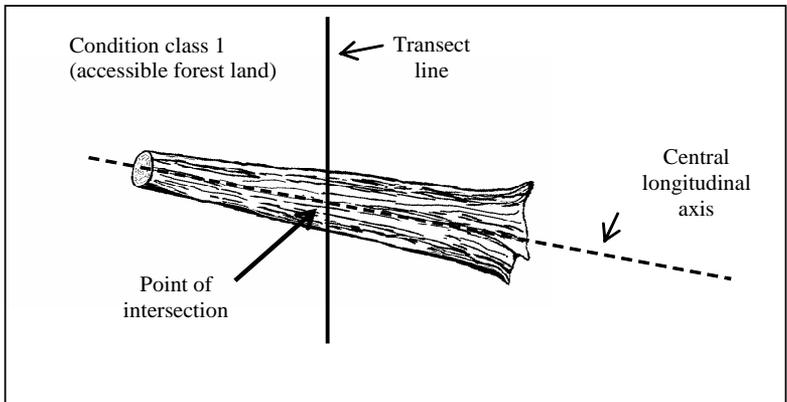


Figure 63. Tally rules for CWD.

2. Tally dead trees, shrubs, and tall stumps that are leaning  $> 45$  degrees from vertical. Do not tally live trees or shrubs. Do not tally standing dead trees and tall stumps ( $\geq 3.0$  feet in length) 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. Most CWD will be laying on the ground.
3. Tally the portions of standing dead shrubs that intersect the transect line. The pieces must still meet the minimum length and diameter requirements.
4. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3 feet, measure the length to the nearest 0.1 foot to determine if it is  $> 3.0$  feet.
5. Decay class of the piece determines which variables to collect (see section 11.3.3RM).

For decay classes 1 to 4: tally a piece if it is  $\geq 3.0$  inches in diameter at the point of intersection with the transect. The piece must be  $\geq 3.0$  feet in length and  $\geq 3.0$  inches or more in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece qualifies (Figure 64).

Note: The 3.0 inch requirement along the 3.0 foot minimum length is derived from P3 protocol which states “the piece ends where it becomes smaller than 3.0 inches”.

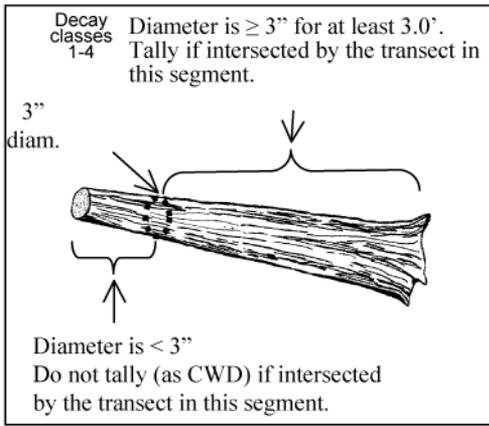


Figure 64. CWD tally rules for decay classes 1-4.

For decay class 5: tally a piece if it is  $\geq 5.0$  inches in diameter at the point of intersection and  $\geq 5.0$  inches high from the ground at the point of intersection. The piece must be  $\geq 3.0$  feet in length and  $\geq 5.0$  inches 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.

6. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting. Estimate the required data for 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.
7. 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 mineral soil, or water the piece ends at the point where it is no longer visible. Clarification: In order to be tallied the piece needs to have three consecutive feet of exposed visible length above ground at the point of intersection. Do not consider things like small shrubs, grasses or forbs that may lay across a piece as below ground, but do consider litter, duff, mineral soil, or water on top of the piece as below ground.

8. 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 (Figure 65).

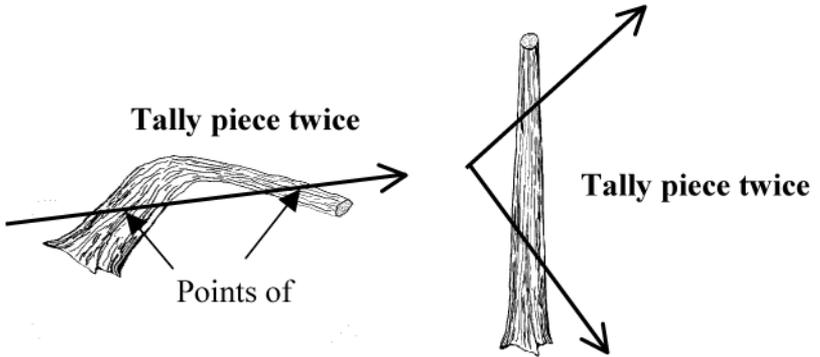


Figure 65. Tally a CWD piece each time it crosses the transect

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 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 (Figure 66).

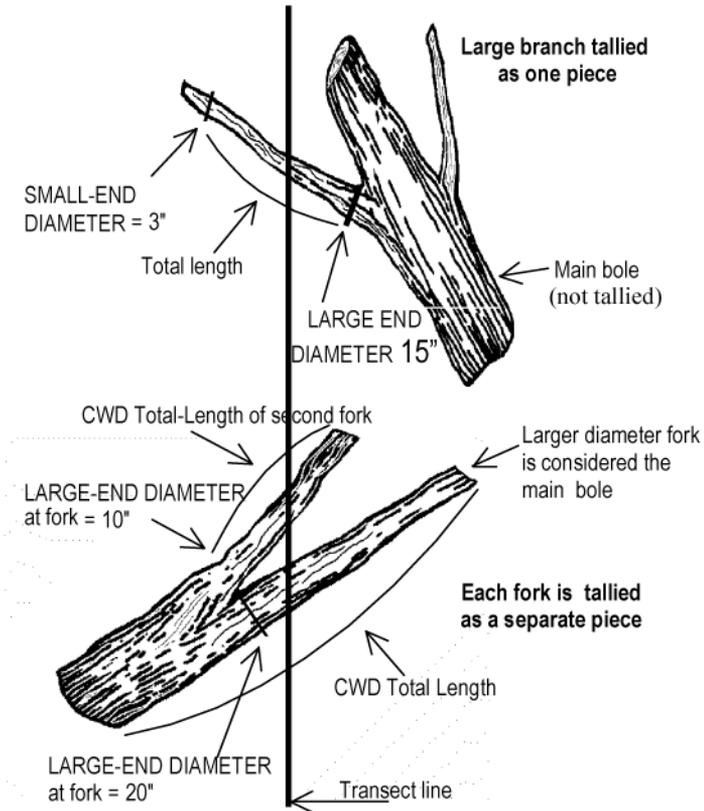


Figure 66. CWD tally rules for forked trees.

13. If a transect intersects a nonforest condition, no CWD is tallied in the nonforest condition.

### 11.3.2RM Recording Procedures for CWD

The tolerance for the total number of pieces ( $\geq 3.0$  inches, transect diameter) tallied across all transects on the plot is :  $\pm 2$  pieces or  $\pm 5\%$ , whichever is greater for the plot. Note: always round up to a whole piece count when using the 5% option.

### 11.3.3RM DECAY CLASS

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the observed total length of the piece. Use the guide in Section 5.23 to determine the DECAY CLASS.

When Collected: All tally pieces

Field width: 1 digit

Tolerance:  $\pm 1$  class

MQO: At least 90% of the time

Values: 1-5 (described in Section 5.23)

**Note:** 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  $\geq 5.0$  inches in diameter,  $\geq 5.0$  inches from the surface of the ground, and at least 3.0 feet long. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

**DECAY CLASS:** The table in Section 5.23 was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other tables 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 DECAY CLASS 2 with a IS THE PIECE HOLLOW? code of 1. DECAY CLASS 1 should be reserved for 'freshly fallen' logs that are completely intact (i.e., recent windfalls, or harvest).

#### 11.3.4RM SPECIES

Record the code indicating the species of the piece. Since CWD pieces are not necessarily always tally species, record the most detailed available species codes. Some species codes are only genus specific (e.g. Prunus), or hardwood-softwood specific. Search for the species code that has the most detail for the identified piece. Enter a code of '0001' for SPECIES if the tally piece is a shrub or vine. However, if a specific code exists (e.g. pin cherry) then use it instead of the generic shrub code.

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 0299 for unknown conifer or 0998 for unknown hardwood. If all else fails, enter the unknown SPECIES code (0999).

When Collected: 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.

#### 11.3.5RM DIAMETER AT POINT OF INTERSECTION (TRANSECT DIAMETER)

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 3

inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually >3.0 inches and a valid tally piece. Mark the location of the transect diameter for decay classes 1-4 with a crayon to aid in remeasurement by QA crews. Do not mark pieces in reserved areas. The diameter is recorded to the nearest inch.

When Collected: All tally pieces

Field width: 3 digits

Tolerance: Pieces < 20.0 in diameter: +/- 3 in

Pieces > 20.0 in diameter: +/- 20%

MQO: At least 90% of the time

Values: 003 to 200

### 11.3.6RM LARGE END DIAMETER CLASS

**Estimate** the appropriate class code for the large end diameter for each CWD piece. If the large end diameter is close to a class breaking point it may be necessary to directly measure the diameter.

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.

The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length. 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.

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 67), and enter the average in the diameter field. This technique applies to intersect large-end diameters.

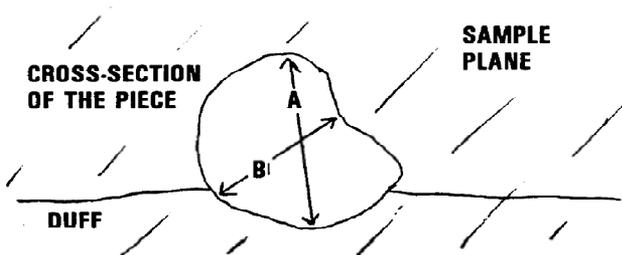


Figure 67. Estimating the diameter of pieces that are not round in cross-section.

If the transect intersects the log at the decayed or splintered end (Figure 68) (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 diameter class according to our established rules (i.e., at the points where they best represent the log volume). If you have a major split located just at the end, 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. Piece length ends when log diameter becomes <3.0 inches in diameter.

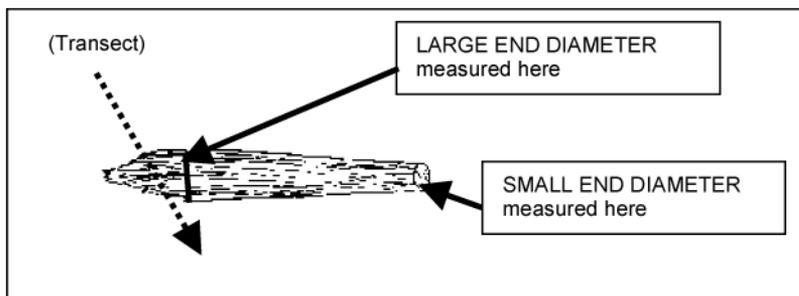


Figure 68. Example of decayed end intersecting the transect.

When Collected: DECAY CLASS = 1 to 4

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values:

- 1 3.0" to 4.9"
- 2 5.0" to 8.9"
- 3 9.0" to 14.9"
- 4 15.0" to 20.9"
- 5 21.0"+

### 11.3.7RM CONDITION CLASS NUMBER

Record the code indicating the number of the condition class that contains each CWD piece. Use the piece's central axis at the transect point of intersection to assign each piece to the appropriate condition. If there is only one condition on the traverse assign all pieces to that condition. If a piece is borderline between two conditions, assign it to the first condition on the traverse. See Section 11.2RM for rules for assigning conditions.

Field width: 1 digit

Tolerance: correct

MQO: At least 90% of the time

Values: 1 - 9

### 11.3.8RM IS THE PIECE HOLLOW?

Record the code indicating whether or not the piece is hollow (Figure 69). A piece is considered hollow if a cavity extends at least 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.

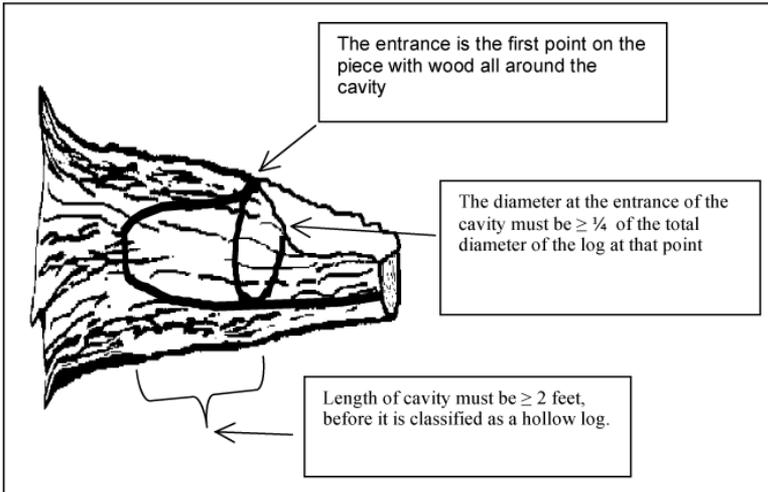


Figure 69. Determining if the piece is hollow.

When Collected: DECAY CLASS = 1 to 4

Field width: 1 digit

Tolerance: No errors

MQO: At least 90% of the time

Values: Y or N

Y Meets the criteria for a hollow log.

N Does not meet criteria for being a hollow log

### 11.3.9RM IS THE PIECE ON A SUBPLOT?

Record the code indicating whether or not the piece is on the subplot. Use the piece's central axis at transect point of intersection to determine if the piece falls within the 24.0 horizontal perimeter of the farther subplot. If a piece falls exactly on the subplot 1 perimeter, record "N" for piece not on a subplot. If a piece falls exactly on subplot 2, 3, or 4 perimeter, record "Y" for piece is on a subplot.

Field width: 1 digit

Tolerance: correct

MQO: At least 90% of the time

Values: N or Y

#### 11.4RM SAMPLING RESIDUE PILES

In some circumstances, piles or windrows created directly by human activity and log piles at the bottom of steep-sided ravines will be encountered on a transect. If this is encountered, estimate the number, diameter, and other required data of CWD pieces that intersect the traverse, and record as separate pieces as best as possible.

#### 11.5RM Sampling Methods for Fine Woody Debris (FWD)

1. Fine Woody Debris (FWD) is sampled when transect starting point occurs in accessible forest land conditions (CONDITION CLASS STATUS = 1). The length of FWD transects are measured in slope distance--no correction is applied to obtain a horizontal distance. The FWD transects start at 14.0 feet slope distance from the subplot stake and extends for 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 FWD transect (See FWD TRANSECT PERCENT SLOPE).
2. Only sample FWD that intersects a plane from the ground to a height of 6 feet.
3. FWD is sampled in three size classes. Two of the FWD size classes (0.01 to 0.24 inches and 0.25 to 0.9 inches) are counted on a 6-foot transect, from 14 to 20 feet. Pieces in the third size class (1.0 to 2.9 inches) are counted on a 10-foot transect, from 14 to 24 feet (see Section 11.1.1RM 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. Only count twigs, branches, wood fragments, or shrub/tree boles which are woody. Do not count 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. 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 2.0-foot section of the transect and then multiplied by 3 to provide an estimate for the 6 foot 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 11.5RM).
8. If rocks, logs, or other obstructions are present along the transect (14- to 24-foot 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 any portion of the FWD transect is covered by snow or water, do not sample FWD. Either the whole transect is sampled or none.

### 11.5.1RM FWD transects

FWD transects that originate in accessible forest land conditions are sampled. Either the whole transect is sampled or none. See instructions for FWD sampled (Section 11.5.2RM).

Establish FWD transects at the end of subplots 2, 3, and 4 traverse transects (360, 120, and 240 degrees azimuth. Figure 60).

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 14 feet (slope distance) from subplot centers' 2, 3, and 4 and extends out either 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	.01 in to 0.24 in	6 feet	14 to 20 feet
Medium FWD	2	0.25 in to 0.9 in	6 feet	14 to 20 feet
Large FWD	3	1.0 in to 2.9 in	10 feet	14 to 24 feet

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.

### 11.5.2RM FWD SAMPLED

If the FWD transect originates in a nonforest condition or if snow/water covers any portion of the FWD transect then do not sample any FWD.

When collected: Each traverse transect

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 All FWD sampled
- 2 No FWD sampled

### 11.5.3RM FWD TRANSECT PERCENT SLOPE

Record the percent slope to the nearest 5% for the FWD transect, from sampling starting point (14 feet slope distance from subplot center) to the ending point (24 feet slope distance from subplot center).

When Collected: When FWD SAMPLED = 1  
Field width: 3 digits  
Tolerance: No errors  
MQO: At least 90% of the time  
Values: 5% increments from 0 to 120

**11.5.4RM**    **CONDITION CLASS NUMBER**

FWD is assigned to only one condition class per transect.  
Record the code indicating the number of the condition class where FWD sampling begins (14 feet slope distance from the subplot centers).

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

**11.5.5RM**    **SMALL FWD COUNT**

Record the number of pieces counted in this size class (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 Section 11.5RM, #6)

When collected: When FWD SAMPLED = 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

**11.5.6RM**    **MEDIUM FWD COUNT**

Record the number of pieces counted in this size class (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 Section 11.5RM, #6)

When collected: When FWD SAMPLED = 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

**11.5.7RM**    **LARGE FWD COUNT**

Record the number of pieces counted in this size class (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 11.5RM, #6).

When collected: When FWD SAMPLED = 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

#### 11.5.8RM HIGH COUNT REASON

Enter a code if any of the counts on a transect are greater than 100 pieces.

When Collected: When the 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

#### 11.6RM DUFF and LITTER DEPTH MEASUREMENTS

Depth measurements are sampled only in accessible forest land conditions (Condition class status =1). The depth of the duff layer and litter layer are important components of fire models used to estimate fire behavior, fire spread, fire effects, and smoke production. An average depth will be calculated in the office and stored with other information about the condition class on the plot. If a log, rock, or other obstruction intersects the measurement location, do not measure the duff or litter depth.

#### 11.6.1RM Definitions

1. **Litter** is the layer of freshly fallen leaves, needles, twigs (< 0.25 inch 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.

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.

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).**

### 11.6.2RM Overview of Measurements

Depth measurements will be taken 24.0 slope feet from the subplot center along the azimuth of the CWM transect that is within an accessible forest land condition. Or, if on a flat slope, at the end of each 120-foot horizontal traverse transect. See P2 DWM TRANSECT LAYOUT for transect details.

The duff and litter variable has two options for indicating if duff and litter were measured at each sample location. A value of 1 is entered if duff and litter were sampled (no obstruction). A value of 2 is entered if no duff and litter are sampled (obstruction).

#### 11.6.2.1RM How to sample Duff and Litter

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 0.1 inch.

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.

**11.6.3RM SAMPLED**

Record the code indicating if the depth of the duff and litter layer was measured.

When collected: For each traverse transect

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values:

- 1 All sampled: Duff and litter
- 2 Nothing sampled

**11.6.4RM DUFF DEPTH**

Record the code indicating the depth of the duff layer to the nearest 0.1 inch.

When collected: When SAMPLED = 1

Field width: 3 digits

Tolerance: +/- 0.5 inch

MQO: At least 90% of the time

Values: 00.0 to 99.9

**11.6.5RM LITTER DEPTH**

Record the code indicating the depth of the litter layer to the nearest 0.1 inch.

When collected: When SAMPLED = 1

Field width: 3 digits

Tolerance: +/- 0.5 inch

MQO: At least 90% of the time

Values: 00.0 to 99.9

**11.7RM ACKNOWLEDGEMENTS**

Contact information for the National Advisor for this indicator is: [Chris Woodall](#), USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN 55108, [cwoodall@fs.fed.us](mailto:cwoodall@fs.fed.us), <http://ncrs2.fs.fed.us/4801\DWM> .

**11.8RM Data Sheets**

See Appendix A.11 P2 DWM Traverse Data Sheet

## **12.0RM FIELD LOCATION REFERENCE FORM and PLOT MONUMENTATION RECORDS**

This section describes items for referencing and relocating the plot center (PC), completing the Field Location Reference record, and the Plot Monumentation variables recorded in the Portable Data Recorder (PDR). Procedures for photographing the PC are also provided at the end of this section.

The information documented on the Field Location Reference record (Appendix A.1) will be used to find the plot in subsequent inventories. The information must be legibly recorded in understandable terms and also recorded in the PDR.

The PDR reference variables are recorded in the Regional "RMRS" data section under "Plotmonument" in the PDR. All reference items must be completed for each plot with a forested condition present. Sampled and Nonsampled plots, including Nonforest land, Noncensus water, Census water, Denied Access, or Hazardous plots may have all or some of the reference items completed depending on the situation.

### **12.1RM MONUMENT TYPE**

Record what is being monumented. Depending on what code is used (codes 1-9), certain variables will be turned on or off. Complete each line of data as it appears in the PDR for each MONUMENT TYPE recorded.

When collected: All plots  
Field width: 1 number  
Tolerance: No errors  
Values:

- 1 Truck
- 2 Reference point (RP)
- 3 X Tree
- 4 Y Tree
- 5 ATV Parking
- 6 Camp Site
- 7 Helispot
- 8 Other (trailhead, etc. - make note)
- 9 Other (trailhead, etc. - make note)

#### **12.1.1RM Truck/ATV/Camp Site/Helispot/Other**

Record the GPS TYPE, ERROR, NUMBER OF READINGS, LATITUDE (DEGREES, MINUTES, SECONDS) AND LONGITUDE (DEGREES, MINUTES, SECONDS) for the Truck, ATV, Camp Spot, Helispot, or any other helpful Coordinates on the Field Location Reference Record and/or electronically in the PDR.

This information can be helpful to future crews for a variety of reasons and may also help the current crew relocate the vehicle, ATV, helispot, horses, or any

other location they may need to find.

Refer to Appendix C for use on the Garmin GPS unit.

#### **12.1.1.1RM Travel Directions**

Record road directions in the NOTES for MONUMENT TYPE 1 (Truck). Start the directions from the nearest post office, Forest Service office, major highway intersection, or other prominent and permanent landmark. This space can also be used to record other travel information that will assist in relocating the plot (e.g., hiking distance and direction from parking location to RP, specific information about obtaining keys for locked gates).

Road directions should contain (at a minimum):

- Road names and route numbers.
- Major landmarks.
- Mileages between roads/landmarks.
- Direction of turns at intersections/forks.
- Description of parking area.

Walking directions should contain (at a minimum):

- Trail name/number if applicable.
- Drainage/creek/stream/ridge etc., name if applicable.
- Major landmarks.
- Approximate distances between trails, creeks, landmarks etc.

#### **12.1.2RM Reference Point (RP)**

On the Field Location Reference Record and in the PDR, record the, AZIMUTH, HORIZONTAL DISTANCE, SLOPE DISTANCE, SPECIES, DIAMETER, GPS TYPE, ERROR, NUMBER OF READINGS, LATITUDE (DEGREES, MINUTES, SECONDS) AND LONGITUDE (DEGREES, MINUTES, SECONDS), a short but detailed description of the RP, and in addition, record MONUMENT TYPE, SUBPLOT REFERENCED, and REFERENCE TYPE in the PDR.

RP selection is critical to the relocation of any field plot. Extreme care is required to select an RP that is easy to locate, is readily identifiable on the ground and the aerial photos, and will likely be identifiable in 10 years. Refer to "Selecting a Suitable RP" (section 0.1.3.1RM).

Remeasurement locations and P3 plots: use the reference point from the previous inventory if it still meets the RP tree requirements.

Tagging the RP -- Attach to the RP, when appropriate, aluminum tags labeled "RP CO # LOC #". If a tree is selected as the RP, nail aluminum tags on two sides of the tree approximately 6 feet above ground level, and with at least 1 inch of nail exposed (to allow for tree growth between inventories). Nail one of the tags facing in the general route of approach to the RP and a 2.5" x 2.5" black, heavy aluminum, diamond shaped tag facing the PC. Nail a third tag at ground level facing towards the plot center. If the RP is in a place where there

is a high probability that a tag at 6 feet above the ground may be vandalized, only attach the tag at ground level and make a note on the Field Location Reference record.

**Note:** Use steel nails only on woodland species. Do not tag aspen trees within any subplot radius. Aspen may be tagged if they are not part of the inventory.

No RP tags are needed if the RP is permanent and readily identifiable, such as the corner of a building or a road intersection. Never nail a tag to a private building or other private structure.

**Reserved land:** Tag RP trees only at the base, facing towards the plot center; do not tag RP trees at 6 feet above the ground. Remove all flagging before you leave the vicinity. For plots within sight of trails or roads, metal tags must be spray painted gray or brown on both sides. With less monumentation occurring on reserved land, the RP must be carefully selected and adequately described to provide adequate means for future relocation.

### 12.1.3RM PC Witness Trees

On the Field Location Reference Record and in the PDR, record AZIMUTH, DISTANCE, SPECIES, DIAMETER, and any other relevant and helpful NOTES about the witness trees, and in addition, record MONUMENT TYPE, SUBPLOT REFERENCED, and REFERENCE TYPE in the PDR.

#### 1. Selection

Reference the PC with two witness trees ("X" and "Y" trees).

On remeasurement locations, use previous witness trees where possible.

Preferably, witness trees should be as follows:

##### "X" Tree

- On the extension of the RP to PC azimuth.
- Close to the PC

##### "Y" Tree

- As close to PC as possible.
- At a right angle to the X tree to PC azimuth.

##### "X and Y" trees should be

- Not likely to die within 10 years.
- A species easily located on the site (e.g., an Engelmann spruce in a lodgepole pine forest type). **Note:** Avoid using aspen, if possible; if an aspen is used, be sure it is off the subplot.
- At least 5.0-inches DBH for timber species and 3.0-inches DRC for woodland trees if possible.

If no live trees are within the vicinity of the PC (e.g., clearcut, burn area, or areas of sparse vegetation) select alternative witness landmarks that are likely to be present in 10 years (e.g., a sound snag, large stump, prominent rock, or handmade rock cairn). Describe the alternative landmarks selected on the Field Location Reference record.

2. Marking

If the X and Y are trees with the minimum diameter requirements, label 2 silver, aluminum tags; one with "X CO # LOC #" (with the actual county and location numbers) and the other "Y CO # LOC #". Nail each tag to the appropriate witness tree, at ground level, with the tags facing the PC stake. In addition a 2.5" x 2.5" black, heavy aluminum, diamond shaped tag (labeled as above) is placed at approximately 6 feet facing the PC on the X tree only.

On multistemmed woodland witness trees, nail the tag at ground level to the stem measured for DRC, or at ground level below the stem measured for DRC if the stem originates above ground level.

**Note:** When driving nails into trees, leave at least 1 inch exposed to allow for tree growth.

If a small tree is used, or if the location is in close proximity to private residence, do not tag. Use a paint pen, mark the witness tree in an inconspicuous location, and record a note under the "Witness Trees" section of the Field Location Reference record.

Do not place tags or drive nails into any Populus species (Aspen/Cottonwood) which occur on any subplot.

Where the witness is not a tree (e.g., rock), mark the object with a paint pen or tag the alternative landmark in some manner if appropriate, with aluminum tags, to aid field crews in re-locating the PC in future remeasurement inventories.

**Reserved locations:** Nail a tag (spray painted gray or brown on both sides) with the appropriate letter (X or Y) and location number inscribed on it only at the base of the tree facing subplot center.

**12.2RM** Depending on MONUMENT TYPE chosen, variables 12.2.1RM - 12.2.17RM may have to be entered into the PDR.

**12.2.1RM** SUBPLOT REFERENCED

Record the subplot number to which the MONUMENT TYPE is referenced.

When collected: All plots and when PLOT MONUMENT = 2, 3, or 4

Field width: 1 number

Tolerance: No errors

Values:

- 1 Subplot 1
- 2 Subplot 2
- 3 Subplot 3
- 4 Subplot 4

**12.2.2RM AZIMUTH**

If MONUMENT TYPE = 2: record the azimuth (to nearest degree) obtained by using the "Route Function" on the GPS unit (see Appendix C), using the averaged coordinates of the RP to the theoretical or previously recorded coordinates of the PC.

If MONUMENT TYPE = 3 or 4: record the azimuth (to nearest degree) from the PC stake to the tag on the tree or landmark.

When collected: MONUMENT TYPE = 2, 3, or 4

Field width: 3 digits

Tolerance:  $\pm 2$  degrees.

**12.2.3RM HORIZONTAL DISTANCE**

Record the horizontal distance, **to the nearest foot**, by using the "Route Function" on the GPS unit (see Appendix C), using the averaged coordinates of the RP to the theoretical or previously recorded coordinates of the PC.

When collected: MONUMENT TYPE = 2

Field width: 4 digits

Tolerance: Distance  $\pm 6$  feet per 100 feet of transect, maximum tolerance of 30 feet.

**12.2.4RM SLOPE DISTANCE**

When MONUMENT TYPE = 2: record the slope distance, **to the nearest foot**, from the RP to the PC obtained by correcting for slope along RP to PC chain.

When MONUMENT TYPE = 3 or 4: record the slope distance (to the nearest 0.1 foot) from the top of the PC stake to the nailed tag. If an alternative landmark is used as a witness, distance is from the top of PC stake to the face of the landmark.

When collected: MONUMENT TYPE = 2, 3, or 4

Field width: 4 digits

Tolerance: When MONUMENT TYPE = 2:  $\pm 6$  feet per 100 feet of transect, maximum tolerance of 30 feet.

When MONUMENT TYPE = 3 or 4:  $\pm 0.2$  feet.

**12.2.5RM REFERENCE TYPE**

Record whether the MONUMENT TYPE is a tree or some other type of reference.

When collected: MONUMENT TYPE = 2, 3, or 4

Field width: 1 digit

Tolerance: No errors

Values:

- 1 Tree (Tally species)
- 2 Other Reference (rock, bush...)

**12.2.6RM SPECIES**

Record the tally FIA species code (see Appendix 3) of the RP or witness tree.

When collected: REFERENCE TYPE = 1

Field width: 4 digits

Tolerance: No errors

**12.2.7RM OTHER REFERENCE**

When a tally tree is not used for the RP or witness to the plot center, such as a sharp bend in a road, a corner of a building, the intersection of two fence lines, a rock cairn, etc. use a short word (10 characters maximum) to describe the landmark (i.e. ROCK, FORK, or CORNER, and further provide more details in the NOTES.

When collected: REFERENCE TYPE = 2

Field width: 10 characters

Tolerance: No errors

**12.2.8RM DIAMETER**

When a tree is used as the RP or X or Y Witness Trees, record the diameter. If a multistemmed woodland tree is used, measure only one stem, preferably the largest or main stem. Record the diameter to the last whole 0.1 inch. If possible, use a tree or stem at least 5.0 inches DBH or 3.0 inches DRC. If the RP or Witness Tree is not a tally species but another reference type (rock, etc), estimate a diameter if one is not possible to take.

When collected: When MONUMENT TYPE = 2, 3, or 4

Field width: 3 digits

Tolerance: +/- 0.2 in per 20.0 in increment of measured diameter.

**12.2.9RM GPS TYPE (GPS UNIT):** See Section 1.19.3

**12.2.10RM GPS ERROR:** See Section 1.19.17

**12.2.11RM NUMBER OF READINGS:** See Section 1.19.18

**12.2.12RM LATITUDE DEGREES:** See Section 1.19.8.1

**12.2.13RM LATITUDE MINUTES:** See Section 1.19.8.2

**12.2.14RM LATITUDE SECONDS:** See Section 1.19.8.3

**12.2.15RM LONGITUDE DEGREES:** See Section 1.19.9.1

**12.2.16RM LONGITUDE DEGREES:** See Section 1.19.9.2

**12.2.17RM LONGITUDE SECONDS:** See Section 1.19.9.3

- 12.3RM**      **GPS distance from the Truck to the PC**  
Record the distance and azimuth from the truck parking spot to the PC obtained from the GPS by using the "Route Function" between the averaged location of the Truck and the theoretical or previously recorded coordinates of the PC . This helpful information can be used to give the next crew an idea of the hike and time involved to complete the plot. Record on the Field Location Reference Form only.
- When collected: All field visited plots
- 12.4RM**      **OWNER**  
Record "private landowner" or the name of the managing agency into the PDR. If a private landowner is listed record the address and telephone number, if known, on the plot packet and under Owner Information on the Field Location Reference form (this information is used for quality control and future crew access and remains confidential). Do not enter the owner's name or any other confidential information such as addresses or phone numbers into the PDR.
- When collected: All plots  
Tolerance: No errors
- 12.5RM**      **ADDITIONAL OWNER CONTACT**  
See item 1.18RM
- 12.6RM**      **4 X 4**  
See item 1.15.2RM
- 12.7RM**      **ATV**  
See item 1.15.3RM
- 12.8RM**      **LOCKED GATE**  
See item 1.15.4RM
- 12.9RM**      **Editing - Field Location Reference record only**

#### **Field Crew Edit**

After measuring the plot, but before leaving the site, the crew supervisor must review the field forms to make sure the required data are correctly and legibly recorded. Examine the following checklist, as a minimum, for completeness:

- All photo work complete, with RP and PC pinpricked.
- Witness trees referenced and data recorded.
- Location and condition class maps drawn; photos taken.
- All data records are complete; no blank spaces.
- Necessary site trees selected and bored.
- Age and radial growth data complete.
- Unknowns collected and pressed.
- Accounting data collected.

- Field equipment gathered (PDR, GPS, camera, borer, tatum, plot packet, etc.).

The crew supervisor will then initial and date the Field Location Reference record in the "Field Crew Edit" box.

#### **12.10RM Field Location and Boundary Map**

On the top of the backside of the Field Location Reference record draw, including any helpful landmarks (old jeep roads, hiking/game trails, the RP, slope, cliffs, or openings), a map of the general area of the PC (including truck parking spot if possible) to aid future crews in locating the PC.

If boundaries occur within any of the 4 subplots draw a map indicating approximate boundary lines, labeling each condition class, on the bottom of the backside of the Field Location Reference record.

#### **12.11RM Photographing the Plot Location**

As an additional aid in describing the plot, and as a record of plot conditions at the time of the field inventory, take photographs of the plot center using digital field cameras.

**Procedure:** At plot center, stand over the PC stake and take four photographs in the cardinal directions (i.e., take pictures facing north, east, south, and west). Include a placard in each picture, placed in the lower right-hand corner of the view, indicating the State, county, location number, year, and direction faced (N, E, S, or W). Be sure the placard is legible, but do not allow the placard to obstruct the view of the site. Crews should use care not to include people or field gear in the plot photos.

It is best to take the photographs in moderate light conditions; shade the lens from direct sunlight when necessary, and use the flash in dark conditions (dense stands, cloudy days, etc.).

In the case of an all-nonforest location, if the crew identifies the PC on the ground, the PC will be photographed in the 4 cardinal directions. If the crew does not identify the PC but determines the approximate location or conditions of the PC, the crew will photograph the PC area (e.g., crew determines PC is on a hill side, but the hill is covered with nonforest species). Crews are required to get as close as necessary to positively identify the nonforest condition. Photographs taken when crew does not occupy the PC should be representative of the sample area.

In the case of a replacement plot (see Section 1.10), the photo placard should show the YEAR, STATE, COUNTY, and P2 NUMBER of the plot that could not be found and also a written note such as "this plot replaced", "could not find this plot", or "SK3" (indicating sample kind 3).

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

<b>(04)</b>	<b>Arizona</b>	<b>(057)</b>	Nevada	<b>(029)</b>	Delta
(001)	Apache	(059)	Orange	(031)	Denver
(003)	Cochise	(061)	Placer	(033)	Dolores
(005)	Coconino	(063)	Plumas	(035)	Douglas
(007)	Gila	(065)	Riverside	(037)	Eagle
(009)	Graham	(067)	Sacramento	(039)	Elbert
(011)	Greenlee	(069)	San Benito	(041)	El Paso
(012)	La Paz	(071)	San Bernardino	(043)	Fremont
(013)	Maricopa	(073)	San Diego	(045)	Garfield
(015)	Mohave	(075)	San Francisco	(047)	Gilpin
(017)	Navajo	(077)	San Joaquin	(049)	Grand
(019)	Pima	(079)	San Luis Obispo	(051)	Gunnison
(021)	Pinal	(081)	San Mateo	(053)	Hinsdale
(023)	Santa Cruz	(083)	Santa Barbara	(055)	Huerfano
(025)	Yavapai	(085)	Santa Clara	(057)	Jackson
(027)	Yuma	(087)	Santa Cruz	(059)	Jefferson
		(089)	Shasta	(061)	Kiowa
<b>(06)</b>	<b>California</b>	(091)	Sierra	(063)	Kit Carson
(001)	Alameda	(093)	Siskiyou	(065)	Lake
(003)	Alpine	(095)	Solano	(067)	La Plata
(005)	Amador	(097)	Sonoma	(069)	Larimer
(007)	Butte	(099)	Sonoma	(071)	Las Animas
(009)	Calaveras	(101)	Sutter	(073)	Lincoln
(011)	Colusa	(103)	Tehama	(075)	Logan
(013)	Contra Costa	(105)	Trinity	(077)	Mesa
(015)	Del Norte	(107)	Tulare	(079)	Mineral
(017)	El Dorado	(109)	Tuolumne	(081)	Moffat
(019)	Fresno	(111)	Ventura	(083)	Montezuma
(021)	Glenn	(113)	Yolo	(085)	Montrose
(023)	Humboldt	(115)	Yuba	(087)	Morgan
(025)	Imperial			(089)	Otero
(027)	Inyo	<b>(08)</b>	<b>Colorado</b>	(091)	Ouray
(029)	Kern	(001)	Adams	(093)	Park
(031)	Kings	(003)	Alamosa	(095)	Phillips
(033)	Lake	(005)	Arapahoe	(097)	Pitkin
(035)	Lassen	(007)	Archuleta	(099)	Prowers
(037)	Los Angeles	(009)	Baca	(101)	Pueblo
(039)	Madera	(011)	Bent	(103)	Rio Blanco
(041)	Marin	(013)	Boulder	(105)	Rio Grande
(043)	Mariposa	(015)	Chaffee	(107)	Routt
(045)	Mendocino	(017)	Cheyenne	(109)	Saguache
(047)	Merced	(019)	Clear Creek	(111)	San Juan
(049)	Modoc	(021)	Conejos	(113)	San Miguel
(051)	Mono	(023)	Costilla	(115)	Sedgewick
(053)	Monterey	(025)	Crowley	(117)	Summit
(055)	Napa	(027)	Custer	(119)	Teller

(121)	Washington	(089)	Yellowstone	(091)	Johnson
(123)	Weld		National Park	(093)	Kearny
(125)	Yuma			(095)	Kingman
		<b>(20)</b>	<b>Kansas</b>	(097)	Kiowa
<b>(16)</b>	<b>Idaho</b>	(001)	Allen	(099)	Labette
(001)	Ada	(003)	Anderson	(101)	Lane
(003)	Adams	(005)	Atchison	(103)	Leavenworth
(005)	Bannock	(007)	Barber	(105)	Lincoln
(007)	Bear Lake	(009)	Barton	(107)	Linn
(009)	Benewah	(011)	Bourbon	(109)	Logan
(011)	Bingham	(013)	Brown	(111)	Lyon
(013)	Blaine	(015)	Butler	(113)	McPherson
(015)	Boise	(017)	Chase	(115)	Marion
(017)	Bonner	(019)	Chautauqua	(117)	Marshall
(019)	Bonneville	(021)	Cherokee	(119)	Meade
(021)	Boundary	(023)	Cheyenne	(121)	Miami
(023)	Butte	(025)	Clark	(123)	Mitchell
(025)	Camas	(027)	Clay	(125)	Montgomery
(027)	Canyon	(029)	Cloud	(127)	Morris
(029)	Caribou	(031)	Coffey	(129)	Morton
(031)	Cassia	(033)	Comanche	(131)	Nemaha
(033)	Clark	(035)	Cowley	(133)	Neosho
(035)	Clearwater	(037)	Crawford	(135)	Ness
(037)	Custer	(039)	Decatur	(137)	Norton
(039)	Elmore	(041)	Dickinson	(139)	Osage
(041)	Franklin	(043)	Doniphan	(141)	Osborne
(043)	Fremont	(045)	Douglas	(143)	Ottawa
(045)	Gem	(047)	Edwards	(145)	Pawnee
(047)	Gooding	(049)	Elk	(147)	Phillips
(049)	Idaho	(051)	Ellis	(149)	Pottawatomie
(051)	Jefferson	(053)	Ellsworth	(151)	Pratt
(053)	Jerome	(055)	Finney	(153)	Rawlins
(055)	Kootenai	(057)	Ford	(155)	Reno
(057)	Latah	(059)	Franklin	(157)	Republic
(059)	Lemhi	(061)	Geary	(159)	Rice
(061)	Lewis	(063)	Gove	(161)	Riley
(063)	Lincoln	(065)	Graham	(163)	Rooks
(065)	Madison	(067)	Grant	(165)	Rush
(067)	Minidoka	(069)	Gray	(167)	Russell
(069)	Nez Perce	(071)	Greeley	(169)	Saline
(071)	Oneida	(073)	Greenwood	(171)	Scott
(073)	Owyhee	(075)	Hamilton	(173)	Sedgwick
(075)	Payette	(077)	Harper	(175)	Seward
(077)	Power	(079)	Harvey	(177)	Shawnee
(079)	Shoshone	(081)	Haskell	(179)	Sheridan
(081)	Teton	(083)	Hodgeman	(181)	Sherman
(083)	Twin Falls	(085)	Jackson	(183)	Smith
(085)	Valley	(087)	Jefferson	(185)	Stafford
(087)	Washington	(089)	Jewell	(187)	Stanton

(189)	Stevens	(073)	Pondera	(051)	Dixon
(191)	Sumner	(075)	Powder River	(053)	Dodge
(193)	Thomas	(077)	Powell	(055)	Douglas
(195)	Trego	(079)	Prairie	(057)	Dundy
(197)	Wabaunsee	(081)	Ravalli	(059)	Fillmore
(199)	Wallace	(083)	Richland	(061)	Franklin
(201)	Washington	(085)	Roosevelt	(063)	Frontier
(203)	Wichita	(087)	Rosebud	(065)	Furnas
(205)	Wilson	(089)	Sanders	(067)	Gage
(207)	Woodson	(091)	Sheridan	(069)	Garden
(209)	Wyandotte	(093)	Silver Bow	(071)	Garfield
		(095)	Stillwater	(073)	Gosper
(30)	<b>Montana</b>	(097)	Sweet Grass	(075)	Grant
(001)	Beaverhead	(099)	Teton	(077)	Greeley
(003)	Big Horn	(101)	Toole	(079)	Hall
(005)	Blaine	(103)	Treasure	(081)	Hamilton
(007)	Broadwater	(105)	Valley	(083)	Harlan
(009)	Carbon	(107)	Wheatland	(085)	Hayes
(011)	Carter	(109)	Wibaux	(087)	Hitchcock
(013)	Cascade	(111)	Yellowstone	(089)	Holt
(015)	Chouteau	(113)	Yellowstone National	(091)	Hooker
(017)	Custer		Park	(093)	Howard
(019)	Daniels			(095)	Jefferson
(021)	Dawson	(31)	<b>Nebraska</b>	(097)	Johnson
(023)	Deer Lodge	(001)	Adams	(099)	Kearney
(025)	Fallon	(003)	Antelope	(101)	Keith
(027)	Fergus	(005)	Arthur	(103)	Keya Paha
(029)	Flathead	(007)	Banner	(105)	Kimball
(031)	Gallatin	(009)	Blaine	(107)	Knox
(033)	Garfield	(011)	Boone	(109)	Lancaster
(035)	Glacier	(013)	Box Butte	(111)	Lincoln
(037)	Golden Valley	(015)	Boyd	(113)	Logan
(039)	Granite	(017)	Brown	(115)	Loup
(041)	Hill	(019)	Buffalo	(117)	McPherson
(043)	Jefferson	(021)	Burt	(119)	Madison
(045)	Judith Basin	(023)	Butler	(121)	Merrick
(047)	Lake	(025)	Cass	(123)	Morrill
(049)	Lewis and Clark	(027)	Cedar	(125)	Nance
(051)	Liberty	(029)	Chase	(127)	Nemaha
(053)	Lincoln	(031)	Cherry	(129)	Nuckolls
(055)	McCone	(033)	Cheyenne	(131)	Otoe
(057)	Madison	(035)	Clay	(133)	Pawnee
(059)	Meagher	(037)	Colfax	(135)	Perkins
(061)	Mineral	(039)	Cuming	(137)	Phelps
(063)	Missoula	(041)	Custer	(139)	Pierce
(065)	Musselshell	(043)	Dakota	(141)	Platte
(067)	Park	(045)	Dawes	(143)	Polk
(069)	Petroleum	(047)	Dawson	(145)	Red Willow
(071)	Phillips	(049)	Deuel	(147)	Richardson

(149)	Rock	(017)	Grant	(047)	Logan
(151)	Saline	(019)	Guadalupe	(049)	McHenry
(153)	Sarpy	(021)	Harding	(051)	McIntosh
(155)	Saunders	(023)	Hidalgo	(053)	McKenzie
(157)	Scotts Bluff	(025)	Lea	(055)	McLean
(159)	Seward	(027)	Lincoln	(057)	Mercer
(161)	Sheridan	(028)	Los Alamos	(059)	Morton
(163)	Sherman	(029)	Luna	(061)	Mountrial
(165)	Sioux	(031)	McKinley	(063)	Nelson
(167)	Stanton	(033)	Mora	(065)	Oliver
(169)	Thayer	(035)	Otero	(067)	Pembina
(171)	Thomas	(037)	Quay	(069)	Pierce
(173)	Thurston	(039)	Rio Arriba	(071)	Ramsey
(175)	Valley	(041)	Roosevelt	(073)	Ransom
(177)	Washington	(043)	Sandoval	(075)	Renville
(179)	Wayne	(045)	San Juan	(077)	Richland
(181)	Webster	(047)	San Miguel	(079)	Rolette
(183)	Wheeler	(049)	Santa Fe	(081)	Sargent
(185)	York	(051)	Sierra	(083)	Sheridan
		(053)	Socorro	(085)	Sioux
		(055)	Taos	(087)	Slope
<b>(32)</b>	<b>Nevada</b>	(057)	Torrance	(089)	Stark
(001)	Churchill	(059)	Union	(091)	Steele
(003)	Clark	(061)	Valencia	(093)	Stutsman
(005)	Douglas			(095)	Towner
(007)	Elko			(097)	Traill
(009)	Esmeralda	<b>(38)</b>	<b>North Dakota</b>	(099)	Walsh
(011)	Eureka	(001)	Adams	(101)	Ward
(013)	Humboldt	(003)	Barnes	(103)	Wells
(015)	Lander	(005)	Benson	(105)	Williams
(017)	Lincoln	(007)	Billings		
(019)	Lyon	(009)	Bottineau		
(021)	Mineral	(011)	Bowman	<b>(41)</b>	<b>Oregon</b>
(023)	Nye	(013)	Burke	(001)	Baker
(027)	Pershing	(015)	Burleigh	(003)	Benton
(029)	Storey	(017)	Cass	(005)	Clackamas
(031)	Washoe	(019)	Cavalier	(007)	Clatsop
(033)	White Pine	(021)	Dickey	(009)	Columbia
(510)	Carson City	(023)	Divide	(011)	Coos
		(025)	Dunn	(013)	Crook
		(027)	Eddy	(015)	Curry
<b>(35)</b>	<b>New Mexico</b>	(029)	Emmons	(017)	Deschutes
(001)	Bernalillo	(031)	Foster	(019)	Douglas
(003)	Catron	(033)	Golden Valley	(021)	Gilliam
(005)	Chaves	(035)	Grand Forks	(023)	Grant
(006)	Cibola	(037)	Grant	(025)	Harney
(007)	Colfax	(039)	Griggs	(027)	Hood River
(009)	Curry	(041)	Hettinger	(029)	Jackson
(011)	De Baca	(043)	Kidder	(031)	Jefferson
(013)	Dona Ana	(045)	La Moure	(033)	Josephine
(015)	Eddy				

(035)	Klamath	(059)	Hand	(019)	Grand
(037)	Lake	(061)	Hanson	(021)	Iron
(039)	Lane	(063)	Harding	(023)	Juab
(041)	Lincoln	(065)	Hughes	(025)	Kane
(043)	Linn	(067)	Hutchinson	(027)	Millard
(045)	Malheur	(069)	Hyde	(029)	Morgan
(047)	Marion	(071)	Jackson	(031)	Piute
(049)	Morrow	(073)	Jerauld	(033)	Rich
(051)	Multnomah	(075)	Jones	(035)	Salt Lake
(053)	Polk	(077)	Kingsbury	(037)	San Juan
(055)	Sherman	(079)	Lake	(039)	Sanpete
(057)	Tillamook	(081)	Lawrence	(041)	Sevier
(059)	Umatilla	(083)	Lincoln	(043)	Summit
(061)	Union	(085)	Lyman	(045)	Tooele
(063)	Wallowa	(087)	McCook	(047)	Uintah
(065)	Wasco	(089)	McPherson	(049)	Utah
(067)	Washington	(091)	Marshall	(051)	Wasatch
(069)	Wheeler	(093)	Meade	(053)	Washington
(071)	Yamhill	(095)	Mellette	(055)	Wayne
		(097)	Miner	(057)	Weber
<b>(46)</b>	<b>South Dakota</b>	(099)	Minnehaha	<b>(53)</b>	<b>Washington</b>
(003)	Aurora	(101)	Moody	(001)	Adams
(005)	Beadle	(103)	Pennington	(003)	Asotin
(007)	Bennett	(105)	Perkins	(005)	Benton
(009)	Bon Homme	(107)	Potter	(007)	Chelan
(011)	Brookings	(109)	Roberts	(009)	Clallam
(013)	Brown	(111)	Sanborn	(011)	Clark
(015)	Brule	(113)	Shannon	(013)	Columbia
(017)	Buffalo	(115)	Spink	(015)	Cowlitz
(019)	Butte	(117)	Stanley	(017)	Douglas
(021)	Campbell	(119)	Sully	(019)	Ferry
(023)	Charles Mix	(121)	Todd	(021)	Franklin
(025)	Clark	(123)	Tripp	(023)	Garfield
(027)	Clay	(125)	Turner	(025)	Grant
(029)	Codington	(127)	Union	(027)	Grays Harbor
(031)	Corson	(129)	Walworth	(029)	Island
(033)	Custer	(135)	Yankton	(031)	Jefferson
(035)	Davison	(137)	Ziebach	(033)	King
(037)	Day			(035)	Kitsap
(039)	Deuel	<b>(49)</b>	<b>Utah</b>	(037)	Kittitas
(041)	Dewey	(001)	Beaver	(039)	Klickitat
(043)	Douglas	(003)	Box Elder	(041)	Lewis
(045)	Edmunds	(005)	Cache	(043)	Lincoln
(047)	Fall River	(007)	Carbon	(045)	Mason
(049)	Faulk	(009)	Daggett	(047)	Okanogan
(051)	Grant	(011)	Davis	(049)	Pacific
(053)	Gregory	(013)	Duchesne	(051)	Pend Oreille
(055)	Haakon	(015)	Emery	(053)	Pierce
(057)	Hamlin	(017)	Garfield	(055)	San Juan

(057) Skagit  
(059) Skamania  
(061) Snohomish  
(063) Spokane  
(065) Stevens  
(067) Thurston  
(069) Wahkiakum  
(071) Walla Walla  
(073) Whatcom  
(075) Whitman  
(077) Yakima

**(56) Wyoming**

(001) Albany  
(003) Big Horn  
(005) Campbell  
(007) Carbon  
(009) Converse  
(011) Crook  
(013) Fremont  
(015) Goshen  
(017) Hot Springs  
(019) Johnson  
(021) Laramie  
(023) Lincoln  
(025) Natrona  
(027) Niobrara  
(029) Park  
(031) Platte  
(033) Sheridan  
(035) Sublette  
(037) Sweetwater  
(039) Teton  
(041) Uinta  
(043) Washakie  
(045) Weston

## Appendix 2. FIA FOREST TYPE Codes

This following list includes all FOREST TYPES in the Continental U.S. and Alaska Types designated East/West are commonly found in those regions, although types designated for one region may occasionally be found in another.

East	West	Code	Species Type
			<b>White / Red / Jack Pine Group</b>
E		101	Jack pine
E		102	Red pine
E		103	Eastern white pine
E		104	Eastern white pine / eastern hemlock
E		105	Eastern hemlock
			<b>Spruce / Fir Group</b>
E		121	Balsam fir
E		122	White spruce
E		123	Red spruce
E		124	Red spruce / balsam fir
E	W	125	Black spruce
E		126	Tamarack
E		127	Northern white-cedar
E		128	Fraser fir
E		129	red spruce/Fraser fir
			<b>Longleaf / Slash Pine Group</b>
E		141	Longleaf pine
E		142	Slash pine
			<b>Tropical Softwoods Group</b>
E		151	Tropical pines
			<b>Loblolly / Shortleaf Pine Group</b>
E		161	Loblolly pine
E		162	Shortleaf pine
E		163	Virginia pine
E		164	Sand pine
E		165	Table-mountain pine
E		166	Pond pine
E		167	Pitch pine
E		168	Spruce pine
			<b>Other Eastern Softwoods Group</b>
E		171	Eastern redcedar
E		172	Florida softwoods
			<b>Pinyon / Juniper Group</b>
	W	182	Rocky Mountain juniper

East	West	Code	Species Type
	W	184	Juniper woodland
	W	185	Pinyon-juniper woodland
			<b>Douglas-fir Group</b>
E	W	201	Douglas-fir
	W	202	Port-Orford-cedar
	W	203	Bigcone Douglas-fir
			<b>Ponderosa Pine Group</b>
E	W	221	Ponderosa pine
	W	222	Incense-cedar
	W	224	Sugar pine
	W	225	Jeffrey pine
	W	226	Coulter pine
			<b>Western White Pine Group</b>
	W	241	Western white pine
			<b>Fir / Spruce / Mountain Hemlock Group</b>
	W	261	White fir
	W	262	Red fir
	W	263	Noble fir
	W	264	Pacific silver fir
	W	265	Engelmann spruce
	W	266	Engelmann spruce / subalpine fir
	W	267	Grand fir
	W	268	Subalpine fir
	W	269	Blue spruce
	W	270	Mountain hemlock
	W	271	Alaska-yellow-cedar
			<b>Lodgepole Pine Group</b>
	W	281	Lodgepole pine
			<b>Hemlock / Sitka Spruce Group</b>
	W	301	Western hemlock
	W	304	Western redcedar
	W	305	Sitka spruce
			<b>Western Larch Group</b>
	W	321	Western larch
			<b>Redwood Group</b>
	W	341	Redwood
	W	342	Giant sequoia
			<b>Other Western Softwoods Group</b>
	W	361	Knobcone pine
	W	362	Southwestern white pine

East	West	Code	Species Type
	W	363	Bishop pine
	W	364	Monterey pine
	W	365	Foxtail pine / bristlecone pine
	W	366	Limber pine
	W	367	Whitebark pine
	W	368	Misc. western softwoods
	W	369	Western juniper
			<b>California Mixed Conifer Group</b>
	W	371	California mixed conifer
			<b>Exotic Softwoods Group</b>
E		381	Scotch pine
E	W	383	Other exotic softwoods
E		384	Norway spruce
E		385	Introduced larch
			<b>Other Softwood Group</b>
		391	Other softwoods
			<b>Oak / Pine Group</b>
E		401	Eastern white pine / N. red oak / white ash
E		402	Eastern redcedar / hardwood
E		403	Longleaf pine / oak
E		404	Shortleaf pine / oak
E		405	Virginia pine / southern red oak
E		406	Loblolly pine / hardwood
E		407	Slash pine / hardwood
E		409	Other pine / hardwood
			<b>Oak / Hickory Group</b>
E		501	Post oak / blackjack oak
E		502	Chestnut oak
E		503	White oak / red oak / hickory
E		504	White oak
E		505	Northern red oak
E		506	Yellow-poplar / white oak / N. red oak
E		507	Sassafras / persimmon
E		508	Sweetgum / yellow-poplar
E		509	Bur oak
E		510	Scarlet oak
E		511	Yellow-poplar
E		512	Black walnut
E		513	Black locust
E		514	Southern scrub oak
E		515	Chestnut oak / black oak / scarlet oak
E		516	Cherry / white ash / yellow-poplar
E		517	Elm / ash / black locust
E		519	Red maple / oak

East	West	Code	Species Type
E		520	Mixed upland hardwoods
			<b>Oak / Gum / Cypress Group</b>
E		601	Swamp chestnut oak / cherrybark oak
E		602	Sweetgum / Nuttall oak / willow oak
E		605	Overcup oak / water hickory
E		606	Atlantic white-cedar
E		607	Baldcypress / water tupelo
E		608	Sweetbay / swamp tupelo / red maple
E		609	Baldcypress / pondcypress
			<b>Elm / Ash / Cottonwood Group</b>
E		701	Black ash / American elm / red maple
E		702	River birch / sycamore
E	W	703	Cottonwood
E	W	704	Willow
E		705	Sycamore / pecan / American elm
E		706	Sugarberry / hackberry / elm / green ash
E		707	Silver maple / American elm
E		708	Red maple / lowland
E	W	709	Cottonwood / willow
	W	722	Oregon ash
			<b>Maple / Beech / Birch Group</b>
E		801	Sugar maple / beech / yellow birch
E		802	Black cherry
E		805	Hard maple / basswood
E		809	Red maple / upland
			<b>Aspen / Birch Group</b>
E	W	901	Aspen
E	W	902	Paper birch
E		903	Gray birch
E	W	904	Balsam poplar
E	W	905	Pin cherry
			<b>Alder / Maple Group</b>
	W	911	Red alder
	W	912	Bigleaf maple
			<b>Western Oak Group</b>
	W	921	Gray pine
	W	922	California black oak
	W	923	Oregon white oak
	W	924	Blue oak
	W	931	Coast live oak
	W	933	Canyon live oak
	W	934	Interior live oak
	W	935	California white oak (valley oak)

East	West	Code	Species Type
			<b>Tanoak / Laurel Group</b>
	W	941	Tanoak
	W	942	California laurel
	W	943	Giant chinkapin
			<b>Other Hardwoods Group</b>
	W	961	Pacific madrone
	W	962	Other hardwoods
			<b>Woodland Hardwoods Group</b>
	W	971	Deciduous oak woodland
	W	972	Evergreen oak woodland
E	W	973	Mesquite woodland
	W	974	Cercocarpus woodland
	W	975	Intermountain maple woodland
E	W	976	Misc. woodland hardwoods
			<b>Tropical and Subtropical Hardwood Groups</b>
E		982	Mangrove swamps
E	W	983	Palms
		984	Dry forest
		985	Moist forest
		986	Wet and rain forest
		987	Lower montane rainforest
E		989	Other tropical and subtropical hardwoods
			<b>Exotic Hardwoods Group</b>
E		991	Paulownia
E		992	Melaluca
E	W	993	Eucalyptus (RM - not a valid code)
E	W	995	Other exotic hardwoods

For nonstocked stands, see section 2.5.3 for procedures to determine FOREST TYPE.

Unless otherwise stated, FOREST TYPES are named for the predominant species (or group of species) on the condition. In order to determine if the type should be classified as softwood versus hardwood, first estimate the stocking (site occupancy) of trees in each of these two categories. If softwoods predominate (50% or more), then the FOREST TYPE will be one of the softwood types (codes 101 through 391) and vice versa for hardwoods (codes 401 through 995).

For the Eastern United States, there are mixed hardwood-pine FOREST TYPES (codes 401 through 409) when the pine and/or redcedar (either eastern or southern) component is between 25 and 49% of the stocking. If the pine/redcedar component is less than 25% of the stocking, then one of the hardwood FOREST TYPES is assigned.

## RM - FOREST TYPE

Classification is determined by stocking types, which are not necessarily biological associations. Forest tree species are listed under at least one stocking group; some species are listed under several groups.

Determine FOREST TYPE as follows:

- a. Sum the basal area of all live hardwoods;
- b. Sum the basal area of all live softwoods;
- c. Determine which category (hardwood or softwood) contains the most basal area;
- d. Look through the Stocking Groups list for the selected Level, and identify which groups within that level contain the species within the condition;
- e. If multiple species occur within a Stocking Group, sum their basal areas.
- f. After all possible summations are computed, compare the total basal areas for the representative Stocking Groups, and identify the Group with the most basal area.
- g. Within the selected Group, determine which FOREST TYPE has the most basal area for the species listed in the type.

For stocked forest land, estimate basal area by using an angle gauge at each subplot within the condition and counting the number of "in" trees by species; each "in" tree would represent a specific number of square feet of basal area (e.g., each tree "in" with a 20-BAF gage represents 20 square feet of basal area). Use same angle gauge for entire plot. Do not change BAF's between conditions or subplots.

RM - Examples:

1. A 10-BAF gauge is used, and the condition consists of 40 ft<sup>2</sup> of Western hemlock, 30 ft<sup>2</sup> of Western redcedar, and 60 ft<sup>2</sup> of Grand fir. All of these species fall within the Softwood Level. Western hemlock is found in both the Western Hemlocks Stocking Group and the Sitka spruce / hemlock Stocking Group. Western redcedar is found in both the Sitka spruce / hemlock Stocking Group and the Douglas fir / Western larch Stocking Group. Because Western Hemlock and Western redcedar share the Sitka spruce / hemlock Stocking Group, their basal areas are summed to arrive at a total of 70 ft<sup>2</sup> in the Sitka spruce / hemlock Stocking Group. Grand fir is located in the True firs Stocking Group and does not share a Stocking Group with the previous species so the total basal area for Grand fir is 60 ft<sup>2</sup>. The FOREST TYPE is then determined from the Sitka spruce / hemlock group; with Western Hemlock having the larger basal area than Western redcedar. The FOREST TYPE for the condition is 301 – Western hemlock.
2. A 10-BAF gauge was used and the condition consisted of 40 ft<sup>2</sup> of Southwestern white pine, 20 ft<sup>2</sup> of Mexican pinyon pine, and 30 ft<sup>2</sup> of

**Alligator juniper.** Looking through the stocking group list you would find Southwestern white pine in the Other Western Pines stocking group.

The Mexican pinyon pine and alligator juniper are both in the Pinyon Juniper stocking group so their basal area would be summed to arrive at 50 ft<sup>2</sup>. Southwestern white pine is the only species in the Other Western Pine group with a total of 40 ft<sup>2</sup>. Within the Pinyon Juniper stocking group Rocky Mountain juniper, Western juniper, or Eastern redcedar (*Juniperus*) are summed individually. Other than these junipers, the other junipers are summed with pinyon stocking. Therefore, in this example, the FOREST TYPE would be 185 – Pinyon Juniper woodland.

3. After working through the summation process, you determine that the condition is mostly stocked with boxelder. Looking through the stocking groups, boxelder is only located in Elm – Ash – Cottonwood Stocking Group. Within that Group, Boxelder is then located in the FOREST TYPE 706 – Sugarberry, Hackberry, Elm, Green Ash; this is the FOREST TYPE coded for the condition.

For situations where the trees tallied do not represent the FOREST TYPE evident on the condition, describe the situation in the notes on the Condition Class Description record.

#### WHITE/RED/JACK PINE GROUP

In these pure pine FOREST TYPES, stocking of the pine component needs to be at least 50 percent. Otherwise, check the FOREST TYPES listed under the Oak / Pine Group (beginning with FOREST TYPE code (401).

- 101 Jack pine: Associates – northern pin oak, bur oak, red pine, bigtooth aspen, paper birch, northern red oak, eastern white pine, red maple, balsam fir, white spruce, black spruce, and tamarack.. Sites - Dry to mesic sites.
- 102 Red pine: Associates – eastern white pine, jack pine, red maple, northern red oak, white spruce, balsam fir, quaking aspen, bigtooth aspen, paper birch, northern pin oak. Sites - common on sandy soils, but reaches best development on well-drained sandy loam to loam soils.
- 103 Eastern white pine: Associates – pitch pine, gray birch, aspen, red maple, pin cherry, white oak, paper birch, sweet birch, yellow birch, black cherry, white ash, northern red oak, sugar maple, basswood, hemlock, northern white cedar, yellow poplar, white oak, chestnut oak, scarlet oak, and shortleaf pine. Sites - wide variety, but best development on well drained sands and sandy loams.
- 104 Eastern white pine/ eastern hemlock (includes Carolina hemlock): Associates – beech, sugar maple, basswood, red maple, yellow birch, gray birch, red spruce, balsam fir, black cherry, white ash, paper birch, sweet birch, northern red oak, white oak, chestnut oak, yellow poplar, and cucumbertree. Sites - wide variety but

- favors cool locations, moist ravines, and north slopes.
- 105 Eastern hemlock (includes Carolina hemlock): Associates – white pine, balsam fir, red spruce, beech, sugar maple, yellow birch, basswood, red maple, black cherry, white ash, paper birch, sweet birch, northern red oak, and white oak. Sites - cool locations, moist ravines, and north and east slopes.

#### SPRUCE/FIR GROUP

These types are mostly in the Eastern United States. See FIR SPRUCE/ MOUNTAIN HEMLOCK for Western United States.

- 121 Balsam fir: Associates – black, white, or red spruce; paper or yellow birch; quaking or bigtooth aspen, beech; red maple; hemlock; tamarack; black ash; or northern white cedar. Sites - upland sites on low-lying moist flats and in swamps.
- 122 White spruce: Associates – black spruce, paper birch, quaking aspen, red spruce, balsam fir, and balsam poplar. Sites - Transcontinental; grows well on calcareous and well-drained soils, but is found on acidic rocky and sandy sites, and sometimes in fen peatlands along the maritime coast.
- 123 Red spruce: Associates – vary widely and may include red maple, yellow birch, eastern hemlock, eastern white pine, white spruce, northern white cedar, paper birch, pin cherry, gray birch, mountain-ash, beech, striped maple, sugar maple, northern red oak, red pine, and aspen. Sites -- include moderately well-drained to poorly drained flats and thin slopes and on varying acidic soils in abandoned fields and pastures. This code should be used where red spruce comprises a plurality or majority of the stand's stocking but where balsam fir is either nonexistent or has very little stocking (< 5 percent of total). Otherwise the plot would be coded 124, red spruce/balsam fir.
- 124 Red spruce/balsam fir: Associates – red maple, paper birch, white pine, hemlock, white spruce, and northern white cedar. Sites - moderately drained to poorly drained flats or on thin soiled upper slopes.
- 125 Black spruce: Associates – white spruce, quaking aspen, balsam fir, paper birch, tamarack, northern white cedar, black ash, and red maple. Sites -- wide variety from moderately dry to very wet.
- 126 Tamarack: Associates – black spruce, balsam fir, white spruce, northern white-cedar, and quaking aspen. Sites -- found on wetlands and poorly drained sites.
- 127 Northern white cedar: Associates – balsam fir, tamarack, black spruce, white spruce, red spruce, black ash, and red maple. Sites - mainly occurs in swamps, but also in seepage areas, limestone uplands and old fields.
- 128 Fraser fir: Associates – red spruce, hemlock, yellow birch, less frequently, beech, sugar maple, yellow buckeye, mountain-ash, and mountain maple. Sites -- mainly occurs in the Appalachian Mountains of North Carolina and Tennessee. This type is used if the stocking of Fraser fir is at least 50 percent of the total

stocking.

- 129 Red spruce/Fraser fir: Associates – hemlock, yellow birch, and less frequently, beech, sugar maple, yellow buckeye, mountain-ash, and mountain maple. Sites -- mainly occurs in the Appalachian Mountains of North Carolina and Tennessee. For this type to be used, the sum of the stocking of red spruce and Fraser fir must be at least 50 percent of the total stocking and red spruce stocking must be between 5 and 49 percent of total and Fraser fir stocking must be between 5 and 49 percent of total.

#### LONGLEAF/SLASH PINE GROUP

- 141 Longleaf pine: Longleaf pine occurs as a pure type or comprises a majority of the trees in the overstory. Associates slash, loblolly and shortleaf pine, southern red oak, blackjack oak, water oak, persimmon, and sweetgum. Sites - those areas that can and do burn on a periodic basis usually occurs on middle and upper slopes with a low severity of hardwood and brush competition. SRS distribution coastal plain and piedmont units.
- 142 Slash pine: Slash pine is pure or provides a majority of the stocking. Associates on moist sites; a wide variety of moist site hardwoods, pond pine, and pondcypress. On dry sites; a wide variety of dry site hardwoods, longleaf, loblolly, and sand pine. Sites - both moist and well drained flatwoods, and bays. SRS distribution coastal plain and piedmont units from North Carolina to Florida.

#### TROPICAL SOFTWOODS GROUP

- 151 Tropical pines: Tropical pine forests and plantations comprised of Caribbean pine (*Pinus caribea*). Associates are *P. oocarpa*, *P. patula* and other pine species native to the Florida Keys, Caribbean, Central America and Mexico. Pines are not native to Puerto Rico or the U.S. Virgin Islands but can be found in plantations or naturally regenerating to a limited extent on sites that were formerly plantations. *P. caribea* was once rare on the South Florida mainland, but practically non-existent there now and it is not used in plantations in Florida.

#### LOBLOLLY/SHORTLEAF PINE GROUP

- 161 Loblolly pine: Associates – sweetgum, southern red oak, post oak, blackjack oak, blackgum, yellow poplar, and pond pine. Sites - upland soils with abundant moisture but good drainage, and on poorly drained depressions.
- 162 Shortleaf pine: Associates – white oak, southern red oak, scarlet oak, black oak, hickory, post oak, blackjack oak, blackgum, red maple, pitch pine, and Virginia pine. Sites - low, well drained ridges to rocky, dry, south slopes and the better drained spur ridges on north slopes and also on old fields.
- 163 Virginia pine: Associates – shortleaf pine, white oak, chestnut oak, southern red oak, black oak, sweetgum, red maple,

- blackgum, and pitch pine. Sites -dry sites, often abandoned fields.
- 164 Sand pine: Sand pine occurs in pure stands or provides a majority of the stocking. Associates - dwarf live oak, dwarf post oak, turkey oak, persimmon, and longleaf pine. Sites - dry, acidic, infertile sands. SRS distribution found chiefly in the central peninsula and panhandle of Florida, although planted stands extend into the sandhills of Georgia and South Carolina.
- 165 Table mountain pine: Associates – chestnut oak, scarlet oak, pitch pine, and black oak. Sites - poor, dry, often rocky slopes.
- 166 Pond pine: Associates – loblolly pine, sweetgum, baldcypress, and Atlantic white cedar. Sites --rare, but found in southern New Jersey, Delaware, and Maryland in low, poorly drained acres, swamps, and marshes.
- 167 Pitch pine: Associates – chestnut oak, scarlet oak, table mountain pine, black oak, and blackgum. Sites - relatively infertile ridges, dry flats, and slopes.
- 168 Spruce pine: Spruce pine comprises a majority of the stocking. Associates any of the moist site softwood or hardwood species. Sites moist or poorly drained areas. SRS distribution this type is rarely encountered and is found almost exclusively in the coastal plain.

#### OTHER EASTERN SOFTWOODS GROUP

- 171 Eastern redcedar (includes southern redcedar): Associates – gray birch, red maple, sweet birch, Virginia Pine, shortleaf pine, oak. Sites -- usually dry uplands and abandoned fields on limestone outcrops and other shallow soils but can grow well on good sites.
- 172 Florida softwoods (includes either Florida yew or Florida torreyia): Either of these two species comprises the majority of stocking. Sites -- Along bluffs and ravines of the Apalachicola River and its tributaries in north Florida and South Georgia.

#### PINYON / JUNIPER GROUP

- 182 Rocky Mountain juniper: Rocky Mountain juniper comprises the majority of stocking. Associates – ponderosa pine, Douglas-fir, other junipers, pinyons, and oaks. Sites -- often found on calcareous and somewhat alkaline soils.
- 184 Juniper woodland: Includes Pinchot juniper, redberry juniper, Ashe juniper, California juniper, alligator juniper, Utah juniper, oneseed juniper and pinyon is NOT present. Associates: various woodland oaks and cercocarpus, ponderosa pine, Arizona cypress, and Douglas-fir. Sites -- lower elevation with low annual precipitation.
- 185 Pinyon-juniper woodland: Includes all pinyons and all junipers except Rocky Mountain and western juniper. Must have pinyon present. Associates: various woodland oaks and cercocarpus, ponderosa pine, Arizona cypress, and Douglas-fir. Sites--occurs at lower elevations with low annual precipitation.

#### DOUGLAS-FIR GROUP

- 201 Douglas-fir: Associates – western hemlock, grand fir, Pacific silver fir, white fir, noble fir, California red fir, western redcedar, bigleaf maple, red alder, ponderosa pine, western white pine, western hemlock, Sitka spruce. Sites -- throughout the western U.S.
- 202 Port-Orford-cedar: Associates – Douglas-fir, western hemlock, Sitka spruce, grand fir, lodgepole pine, western redcedar, redwood, tanoak, red alder, bigleaf maple and California laurel. Sites --higher elevations tending to occur on northerly aspects.
- 203 Bigcone Douglas-fir: Associates – Canyon live oak, ponderosa, Jeffrey, sugar, knobcone, and Coulter pines, incense-cedar, white fir, California black oak, California laurel, and bigleaf maple. Sites -- Mainly confined to the Transverse and Peninsular Ranges of southern California. Stands are found on many combinations of slope, aspect, soil, but as elevations increase, the preferred aspect shifts from cooler to warmer slopes.

#### PONDEROSA PINE GROUP

- 221 Ponderosa pine (includes Arizona pine): Associates – Douglas-fir, lodgepole pine, grand fir, Jeffrey pine, western larch, quaking aspen, Utah juniper, Gambel oak. Sites -- this FOREST TYPE is distributed over vast areas in the West and therefore can have great differences in environmental conditions.
- 222 Incense-cedar: Associates – Douglas-fir, ponderosa pine, sugar pine, western white pine, Jeffrey pine, white and grand fir, western hemlock, western redcedar, Port-Orford-cedar, giant sequoia, Oregon white oak, California black oak, tanoak, giant chinkapin, and Pacific madrone; it is rarely found in pure stands. Sites -- Grows from the coastal fog belt to the dry inland slopes of eastern California and central Oregon. Once established, incense-cedar is a good competitor on hot, dry sites and commonly shares an upper canopy position on southwestern slopes. On cooler, moister aspects, it is usually subdominant to other species.
- 224 Sugar pine: Associates – In the northern part of its range: Douglas-fir, ponderosa pine, grand fir, incense-cedar, western hemlock, western redcedar, Port-Orford-cedar, tanoak, and madrone. In the central part of its range: ponderosa pine, Jeffrey pine, white fir, incense-cedar, California red fir, giant sequoia, and California black oak. Farther south: Jeffrey pine, ponderosa pine, Coulter pine, incense-cedar, white fir, and bigcone Douglas-fir. Sites -- grows in areas that have warm, dry summers and cool, wet, mild winters. Terrain is commonly steep and rugged, favoring warm exposures as the elevation increases. Found in Oregon and California, but is most abundant in the mixed conifer forests on the west slope of the Sierra Nevada.
- 225 Jeffrey pine: Associates – Incense-cedar, ponderosa pine, sugar pine, Douglas-fir, Port-Orford-cedar, western white pine, knobcone pine, Digger pine, red and white fir. Sites -- thrives in fairly harsh

- environments throughout most of its range, and is cold hardy, drought tolerant, adapted to short growing seasons, and tolerant of infertile sites. The majority of trees are found in California, although its range extends into SW Oregon and western Nevada.
- 226 Coulter pine: Associates – blue oak, California black oak, interior live oak, interior live oak, coast live oak, valley oak, California scrub oak, buckeye, ponderosa pine. Sites -- grows singly or in small stands primarily on dry, rocky slopes of southern California coastal ranges, between 3,000 and 6,000 feet. Occurs from Mt. Diablo and the Santa Lucia Mountains down to the San Bernardino, San Jacinto, and Cuyamaca Mountains in the south.

#### WESTERN WHITE PINE GROUP

- 241 Western white pine: Associates – western larch, grand fir, western redcedar, and western hemlock. Sites -- occurs primarily on moist, mid-elevation sites from 1,500 to 4,000 feet.

#### FIR/SPRUCE/MOUNTAIN HEMLOCK GROUP

- 261 White fir: Associates – Douglas-fir, sugar pine, ponderosa pine, Jeffrey pine, incense-cedar, California red fir, blue spruce, limber pine, and aspen. Sites -- deep well-drained sandy loam-covered slopes and benches with a northerly exposure.
- 262 Red fir (includes California and Shasta red fir): Associates – Jeffrey pine, western white pine, lodgepole pine, mountain hemlock, and sugar pine. Sites -- found at elevations ranging from 5,400 to 7,500 feet.
- 263 Noble fir: Associates - Douglas-fir, Pacific silver fir, western and mountain hemlocks, lodgepole pine, western redcedar, and Alaska cedar. Sites -- found on a variety of sites where precipitation is high and snowpacks are common, generally above 3,000 feet in elevation in the Cascade and Coast ranges.
- 264 Pacific silver fir: Associates - western and mountain hemlocks, western redcedar, Alaska cedar, grand fir, Sitka spruce, lodgepole pine, subalpine fir, and Engelmann spruce. Sites -- most abundant on sites where summer drought is minimal and snowpacks are common, such as areas of heavy rainfall, seepage, or prolonged snowmelt.
- 265 Engelmann spruce: Associates – western white pine, western redcedar, western hemlock, Douglas-fir, western larch, grand fir, subalpine fir, and lodgepole pine. For this type to be used, the total stocking of Engelmann spruce must be at least 75 percent of the total stocking.
- 266 Engelmann spruce-subalpine fir: Associates – western white pine, western redcedar, western hemlock, Douglas-fir, western larch, grand fir, and lodgepole pine. Sites -- this type is widespread in the Western U.S. For this type to be used, the sum of the stocking of Engelmann spruce and subalpine fir must be at least 75 percent of the total stocking and Engelmann spruce stocking must be between 5 and 74 percent of total and subalpine fir stocking must

- be between 5 and 74 percent of total.
- 267 Grand fir: Associates – ponderosa pine, Douglas-fir, western hemlock, western redcedar, western white pine, Pacific yew, lodgepole pine, and western larch. Sites -- in Idaho, found on moist slopes from 1,500 to 5,200-foot elevations; in Oregon, it occupies moist low-elevation sites, but also extends up to mid-elevations to as high as 6,000 feet.
- 268 Subalpine fir: Associates – western white pine, western redcedar, western hemlock, Douglas-fir, western larch, grand fir, Engelmann spruce, and lodgepole pine. For this type to be used, the total stocking of subalpine fir must be at least 75 percent of the total stocking. Sites -- found at high elevations, near timberline.
- 269 Blue spruce: Associates – Douglas-fir, ponderosa pine, white fir, lodgepole pine, and Rocky Mountain juniper. Sites -- restricted to the southern Rocky Mountains, typically located in the montane zone.
- 270 Mountain hemlock: Associates – Alaska-cedar, Pacific silver fir, western white pine, lodgepole pine, noble fir, and subalpine fir. Sites -- occurs in cold, moist regions and growing conditions are poor.
- 271 Alaska-yellow-cedar: Associates: In California, California red fir, Brewer spruce, incense-cedar, Pacific yew, and western white pine; in Oregon and Washington, found with mountain hemlock, subalpine fir, Pacific silver fir, noble fir, western white pine, and western hemlock. Sites -- Cool and humid climate, most stands grow within 100 miles of the Pacific coast.

#### LOGEPOLE PINE GROUP

- 281 Lodgepole pine: Associates – subalpine fir, Engelmann spruce, white spruce, Douglas-fir, western redcedar, red alder, and western hemlock. Sites -- one of the most widespread types in the Western U.S. tolerating a broad range of temperature and moisture regimes.

#### HEMLOCK/SITKA SPRUCE GROUP

- 301 Western hemlock: Associates – Sitka spruce, western redcedar, Douglas-fir, Alaska-yellow-cedar, grand fir, Engelmann spruce, bigleaf maple, and red alder. Sites -- nearly any soil provides a seedbed but requires abundant moisture. Often comes in cut-over or burned-over areas.
- 304 Western redcedar: Associates – western white pine, western hemlock, western larch, grand fir, Douglas-fir, and Pacific silver fir. Sites -- inhabits moist flats and slopes, the banks of rivers and swamps and can be found in bogs.
- 305 Sitka spruce: Associates – western hemlock, Douglas-fir, western redcedar, Port Orford-cedar, red alder, bigleaf maple, and black cottonwood. Sites - -limited to a relatively narrow oceanside strip characterized by mild winters, cool summers, and abundant moisture throughout the growing season.

#### WESTERN LARCH GROUP

- 321 Western larch: Associates – Douglas-fir, subalpine fir, lodgepole pine, Engelmann spruce, western hemlock, and western redcedar. Sites -- best growth on deep, moist, porous soils in high valleys and on mountain slopes of northern and western exposure.

#### REDWOOD GROUP

- 341 Redwood: Associates – Douglas-fir, grand fir, western hemlock, California torreyia, Pacific yew, and western redcedar. Sites - - largely confined to coastal topography between 35 degrees 41 minutes and 42 degrees 9 minutes north latitude.
- 342 Giant sequoia: Associates: California white fir, sugar pine, incense-cedar, California red fir, California white fir, ponderosa pine and California black oak. Sites -- Deep, well-drained soils with high soil moisture available during dry summers. Most stands found above 4,000 feet elevation, rarely forming pure stands.

#### OTHER WESTERN SOFWOODS GROUP

- 361 Knobcone pine: Associates – Digger pine, canyon live oak and many western oaks, Douglas-fir, and Port Orford-cedar. Sites -- found on soils that are shallow, dry, stony or high in magnesium.
- 362 Southwestern white pine: Associates- Douglas-fir, white fir, ponderosa pine, Gambel oak, and aspen. Sites -- higher elevations in Arizona and New Mexico
- 363 Bishop pine: Grows singly or in small stands along the coast of California.
- 364 Monterey pine: Grows singly or in small stands. Sites -- Native stands are found in the high humidity and summer fogs of the central-coast area of California in San Mateo, Santa Cruz, Monterey, and San Luis Obispo Counties.
- 365 Foxtail pine/bristlecone pine: Associates – limber pine, white fir, Engelmann spruce, ponderosa pine, and pinyon. Sites -- found on rocky outcrops, usually on southern or southwestern exposures and can range in elevation from 8,000 to 11,000 feet.
- 366 Limber pine: Associates – low to mid elevations.: Douglas-fir, ponderosa pine, Rocky Mountain juniper; mid to high elevations: lodgepole pine and aspen; high elevations: Engelmann spruce, subalpine fir, bristlecone pine, and whitebark pine. Sites -- a very wide range of elevations and latitudes across the Rocky mountains; can be the majority species as an early seral stage under a variety of harsh establishment conditions, as climax in dry, high elevation sites in the central and southern Rockies.
- 367 Whitebark pine: Associates – subalpine fir, subalpine larch, Engelmann spruce, and lodgepole pine. Sites -- poor, high elevation.
- 368 Miscellaneous western softwoods: A "catch-all" group for such species as all cypress (Cupressus) species, subalpine larch, Brewer spruce, Apache pine, Chihuahua pine, Washoe pine,

Torrey pine, Pacific yew, and California torreyia.

- 369 Western juniper: Associates – ponderosa pine and Jeffrey pine.  
Sites -- found on dry sites and ranges in elevation from just above sea level to 6,500 feet.

#### CALIFORNIA MIXED CONIFER GROUP

- 371 California mixed conifer: Associates - a complex association of ponderosa pine, sugar pine, Douglas-fir, white fir, red fir, and incense-cedar. Generally, five or six conifer species are intermixed either as single trees or in small groups. Sites -- Mixed conifer sites are often on east-facing slopes of the California Coast Range and on the west-facing and higher elevation east-facing slopes of the Oregon Cascades and Sierra Nevadas.

#### EXOTIC SOFTWOODS GROUP

- 381 Scotch pine: plantation type, not naturally occurring.  
383 Other exotic softwoods; Austrian pine  
384 Norway spruce: plantation type, not naturally occurring  
385 Introduced larch: introduced larch (species code 0070)

#### OTHER SOFTWOODS GROUP

- 391 Other softwoods: All softwood species identified to genus level only, except cypress, baldcypress, and larch.

#### OAK/PINE GROUP

In these oak/pine FOREST TYPEs, stocking of the pine component needs to be 25-49 percent.

- 401 Eastern white pine/northern red oak/white ash: Associates – red maple, basswood, yellow birch, bigtooth aspen, sugar maple, beech, paper birch, black cherry, hemlock, and sweet birch. Sites -deep, fertile, well-drained soil.
- 402 Eastern redcedar/hardwood: Associates - oak, hickory, walnut, ash, locust, dogwood, blackgum, hackberry, winged elm, shortleaf pine, and Virginia pine. Sites - usually dry uplands and abandoned fields.
- 403 Longleaf pine/oak: Longleaf pine and scrub oaks primarily turkey, bluejack, blackjack, and dwarf post oak comprise the type. Associates southern scrub oaks in the understory. Sites - common on sandhills where soils are dry, infertile, and coarse textured. SRS distribution - coastal plain and piedmont units.
- 404 Shortleaf pine/oak: Associates - (oaks generally include white, scarlet, blackjack, black, post, and southern red) hickory, blackgum, sweetgum, Virginia pine, and pitch pine. Sites - generally in dry, low ridges, flats, and south slopes.
- 405 Virginia pine/southern red oak: Associates – black oak, scarlet oak, white oak, post oak, blackjack oak, shortleaf pine, blackgum, hickory, pitch pine, table mountain pine, chestnut oak. Sites - dry slopes and ridges.
- 406 Loblolly pine/hardwood: Associates – wide variety of moist and

- wet site hardwoods including blackgum, sweetgum, yellow poplar, red maple, white and green ash, and American elm; on drier sites associates include southern and northern red oak, white oak, post oak, scarlet oak, persimmon, and hickory. Sites - usually moist to very moist though not wet all year, but also on drier sites.
- 407 Slash pine/hardwood: Slash pine and a variable mixture of hardwoods comprise the type. Associates codominant with the slash pine component are sweetbay, blackgum, loblolly bay, pondcypress, pond pine, Atlantic white cedar, red maple, ash, and water oak. Sites - undrained or poorly drained depressions such as bays or pocosins and along pond margins. SRS distribution primarily coastal plain units.
- 409 Other pine/hardwood: A type used for those unnamed pine-hardwood combinations that meet the requirements for oak-pine. These are stands where hardwoods (usually oaks) comprise the plurality of the stocking with at least a 25 to 49 percent pine, eastern redcedar, or southern redcedar component.

#### OAK/HICKORY GROUP

- 501 Post oak/blackjack oak (includes dwarf post oak): Associates – black oak, hickory, southern red oak, white oak, scarlet oak, shingle oak, live oak, shortleaf pine, Virginia pine, blackgum, sourwood, red maple, winged elm, hackberry, chinkapin oak, shumard oak, dogwood, and eastern redcedar. Sites - dry uplands and ridges.
- 502 Chestnut oak: Associates – scarlet oak, white oak, black oak, post oak, pitch pine, blackgum, sweetgum, red maple, red oak, shortleaf pine, Virginia pine. Sites - rocky outcrops with thin soil, ridge tops.
- 503 White oak/red oak/hickory (includes all hickories except water and shellbark hickory): Associates – pin oak, northern pin oak, chinkapin oak, black oak, dwarf chinkapin oak, American elm, scarlet oak, bur oak, white ash, sugar maple, red maple, walnut, basswood, locust, beech, sweetgum, blackgum, yellow poplar, and dogwood. Sites - wide variety of well-drained upland soils.
- 504 White oak: Associates – black oak, northern red oak, bur oak, hickory, white ash, yellow poplar. Sites - scattered patches on upland, loamy soils but on drier sites than type 503.
- 505 Northern red oak: Associates – black oak, scarlet oak, chestnut oak, and yellow poplar. Sites -spotty distribution on ridge crests and north slopes in mountains but also found on rolling land, slopes, and benches on loamy soil.
- 506 Yellow poplar/white oak/northern red oak: Associates – black oak, hemlock, blackgum, and hickory. Sites - northern slopes, coves, and moist flats.
- 507 Sassafras/persimmon: Associates – elm, eastern redcedar, hickory, ash, sugar maple, yellow poplar, Texas sophora, and oaks. Sites - abandoned farmlands and old fields.

- 508 Sweetgum/yellow poplar: Associates – red maple, white ash, green ash, and other moist site hardwoods. Sites - generally occupies moist, lower slopes.
- 509 Bur oak: Associates—northern pin oak, black oak, chinkapin oak, and eastern redcedar in northern and dry upland sites; shagbark hickory, black walnut, eastern cottonwood, white ash, American elm, swamp white oak, honey locust, and American basswood in southern and lowland sites. Sites -- drier uplands to moist bottomlands with the drier uplands more common in the northern part of the range and the moist bottomlands more common in the southern part of the range.
- 510 Scarlet oak: Associates – black oak, southern red oak, chestnut oak, white oak, post oak, hickory, pitch pine, blackgum, sweetgum, black locust, sourwood, dogwood, shortleaf pine, and Virginia pine. Sites - dry ridges, south or west facing slopes and flats but often moister situations probably as a result of logging or fire.
- 511 Yellow poplar: Associates – black locust, red maple, sweet birch, cucumbertree, and other moist site hardwoods (except sweetgum, see type 508) and white oak and northern red oak (see type 503). Sites - lower slopes, northerly slopes, moist coves, flats, and old fields.
- 512: Black walnut: Associates – yellow poplar, white ash, black cherry, basswood, beech, sugar maple, oaks, and hickory. Sites - coves and well-drained bottoms.
- 513 Black locust: Associates – many species of hardwoods and hard pines may occur with it in mixture, either having been planted or from natural seeding. Sites - may occur on any well-drained soil but best on dry sites, often in old fields.
- 514 Southern scrub oak: This forest cover type consists of a mixture of scrub oaks that may include several of the following species: turkey oak, bluejack oak, dwarf live oak, Durand oak, and bear oak (otherwise known as scrub oak). Also includes anacahuita. Sites dry sandy ridges the type frequently develops on areas formerly occupied by longleaf pine. SRS distribution - common throughout all coastal plain units and into the lower Piedmont.
- 515 Chestnut oak/black oak/scarlet oak: Associates—northern and southern red oaks, post oak, white oak, sourwood, shagbark hickory, pignut hickory, yellow-poplar, blackgum, sweetgum, red maple, eastern white pine, pitch pine, Table Mountain pine, shortleaf pine, and Virginia pine. Sites --dry upland sites on thin-soiled rocky outcrops on dry ridges and slopes.
- 516 Cherry/white ash/yellow-poplar: Associates – sugar maple, American beech, northern red oak, white oak, blackgum, hickory, cucumbertree, and yellow birch. Sites -- fertile, moist, well-drained sites.
- 517 Elm/ash/black locust: Associates – Black locust, silver maple, boxelder, blackbead ebony, American elm, slippery elm, rock elm, red maple, green ash predominate. Found in North Central region, unknown in Northeast. Sites -- upland.

- 519 Red maple/oak: Associates – the type is dominated by red maple and some of the wide variety of central hardwood associates include upland oak, hickory, yellow-poplar, black locust, sassafras as well as some central softwoods like Virginia and shortleaf pines. Sites -- uplands.
- 520 Mixed upland hardwoods: Includes Ohio buckeye, yellow buckeye, Texas buckeye, red buckeye, painted buckeye, American hornbeam, American chestnut, eastern redbud, flowering dogwood, hawthorn spp., cockspur hawthorn, downy hawthorn, Washington hawthorn, fleshy hawthorn, dwarf hawthorn, honeylocust, Kentucky coffeetree, Osage-orange, all mulberries, blackgum, sourwood, southern red oak, shingle oak, laurel oak, water oak, live oak, willow oak, black locust, blackbead ebony, anacahuita, and September elm. Associates – Any mixture of hardwoods of species typical of the upland central hardwood region, should include at least some oak. Sites -wide variety of upland sites.

#### OAK/GUM/CYPRESS GROUP

- 601 Swamp chestnut oak/cherrybark oak: Associates – Shumard oak, Delta post oak, white ash, hickory, white oak, blackgum, sweetgum, southern red oak, post oak, American elm, winged elm, yellow poplar, and beech. Sites - within alluvial flood plains of major rivers, on all ridges in the terraces, and on the best fine sandy loam soils on the highest first bottom ridges.
- 602 Sweetgum/Nuttall oak/willow oak: Associates – American holly, green ash, American elm, pecan, cottonwood, red maple, honeylocust, persimmon, anacahuita. Sites - very wet.
- 605 Overcup oak/water hickory (includes shellbark hickory): Associates – pin oak, willow oak, American elm, green ash, hackberry, persimmon, and red maple. Sites - in South within alluvial flood plains in low, poorly drained flats with clay soils; also in sloughs and lowest backwater basins and low ridges with heavy soils that are subject to late spring inundation.
- 606 Atlantic white cedar: Associates – North includes gray birch, pitch pine, hemlock, blackgum, and red maple. South includes pond pine, baldcypress, and red maple. Sites - usually confined to sandy bottomed, peaty, interior, and river swamps, wet depressions, and stream banks.
- 607 Baldcypress/water tupelo: 25-50 percent stocking of baldcypress (either baldcypress or Montezuma baldcypress). Associates – blackgum, willow, red maple, American elm, persimmon, overcup oak, and sweetgum. Sites - very low, poorly drained flats, deep sloughs, and swamps; wet most all the year. Also, floodplains and stream margins.
- 608 Sweetbay/swamp tupelo/red maple: Associates – blackgum, Florida maple, water birch, gum bumelia, waterlocust, loblolly bay, all magnolias, red maple, Ogechee tupelo, red bay, water-elm, Oglethorpe oak, loblolly and pond pines, American elm, and other

moist site hardwoods. Sites - very moist but seldom wet all year shallow ponds, muck swamps, along smaller creeks in Coastal Plain (rare in Northeast).

- 609 Baldcypress/pondcypress: > 50 percent stocking of baldcypress and/or pondcypress. Associates – blackgum, willow, red maple, American elm, persimmon, overcup oak, and sweetgum. Sites -- very low, poorly drained flats, deep sloughs, and swamps; wet most all the year. Also, floodplains and stream margins.

#### ELM/ASH/COTTONWOOD GROUP

- 701 Black ash/American elm/red maple (includes slippery and rock elm): Associates – swamp white oak, silver maple, sycamore, pin oak, blackgum, white ash, and cottonwood. Sites - moist to wet areas, swamps, gullies, and poorly drained flats.
- 702 River birch/sycamore: Associates – red maple, black willow, and other moist site hardwoods. Sites - moist soils at edges of creeks and rivers.
- 703 Cottonwood: Associates – willow, white ash, green ash, and sycamore. Sites - streambanks where bare, moist soil is available.
- 704 Willow (includes peachleaf and black willow): Associates – cottonwood, green ash, sycamore, pecan, American elm, red maple, and boxelder. Sites - streambanks where bare, moist soil is available.
- 705 Sycamore/pecan/American elm (includes slippery and rock elm): Associates – sweetgum, green ash, hackberry, silver maple, cottonwood, willow, boxelder, and river birch. Sites - bottomlands, alluvial flood plains of major rivers.
- 706 Sugarberry/hackberry/elm/green ash (includes American, winged, cedar, slippery and rock elm): Associates – boxelder, pecan, blackgum, persimmon, honeylocust, red maple, hackberry, and boxelder. Sites - low ridges and flats in flood plains.
- 707 Silver maple/American elm: Silver maple and American elm are the majority species in this type. Associates – chalk maple, sweetgum, pin oak, swamp white oak, eastern cottonwood, sycamore, green ash, and other moist-site hardwoods, according to the region. Sites -- primarily on well-drained moist sites along river bottoms and floodplains, and beside lakes and larger streams.
- 708 Red maple/lowland: Red maple comprises a majority of the stocking. Because this type grows on a wide variety of sites over an extensive range, associates are diverse. Associates include yellow-poplar, blackgum, sweetgum, and loblolly pine. Site -- generally restricted to very moist to wet sites with poorly drained soils, and on swamp borders.
- 709 Cottonwood/willow (includes peachleaf, black and Bebb willow): Associates – white ash, green ash, sycamore, American elm, red maple and boxelder. Sites -- stream banks where bare, moist soil is available.

- 722 Oregon ash: Associates - red alder, bigleaf maple, black cottonwood, willow. Sites -- riparian areas, prefers damp, loose soils, below 3000 feet.

#### MAPLE/BEECH/BIRCH GROUP

- 801 Sugar maple/beech/yellow birch: Associates – butternut, basswood, red maple, hemlock, northern red oak, white ash, white pine, black cherry, sweet birch, American elm, rock elm, and eastern hophornbeam. Sites - fertile, moist, well-drained sites.
- 802 Black cherry: Associates – sugar maple, northern red oak, red maple, white ash, basswood, sweet birch, butternut, American elm, and hemlock. Sites - fertile, moist, well-drained sites.
- 805 Hard maple/basswood (includes American, Carolina, and white basswood): Associates – black maple, white ash, northern red oak, eastern hophornbeam, American elm, red maple, eastern white pine, eastern hemlock. Sugar maple and basswood occur in different proportions but together comprise the majority of the stocking. Sites - fertile, moist, well-drained sites.
- 809 Red maple/upland: Associates – the type is dominated by red maple and some of the wide variety of northern hardwood associates include sugar maple, beech, birch, aspen, as well as some northern softwoods like white pine, red pine, and hemlock; this type is often the result of repeated disturbance or cutting. Sites -- uplands. (See Type 519 under oak/hickory group)

#### ASPEN/BIRCH GROUP

- 901 Aspen: Associates – Engelmann spruce, lodgepole pine, ponderosa pine, Douglas-fir, subalpine fir, white fir, white spruce, balsam poplar, and paper birch. Sites -- aspen has the capacity to grow on a variety of sites and soils, ranging from shallow stony soils and loamy sands to heavy clays.
- 902 Paper birch (includes northern paper birch): Associates – aspen, white spruce, black spruce, and lodgepole pine. Sites -- can be found on a range of soils, but best developed on well-drained sandy loam and silt loam soils.
- 903 Gray birch: Associates – oaks, red maple, white pine, and others. Sites -- poor soils of abandoned farms and burns.
- 904 Balsam poplar: Associates – paper birch, white spruce, black spruce, and tamarack. Sites --occurs on rich floodplains where erosion and folding are active.
- 905 Pin cherry: Associates – quaking and bigtooth aspen; paper and yellow birch; striped, red and sugar maple; beech; northern red oak; balsam fir; and red spruce. In the Appalachians, Fraser fir and mountain-ash are additional associates. In the central and Lake states, chokecherry and black cherry are common. Sites -- Occurs over a wide range of soils and drainage classes, found on sites varying from dry rocky ledges and sandy plains to moist loamy soils.

#### ALDER/MAPLE GROUP

- 911 Red alder: Associates - Douglas-fir, western hemlock, western redcedar, grand fir, Sitka spruce, black cottonwood, bigleaf maple, willow. Sites -- stream bottoms and lower slopes, west of the Cascades, usually within 125 miles of the coast, below 2,400 feet.
- 912 Bigleaf maple: Associates - Douglas-fir, western hemlock, western redcedar, black cottonwood, Pacific madrone, Pacific dogwood, red alder. Sites -- Flat interior valleys, gently sloping stream bottoms, and moderate to steep slopes; favors moist, well-drained soils of river terraces and flood plains, but also grows on drier rocky, south-facing slopes in the Coast Ranges of northwestern Oregon.

#### WESTERN OAK GROUP

- 921 Gray pine: Associates - Blue oak, California black oak, interior live oak, coast live oak, valley oak, California scrub oak, buckeye, western juniper, Coulter pine. Sites -- dry foothill woodland communities of California's Central Valley, on rocky slopes and steep canyon walls below 3,000 feet. Prefers areas with hot, dry summers and absence of summer fog. Tolerates infertile, low moisture soils.
- 922 California black oak: Associates – ponderosa pine, Douglas-fir, incense-cedar, knobcone pine, Pacific madrone, tanoak, and Oregon white oak.
- 923 Oregon white oak: Associates – Douglas-fir, bigleaf maple, and Oregon ash. Sites -- commonly occurs in very moist locations, in mixture with Oregon ash on floodplains of the Willamette Valley, and on poorly drained heavy clay soils.
- 924 Blue oak: Associates – Gray pine, interior live oak, canyon live oak, valley oak, and California buckeye. Sites -- low valleys and foothills of the Coast Ranges and Sierras in California.
- 931 Coast live oak: Associates – knobcone pine, Monterey pine, interior live oak, valley oak, blue oak, tanoak, Pacific madrone, and California laurel. Sites -- usually occupies well-drained soils.
- 933 Canyon live oak: Associates – Douglas-fir, bigcone Douglas-fir, ponderosa pine, Jeffrey pine, bigleaf maple, Pacific madrone, and California laurel. Sites -- found on steep rocky canyon slopes and boulder-filled bottoms.
- 934 Interior live oak: Associates - Blue oak, coast live oak, valley oak, canyon live oak, gray pine, ponderosa pine, Douglas-fir. Sites -- from valleys to foothills, below 5,000 feet; grows on moister sites than blue oak.
- 935 California white oak (valley oak): Associates - Canyon live oak, coast live oak, California black oak, blue oak, California buckeye, gray pine, ponderosa pine. Sites -- hot interior valleys and slopes below 2,000 feet; tolerates cool wet winters and hot dry summers; prefers fertile soils of valley floors.

#### TANOAK/LAUREL GROUP

- 941 Tanoak: Associates – Douglas-fir, Pacific madrone, and canyon live oak. Sites -- sea level to 5,000 feet elevation from southern Oregon south along the Coast Ranges to the Santa Ynez Mountains in California.
- 942 California laurel: Associates - usually found in mixed stands with a wide variety of associated species. Sites -- from the cool, humid conditions of dense coastal forests to hot, dry sites found inland in open woodlands and chaparral, below 4,000 feet.
- 943 Giant chinkapin: Associates - rarely grows in pure stands, usually a component of other types. Found with Douglas-fir, western hemlock, incense-cedar, white fir, western white pine, sugar pine, ponderosa pine, Pacific madrone, tanoak, and California black oak. Sites -- from valley bottoms to ridgetops, in the coast and cascade ranges, below 5,000 feet. Tolerates infertile and droughty sites.

#### OTHER HARDWOODS GROUP

- 961 Pacific madrone: Associates - a wide variety of species, but most common with Douglas-fir and tanoak. Sites -- grows on all aspects but is found most often on those facing south and west, and tolerates low soil moisture in summer
- 962 Other hardwoods: A "catch-all" group for any of the following, especially where on a mapped subplot, only one or two trees of a single "odd-ball" species is tallied. Includes all hardwood species identified to the genus level only except hackberry spp., hawthorn spp., eucalyptus spp., persimmon spp., magnolia spp., mulberry spp., mesquite spp., citrus spp., royal palm spp., willow spp., and saltcedar spp., AND striped maple, mountain maple, California buckeye, Arizona alder, serviceberry, Arizona madrone, pawpaw, sweet birch, Virginia roundleaf birch, Alleghany chinkapin, Ozark chinkapin, southern catalpa, northern catalpa, yellowwood, Pacific dogwood, pumpkin ash, blue ash, velvet ash, Carolina ash, Texas ash, all silverbells, California black walnut, southern California black walnut, Texas walnut, Arizona walnut, all apple species, eastern hophornbeam, California sycamore, Arizona sycamore, chokecherry, peach, Canada plum, wild plum, bitter cherry, Allegheny plum, Chickasaw plum, sweet cherry, sour cherry, European plum, Mahaleb plum, western soapberry, American mountain-ash, northern mountain-ash, Joshua tree, smoketree, great leucaena, and berlandier ash.

#### WOODLAND HARDWOODS GROUP

- 971 Deciduous oak woodland: areas with predominantly Gambel oak, which is often associated with ponderosa pine, white fir, Douglas-fir, alligator juniper, bigtooth maple, and chokecherry. Sites -- most soils, on elevations generally ranging from 4,000 to 8,000 feet.
- 972 Evergreen oak woodland: areas with predominantly evergreen oaks, such as Arizona white oak, Emory oak, Engelmann oak,

- Mexican blue oak, silverleaf oak, gray oak and/or netleaf oak.  
Other associates – various pinyons and junipers. Sites -- alluvial soils, from 4,000 to 7,500 feet elevation.
- 973 Mesquite woodland: Honey mesquite and screwbean mesquite comprise the majority of the stocking of this cover type. Honey mesquite associates, which are many, vary with climate and soils. Sites -- occurs on a wide variety of soils at elevations mostly below 5,000 feet.
- 974 Cercocarpus (Mountain brush) woodland (includes curlleaf mountain-mahogany): Associates - Rocky Mountain juniper, big sagebrush, and snowberry. Sites -- dry, coarse-textured soils.
- 975 Intermountain maple woodland (includes Rocky Mountain and/or bigtooth maple): Associates - chokecherry, boxelder, birchleaf mountain-mahogany, and Gambel oak. Sites -- most soils but **does not tolerate long flooding periods. Found growing between 4,500 and 7,500 feet elevation.**
- 976 Miscellaneous woodland hardwoods [includes acacia, New Mexico locust, and/or Arizona ironwood (tesota)]. Sites – occurs on a wide variety of soils at elevations mostly below 5,000 feet.

#### TROPICAL AND SUBTROPICAL HARDWOODS GROUPS

- 982 Mangrove swamps: Forests in which mangrove comprises a majority of the stocking. Associates - cabbage palm on some of the higher sites in the area. Sites - predominantly salt marshes; mangrove frequently develops its own island or shoreline made up of a dense mat of root structures. SRS distribution - restricted to South Florida and the Keys.
- 983 Palms: Includes paurotia-palm, silver palm, coconut palm, royal palm spp., cabbage palmetto, Mexican palmetto, key thatch palm, Florida thatch palm, and other palms. Associates – Sand live oak, slash pine, live oak, laurel oak, water oak, baldcypress, southern magnolia, red maple, redbay, swamp tupelo, sweetgum, southern redcedar, and loblolly pine. In extreme southern Florida, tropical hardwoods replace temperate hardwoods as associates. Sites -- can tolerate a broad range of soil pH, salinity, and drainage.
- 984 Dry forest (FGDC – Lowland to Submontane Drought Deciduous, Semi-deciduous and Semi-evergreen Forest; Holdridge life zone - Subtropical Dry Forest): *Bursera simaruba* (L.) Sarg., *Bucida buceras* L., *Cephalocereus royenii* (L.) Britton, and *Guaiacum officinale* L. are species commonly associated with Puerto Rican dry forest. The more heavily-disturbed dry forest areas have numerous, smaller stemmed *Leucaena leucocephala* (Lam.) deWit, *Prosopis juliflora* (Sw.) DC., *Acacia macracantha* Humb. & Bonpl. and *Acacia farnesiana* (L.) Willd. individuals. Some of the native tree species that are common in subtropical dry forest in the U.S. Virgin Islands are *Bursera simaruba* (L.) Sarg., *Amyris elemifera* L., *Capparis cynophallophora* L., *Cordia rickseckeri* Millsp., *Pisonia subcordata* Sw., *Guaiacum officinale* L., *Plumeria alba* L., and *Pictetia aculeata* (Vahl) Urban. The more heavily-

- disturbed dry forest areas have numerous, smaller stemmed *Leucaena leucocephala* (Lam.) deWit, *Prosopis juliflora* (Sw.) DC., *Acacia macracantha* Humb. & Bonpl., and *Acacia farnesiana* (L.) Willd. Individuals.
- 985 Moist forest (FGDC – Lowland and Submontane Seasonal Evergreen; Holdridge life zone – Subtropical Moist Forest): In the Caribbean, subtropical moist forests are found in areas with 1000 to 2200 mm of annual precipitation. The subtropical moist life zone is the most extensive on Puerto Rico and covers a wide variety of soil parent materials, topographic classes and land uses resulting in highly diverse mixes that typically include *Tabebuia heterophylla* (DC.) Britton, *Spathodea campanulata* Beauv., *Guarea guidonia* (L.) Sleumer, *Andira inermis* (W. Wright) Kunth ex DC., *Roystonea borinquena* O. F. Cook, *Mangifera indica* L., *Cecropia peltata* L., *Schefflera morototonii* (Aubl.) Maguire, Steyermark and species of the *Nectandra*, *Ocotea*, and *Coccoloba* genera. Some of the many natural indicator species of subtropical moist forest in the U.S. Virgin Islands include the *Andira inermis* (W. Wright) Kunth ex DC., *Guapira fragrans* (Dum.-Cours.) Little, *Spondias mombin* L., *Bucida buceras* L., *Hura crepitans* L., *Ceiba pentandra* (L.) Gaertn., *Cedrela odorata* L., *Pimenta racemosa* var. *racemosa*, *Roystonea borinquena* O.F. Cook (on St. Croix only), *Hymanaea courbaril* L., *Cecropia schreberiana* Miq., and *Tabebuia heterophylla* (DC.) Britt. While subtropical moist forests have some of the same introduced species found in subtropical dry forest, *Tamarindus indica* L. and *Melicoccus bijugatus* Jacq. are also common.
- 986 Wet and rain forest (FGDC – Submontane Evergreen Forest; Holdridge life zone – Subtropical Wet and Rain Forest): In the Caribbean, subtropical wet and rain forests are found in areas with 2000 to 4000 mm of annual precipitation. *Dacryodes excelsa* Vahl., *Sloanea berteriana* Choisy, *Manilkara bidentata* (A.DC.) are species indicative of the tabonuco FOREST TYPE. *Cecropia peltata* L., *Schefflera morototonii* (Aubl.) Maguire and *Ochroma lagopus* Sw. are also common in wet forest stands at early stages of succession or recovery from disturbance. Wet forest shade coffee plantations hold species such as *Guarea guidonia* (L.) Sleumer, *Inga laurina* (Sw.) Willd., *Inga vera* Willd., and *Erythrina poeppigiana* (Walp.) O.F. Cook.
- 987 Lower montane rainforest (FGDC – Montane Evergreen Forest; Holdridge life zone – Lower Montane Wet and Rain Forest): In the Caribbean, lower montane wet and rain forests are found in areas with elevations between 700-1000 meters. FOREST TYPES and their typical species include the palo colorado FOREST TYPE (*Cyrilla racemiflora* L., *Ocotea spathulata* Mez., *Micropholis guyanensis* (A. DC.) Pierre and *Micropholis garciniifolia* Pierre), elfin FOREST TYPE (*Eugenia borinquensis* Britton, *Tabebuia rigida* Urban, *Weinmannia pinnata* L. and *Calycogonium squamulosum* Cogn.) and the palm brake FOREST TYPE

- (*Prestoea montana* (Graham) Nichols.).
- 989 Other tropical and subtropical hardwoods: This type consists of dense forests of hardwood trees and palms. Includes gumbo-limbo, tamarind, poisonwood, pigeon-plum, torchwood, willow bastic, false mastic, pond apple, sheoak, gray sheoak, river sheoak, camphor tree, fiddlewood, citrus spp., soldierwood, Geiger tree, carrotwood, red stopper, inkwood, strangler fig, shortleaf fig, blolly, manchineel, paradise tree, Java plum, false tamarind, mango, fishpoison tree, and octopus tree. Associates –black ironwood (leadwood), lancewood, and mastic as well as more temperate live oak and red bay. Sites -- Occurs on land slightly higher than surrounding fresh and saltwater marshes or on pine land.

#### EXOTIC HARDWOODS GROUP

- 991 Paulownia: Stands with the majority of stocking comprised of *Paulownia tomentosa*, commonly known as Princess tree, royal paulownia or empress tree. Sites -- can be found along roadsides, streambanks, and forest edges. It tolerates infertile and acid soils and drought conditions. It easily adapts to disturbed habitats, including previously burned areas, forests defoliated by pests (such as the gypsy moth) and landslides and can colonize rocky cliffs and scoured riparian zones. Paulownia can also be found in plantations.
- 992 Melaleuca: Stands with the majority of stocking comprised of melaleuca (*Melaleuca quinquenervia*). Melaleuca trees, also known as punk trees or paperbark tea trees, are native to Australia. Sites -- In the gulf-coastal plain, it is found in swamps and glades, often eliminating all other forms of vegetation
- 993 Eucalyptus: Associates - As an introduced and naturalized species, it has few common associates. Usually planted as an ornamental, in plantations for firewood, or along roads and parks for cover. Sites -- good drainage, low salinity, mild temperate climates.
- 995 Other exotic hardwoods: Includes any of the following species: Norway maple, ailanthus, mimosa, European alder, Chinese chestnut, ginkgo, Lombardy poplar, European mountain-ash, West Indian mahogany, Siberian elm, saltcedar spp., chinaberry, Chinese tallowtree, tung-oil-tree, Russian-olive, and avocado.

For nonstocked stands, see sections 2.5.3 for procedures to determine FOREST TYPE.

### Appendix 3. FIA Tree Species Codes

This list includes all tree species tallied in the Continental U.S., Alaska, and the Caribbean. Species designated East/West/Caribbean are commonly found in those regions, although species designated for one region may occasionally be found in another. Woodland species designate species where DRC is measured instead of DBH. Species that have an "X" in the Core column are tallied in all regions. All other species on the list are "core optional".

(\* ) Associated with the species code denotes species tallied in the Rocky Mountain Region.

\* Note: The regional common names and Caribbean codes were left out due to space restrictions.

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E	W		0010	ABIES	Fir spp.	Abies	spp.
X		W		0011	ABAM	Pacific silver fir	Abies	amabilis
X	E	W		0012	ABBA	balsam fir	Abies	balsamea
X		W		0014	ABBR	Santa Lucia fir, bristlecone fir	Abies	bracteata
X		W		0015*	ABCO	white fir	Abies	concolor
X	E			0016	ABFR	Fraser fir	Abies	fraseri
X		W		0017*	ABGR	grand fir	Abies	grandis
X		W		0018*	ABLAA	corkbark fir	Abies	lasiocarpa var. arizonica
X		W		0019*	ABLA	subalpine fir	Abies	lasiocarpa
X		W		0020*	ABMA	California red fir	Abies	magnifica
X		W		0021*	ABSH	Shasta red fir	Abies	shastensis
X		W		0022*	ABPR	noble fir	Abies	procera
	E	W		0040	CHAMA4	cedar spp.	Chamaecyparis	spp.
X		W		0041	CHLA	Port-Orford- cedar	Chamaecyparis	lawsoniana
X		W		0042	CHNO	Alaska yellow- cedar	Chamaecyparis	nootkatensis
X	E			0043	CHTH2	Atlantic white- cedar	Chamaecyparis	thyoides
		W		0050	CUPRE	cypress	Cupressus	spp.
X		W		0051*	CUAR	Arizona cypress	Cupressus	arizonica
X		W		0052	CUBA	Baker cypress, Modoc cypress	Cupressus	bakeri
X		W		0053	CUFO2	tecate cypress	Cupressus	forbesii
X		W		0054	CUMA2	Monterey cypress	Cupressus	macrocarpa

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
		W		0055	CUSA3	Sargent's cypress	Cupressus	sargentii
X		W		0056	CUMA	MacNab's cypress	Cupressus	macnabiana
	E	W		0057	JUNIP	redcedar, juniper spp.	Juniperus	spp.
X		W	w	0058*	JUPI	Pinchot juniper	Juniperus	pinchotii
X		W	w	0059*	JUCO11	redberry juniper	Juniperus	coahuilensis
	E		w	0060	JUFL	drooping juniper	Juniperus	flaccida
X	E			0061	JUAS	Ashe juniper	Juniperus	ashei
X		W	w	0062*	JUCA7	California juniper	Juniperus	californica
X		W	w	0063*	JUDE2	alligator juniper	Juniperus	depeana
X		W		0064*	JUOC	western juniper	Juniperus	occidentalis
X		W	w	0065*	JUOS	Utah juniper	Juniperus	osteosperma
X	E	W	w	0066*	JUSC2	Rocky Mountain juniper	Juniperus	scopulorum
	E			0067	JUVIS	southern redcedar	Juniperus	virginiana var. silicicola
X	E			0068*	JUVI	eastern redcedar	Juniperus	virginiana
X		W	w	0069*	JUMO	oneseed juniper	Juniperus	monosperma
	E	W		0070	LARIX	larch spp.	Larix	spp.
X	E	W		0071	LALA	tamarack (native)	Larix	laricina
X		W		0072*	LALY	subalpine larch	Larix	lyallii
X		W		0073*	LAOC	western larch	Larix	occidentalis
X		W		0081*	CADE27	incense-cedar	Calocedrus	decurrens
	E	W		0090	PICEA	spruce spp.	Picea	spp.
X	E			0091	PIAB	Norway spruce	Picea	abies
X		W		0092	PIBR	Brewer spruce	Picea	breweriana
X		W		0093*	PIEN	Engelmann spruce	Picea	engelmannii
X	E	W		0094*	PIGL	white spruce	Picea	glauca
X	E	W		0095	PIMA	black spruce	Picea	mariana
X	E	W		0096*	PIPU	blue spruce	Picea	pungens
X	E			0097	PIRU	red spruce	Picea	rubens
X		W		0098	PISI	Sitka spruce	Picea	sitchensis
	E	W		0100	PINUS	pine spp.	Pinus	spp.

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X		W		0101*	PIAL	whitebark pine	Pinus	albicaulis
X		W		0102*	PIAR	Rocky Mountain bristlecone pine	Pinus	aristata
X		W		0103*	PIAT	knobcone pine	Pinus	attenuata
X		W		0104*	PIBA	foxtail pine	Pinus	balfouriana
X	E			0105	PIBA2	jack pine	Pinus	banksiana
X		W	w	0106*	PIED	Common pinyon, two- needle pinyon	Pinus	edulis
X	E			0107	PICL	sand pine	Pinus	clausa
X		W		0108*	PICO	lodgepole pine	Pinus	contorta
X		W		0109	PICO3	Coulter pine	Pinus	coulteri
X	E			0110	PIEC2	shortleaf pine	Pinus	echinata
X	E			0111	PIEL	slash pine	Pinus	elliottii
X		W		0112*	PIEN2	Apache pine	Pinus	engelmannii
X		W		0113*	PIFL2	limber pine	Pinus	flexilis
X		W		0114*	PIST3	southwestern white pine	Pinus	strobiformis
X	E			0115	PIGL2	spruce pine	Pinus	glabra
X		W		0116*	PIJE	Jeffrey pine	Pinus	jeffreyi
X		W		0117*	PILA	sugar pine	Pinus	lambertiana
X		W		0118*	PILE	Chihuahua pine	Pinus	leiophylla
X		W		0119*	PIMO3	western white pine	Pinus	monticola
X		W		0120	PIMU	bishop pine	Pinus	muricata
X	E			0121	PIPA2	longleaf pine	Pinus	palustris
X	E	W		0122*	PIPO	ponderosa pine	Pinus	ponderosa
X	E			0123	PIPU5	Table Mountain pine	Pinus	pungens
X		W		0124	PIRA2	Monterey pine	Pinus	radiata
X	E			0125	PIRE	red pine	Pinus	resinosa
X	E			0126	PIRI	pitch pine	Pinus	rigida
X		W		0127	PISA2	gray pine, California foothill pine	Pinus	sabiniana
X	E			0128	PISE	pond pine	Pinus	serotina
X	E			0129	PIST	eastern white pine	Pinus	strobus

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E	W		0130*	PISY	Scotch pine	Pinus	sylvestris
X	E			0131	PITA	loblolly pine	Pinus	taeda
X	E			0132	PIV2	Virginia pine	Pinus	virginiana
X		W	w	0133*	PIMO	singleleaf pinyon	Pinus	monophylla
X		W	w	0134*	PIDI3	border pinyon	Pinus	discolor
X		W		0135*	PIAR5	Arizona pine	Pinus	arizonica
X	E			0136*	PINI	Austrian pine	Pinus	nigra
X		W		0137*	PIWA	Washoe pine	Pinus	washoensis
X		W	w	0138	PIQU	four-leaf pine, Parry pinyon pine	Pinus	quadrifolia
X		W		0139	PITO	Torrey pine	Pinus	torreyana
X		W	w	0140*	PICE	Mexican pinyon pine	Pinus	cembroides
	E		w	0141	PIRE5	papershell pinyon pine	Pinus	remota
X		W		0142*	PILO	Great Basin bristlecone pine	Pinus	longaeva
X		W	w	0143*	PIMOF	Arizona pinyon pine	Pinus	monophylla var. fallax
X	E			0144	PIELE2	Carribbean pine	Pinus	elliottii var. elliottii
		W		0200	PSEUD7	Douglas-fir spp.	Pseudotsuga	spp.
X		W		0201	PSMA	bigcone Douglas-fir	Pseudotsuga	macrocarpa
X		W		0202*	PSME	Douglas-fir	Pseudotsuga	menziesii
X		W		0211	SESE3	redwood	Sequoia	sempervirens
X		W		0212	SEGI2	giant sequoia	Sequoiadendron	giganteum
	E			0220	TAXOD	cypress spp.	Taxodium	spp.
X	E			0221	TADI2	baldcypress	Taxodium	distichum
X	E			0222	TAAS	pondcypress	Taxodium	ascendens
	E			0223	TAMU	Montezuma baldcypress	Taxodium	mucronatum
	E	W		0230	TAXUS	yew spp.	Taxus	spp.
		W		0231*	TABR2	Pacific yew	Taxus	brevifolia
X	E			0232	TAFL	Florida yew	Taxus	floridana
	E	W		0240	THUJA	Thuja spp.	Thuja	spp.
X	E			0241	THOC2	northern white- cedar	Thuja	occidentalis

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X		W		0242*	THPL	western redcedar	Thuja	plicata
	E	W		0250	TORRE	torreya (nutmeg) spp.	Torreya	spp.
X		W		0251	TOCA	California torreya (nutmeg)	Torreya	californica
X	E			0252	TOTA	Florida torreya (nutmeg)	Torreya	taxifolia
	E	W		0260	TSUGA	hemlock spp.	Tsuga	spp.
X	E			0261	TSCA	eastern hemlock	Tsuga	canadensis
X	E			0262	TSCA2	Carolina hemlock	Tsuga	caroliniana
X		W		0263*	TSHE	western hemlock	Tsuga	heterophylla
X		W		0264*	TSME	mountain hemlock	Tsuga	mertensiana
X	E	W		0299	2TE	unknown dead conifer	Tree	evergreen
	E	W	w	0300	ACAC1	acacia spp.	Acacia	spp.
	E	W	w	0303	ACFA	sweet acacia	Acacia	farnesiana
	E	W	w	0304	ACGR	catclaw acacia	Acacia	greggii
	E	W		0310	ACER	maple spp.	Acer	spp.
X	E			0311	ACBA3	Florida maple	Acer	barbatum
X		W		0312	ACMA3	bigleaf maple	Acer	macrophyllum
X	E	W		0313*	ACNE2	boxelder	Acer	negundo
X	E			0314	ACNI5	black maple	Acer	nigrum
X	E			0315	ACPE	striped maple	Acer	pensylvanicum
X	E			0316	ACRU	red maple	Acer	rubrum
X	E			0317	ACSA2	silver maple	Acer	saccharinum
X	E			0318	ACSA3	sugar maple	Acer	saccharum
	E			0319	ACSP2	mountain maple	Acer	spicatum
	E			0320	ACPL	Norway maple	Acer	platanooides
		W	w	0321	ACGL	Rocky Mountain maple	Acer	glabrum
		W	w	0322*	ACGR3	bigtooth maple	Acer	grandidentatum
X	E			0323	ACLE	chalk maple	Acer	leucoderme
	E	W		0330	AESCU	buckeye, horsechestnut spp.	Aesculus	spp.
X	E			0331	AEGL	Ohio buckeye	Aesculus	glabra

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0332	AEFL	yellow buckeye	Aesculus	flava
		W		0333	AECA	California buckeye	Aesculus	californica
	E			0334	AEGLA	Texas buckeye	Aesculus	glabra var. arguta
	E			0336	AEPA	red buckeye	Aesculus	pavia
X	E			0337	AESY	painted buckeye	Aesculus	sylvatica
X	E	W	w	0341	AIAL	ailanthus	Ailanthus	altissima
X	E	W		0345	ALJU	mimosa/silktree	Albizia	julibrissin
		W		0350	ALNUS	alder spp.	Alnus	spp.
X		W		0351*	ALRU2	red alder	Alnus	rubra
X		W		0352*	ALRH2	white alder	Alnus	rhombifolia
X		W		0353*	ALOB2	Arizona alder	Alnus	oblongifolia
X	E			0355	ALGL2	European alder	Alnus	glutinosa
	E	W		0356	AMELA	serviceberry spp.	Amelanchier	spp.
	E	W		0357	AMAR3	common serviceberry	Amelanchier	arborea
	E	W		0358	AMSA	roundleaf serviceberry	Amelanchier	sanguinea
		W		0360	ARBUT	Madrone spp.	Arbutus	spp.
X		W		0361*	ARME	Pacific madrone	Arbutus	menziesii
X		W		0362*	ARAR2	Arizona madrone	Arbutus	arizonica
	E	W	w	0363	ARXA80	Texas madrone	Arbutus	xalapensis
X	E			0367	ASTR	Pawpaw	Asimina	triloba
	E	W		0370	BETUL	birch spp.	Betula	spp.
X	E			0371	BEAL2	yellow birch	Betula	alleganiensis
X	E			0372	BELE	sweet birch	Betula	lenta
X	E			0373	BENI	river birch	Betula	nigra
X	E	W		0374*	BEOC2	water birch	Betula	occidentalis
X	E	W		0375*	BEPA	paper birch	Betula	papyrifera
X	E			0377	BEUB	Virginia roundleaf birch	Betula	uber
X		W		0378	BEUT	northwestern paper birch	Betula	X utahensis
X	E			0379	BEPO	gray birch	Betula	populifolia
	E			0381	SILAL3	Chittamwood, gum bumelia	Sideroxylon	lanuginosum ssp. lanuginosum

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0391	CACA18	American hornbeam, musclewood	Carpinus	caroliniana
	E			0400	CARYA	hickory spp.	Carya	spp.
X	E			0401	CAAQ2	water hickory	Carya	aquatica
X	E			0402	CACO15	bitternut hickory	Carya	cordiformis
X	E			0403	CAGL8	pignut hickory	Carya	glabra
X	E			0404*	CAIL2	pecan	Carya	illinoensis
X	E			0405	CALA21	shellbark hickory	Carya	laciniosa
X	E			0406	CAMY	nutmeg hickory	Carya	myristiciformis
X	E			0407	CAOV2	shagbark hickory	Carya	ovata
X	E			0408	CATE9	black hickory	Carya	texana
X	E			0409	CAAL27	mockernut hickory	Carya	alba
X	E			0410	CAPA24	sand hickory	Carya	pallida
X	E			0411	CAFL6	scrub hickory	Carya	floridana
X	E			0412	CAOV3	red hickory	Carya	ovalis
X	E			0413	CACA38	southern shagbark hickory	Carya	carolinae-septentrionalis
	E	W		0420	CASTA	chestnut spp.	Castanea	spp.
	E			0421	CADE12	American chestnut	Castanea	dentata
X	E			0422	CAPU9	Allegheny chinkapin	Castanea	pumila
	E			0423	CAPUO	Ozark chinkapin	Castanea	pumila var. ozarkensis
X	E	W		0424	CAMO83	Chinese chestnut	Castanea	mollissima
		W		0431	CHCHC4	giant chinkapin, golden chinkapin	Chrysolepis	chrysophylla var. chrysophylla
	E			0450	CATAL	catalpa spp.	Catalpa	spp.
X	E			0451	CABI8	southern catalpa	Catalpa	bignonioides
X	E			0452	CASP8	northern catalpa	Catalpa	speciosa
	E	W		0460	CELT1	hackberry spp.	Celtis	spp.
X	E	W		0461*	CELA	sugarberry	Celtis	laevigata
X	E	W		0462*	CEOC	hackberry	Celtis	occidentalis
	E	W		0463	CELAR	netleaf hackberry	Celtis	laevigata var. reticulata

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0471	CECA4	eastern redbud	Cercis	canadensis
		W	w	0475*	CELE3	curleaf mountain-mahogany	Cercocarpus	ledifolius
X	E			0481	CLKE	yellowwood	Cladrastis	kentukea
	E	W		0490	CORNU	dogwood spp.	Cornus	spp.
X	E			0491	COFL2	flowering dogwood	Cornus	florida
X		W		0492*	CONU4	Pacific dogwood	Cornus	nuttallii
	E			0500	CRATA	hawthorn spp.	Crataegus	spp.
	E			0501	CRCR2	cockspur hawthorn	Crataegus	crus-galli
	E			0502	CRMO2	downy hawthorn	Crataegus	mollis
	E			0503	CRBR3	Brainerd hawthorn	Crataegus	brainerdii
	E			0504	CRCA	pear hawthorn	Crataegus	calpodendron
	E			0505	CRCH	fireberry hawthorn	Crataegus	chrysoarpa
	E			0506	CRDI	broadleaf hawthorn	Crataegus	dilatata
	E			0507	CRFL	fanleaf hawthorn	Crataegus	flabellata
	E			0508	CRMO3	oneseed hawthorn	Crataegus	monogyna
	E			0509	CRPE	scarlet hawthorn	Crataegus	pedicellata
	E			5091	CRPH	Washington hawthorn	Crataegus	phaenopyrum
	E			5092	CRSU5	fleshy hawthorn	Crataegus	succulenta
	E			5093	CRUN	dwarf hawthorn	Crataegus	uniflora
	E	W		0510	EUCAL	eucalyptus spp.	Eucalyptus	spp.
X		W		0511	EUGL	Tasmanian bluegum	Eucalyptus	globulus
X	E			0512	EUCA2	river redgum	Eucalyptus	camaldulensis
X	E			0513	EUGR12	grand eucalyptus	Eucalyptus	grandis
X	E			0514	EURO2	swamp mahogany	Eucalyptus	robusta
	E			0520	DIOSP	persimmon spp.	Diospyros	spp.
X	E			0521	DIVI5	common persimmon	Diospyros	virginiana
X	E			0522	DITE3	Texas persimmon	Diospyros	texana
	E		w	0523	EHAN	Anacua	Ehretia	anacua

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0531	FAGR	American beech	Fagus	grandifolia
	E	W		0540	FRAXI	ash spp.	Fraxinus	spp.
X	E			0541	FRAM2	white ash	Fraxinus	americana
X		W		0542	FRLA	Oregon ash	Fraxinus	latifolia
X	E			0543	FRNI	black ash	Fraxinus	nigra
X	E			0544*	FRPE	green ash	Fraxinus	pennsylvanica
X	E			0545	FRPR	pumpkin ash	Fraxinus	profunda
X	E			0546	FRQU	blue ash	Fraxinus	quadrangulata
X		W		0547*	FRVE2	velvet ash	Fraxinus	velutina
X	E			0548	FRCA3	Carolina ash	Fraxinus	caroliniana
X	E			0549	FRTE	Texas ash	Fraxinus	texensis
	E			5491	FRBE	Berlandier ash	Fraxinus	berlandieriana
	E			0550	GLEDI	locust spp.	Gleditsia	spp.
X	E			0551	GLAQ	waterlocust	Gleditsia	aquatica
X	E			0552*	GLTR	honeylocust	Gleditsia	tricanthos
X	E			0555	GOLA	loblolly bay	Gordonia	lasianthus
X	E	W		0561	GIBI2	Ginkgo, maidenhair tree	Ginkgo	biloba
X	E			0571	GYDI	Kentucky coffeetree	Gymnocladus	dioicus
	E			0580	HALES	silverbell spp.	Halesia	spp.
X	E			0581	HACA3	Carolina silverbell	Halesia	carolina
X	E			0582	HADI3	two-wing silverbell	Halesia	diptera
X	E			0583	HAPA2	little silverbell	Halesia	parviflora
X	E			0591	ILOP	American holly	Ilex	opaca
	E	W		0600	JUGLA	walnut spp.	Juglans	spp.
X	E			0601	JUCI	butternut	Juglans	cinerea
X	E	W		0602*	JUNI	black walnut	Juglans	nigra
		W		0603	JUHI	Northern California black walnut	Juglans	hindsii
X		W		0604	JUCA	Southern California black walnut	Juglans	californica
	E	W		0605	JUMI	Texas walnut	Juglans	microcarpa
X		W		0606*	JUMA	Arizona walnut	Juglans	major

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0611	LIST2	sweetgum	Liquidambar	styraciflua
X	E			0621	LITU	yellow-poplar	Liriodendron	tulipifera
X		W		0631	LIDE3	tanoak	Lithocarpus	densiflorus
X	E			0641	MAPO	Osage-orange	Maclura	pomifera
	E			0650	MAGNO	magnolia spp.	Magnolia	spp.
X	E			0651	MAAC	cucumbertree	Magnolia	acuminata
X	E			0652	MAGR4	southern magnolia	Magnolia	grandiflora
X	E			0653	MAV12	sweetbay	Magnolia	virginiana
X	E			0654	MAMA2	bigleaf magnolia	Magnolia	macrophylla
X	E			0655	MAFR	mountain magnolia, Fraser magnolia	Magnolia	fraseri
X	E			0657	MAPY	pyramid magnolia	Magnolia	pyramidata
X	E			0658	MATR	umbrella magnolia	Magnolia	tripetala
	E	W		0660	MALUS	apple spp.	Malus	spp.
X		W		0661	MAFU	Oregon crabapple	Malus	fusca
X	E			0662	MAAN3	southern crabapple	Malus	angustifolia
X	E			0663	MACO5	sweet crabapple	Malus	coronaria
X	E			0664	MAIO	prairie crabapple	Malus	ioensis
	E			0680	MORUS	mulberry spp.	Morus	spp.
X	E			0681	MOAL	white mulberry	Morus	alba
X	E			0682	MORU2	red mulberry	Morus	rubra
	E	W		0683	MOMI	Texas mulberry	Morus	microphylla
X	E			0684	MONI	black mulberry	Morus	nigra
	E			0690	NYSSA	tupelo spp.	Nyssa	spp.
X	E			0691	NYAQ2	water tupelo	Nyssa	aquatica
X	E			0692	NYOG	Ogeechee tupelo	Nyssa	ogeche
X	E			0693	NYSY	blackgum	Nyssa	sylvatica
X	E			0694	NYBI	swamp tupelo	Nyssa	biflora
X	E			0701	OSVI	eastern hophornbeam	Ostrya	virginiana
X	E			0711	OXAR	sourwood	Oxydendrum	arboresum

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Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0712	PATO2	paulownia, empress-tree	Paulownia	tomentosa
	E	W		0720	PERSE	bay spp.	Persea	spp.
X	E			0721	PEBO	redbay	Persea	borbonia
X		W		7211	PEAM3	avocado	Persea	americana
X	E			0722	PLAQ	water-elm, planertree	Planera	aquatica
	E	W		0729	PLATA	sycamore spp.	Platanus	spp.
X		W		0730	PLRA	California sycamore	Platanus	racemosa
X	E			0731	PLOC	American sycamore	Platanus	occidentalis
X		W		0732*	PLWR2	Arizona sycamore	Platanus	wrightii
	E	W		0740	POPUL	cottonwood and poplar spp.	Populus	spp.
X	E	W		0741*	POBA2	balsam poplar	Populus	balsamifera
X	E			0742*	PODE3	eastern cottonwood	Populus	deltoides
X	E			0743	POGR4	bigtooth aspen	Populus	grandidentata
X	E			0744	POHE4	swamp cottonwood	Populus	heterophylla
X	E	W		0745*	PODEM	plains cottonwood	Populus	deltoides ssp. monilifera
X	E	W		0746*	POTR5	quaking aspen	Populus	tremuloides
X		W		0747*	POBAT	black cottonwood	Populus	balsamifera ssp. trichocarpa
X		W		0748*	POFR2	Fremont's cottonwood	Populus	fremontii
X		W		0749*	POAN3	narrowleaf cottonwood	Populus	angustifolia
X	E			0752	POAL7	silver poplar	Populus	alba
X	E			0753	PONI	Lombardy poplar	Populus	nigra
	E	W	w	0755	PROSO	mesquite spp.	Prosopis	spp.
X	E	W	w	0756*	PRGL2	honey mesquite	Prosopis	glandulosa
X	E	W	w	0757*	PRVE	velvet mesquite	Prosopis	velutina
X	E	W	w	0758*	PRPU	screwbean mesquite	Prosopis	pubescens
	E	W		0760	PRUNU	cherry and plum spp.	Prunus	spp.
	E	W		0761	PRPE2	pin cherry	Prunus	pensylvanica

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0762	PRSE2	black cherry	Prunus	serotina
	E	W		0763	PRVI	common chokecherry	Prunus	virginiana
	E			0764	PRPE3	peach	Prunus	persica
X	E			0765	PRNI	Canada plum	Prunus	nigra
X	E			0766	PRAM	American plum	Prunus	americana
		W		0768	PREM	bitter cherry	Prunus	emarginata
	E			0769	PRAL5	Allegheny plum	Prunus	alleghaniensis
	E	W		0770	PRAN3	Chickasaw plum	Prunus	angustifolia
X	E			0771	PRAV	sweet cherry (domesticated)	Prunus	avium
	E			0772	PRCE	sour cherry (domesticated)	Prunus	cerasus
	E			0773	PRDO	European plum (domesticated)	Prunus	domestica
	E			0774	PRMA	Mahaleb plum (domesticated)	Prunus	mahaleb
	E	W		0800	QUERC	oak spp	Quercus	spp.
X		W		0801	QUAG	California live oak	Quercus	agrifolia
X	E			0802	QUAL	white oak	Quercus	alba
X		W	w	0803*	QUAR	Arizona white oak	Quercus	arizonica
X	E			0804	QUBI	swamp white oak	Quercus	bicolor
		W		0805	QUCH2	canyon live oak	Quercus	chrysolepis
X	E			0806	QUCO2	scarlet oak	Quercus	coccinea
X		W		0807	QUDO	blue oak	Quercus	douglasii
X	E			0808	QUSIS	Durand oak	Quercus	sinuata var. sinuata
X	E			0809	QUEL	northern pin oak	Quercus	ellipsoidalis
X		W	w	0810*	QUEM	Emory oak	Quercus	emoryi
X		W		0811	QUEN	Engelmann oak	Quercus	engelmannii
X	E			0812	QUFA	southern red oak	Quercus	falcata
X	E			0813	QUPA5	cherrybark oak	Quercus	pagoda
X		W	w	0814*	QUGA	Gambel oak	Quercus	gambelii
X		W		0815	QUGA4	Oregon white oak	Quercus	garryana

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0816	QUIL	scrub oak	Quercus	ilicifolia
X	E			0817	QUIM	shingle oak	Quercus	imbricaria
X		W		0818	QUKE	California black oak	Quercus	kelloggii
X	E			0819	QULA2	turkey oak	Quercus	laevis
X	E			0820	QULA3	laurel oak	Quercus	laurifolia
X		W		0821	QULO	California white oak	Quercus	lobata
X	E			0822	QULY	overcup oak	Quercus	lyrata
X	E			0823*	QUMA2	bur oak	Quercus	macrocarpa
X	E			0824	QUMA3	blackjack oak	Quercus	marilandica
X	E			0825	QUMI	swamp chestnut oak	Quercus	michauxii
X	E			0826*	QUMU	chinkapin oak	Quercus	muehlenbergii
X	E			0827	QUNI	water oak	Quercus	nigra
X	E			0828	QUTE	Texas red oak	Quercus	texana
X		W	w	0829*	QUOB	Mexican blue oak	Quercus	oblongifolia
X	E			0830	QUPA2	pin oak	Quercus	palustris
X	E			0831	QUPH	willow oak	Quercus	phellos
X	E			0832	QUPR2	chestnut oak	Quercus	prinus
X	E			0833	QURU	northern red oak	Quercus	rubra
X	E			0834	QUSH	Shumard's oak	Quercus	shumardii
X	E			0835	QUST	post oak	Quercus	stellata
	E			0836	QUSI2	Delta post oak	Quercus	similis
X	E			0837	QUVE	black oak	Quercus	velutina
X	E			0838	QUVI	live oak	Quercus	virginiana
X		W		0839	QUWI2	interior live oak	Quercus	wislizeni
X	E			0840	QUMA6	dwarf post oak	Quercus	margarettae
X	E			0841	QUMI2	dwarf live oak	Quercus	minima
X	E			0842	QUIN	bluejack oak	Quercus	incana
X		W	w	0843*	QUHY	silverleaf oak	Quercus	hypoleucoides
X	E			0844	QUOG	Oglethorpe oak	Quercus	oglethorpensis
	E			0845	QUPR	dwarf chinkapin oak	Quercus	prinoides
X		W	w	0846*	QUGR3	gray oak	Quercus	grisea

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X		W	w	0847*	QURU4	netleaf oak	Quercus	rugosa
	E			0851	QUGR	Chisos oak	Quercus	graciliformis
	E			8511	QUGR2	Graves oak	Quercus	gravesii
	E			8512	QUPO2	Mexican white oak	Quercus	polymorpha
	E			8513	QUBU2	Spanish oak	Quercus	buckleyi
	E			8514	QULA	lacey oak	Quercus	laceyi
	E			0852	AMEL	torchwood	Amyris	elemifera
	E			0853	ANGL4	pond apple	Annona	glabra
	E			0854	BUSI	gumbo limbo	Bursera	simaruba
	E			0855	CASUA	sheoak spp.	Casuarina	spp.
X	E			0856	CAGL11	gray sheoak	Casuarina	glauca
X	E			0857	CALE28	Australian pine	Casuarina	lepidophloia
	E			0858	CICA	camphor tree	Cinnamomum	camphora
	E			0859	CIFR	fiddlewood	Citharexylum	fruticosum
	E			0860	CITRU2	citrus spp.	Citrus	spp.
	E			0863	CODI8	pigeon plum, tietongue	Coccoloba	diversifolia
	E			0864	COEL2	soldierwood	Colubrina	elliptica
	E			0865	COSE2	geiger tree	Cordia	sebestena
	E			8651	COBO2	anacahuita	Cordia	boissieri
	E			0866	CUAN4	carrotwood	Cupaniopsis	anacardioides
	E		w	0867	COHO	bluewood	Condalia	hookeri
	E			0868	EBEB	blackbead ebony	Ebenopsis	ebano
	E			0869	LEPU3	great leucaena	Leucaena	pulverulenta
	E			0870	SOAF	Texas sophora	Sophora	affinis
	E			0873	EURH	red stopper	Eugenia	rhombea
	E			0874	EXPA	Inkwood, butterbough	Exothea	paniculata
	E			0876	FIAU	strangler fig	Ficus	aurea
	E			0877	FICI	shortleaf fig, wild banyantree	Ficus	citrifolia
	E			0882	GUDI	Blolly, beeftree	Guapira	discolor
	E			0883	HIMA2	manchineel	Hippomane	mancinella

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E			0884	LYLA3	false tamarind	Lysiloma	latisiliquum
	E			0885	MAIN3	mango	Mangifera	indica
	E			0886	METO3	poisonwood	Metopium	toxiferum
	E			0887	PIPI3	fishpoison tree	Piscidia	piscipula
	E			0888	SCAC2	schefflera, octopus tree	Schefflera	actinophylla
	E			0890	SIFO	false mastic	Sideroxylon	foetidissimum
	E			0891	SISA6	white bully, willow busic	Sideroxylon	salicifolium
	E			0895	SIGL3	paradise tree	Simarouba	glauca
	E			0896	SYCU	Java plum	Syzygium	cumini
	E			0897	TAIN2	tamarind	Tamarindus	indica
X	E	W		0901*	ROPS	black locust	Robinia	pseudoacacia
		W	w	0902	RONE	New Mexico locust	Robinia	neomexicana
	E			0906	ACWR4	paurotis palm	Acoelorrraphe	wrightii
	E			0907	COAR	silver palm	Coccothrinax	argentata
	E			0908	CONU	coconut palm	Cocos	nucifera
	E			0909	ROYST	royal palm spp.	Roystonea	spp.
	E			0911	SAME8	Mexican palmetto	Sabal	mexicana
X	E			0912	SAPA	cabbage palmetto	Sabal	palmetto
	E			0913	THMO4	key thatch palm	Thrinax	morrisii
	E			0914	THRA2	Florida thatch palm	Thrinax	radiata
	E			0915	ARECA	other palms	Family Arecaceae	not listed above
	E	W		0919	SASAD	western soapberry	Sapindus	saponaria var. drummondii
	E	W		0920	SALIX	willow spp.	Salix	spp.
	E	W		0921	SAAM2	peachleaf willow	Salix	amygdaloides
	E	W		0922	SANI	black willow	Salix	nigra
	E	W		0923	SABE2	Bebb willow	Salix	bebbiana
		W		0924	SABO	red willow	Salix	bonplandiana
X	E			0925	SACA5	coastal plain willow	Salix	caroliniana
X	E			0926	SAPY	balsam willow	Salix	pyrifolia

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E	W		0927	SAAL2	white willow	Salix	alba
		W		0928	SASC	Scouler's willow	Salix	scouleriana
X	E			0929	SASE10	weeping willow	Salix	sepulcralis
X	E			0931	SAAL5	sassafras	Sassafras	albidum
	E			0934	SORBU	mountain ash spp.	Sorbus	spp.
	E			0935	SOAM3	American mountain ash	Sorbus	americana
X	E			0936	SOAU	European mountain ash	Sorbus	aucuparia
X	E			0937	SODE3	northern mountain ash	Sorbus	decora
	E			0940	SWMA2	mahogany	Swietenia	mahagoni
	E			0950	TILIA	basswood spp.	Tilia	spp.
X	E			0951	TIAM	American basswood	Tilia	americana
	E			0952	TIAMH	white basswood	Tilia	americana var. heterophylla
	E			0953	TIAMC	Carolina basswood	Tilia	americana var. caroliniana
	E			0970	ULMUS	elm spp.	Ulmus	spp.
X	E			0971	ULAL	winged elm	Ulmus	alata
X	E			0972*	ULAM	American elm	Ulmus	americana
X	E			0973	ULCR	cedar elm	Ulmus	crassifolia
X	E			0974*	ULPU	Siberian elm	Ulmus	pumila
X	E			0975	ULRU	slippery elm	Ulmus	rubra
X	E			0976	ULSE	September elm	Ulmus	serotina
X	E			0977	ULTH	rock elm	Ulmus	thomasii
X		W		0981	UMCA	California laurel	Umbellularia	californica
		W		0982	YUBR	Joshua tree	Yucca	brevifolia
	E			0986	AVGE	black mangrove	Avicennia	germinans
	E			0987	COER2	buttonwood mangrove	Conocarpus	erectus
	E			0988	LARA2	white mangrove	Laguncularia	racemosa
X	E			0989	RHMA2	American mangrove	Rhizophora	mangle
		W	w	0990	OLTE	desert ironwood	Olneya	tesota
	E	W		0991	TAMAR2	saltcedar	Tamarix	spp.

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0992	MEQU	melaleuca	Melaleuca	quinquenervia
X	E			0993	MEAZ	chinaberry	Melia	azedarach
X	E			0994	TRSE6	Chinese tallowtree	Triadica	sebifera
X	E			0995	VEFO	tungoil tree	Vernicia	fordii
X	E			0996	COOB2	smoketree	Cotinus	obovatus
	E	W		0997	ELAN	Russian-olive	Elaeagnus	angustifolia
X	E	W		0998	2TB	unknown dead hardwood	Tree	broadleaf
X	E	W		0999	2TREE	other, or unknown live tree	Tree	unknown

(\*) associated with the species code denotes species tallied in the Rocky Mountain Region.

## Appendix 4. Site Tree Selection Criteria and Species List

### Western U.S. Site-Tree Selection Criteria

Ideally, site trees in the western U.S. should be between 35-80 years old. If preferred trees cannot be found in this age range, expand the age range to 15-250 years. Reject trees outside the 15-250 year age range, trees that exhibit signs of damage, trees with ring patterns that show signs of suppression, trees less than 5.0 inches DBH, trees with abnormalities at DBH, trees with rotten cores, and woodland species. A list of preferred site-tree species is provided. Site trees should be selected in the following order of preference:

- 1st Choice: representative of the stand, on the list for your region.
- 2nd Choice: representative of the stand, on the list for an adjoining western region.
- 3rd Choice: not representative of the stand, on the list for your region.
- 4th Choice: not representative of the stand, on the list for an adjoining western region.

Note: PNW = Pacific Northwest FIA, RMRS = Rocky Mountain FIA

\*Eastern U.S. Site - Tree Selection Criteria not included in this field guide

Code	Common Name	Region
----- Softwood Species -----		
0011	Pacific silver fir	PNW
0015	white fir	RMRS, PNW
0017	grand fir	RMRS, PNW
0018	corkbark fir	RMRS
0019	subalpine fir	RMRS, PNW
0020	California red fir	RMRS, PNW
0021	shasta red fir	PNW
0022	noble fir	PNW
0042	Alaska yellow-cedar	PNWRS
0073	western larch	RMRS, PNW
0081	incense-cedar	RMRS, PNW
0093	Engelmann spruce	RMRS, PNW
0094	white spruce	RMRS, PNW
0095	black spruce	PNW
0096	blue spruce	RMRS
0098	sitka spruce	PNW
0104	foxtail pine	RMRS
0108	lodgepole pine	RMRS, PNW
0109	Coulter pine	PNW
0112	Apache pine	RMRS
0116	Jeffrey pine	RMRS, PNW
0117	sugar pine	RMRS, PNW

<b>Code</b>	<b>Common Name</b>	<b>Region</b>
0119	western white pine	RMRS, PNW
0120	bishop pine	PNW
0122	ponderosa pine	RMRS, PNW
0135	Arizona pine	RMRS
0201	bigcone Douglas-fir	PNW
0202	Douglas-fir	RMRS, PNW
0211	redwood	PNW
0231	Pacific yew	PNW
0242	western redcedar	RMRS, PNW
0263	western hemlock	RMRS, PNW
0264	mountain hemlock	RMRS, PNW

----- **Hardwood Species** -----

0312	bigleaf maple	PNW
0351	red alder	PNW
0375	paper birch	RMRS, PNW
0741	balsam poplar	RMRS, PNW
0745	plains cottonwood	RMRS
0746	quaking aspen	RMRS, PNW
0747	black cottonwood	RMRS, PNW
0748	Fremont poplar	RMRS
0749	narrowleaf cottonwood	RMRS

**Appendix 5. Stocking Chart - Not used in the Rocky Mountain Region**

## Appendix 6. 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 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 1.0 foot 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 1.0 acre in size and 120.0 feet wide at the point of occurrence.

**ALLUVIAL FAN - RM** - A fan-shaped deposit of unconsolidated material and debris, forming at the point where a stream emerges from a narrow valley onto a broader, less sloping valley floor.

**Alpine- RM** - The zone of low arctic-type vegetation above tree line.

**Annular plot** – a circular ring with a beginning radius of 24.0 feet from subplot center and an ending radius of 58.9 feet.

**Artificial Regeneration Species** – Indicates the predominant species that is planted or seeded in an artificially regenerated condition.

**AZIMUTH - RM** - The horizontal angle or bearing of a point, measured clockwise from north. Note: The azimuth plus or minus 180 degrees is termed the back azimuth.

**Bajada -RM** - A broad, gently inclined slope formed by the lateral blending of a series of alluvial fans, and having a broadly undulating profile.

**Basal Area (BA) - RM** - The cross-sectional area of a tree stem at the point where diameter (DBH/DRC) is measured, inclusive of bark; BA is expressed in square feet. The BA per acre is often used to represent tree stocking.

**Basal Area Factor (BAF) - RM** - The basal area factor is an index for the sampling angle used in variable-radius plot tree cruising. The BAF is the amount of basal area each tally tree on a

sample point represents per acre.

**Baseline - RM** - A reference line of sight, located and measured on both the aerial photo and the ground.

**Bench - RM** - A nearly level to gently inclined surface developed on resistant strata in areas where valleys are cut, and forming a shelf above the level of the valley bottom.

**BH - RM** - Breast height: 4.5 feet above the ground. BH is in reference to the place of diameter measurement for timber species.

**Blind check** – a re-installation of a production plot done by a qualified crew without production crew data on hand. A full re-installation of the plot is recommended for the purpose of obtaining a measure of uncertainty in the data. If a full plot re-installation is not possible, then full subplots will be completed with a minimum of 15 total trees being remeasured. All plot-level information (e.g., boundary and condition information) will be collected on each blind check plot. 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 4 inches

**Botched plot** – A plot that should not be included in the standard inventory data base due to data collection errors or other problems.

**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.

**BUREAU OF LAND MANAGEMENT LANDS - RM** - Public lands administered by the Bureau of Land Management (BLM), U.S. Department of the Interior.

**Canopy Cover - RM** - Percentage of the ground surface covered by a vertical projection of tree crowns. Synonymous with Crown Cover.

**Census Water** – Rivers and streams that are more than 200 feet wide and bodies of water that are greater than 4.5 acres 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.

**Chaining (woodland treatment method) - RM** - A mechanical method of land clearing (or possible type conversion) to reduce or eliminate undesirable vegetation (e.g., reduce the number of juniper trees to enhance herbage production for livestock use). With this method, a heavy chain is dragged between two tractors for the purpose of uprooting the undesirable vegetation.

**Cirque - RM** - A semicircular, concave, bowl-like area with a steep face, primarily resulting from erosive activity of a mountain glacier. A glacial cirque appears as an amphitheater-like carving in the mountainside, with steep slopes providing headwaters for drainage.

**Cliff - RM** - A high, very steep to perpendicular or overhanging face of rock or earth.

**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 - RM** - An area of relatively uniform ground cover, such as a homogeneous vegetation cover.

**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.

**Conk - RM** - The fruiting body of a wood-destroying fungus that projects from the bole, roots, or other tree parts. The size, shape, and color of conks will vary depending on the fungus species.

**Contrasting Condition Class - RM** - Any qualifying condition class that is different than a previously assigned class based on the defining attributes.

**Cord - RM** - A stack of wood equivalent to 128 cubic feet of wood and air space, having standard dimensions of 4 by 4 by 8 feet.

**Crook - RM** - An abrupt curvature or bend in a tree bole.

**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.

**CROWN COVER - RM** - Percentage of the ground surface covered by a vertical projection of tree crowns. Synonymous with Canopy Cover.

**CROWN RATIO - RM** - The portion of tree bole supporting live, healthy foliage, expressed as a percent of either total tree height (Uncompacted) or total tree length (Compacted).

**CUBIC-FOOT CULL - RM** - An assessment of the rotten, missing, or otherwise defective portions of a tree bole that are unsuitable for industrial wood products. Cubic-foot cull is expressed as a percentage of the entire bole.

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

**Cull Tree - RM** - A live timber species that fails to meet the specifications for a sound tree now or prospectively (see Rotten Tree and Rough Tree).

**Diameter at Breast Height (DBH)** – The diameter of the bole of a tree at breast height (4.5 feet above the ground), measured outside of the bark.

**Dead Volume - RM** - That part of a tree's merchantable portion, consisting of sound dead wood (expressed as a percent).

**Diameter Class - RM** - A grouping of tree diameters (DBH or DRC). For the current inventory, 2-inch diameter classes are used, with the even-inch the appropriate mid-point for a class. For example, the 6-inch class includes trees 5.0- to 6.9-inches DBH inclusive.

**DIB - RM** - Diameter inside bark.

**Downed Tree - RM** - For single-stemmed trees -- a tree 1.0-inch in diameter or larger, lying along the ground and usually with a portion of the stem or bole resting on the ground. For multi-stemmed trees -- a tree 1.0-inch DRC or larger, with more than 2/3 of the present volume no longer attached or upright; do not consider cut and removed volume.

**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.

**Ephemeral Stream - RM** - See "Stream, Ephemeral."

**Established Seedling - RM** - A live tree smaller than 1.0-inch DBH/DRC, having a root system in mineral soil, and at least 6.0-inches tall for softwoods (e.g., pines, firs, spruces, pinyon, juniper), or 12.0-inches tall for hardwoods (e.g., aspen, cottonwood, oak, maple, mountain-mahogany). A seedling is not considered established if it will not survive due to form defects, insect infestation, or disease.

**Face - RM** - A section of the tree surface (usually within the butt sixteen feet) that is ¼ of the circumference of the tree and extending the full length of the log.

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

**Field Location - RM** - A reference to the sample site; an area containing the field location center and all sample points, distributed over an area approximately 2.5 acres in size. A field location consists of four fixed-radius subplots for sampling trees and understory vegetation and 4 microplots for sampling seedlings and saplings.

**Fixed-Radius Plot - RM** - A circular sample plot of a specified horizontal radius:

Microplot: 1/300 acre = 6.8-foot radius  
Subplot: 1/24 acre = 24.0-foot radius

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

**Forest Land - RM** - Land that is at least 10 percent stocked by forest trees of any size (or 5 percent crown cover where stocking cannot be determined), or land formerly having such tree cover, and is not currently developed for a nonforest use. (RM a condition is considered 10% stocked if it has 5% crown cover or 40 established seedlings per acre of any tally tree species (Appendix 3)). The minimum area for classification as forest land is one acre. Roadside, stream-side, and shelterbelt strips of timber must be at least 120 feet wide to qualify as forest land. Unimproved roads and trails or natural clearings in forested areas shall be classified as forest, if less than 120 feet in width or an acre in size. Streams and other bodies of water within forest will be considered forest land if they are less than 1 acre and 30-feet wide. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied. (Also see definitions of nonforest land, idle farmland and improved/maintained pasture.)

Note: In some instances, areas previously stocked with woodland species that have had some type of treatment (e.g., chaining or other mechanical treatment) are classified as nonforest land.

**Forest Trees** – Plants having a well-developed, woody stem and usually more than 12 feet 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.

**Geographic Tree Center - RM** - The physical center of a single stemmed tree or the physical center of all the stems of a multistemmed woodland tree (defined as the center of a polygon scribed by connecting the centers of the outermost stems in the tree at the DRC point; stems of any diameter are to be used).

**Glacial Moraine - RM** - An accumulation of rock material built chiefly by the direct action of glacial ice, glacial drift, or by running water emanating from the glacier. Moraines may be classified as lateral or terminal depending on their relationship to the movement of the ice mass.

Lateral Moraine -- A ridge-like moraine carried on and deposited at the side margin of a valley glacier, composed chiefly of rock fragments derived from valley walls.

Terminal Moraine -- A moraine produced at the front end of an actively flowing glacier. This moraine marks the glacier's farthest advance, and usually has the form of a massive curved ridge or complex of ridges.

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

**Hard Dead Tree - RM** - A standing dead tally tree, 1.0-inch DBH/DRC or larger, that has a minimum of 1/3 of the original merchantable volume sound (less than 2/3 rotten and/or missing).

Formerly called "salvable". Also, a down dead tally tree, 1.0-inch DBH/DRC or larger, with a minimum of 1/3 of the original merchantable volume sound and intact.

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

**Herbaceous - RM** - Of or relating to a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue, and dies down at the end of a growing season.

**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.

**Improved Road - RM** - All roads graded or otherwise regularly maintained for long-term continuing use. These roads are generally paved or graveled, and may have culverts; however, some temporary logging roads appear as improved roads; reference field maps.

**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.

**Inhibiting Vegetation - RM** - Includes all vegetation considered to repress the natural establishment of tree seedlings.

**Intermittent Stream - RM** - See "Stream, Intermittent."

**Land - RM** - This includes (1) areas of dry ground and ground temporarily or partly covered by water, such as marshes, swamps, and river flood plains, (2) streams, sloughs, estuaries, and canals less than 30 feet in width, and (3) lakes, reservoirs, and ponds smaller than 1 acre in size.

**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 200 feet in width, and ponds less than 4.5 acres in area.

**Land Use - RM** - The classification of a land condition class by use or type.

**Limbs - RM** - That part of a tree above the stump which does not meet the requirements for

sawlog and upper-stem portions, including all live, sound branches to a minimum of 4 inches DOB at the knot collar.

**Limiting Distance - RM** - The maximum horizontal distance a tree can be from the plot center and still be considered for tally. In reference to fixed-area plots, limiting distance is determined by the size of the sample; for a 1/24-acre sample, the limiting distance to the geographic center of the tree at the base is 24 feet; for a 1/300-acre sample, the limiting distance is 6.8 feet. In reference to variable-radius plot sampling, limiting distance is a function of the selected basal area factor (e.g., 20 or 40) and the diameter of the tree; the distance is measured from the plot center to the center of a single-stemmed tree (to the face of the tree if table is used) at the diameter point or to the geographic center of a multistemmed woodland tree at the average diameter height. A tally tree is one that is at or within its limiting distance from the point stake.

**Litter - RM** - The uppermost layer of organic debris on a forest floor; that is, essentially the freshly fallen, or only slightly decomposed material, mainly foliage, but also bark fragments, twigs, flowers, fruits, and so forth. For the ground cover transect, litter also includes any dead organic material including carcasses, feces, etc. Note: Litter and humus together are often termed duff.

**Location Center (LC) - RM** - The LC is the intersection of map grid lines as established on the ground; it becomes the center point of the field location, and the center of subplot 1 on the location layout. On previously established locations, the LC is either point 1 of a 5-point "timberland" location layout, or the center of the 1/10-acre or 1/20-acre fixed-radius "woodland" location layout.

**Logging - RM** - The felling and extraction of timber.

**Macroplot** – A circular, fixed area plot with a radius of 58.9 feet. Macroplots may be used for sampling relatively rare events.

**Main Plot (OLD PLOT DESIGN) - RM** - For previously sampled "timberland" field location sample points, the main plot is the variable-radius plot. For previously sampled "woodland" field locations, the main plot is the quadrant area sample on a 1/10-acre or 1/20-acre fixed-radius plot. The quadrant area is synonymous with the term "point."

**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 Bole - RM** - On timber species: cubic volume- the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter; board foot softwoods

– the portion of a tree, 9.0-inches DBH or larger, between a 1-foot stump and a 7.0-inch top diameter; board foot hardwoods – the portion of a tree, 11.0-inches or larger DBH, between a 1-foot stump and a 9.0-inch top diameter.

**Merchantable Bolt - RM** - On timber species 5.0-inches DBH and larger: a solid 8-foot section of tree bole with a large-end diameter of at least 5.0 inches and a small-end diameter of at least 4.0 inches.

**Merchantable Portion (woodland species) - RM** - For woodland trees, the merchantable portion includes all qualifying segments above the place(s) of diameter measurement for any tree with at least one 3.0-inch stem; sections below the place(s) of diameter measurement are not included. Qualifying segments are stems or branches that are a minimum of 1 foot in length and at least 1.5 inches in diameter; portions of stems or branches smaller than 1.5 inches in diameter, such as branch tips, are not included in the merchantable portion of the tree.

**Merchantable Top** – The point on the bole of trees above which merchantable material cannot be produced. Merchantable top is 1.5 inches for woodland species and 4.0 inches for all other species. **RM** - the merchantable top when estimating FORM DEFECT is 7.0 inch DOB softwoods and 11.0 inch DOB hardwoods.

**Mesa - RM** - A broad, nearly flat-topped, and usually isolated land formation with steep sides.

**Microplot** – A circular, fixed-radius plot with a radius of 6.8 feet that is used to sample trees less than 5.0 inches at DBH, as well as other vegetation.

**Mortality Tree - RM** - A standing or downed tree, 1.0-inch DBH/DRC and larger, that was live within the past 5 years or at the last inventory.

**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.

**National Park Land - RM** - Public lands administered by the Park Service, U.S. Department of the Interior, such as National Parks, National Monuments, National Historic Sites (such as National Memorials and National Battlefields), and some National Recreation Areas.

**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.

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

**NFS - RM** - An abbreviation for “National Forest System.”

**Non-census Water\*** – Portions of rivers, streams, sloughs, estuaries, and canals that are 30 to 200 feet wide and at least 1 acre in size; and lakes, reservoirs, and ponds 1 to 4.5 acres in size. Portions of rivers and streams not meeting the criteria for census water, but at least 30 feet wide and 1 acre in size, are considered noncensus water. Portions of braided streams not meeting

the criteria for census water, but at least 30 feet in width and 1 acre in size and more than 50 percent water at normal high-water level are considered noncensus water. Ephemeral and intermittent streams are classified as land.

**Nonforest Land\*** -- This is land that (1) has never supported forests (e.g., barren, alpine tundra), or (2) was formerly tree land, but has been converted to a non-tree land status (e.g., cropland, improved pasture).

Other examples of nonforest land are improved roads of any width, graded or otherwise regularly maintained for long-term continuing use, and rights-of-way of all powerlines, pipelines, other transmission lines, and operating railroads. If intermingled in forest areas, unimproved roads and nonforest strips must be at least 120-feet wide and 1 acre in size to qualify as non-tree land.

This category also includes formerly stocked woodland areas if they are currently nonstocked due to a treatment (e.g., chaining, other land clearing). These areas are treated to eliminate woodland trees for the purpose of enhancing or providing for non-wood commodities or uses (e.g., increasing herbage production). Chained woodland areas remain nonforest until they meet stocking with new reproduction.

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

**Nonstocked Forest Land - RM** - Formerly stocked forest land that currently has less than 10 percent stocking (as represented in the field by 5 percent crown cover or adequate reproduction) but has the potential to again become 10 percent stocked. For example, recently harvested, burned, or windthrow-damaged areas.

**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.

**Outcrop - RM** - Surface exposure of a significant geologic strata.

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

**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.

**Pathogen - RM** - An organism capable of causing disease.

**Perennial Stream - RM** - See "Stream, Perennial."

**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 1/6 acre. The subplots are established so that subplot 1 is centered within the sample and the centers of subplots 2, 3, and 4 are located 120.0 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and macroplot.

**Poletimber Trees - RM** - See "Tree Size Class."

**Primary Wood Processing Plant - RM** - An industrial plant that processes roundwood products such as sawlogs, pulpwood bolts, or veneer logs.

**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 measured by a production crew. These plots may also be used for training purposes.

**Reference Point (RP) - RM** - A landmark readily identifiable on both ground and aerial photographs. Examples include the following: a prominent tree or rock; a sharp bend in a road or drainage ditch; a fence corner. The RP for field locations should be either a tree not likely to die, or a landmark not likely to be removed, within the next 10-15 years, and if possible, located at least 100 feet from the location center.

**Reference plot (off grid)** – A plot that is used for crew certification. These plots are NOT included in the ongoing inventory process and data from these plots do not become part of the standard inventory data base. To ensure that these plots do not enter into the inventory data base, they are assigned plot numbers outside the normal range of production plots or other invalid plot identification information such as an invalid STATE code (STATECD).

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

**Remeasurement Location - RM** - A field location originally established and measured in a previous inventory.

**Reserved Land** – Land reserved from wood products utilization through statute or administrative designation. Reserved land is withdrawn through administrative designation, based on a written document(s), which carries the weight of legal authority, prohibiting the management of land for the production of wood products (not merely controlling wood harvesting methods). Such authority is usually vested in a public agency, department, etc.,

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 is rather permanent in nature. Examples include Wilderness areas and National Parks and Monuments.

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

**Rotation - RM** - The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

**Rotation Age - RM** - The age of a stand when it is considered ready for harvesting. Rotation age is 80 years for aspen and paper birch, and 120 years for all other timber species.

**Rotten Tree - RM** - A live timber species, 5.0-inch DBH and larger, with 2/3 (67 percent) or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing cubic-foot volume loss.

**Rotten/Missing Volume - RM** - The part of a tree's merchantable portion that is rotten and/or missing (expressed as a percent). This does NOT include missing volume from a broken or missing top.

**Rough Tree - RM** - A live timber species, 5.0-inch DBH and larger, with 2/3 (67 percent) or more of the merchantable volume cull, and more than half of this cull due to sound dead wood cubic-foot volume loss or severe form-defect volume loss (e.g., severe sweep and crook, forks, extreme form reduction). Also, a live timber species sapling (1.0- to 4.9-inches DBH) that is not expected to become a sound tree with good form and vigor due to defect, or a timber species (5.0-inches DBH and larger) that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

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

**Saplings** – Live trees 1.0 to 4.9 inches DBH/DRC.

**Seedlings** – Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. For woodland species, each stem on a single tree must be less than 1.0 inch in DRC.

**Site Tree - RM** - A tree used to provide an index of site quality.

**Slash - RM** - Unmerchantable tree residue on the ground from logging activities or from natural breakup of trees caused by insects, disease, weather, etc. Slash includes logs, stems, heavier branch wood, stumps, etc.

**SOD - RM** - A continuous cover of grass and/or herbaceous plants.

**Soft Dead Tree - RM** - A standing dead tally tree, 1.0-inch DBH/DRC or larger, that has less than 1/3 of the original merchantable volume sound (more than 2/3 rotten/missing). Also, a down dead tree, 1.0-inch DBH/DRC or larger, with less than 1/3 of the original merchantable bole sound and intact. Formerly called "nonsalvable".

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

**Sound Tree - RM** - Formerly called "growing-stock tree." A live timber species, 5.0-inches DBH or larger, that has less than 2/3 (67 percent) of the merchantable volume cull, and contains at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole. Also, a live timber-species sapling (1.0- to 4.9-inches DBH) that is expected to become a sound live tree with good form and vigor, 5.0-inches DBH or larger

**Sprig - RM** - Any woody or non-woody lateral growth, without secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

**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.

**Stream - RM** - A body of running water. Note: For purposes of this inventory, ephemeral and intermittent streams are classified as land.

**Ephemeral:** A stream that flows only in direct response to precipitation or surface run-off.

**Intermittent:** A stream that flows for protracted periods only when it receives ground water discharge or long-continued contributions from melting snow or other surface and shallow subsurface sources.

**Perennial:** A stream that flows year-round.

**Stream Bottom - RM** - A gently sloping stream pathway subject to frequent flooding.

**Stream Terrace - RM** - A nearly level strip of land with a more or less abrupt descent along the

margin of a river or stream, but not subject to frequent flooding.

**Stump Height - RM** - For purposes of this inventory, stump height for timber species is the height on a tree from ground level to the top of a 1.0-foot stump.

**Sound Knot or Limb - RM** – Knots or limbs that are intergrown, or encased, with the surrounding wood, and that show no signs of decay. Bark may not be present on the limbs.

**Subplot** – A circular, fixed-area plot with a radius of 24.0 feet. Each subplot represents  $\frac{1}{4}$  of the fixed plot sample unit.

**Suppression - RM** - The process whereby certain trees, shrubs, etc., in a community become weakened and/or stunted, essentially due to competition by surrounding trees, shrubs, etc., in the immediate environment (natural suppression). Suppression may also be the result of human intervention (e.g., selective lopping, girdling, cutting back) or selective browsing by animals (artificial suppression).

**Sweep - RM** - A curve in a tree bole, not an abrupt bend (crook).

**Tally Tree - RM** - Tree species listed in this manual (chapter 10) as timber or woodland trees and measured for volume, growth, and mortality.

**Talus - RM** - The accumulated mass of loose, broken rock fragment derived from and lying at the base of a cliff or steep rock slope.

**Timberland - RM** - In previous inventories, this was forest land (including areas with mixtures of timber species and woodland trees) where timber species have 5 percent or more crown cover, or forest land with sufficient timber species reproduction (minimum of 40 saplings and/or established seedlings per acre). The timberland designation required the establishment of a 5-point variable-radius tree sample.

**Timber Species - RM** - Tally tree species measured at breast height; these include all species of conifers, except pinyon, or juniper. In addition, hardwoods included in this category are aspen, paper birch, cottonwood (*Populus* spp.), two oak species (*macrocarpa* and *muehlenbergii*) and boxelder. Western juniper is measured as a timber species, though measured for age and radial growth using woodland species rules.

**Timber Stand Improvement - RM** - A term comprising all intermediate cuttings or treatments made to improve the composition, health, and growth of the remaining trees (TSI) in the stand. Trees removed are often smaller than sawtimber size.

**Total Height - RM** - The vertical distance between ground level to the tip of the apical meristem (tree) or to the highest tip of other vegetation. In contrast to length, height is reduced with increasing angle of lean.

**TOTAL LENGTH** – The total length of the tree, recorded to the nearest 1.0 foot 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.

**Trail - RM** - A pathway consistently used by wildlife, domestic animals, or humans.

**Improved trail:** used for human recreation/travel, maintained through tree removal and brush clearing, often with posted signs at a trailhead or fork, and documented on forest/recreation maps.

**Unimproved trail:** used for human recreation/travel, sometimes documented on a forest/recreation map, but rarely cleared or posted.

**Wildlife/Animal trail:** not cleared, maintained, posted, or documented for human use.

**Training (practice) plot** – A plot established for training or certification purposes only. It is NOT a plot in the ongoing inventory process and data from these plots do not become part of the standard inventory data base. To ensure that these plots do not enter into the inventory data base, they are assigned plot numbers outside the normal range of production plots or other invalid plot identification information such as an invalid STATE code (STATECD).

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

**Tree Class - RM** - A classification system based on a tree's physical characteristics, and used to classify all live timber species as sound, rough, or rotten trees, and dead timber and dead woodland species as either hard or soft.

**Twig - RM** - Any woody lateral growth, with secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

**Unimproved Road - RM** - A road not regularly maintained for long-term continuing use, such as a jeep trail, old logging road, etc. These may or may not be posted with road signs.

**Upper Stem Portion - RM** - The part of the bole of sawtimber trees above the sawlog top to a minimum top diameter of 4.0 inches DOB, or to the point where the central stem breaks into limbs.

**Urban Areas - RM** - Nonsampled tree land or non-tree land within the legal boundaries of cities and towns (e.g., school yards, cemeteries, airports, golf courses).

**Variable Radius Plot - RM** - A plot, used in previous inventories, where a predetermined critical angle is projected from a central point and swept in a full circle to determine the basal area (tree count) and volume per unit of area. The radius of this plot is a function of an individual tree's size and distance from the point center.

**Water - RM** - In terms of a Ground Cover Classification, water is defined as streams, sloughs, estuaries, and canals more than 30 feet in width; and lakes, reservoirs, and ponds more than 1 acre in size.

For use in determining the “water proximity” or “water type” nearest the field location center, water implies any reliable source of water for wildlife, livestock, recreators, etc.

**Wilderness - RM** - An area of undeveloped land currently included in the Wilderness System, managed so as to preserve its current conditions and retain its natural character and influence.

**Woodland - RM** - In previous inventories, this was forest land with 10 percent or more crown cover in (1) woodland trees, or (2) timber species and woodland trees, but less than 5 percent crown cover in timber species; or forest land with sufficient woodland species reproduction (minimum of 40 saplings and/or established seedlings per acre).

**Woodland Species - RM** - Tally tree species measured at ground level (DRC); these include pinyon, juniper (except Western juniper), oak, mesquite, mountain-mahogany, and bigtooth maple.

\* Indicates a National definition that has been edited or modified.

## Appendix 7. Tolerance / MQO / Value / Units Table

Core optional variables are in italics. n/a is not applicable. Variables with both a core and core optional listing are marked with an asterisk.

Variable Name	Tolerance	MQO	Values	Units
<b>General Description</b>				
New Subplot Location	+/- 7 feet	95% of the time	n/a	feet
New Microplot Location	+/- 1 foot	95% of the time	n/a	feet
<b>Plot Level Data</b>				
STATE	No errors	99% of the time	Appendix 1	n/a
COUNTY	No errors	99% of the time	Appendix 1	n/a
PLOT NUMBER	No errors	99% of the time	00001 to 99999	n/a
PLOT STATUS	No errors	99% of the time	1 to 3	n/a
NONFOREST SAMPLING STATUS	No errors	99% of the time	0 to 1	n/a
NONFOREST PLOT STATUS	No errors	99% of the time	1 to 3	n/a
PLOT NONSAMPLED REASON	No errors	99% of the time	01 to 03 and 05 to 11	n/a
NONFOREST PLOT NON-SAMPLED REASON	No errors	99% of the time	02, 03, 08, 09, 10	n/a
SUBPLOTS EXAMINED	No errors	90% of the time	1, 4	n/a
SAMPLE KIND	No errors	99% of the time	1 to 3	n/a
PREVIOUS PLOT NUMBER	No errors	99% of the time	00001 to 99999	n/a
FIELD GUIDE VERSION	No errors	99% of the time	4.0	n/a
YEAR	No errors	99% of the time	> 2003	year
MONTH	No errors	99% of the time	Jan – Dec (01 – 12)	month
DAY	No errors	99% of the time	01 to 31	day
DECLINATION	No errors	99% of the time	+/- 50	degrees
HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	90% of the time	1 to 9	n/a
WATER ON PLOT	No errors	90% of the time	0 to 5, 9	n/a
QA STATUS	No errors	99% of the time	1 to 7	n/a
CREW NUMBER	No errors	99% of the time	RMRS 220001-229999	n/a
GPS UNIT	No errors	99% of the time	0 to 4	n/a

Variable Name	Tolerance	MQO	Values	Units
GPS SERIAL NUMBER	No errors	99% of the time	000001 to 999999	n/a
GPS ENTRY METHOD	No errors	99% of the time	0, 1	n/a
GPS DATUM	No errors	99% of the time	NAD83	n/a
COORDINATE SYSTEM	No errors	99% of the time	1, 2	n/a
LATITUDE DEGREES	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	0-90	degrees
LATITUDE MINUTES	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	1 – 59	minutes
LATITUDE SECONDS	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	0.00 – 59.99	seconds
LONGITUDE DEGREES	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	1-180	degrees

Variable Name	Tolerance	MQO	Values	Units
LONGITUDE MINUTES	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	1 – 59	minutes
LONGITUDE SECONDS	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	0.00 – 59.99	seconds
UTM ZONE	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	Number varies from 2 in Alaska to 19 on the East Coast. The letter varies from Q in Hawaii to W in Alaska	n/a
EASTING (X) UTM	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	0000000-9999999	
NORTHING (Y) UTM	When GPS ENTRY METHOD = 0, no errors in data entry When GPS ENTRY METHOD = 1, not applicable	When GPS ENTRY METHOD = 0, 99% of the time When GPS ENTRY METHOD = 1, not applicable	0000000-9999999	
AZIMUTH TO PLOT CENTER	+/- 3 degrees	99% of the time	000 at plot center 001 to 360 not at plot center	degrees

Variable Name	Tolerance	MQO	Values	Units
DISTANCE TO PLOT CENTER	+/- 6 ft	99% of the time	000 at plot center 001 to 200 if a Laser range finder not used 001 to 999 if a Laser range finder is used	feet
GPS ELEVATION	No errors	99% of the time	-00100 to 20000	feet
GPS ERROR	No errors	99% of the time	000 to 999 071 to 999 if an error < 70 cannot be obtained	feet
NUMBER OF READINGS	No errors	99% of the time	001 to 999	n/a
GPS FILENAME	No errors	99% of the time	English words, phrases and numbers	n/a
MACROPLOT BREAK-POINT DIAMETER	No errors	99% of the time	21, 24, and 30	inches
PLOT NOTES	n/a	n/a	English, alpha-numeric	n/a
<b>Condition Class Information</b>				
CONDITION CLASS NUMBER	No errors	99% of the time	1 to 9	n/a
CONDITION CLASS STATUS	No errors	99% of the time	1 to 5	n/a
CONDITION NONSAMPLED REASON	No errors	99% of the time	01, 02, 03, 10, 11	n/a
NONFOREST CONDITION CLASS STATUS	No errors	99% of the time	2, 5	n/a
NONFOREST CONDITION NONSAMPLED REASON	No errors	99% of the time	02, 03, 10	n/a
RESERVED STATUS*	No errors	99% of the time	0, 1	n/a
OWNER GROUP*	No errors	99% of the time	10, 20, 30, 40	n/a
FOREST TYPE	No errors	99% of the time in group 95% of the time in type no MQO when STAND SIZE CLASS = 0	Appendix 2	n/a

Variable Name	Tolerance	MQO	Values	Units
STAND SIZE CLASS	No errors	99% of the time	0 to 6	class
REGENERATION STATUS	No errors	99% of the time	0, 1	n/a
TREE DENSITY	No errors	99% of the time	1 to 3	n/a
OWNER CLASS*	No errors	99% of the time	11-13; 21-25; 31-33; 41-45	class
PRIVATE OWNER INDUSTRIAL STATUS*	No errors	99% of the time	0, 1	n/a
ARTIFICIAL REGENERATION SPECIES	No errors	99% of the time	Appendix 3	n/a
STAND AGE	+/- 10%	95% of the time	000 to 997, 998, 999	year
DISTURBANCE 1	No errors	99% of the time	00; 10-12; 20-22; 30-32; 40-46; 50-54; 60; 70; 80; 90-95; 9999	n/a
DISTURBANCE YEAR 1	+/- 1 year for 5-year measure. cycles+/- 2 years for > 5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year
DISTURBANCE 2	No errors	99% of the time	00; 10-12; 20-22; 30-32; 40-46; 50-54; 60; 70; 80; 90-95; 9999	n/a
DISTURBANCE YEAR 2	+/- 1 year for 5-year measure. cycles+/- 2 years for > 5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year

Variable Name	Tolerance	MQO	Values	Units
DISTURBANCE 3	No errors	99% of the time	00; 10-12; 20-22; 30-32; 40-46; 50-54; 60; 70; 80; 90-95; 9999	n/a
DISTURBANCE YEAR 3	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year
TREATMENT 1	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a
TREATMENT YEAR 1	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
TREATMENT 2	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a
TREATMENT YEAR 2	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
TREATMENT 3	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a
TREATMENT YEAR 3	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
PHYSIOGRAPHIC CLASS	No errors	80% of the time	xeric: 11, 12, 13, 19 mesic: 21, 22, 23, 24, 25, 29 hydric: 31, 32, 33, 34, 35, 39	n/a

Variable Name	Tolerance	MQO	Values	Units
PRESENT NONFOREST LAND USE*	No errors	99% of the time	10-17; 20; 30-34; 40-44	n/a
CANOPY COVER SAMPLE METHOD	None	90% of the time	1-4	n/a
LIVE CANOPY COVER	No errors for 0-12% live canopy cover; 10% for 13-20% live canopy cover; 25% for 21-100% live canopy cover	99% of the time	00-99 (where 99 = 99-100)	percent
LIVE PLUS MISSING CANOPY COVER	No errors% for 0-12% live plus missing canopy cover; 10% for 13-20% live plus missing canopy cover; 25% for 21-100% live plus missing canopy cover	80% of the time	00-99 (where 99 = 99-100)	percent
TOTAL STEMS	10%	90% of the time	00000-99999	n/a
<b>Subplot Information</b>				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
SUBPLOT/				
MACROPLOT STATUS	No errors	99% of the time	1 to 4	n/a
SUBPLOT NONSAMPLED REASON	No errors	99% of the time	01 to 05, 10, 11	n/a
NONFOREST SUBPLOT/ MACROPLOT STATUS	No errors	99% of the time	1 to 3	n/a
NONFOREST SUBPLOT/ MACROPLOT NON-SAMPLED REASON	No errors	99% of the time	02, 03, 04, 10	n/a
SUBPLOT CENTER CONDITION	No errors	99% of the time	1 to 9	n/a
MICROPLOT CENTER CONDITION	No errors	99% of the time	1 to 9	n/a
SUBPLOT SLOPE	+/- 10 %	90% of the time	000, 005 to 155	percent
SUBPLOT ASPECT	+/- 10 degrees	90% of the time	000 to 360	degrees

Variable Name	Tolerance	MQO	Values	Units
SNOW/WATER DEPTH	+/- 0.5 ft	at the time of measurement	0.0 to 9.9	feet
SUBPLOT/ MACROPLOT CONDITION LIST	No errors	99% of the time	1000 to 9876	n/a
<b>Boundary Data</b>				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
PLOT TYPE	No errors	99% of the time	1 to 4	n/a
BOUNDARY CHANGE	No errors	99% of the time	0 to 3	n/a
CONTRASTING CONDITION	No errors	99% of the time	1 to 9	n/a
LEFT AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
CORNER AZIMUTH	+/- 10 degrees	90% of the time	000 to 360	degrees
CORNER DISTANCE	+/- 1 ft	90% of the time	microplot: 01 to 07 (6.8 ft actual limiting distance) subplot: 01 to 24 macroplot: 01 to 59 (58.9 ft actual limiting distance) hectare: 01 to 185	feet
RIGHT AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
<b>Tree and Sapling Data</b>				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
TREE RECORD NUMBER	No errors	99% of the time	000, 001 to 999	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1 to 9	n/a
AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees

Variable Name	Tolerance	MQO	Values	Units
HORIZONTAL DISTANCE	microplot: +/- 0.2 ft microplot woodland species: +/- 0.4 ft subplot: +/- 1.0 ft subplot woodland species: +/- 2.0 ft annular plot: +/- 3.0 ft annular plot woodland species: +/- 6.0 ft	90% of the time	microplot: 00.1 to 06.8 subplot: 00.1 to 24.0 annular plot: 24.1 to 58.9	feet
PREVIOUS TREE STATUS	No errors	95% of the time	1, 2	n/a
PRESENT TREE STATUS	No errors	95% of the time	0 to 3	n/a
RECONCILE	No errors	95% of the time	1 to 4: valid for new trees on the plot 5 to 9: valid for remeasured trees that no longer qualify as tally	n/a
STANDING DEAD	No errors	99% of the time	0, 1	n/a
MORTALITY	No errors	85% of the time	0, 1	n/a
SPECIES	No errors	at least 99% of the time for genus at least 95% of the time for species	Appendix 3	n/a

Variable Name	Tolerance	MQO	Values	Units
DIAMETER	+/- 0.1 inch per 20.0 inch increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2 +/-1.0 inch per 20.0 inch increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5 For woodland species: +/- 0.2 inch per stem	95% of the time	001.0 to 999.9	inches
DRC STEM DIAMETER	+/- 0.2 inch per stem	95% of the time	001.0 to 999.9	inch
DRC STEM STATUS	No errors	95% of the time	1, 2	n/a
PAST NUMBER OF STEMS	No errors	90% of the time	1 to 99	n/a
CURRENT NUMBER OF STEMS	No errors	90% of the time	1 to 99	n/a
DIAMETER CHECK	No errors	99% of the time	0 to 2	n/a
ROTTEN / MISSING CULL*	+/- 10%	90% of the time	00 to 99	percent
TOTAL LENGTH*	+/- 10% of true length	90% of the time	005 to 400	feet
ACTUAL LENGTH*	+/- 10% of true length	90% of the time	005 to 400	feet
LENGTH METHOD*	No errors	99% of the time	1 to 3	n/a
CROWN CLASS	No errors	85% of the time	1 to 5	n/a
UNCOMPACTED LIVE CROWN RATIO*	+/- 10%	90% of the time	00 to 99	percent
COMPACTED CROWN RATIO	+/- 10%	80% of the time	00 to 99	percent
DAMAGE LOCATION 1	+/- 1 location class	80% of the time	0 to 9	class

Variable Name	Tolerance	MQO	Values	Units
DAMAGE TYPE 1	No errors	80% of the time	1-5; 11-13; 20-25; 31	n/a
DAMAGE SEVERITY 1	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	80% of the time	Defined for each DAMAGE TYPE	class
DAMAGE LOCATION 2	+/- 1 location class	80% of the time	0 to 9	class
DAMAGE TYPE 2	No errors	80% of the time	1-5; 11-13; 20-25; 31	n/a
DAMAGE SEVERITY 2	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	80% of the time	Defined for each DAMAGE TYPE	class
CAUSE OF DEATH*	No errors	80% of the time	10 to 80	n/a
MORTALITY YEAR	+/- 1year for 5-year measure. cycles+/- 2years for > 5-year measure. cycles	70% of the time	1994 or higher	year
DECAY CLASS	+/- 1 class	90% of the time	1 to 5	class
LENGTH TO DIAMETER MEASUREMENT POINT	+/- 0.2 ft	90% of the time	00.1 to 15.0	feet
ROUGH CULL	+/- 10 %	90% of the time	00 to 99	percent
DWARF MISTLETOE CLASS	+/- 1 class	90% of the time	0 to 6	class
TREE NOTES	n/a	n/a	English, alpha-numeric	n/a
Seedling Data				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
SPECIES	No errors	90% of the time for genus 85% of the time for species	Appendix 3	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1-9	n/a

Variable Name	Tolerance	MQO	Values	Units
SEEDLING COUNT	No errors for 5 or less per species +/- 20% over a count of 5	90% of the time	001-999	number
<b>Site Tree Information</b>				
CONDITION CLASS LIST	No errors	99% of the time	1000 to 9876	n/a
SPECIES	No errors	99% of the time for genus		
95% of the time for species	Appendix 3	n/a		
DIAMETER	+/- 0.1 in per 20.0 in increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2 +/- 1.0 in per 20.0 in increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5 For woodland species: +/- 0.2 in per stem	95% of the time	001.0 to 999.9	inches
SITE TREE LENGTH	+/- 10% of true length	90% of the time	005 to 999	feet
TREE AGE AT DIAMETER	+/- 5 years	95% of the time	001 to 999	year
SITE TREE NOTES	n/a	n/a	English, language words, phrases and numbers	n/a
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
HORIZONTAL DISTANCE	+/-5 ft	90% of the time	000.1 to 200.0	feet
<b>Phase 2 (P2) Vegetation Profile</b>				

Variable Name	Tolerance	MQO	Values	Units
P2 VEGETATION SAM- PLING STATUS	No errors	99% of the time	0 to 2	n/a
LEVEL OF DETAIL	No errors	99% of the time	1 to 3	n/a
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
P2 VEG SUBPLOT SAMPLE STATUS	No errors	99% of the time	1, 2	n/a
VEGETATION NONS- AMPLED REASON	No errors	99% of the time	04, 05, 10	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1 to 9	n/a
VEGETATION SUBPLOT NOTES	n/a	n/a	English language ords, phrases, and numbers	n/a
TALLY TREE SPECIES COVER LAYER 1	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26- 50%, 51-75%, 76-95%, 96- 100%	90% of the time	000-100	percent
TALLY TREE SPECIES COVER LAYER 2	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26- 50%, 51-75%, 76-95%, 96- 100%	90% of the time	000-100	percent
TALLY TREE SPECIES COVER LAYER 3	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26- 50%, 51-75%, 76-95%, 96- 100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
TALLY TREE SPECIES COVER LAYER 4	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
TALLY TREE SPECIES COVER – AERIAL VIEW	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
NON-TALLY TREE SPECIES COVER LAYER 1	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
NON-TALLY TREE SPECIES COVER LAYER 2	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
NON-TALLY TREE SPECIES COVER LAYER 3	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
NON-TALLY TREE SPECIES COVER LAYER 4	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
NON-TALLY TREE SPECIES COVER – AERIAL VIEW	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
SHRUB AND WOODY VINE COVER LAYER 1	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
SHRUB AND WOODY VINE COVER LAYER 2	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
SHRUB AND WOODY VINE COVER LAYER 3	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
SHRUB AND WOODY VINE COVER LAYER 4	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
SHRUB AND WOODY VINE COVER – AERIAL VIEW	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
FORB COVER LAYER 1	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
FORB COVER LAYER 2	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
FORB COVER LAYER 3	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
FORB COVER LAYER 4	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
FORB COVER LAYER – AERIAL VIEW	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
GRAMINOID COVER LAYER 1	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
GRAMINOID COVER LAYER 2	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
GRAMINOID COVER LAYER 3	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent

Variable Name	Tolerance	MQO	Values	Units
GRAMINOID COVER LAYER 4	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
GRAMINOID COVER LAYER – AERIAL VIEW	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
SPECIES GROWTH HABIT	No errors	95% of the time	SD, SH, FB, GR, LT	n/a
SPECIES CODE	No errors	80% of the time	Accepted NRCS species code when the species is known, or an accepted NRCS genus or unknown code when the species is not known	n/a
UNIQUE SPECIES NUMBER	No errors	99% of the time	1-99, assigned in sequential numbers	n/a

Variable Name	Tolerance	MQO	Values	Units
SPECIES CANOPY COVER	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	001-100	percent
SPECIES VEGETATION LAYER	No errors	90% of the time	1 to 4	n/a
SPECIMEN OFFICIALLY COLLECTED	No errors	99% of the time	0, 1	n/a
SPECIMEN LABEL NUMBER	No errors	99% of the time	1 to 99999, as pre-printed and assigned by region	n/a
P2 SPECIMEN NOT COLLECTED REASON CODE	No errors	99% of the time	01-07, 10	n/a
VEGETATION SPECIES NOTES	n/a	n/a	English language words, phrases, and numbers	n/a
<b>Invasive Plants</b>				
INVASIVE PLANT SAMPLING STATUS	No errors	99% of the time	0 to 2	n/a
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
INVASIVE PLANT SUBPLOT STATUS	No errors	99% of the time	1 to 3	n/a
INVASIVE PLANT NONSAMPLED REASON	No errors	99% of the time	4, 5, 10	n/a
INVASIVE PLANT DATA NOTES	n/a	n/a	English language words, phrases, and numbers	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1-9	n/a

Variable Name	Tolerance	MQO	Values	Units
SPECIES CODE	No errors	99% of the time	Accepted NRCS species code from the appropriate list for the unit when the species is known, or a NRCS unknown code when the species is not known.	n/a
UNIQUE SPECIES NUMBER	No errors	99% of the time	1-99, assigned in sequential numbers	n/a
SPECIES CANOPY COVER	+/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%	90% of the time	000-100	percent
INVASIVE PLANT SPECIMENCOLLECTION RULE	No errors	99% of the time	0, 1	n/a
INVASIVE SPECIMEN COLLECTED	No errors	99% of the time	0, 1	n/a
SPECIMEN LABEL NUMBER	No errors	99% of the time	1 to 99999, as pre-printed and assigned by FIA unit	n/a
INVASIVE PLANT NOTES	n/a	n/a	English language words, phrases, and numbers	n/a

## Appendix 8. Tree Coding Guide

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
SAMPLE KIND 1 or 3						
	Live 1.0+DBH/DRC		1			
	Dead 5.0+ DBH/DRC		2			
SAMPLE KIND 2 (Remeasure)						
Live 5.0+ DBH/DRC	Live 5.0+ DBH/DRC	1	1			
Live 1.0-4.9 DBH/DRC on microplot	Live 5.0+ DBH	1	1			
Live 1.0-4.9 DBH/DRC on microplot	Live 1.0-4.9 DBH/DRC on microplot	1	1			
Live 5.0+ DBH/DRC	Live but shrank < 5.0 and on microplot	1	1			
Live 1 inch +	Live but land no longer qualifies as forest	1	1			
Live 5.0+ DBH/DRC	Standing dead 5.0+	1	2		1	10-80
Live 5.0+ DBH/DRC	Down dead 5.0+	1	2		0	10-80
Live 1.0-4.9 DBH/DRC on microplot	Dead 1.0-4.9 DBH/DRC	1	2		0	10-80
Live 1.0-4.9 DBH/DRC on microplot	Dead 5.0+ (standing or down)	1	2		0 or 1	10-80
RM Live 1.0-4.9" DBH/DRC	Dead tree shrank <1.0"	1	2		0	10-80

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Live 1.0+ DBH/ DRC	Cruiser unable to locate tree due to a weather (including geologic, such as landslide) or fire event & assume tree is down dead or you can see tree and it is dead and off the plot	1	2		0	30 or 50
Live 1.0+ DBH/ DRC	Cut and left in the woods	1	2		0	80
Live 1 inch +	Dead and land no longer qualifies as forest (land clearing or conversion to nonforest land use)	1	2		0 or 1	10-80
Live 1.0+ DBH/ DRC	Tree removed (cut and hauled away)	1	3			80
Live 1 inch +	Gone (cut and removed?) and land no longer qualifies as forest	1	3			80
Dead 5.0+ DBH/ DRC	Dead standing 5.0 DBH/DRC	2	2		1	
Dead 5.0+ DBH/ DRC	Dead down 5.0+	2	2		0	
Dead 5.0+ DBH/ DRC	Dead DBH/DRC < 5.0	2	2		0	
Dead 5.0+ DBH/ DRC	Cruiser is unable to locate tree due to a weather (including geologic) or fire event & assume it is down dead	2	2		0	

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Dead 5.0+ DBH/ DRC	Tree removed (cut and hauled away)	2	3			
RM Live 5.0+ DBH/DRC	Dead tree shrank <5.0"	1	2		0	10-80
Live 5.0+ DBH/ DRC	(RM Live) tree shrank <5.0 and NOT on microplot	1	0	5		
Live 1.0-4.9 DBH/ DRC	(RM Live) Tree shrank <1.0	1	0	5		
Live 1.0-4.9 DBH/ DRC	Live 1.0-4.9 DBH/DRC, shouldn't have been tallied—beyond 6.8—cruiser error	1	0	7		
Live 5.0+ DBH/ DRC	Live 5.0+ DBH/ DRC, shouldn't have been tallied –beyond 24.0—cruiser error	1	0	7		
Live 1.0+ DBH/ DRC	No longer a tally species	1	0	8		
Live 1.0+ DBH/ DRC	Tree moved off plot due to a geologic (e.g., slight earth movement) or weather event (e.g., hurricane) and you can still see it (Live before, live now)	1	0	6		
Live 1 inch +	Nonsampled area now	1	0	9		
Dead 5.0+ DBH/ DRC	No longer a tally species	2	0	8		

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Dead 5.0 DBH/ DRC	Tree moved off plot due to a geologic (e.g., small earth movement) or weather event (e.g., hurricane) and you can still see the tree	2	0	6		
Dead 5 inch +	Nonsampled area now	2	0	9		
Missed live	Live 1.0+ DBH/DRC	-	1	3		
< 5.0 live	5.0+ DBH/DRC live (not on the microplot)	-	1	1		
< 1.0 live	1.0-4.9 DBH/ DRC live	-	1	1		
< 1.0 live	5.0+ DBH/ DRC live (on the microplot) (Through growth)	-	1	2		
Nonsampled area before	Live 1 inch +	-	1	3		
Nonforest before	Forest now, Live 1 inch+	-	1	1		
Missed dead	Dead 5.0+ DBH/DRC	-	2	4	1	
Missed live	Dead 5.0+ DBH/DRC	-	2	3	1	10-80
< 5.0 live	5.0+ DBH/DRC dead (very rare)	-	2	1	0 or 1	10-80
Nonsampled area before	Standing Dead 5 inch+	-	2	3 or 4		
Nonforest before	Forest now, Standing Dead 5 inch+	-	2	1		

## Appendix 9. Invasive Plant List

			Forest Service Regions and States in which the invasive plant species data are collected						
PLANTS Code	Scientific name	Common name	NRS <sup>a</sup>	PNW AK <sup>b</sup>	PNW R5 <sup>c</sup>	RM States <sup>d</sup>	SR All <sup>e</sup>	SR Added for FL <sup>f</sup>	SR group <sup>g</sup>
ABPR3	<i>Abrus precatorius</i>	rosarypea						Y	
ABTH	<i>Abutilon theophrasti</i>	velvetleaf				CO			
ACPL	<i>Acer platanoides</i>	Norway maple	Y						
ACBR5	<i>Achnatherum brachychaetum</i>	short-bristled needlegrass				AZ			
ACRE3	<i>Acroptilon repens</i>	hardheads				AZ, CO, ID, MT, NV, NM, UT, WY			
AECY	<i>Aegilops cylindrica</i>	jointed goatgrass				AZ, CO, ID, NM			
AIAL	<i>Ailanthus altissima</i>	tree of heaven (341) <sup>h</sup>	Y				Y	Y	
ALJU	<i>Albizia julibrissin</i>	silktree (345) <sup>h</sup>	Y				Y	Y	
ALMA12	<i>Alhagi maurorum</i>	camelthorn				AZ, CO, NV, NM			
ALPE4	<i>Alliaria petiolata</i>	garlic mustard	Y	Y			Y	Y	
ALPH	<i>Alternanthera philoxeroides</i>	alligator-weed				AZ			
AMTO3	<i>Ambrosia tomentosa</i>	skeleton-leaf burr ragweed				ID, WY			
ANCR2	<i>Anoda cristata</i>	crested anoda				CO			
ANAR6	<i>Anthemis arvensis</i>	corn chamomile				CO			
ANCO2	<i>Anthemis cotula</i>	stinking chamomile				CO, NV			

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ARM12	<i>Arctium minus</i>	lesser burdock				CO, WY			
ARCR80	<i>Ardisia crenata</i>	hen's eyes						Y	
ARAB3	<i>Artemisia absinthium</i>	absinthium				CO			
ARDO4	<i>Arundo donax</i>	giant reed					Y	Y	
ASF12	<i>Asphodelus fistulosus</i>	onionweed				NM			
BAMBU	<i>Bambusa</i>	Non-native bamboos					Y	Y	1
BETH	<i>Berberis thunbergii</i>	Japanese barberry	Y						
BEVU	<i>Berberis vulgaris</i>	Common barberry	Y						
BRIN2	<i>Bromus inermis</i>	smooth brome		Y					
BRITE	<i>Bromus tectorum</i>	cheatgrass		Y		CO			
CABU2	<i>Capsella bursa-pastoris</i>	shepherd's purse		Y					
CAAR18	<i>Caragana arborescens</i>	Siberian peashrub		Y					
CACH10	<i>Cardaria chalapensis</i>	lenspod whitetop				AZ			
CADR	<i>Cardaria draba</i>	whitetop				AZ, CO, ID, MT, NV, NM, UT, WY			
CAPU6	<i>Cardaria pubescens</i>	hairy whitetop				AZ, WY			
CAAC	<i>Carduus acanthoides</i>	spiny plumeless thistle				AZ, CO, WY			
CANU4	<i>Carduus nutans</i>	nodding plumeless thistle			Y	CO, ID, NV, NM, UT, WY			
CACA19	<i>Carum carvi</i>	caraway				CO			

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CAEQ	Casuarina equisetifolia	beach sheoak						Y	
CEOR7	Celastrus orbiculatus	oriental bit-tersweet	Y				Y	Y	
CEEC	Cenchrus echinatus	southern sandbur				AZ			
CESP4	Cenchrus spinifex	coastal sandbur				AZ			
CEBI2	Centaurea biebersteinii	spotted knapweed	Y	Y	Y	AZ, CO, ID, MT, NV, NM, UT, WY			
CECA2	Centaurea calcitrapa	red star-thistle				AZ, NV, NM			
CEDE5	Centaurea debeauxii	meadow knapweed				CO, ID			
CEDI3	Centaurea diffusa	white knapweed			Y	AZ, CO, ID, MT, NV, NM, UT, WY			
CEIB	Centaurea iberica	Iberian knapweed				AZ, NV			
CEME2	Centaurea melitensis	Maltese star-thistle				NV, NM			
CES03	Centaurea solstitialis	yellow star-thistle			Y	AZ, CO, ID, MT, NV, NM, UT			
CESU	Centaurea sulphurea	sulphur knapweed				AZ, CO			
CETR8	Centaurea triumfettii	squarrose knapweed				AZ, CO, NV, UT			
CHJU	Chondrilla juncea	hogbite			Y	AZ, CO, ID, MT, NV			
CIIN	Cichorium intybus	chicory				CO			
CIMA2	Cicuta maculata	spotted water hemlock				NV			

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CICA	Cinnamomum camphora	camphor-tree						Y	
CIAR4	Cirsium arvense	Canada thistle	Y	Y	Y	AZ, CO, ID, MT, NV, NM, UT, WY			
CIVU	Cirsium vulgare	bull thistle	Y	Y		CO, NM			
CLOR	Clematis orientalis	oriental virginibower				CO			
COMA2	Conium maculatum	poison hemlock				CO, ID, NV, NM			
COAR4	Convolvulus arvensis	field bindweed				AZ, CO, ID, MT, NM, UT, WY			
COSQ	Coronopus squamatus	greater swinecress				AZ			
CRTE3	Crepis tectorum	narrowleaf hawk-beard		Y					
CRVU2	Crupina vulgaris	common crupina				CO, ID, NV			
CUME	Cucumis melo	cantaloupe				AZ			
CUAN4	Cupaniopsis anacardioides	carrotwood						Y	
CUSCU	Cuscuta	Dodder				AZ			
CYLO11	Cynanchum louiseae	Louis' swallow-wort	Y						
CYRO8	Cynanchum rossicum	European swallow-wort	Y						
CYDA	Cynodon dactylon	Bermudagrass				UT			
CYOF	Cynoglossum officinale	gypsy-flower				CO, MT, NV, WY			

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CYES	<i>Cyperus esculentus</i>	chufa flatsedge				CO			
CYSC4	<i>Cytisus scoparius</i>	scotchbroom		Y		ID			
DAGL	<i>Dactylis glomerata</i>	orchardgrass		Y					
DIBU	<i>Dioscorea bulbifera</i>	air yam					Y	Y	4
DIOP	<i>Dioscorea oppositifolia</i>	Chinese yam					Y	Y	4
DIFU2	<i>Dipsacus fullonum</i>	Fuller's teasel				CO,NM			
DILA4	<i>Dipsacus laciniatus</i>	Cutleaf teasel				CO			
DRAR7	<i>Drymaria arenarioides</i>	sandwort drymary				AZ, NM			
EIAZ2	<i>Eichhornia azurea</i>	anchored water hyacinth				AZ			
EICR	<i>Eichhornia crassipes</i>	common water hyacinth				AZ			
ELAN	<i>Elaeagnus angustifolia</i>	Russian olive	Y			CO, NM	Y	Y	
ELPU2	<i>Elaeagnus pungens</i>	thorny olive					Y	Y	
ELUM	<i>Elaeagnus umbellata</i>	autumn olive	Y				Y	Y	
ELRE4	<i>Elymus repens</i>	quackgrass		Y		AZ, CO, UT, WY			
ERIC6	<i>Erodium cicutarium</i>	redstem stork's bill				CO			
EUUN2	<i>Eugenia uniflora</i>	Surinam cherry						Y	
EUAL8	<i>Euonymus alata</i>	winged burning bush					Y	Y	
EUF05	<i>Euonymus fortunei</i>	winter creeper					Y	Y	

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EUCY2	<i>Euphorbia cyparissias</i>	cypress spurge				CO			
EUDE4	<i>Euphorbia dentata</i>	toothed spurge				ID			
EUES	<i>Euphorbia esula</i>	leafy spurge	Y		Y	AZ, CO, ID, MT, NV, NM, UT, WY			
EUMY2	<i>Euphorbia myrsinites</i>	myrtle spurge				CO			
EUOB4	<i>Euphorbia oblongata</i>	eggleaf spurge			Y				
EUMU	<i>Euryops multifidus</i>	hawk's eye				AZ			
FRAL4	<i>Frangula alnus</i>	glossy buckthorn	Y						
GAOF	<i>Galega officinalis</i>	professor-weed				NV			
GALEO	<i>Galeopsis</i>	hempnettle		Y					
GEMO2	<i>Genista monspesulana</i>	French broom			Y				
HAGL	<i>Halogeton glomeratus</i>	saltlover				AZ, CO, NM			
HEHE	<i>Hedera helix</i>	English ivy	Y				Y	Y	
HECI	<i>Helianthus ciliaris</i>	Texas blueweed				AZ			
HEMA3	<i>Hesperis matronalis</i>	dames rocket	Y			CO			
HITR	<i>Hibiscus trionum</i>	flower of an hour				CO			
HIAU	<i>Hieracium aurantiacum</i>	orange hawkweed		Y		CO, ID, MT			
HICA10	<i>Hieracium caespitosum</i>	meadow hawkweed		Y		ID, MT			
HIPI	<i>Hieracium pilosella</i>	mouseear hawkweed		Y					
HIPI2	<i>Hieracium piloselloides</i>	tall hawkweed				MT			

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HIUM	Hieracium umbellatum	narrowleaf hawkweed		Y					
HIFL3	Hieracium x floribundum					MT			
HOJU	Hordeum jubatum	foxtail barley		Y					
HYVE3	Hydrilla verticillata	waterthyme				AZ, CO, NV, NM			
HYNI	Hyoscyamus niger	black henbane				CO, ID, NV, NM			
HYPE	Hypericum perforatum	common St. Johnswort			Y	CO, MT, NV, WY			
HYRA3	Hypochaeris radicata	hairy catsear		Y					
IMGL	Impatiens glandulifera	ornamental jewelweed		Y					
IMCY	Imperata cylindrica	cogongrass					Y	Y	
INHI	Indigofera hirsuta	roughhairy indigo						Y	
IPOMO	Ipomoea	morning-glory				AZ			
IPTR2	Ipomoea triloba	littlebell				AZ			
IRPS	Iris pseudacorus	paleyellow iris				MT			
ISTI	Isatis tinctoria	Dyer's woad				CO, ID, MT, NV, NM, UT, WY			
KOSC	Kochia scoparia	Mexican fireweed							
LACA2	Lantana camara	lantana						Y	
LASQ	Lappula squarrosa	European stickseed		Y					
LELA2	Lepidium latifolium	broad-leaved pepperweed				CO, ID, MT, NV, NM, UT, WY			

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LEBI2	Lespedeza bicolor	shrubby lespedeza					Y	Y	
LECU	Lespedeza cuneata	Chinese lespedeza				CO	Y	Y	
LEVU	Leucanthemum vulgare	oxeye daisy		Y		CO, MT, WY			
LIJA	Ligustrum japonicum	Japanese privet					Y	Y	7
LILU2	Ligustrum lucidum	glossy privet					Y	Y	7
LISI	Ligustrum sinense	Chinese privet					Y	Y	9
LIVU	Ligustrum vulgare	common privet	Y				Y	Y	9
LIDA	Linaria dalmatica	Dalmatian toadflax				AZ, CO, ID, MT, NV, NM, WY			
LIGE	Linaria genistifolia	broomleaf toadflax				CO			
LIVU2	Linaria vulgaris	butter and eggs		Y		CO, ID, MT, NV, NM, WY			
LOLIU	Lolium	ryegrass		Y					
LOAR10	Lolium arundinaceum	tall fescue					Y	Y	
LONIC	Lonicera <sup>j</sup>	Non-native bush honeysuckles					Y	Y	
LOJA	Lonicera japonica	Japanese honeysuckle	Y				Y	Y	
LOMA6	Lonicera maackii	Amur honeysuckle	Y						
LOMO2	Lonicera morrowii	Morrow's honeysuckle	Y						
LOTA	Lonicera tatarica	Tatarian honeysuckle	Y						

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LOBE	Lonicera x bella	Showy fly honey-suckle	Y						
LYJA	Lygodium japonicum	Japanese climbing fern					Y	Y	
LYMI	Lygodium microphyllum	small-leaf climbing fern						Y	
LYNU	Lysimachia nummularia	creeping jenny	Y						
LYSA2	Lythrum salicaria	purple loosestrife	Y			AZ, CO, ID, MT, NV, NM, UT, WY			
LYVI3	Lythrum virgatum	European wand loosestrife				MT, NV			
MAUN3	Macfadyena unguis-cati	catclawvine						Y	
MADI6	Matricaria discoidea	disc mayweed		Y					
MEDIC	Medicago	alfalfa		Y					
MEPO3	Medicago polymorpha	burclover				AZ			
MEQU	Melaleuca quinque-nervia	punktree (992) h	Y					Y	
MEAZ	Melia azedarach	Chinaberrytree (993) h	Y				Y	Y	
MEAL12	Melilotus alba	white sweetclover		Y					
MEOF	Melilotus officinalis	yellow sweetclover		Y					
MIVI	Microstegium vimineum	Nepalese browntop	Y				Y	Y	
MIVE3	Millium vernale	spring milletgrass				ID			

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MISI	Miscanthus sinensis	Chinese silvergrass					Y	Y	
MYSP2	Myriophyllum spicatum	spike watermilfoil				CO, ID, MT, NV, NM			
NADO	Nandina domestica	sacred bamboo					Y	Y	
NAST3	Nardus stricta	matgrass				ID			
NATR3	Nassella trichotoma	serrated tussock grass				AZ			
NECO3	Nephrolepis cordifolia	narrow swordfern						Y	
ONAC	Onopordum acanthium	Scotch cottonthistle				AZ, CO, ID, NV, NM, UT, WY			
ONTA	Onopordum tauricum	bull cottonthistle				CO			
ORRA	Orobanche ramosa	hemp broomrape				AZ			
PAFO3	Paederia foetida	stinkvine						Y	
PAMI2	Panicum miliaceum	broomcorn millet				CO			
PARE3	Panicum repens	torpedo grass				AZ			
PATO2	Paulownia tomentosa	princess tree (712) h	Y				Y	Y	
PEHA	Peganum harmala	harmal peganum				AZ, CO, NV, NM			
PECI	Pennisetum ciliare	Buffelgrass				AZ			
PEPU2	Pennisetum purpureum	elephant grass						Y	
PHAR3	Phalaris arundinacea	reed canarygrass	Y	Y					
PHPR3	Phleum pratense	timothy		Y					

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PHAU7	Phragmites australis	common reed	Y						
PHYLL6	Phyllostachys	Non-native bamboos					Y	Y	1
PLMA2	Plantago major	common plantain		Y					
POAV	Polygonum aviculare	prostrate knotweed		Y					
POCU6	Polygonum cuspidatum	Japanese knotweed	Y	Y					
POSA4	Polygonum sachalinense	giant knotweed	Y						
POBO10	Polygonum x. bohemicum <sup>j</sup>	Japanese/giant knotweed hybrid	Y						
POOL	Portulaca oleracea	little hogweed				AZ			
PORE5	Potentilla recta	sulphur cinquefoil				CO, MT, NV			
PRPA5	Prunus padus	European bird cherry		Y					
PSGU	Psidium guajava	guava						Y	
PUMOL	Pueraria montana var. lobata	kudzu					Y	Y	
PYCA80	Pyrus calleryana	Callery pear					Y	Y	
RAAC3	Ranunculus acris	tall buttercup				MT			
RARE3	Ranunculus repens	creeping buttercup		Y					
RHCA3	Rhamnus cathartica	common buckthorn	Y						
RHTO	Rhodomyrtus tomentosus	rose myrtle						Y	

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ROPS	<i>Robinia pseudoacacia</i>	black locust	Y						
ROAU	<i>Rorippa austriaca</i>	Austrian yellowcress				AZ, NV			
ROSA5	<i>Rosa</i>	non-native rose					Y	Y	
ROMU	<i>Rosa multiflora</i>	multiflora rose	Y						
SAAE	<i>Salvia aethiops</i>	Mediterranean sage				CO, NV			
SAMO5	<i>Salvinia molesta</i>	kariba-weed				AZ, CO, NV			
SAOF4	<i>Saponaria officinalis</i>	bouncing-bet				CO			
SCAC2	<i>Schefflera actinophylla</i>	octopus tree						Y	
SCTE	<i>Schinus terebinthifolius</i>	Brazilian peppertree						Y	
SEJA	<i>Senecio jacobaea</i>	stinking willie		Y		AZ, CO, ID, MT			
SEVU	<i>Senecio vulgaris</i>	old-man-in-the-Spring		Y					
SOCA3	<i>Solanum carolinense</i>	Carolina horsenettle				AZ, NV			
SOEL	<i>Solanum elaeagnifolium</i>	silverleaf nightshade				ID, NV			
SORO	<i>Solanum rostratum</i>	buffalobur nightshade				ID			
SOTA3	<i>Solanum tampicense</i>	scrambling nightshade						Y	
SOVI2	<i>Solanum viarum</i>	tropical soda apple				AZ	Y	Y	
SOAR2	<i>Sonchus arvensis</i>	field sowthistle		Y		AZ, CO, ID, NV, WY			
SOAL	<i>Sorghum alnum</i>	Columbus grass				NV, UT			

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SOBI2	<i>Sorghum bicolor</i>	sorghum				NV			
SOHA	<i>Sorghum halepense</i>	Johnson-grass				CO, ID, NV, UT			
SOPR3	<i>Sorghum propinquum</i>	sorghum				NV			
SPSA3	<i>Sphaerophysa salsula</i>	alkali swainson-pea				NV			
SPJA	<i>Spiraea japonica</i>	Japanese meadow-sweet	Y						
STME2	<i>Stellaria media</i>	common chickweed		Y					
STRIG	<i>Striga</i>	witchweed				AZ			
SYCU	<i>Syzygium cumini</i>	Java plum					Y		
TACA8	<i>Taeniatherum caput-medusae</i>	medusa-head			Y	CO, NV, UT			
TAMAR2	<i>Tamarix</i>	tamarisk				MT, NM, WY			
TACH2	<i>Tamarix chinensis</i>	Fivestamen tamarisk				CO			
TAPA4	<i>Tamarix parviflora</i>	smallflower tamarisk				CO, NV			
TARA	<i>Tamarix ramosissima</i>	saltcedar	Y			CO, NV			
TAVU	<i>Tanacetum vulgare</i>	common tansy		Y		CO, MT			
TAOF	<i>Taraxacum officinale</i>	common dandelion		Y					
TRDU	<i>Tragopogon dubius</i>	yellow salsify		Y					
TRNA	<i>Trapa natans</i>	water chestnut				AZ			
TRSE6	<i>Triadica sebifera</i>	tallowtree (994) h	Y				Y	Y	
TRTE	<i>Tribulus terrestris</i>	puncturevine				AZ, CO, ID, NV			

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TRIFO	Trifolium	clover		Y					
TRPE21	Tripleurospermum perforata	scentless false mayweed				CO			
ULPU	Ulmus pumila	Siberian elm (974) h	Y			NM			
VEBL	Verbascum blattaria	moth mullein				CO			
VETH	Verbascum thapsus	common mullein				CO			
VIOP	Viburnum opulus	European cranberrybush	Y						
VICRC	Vicia cracca ssp. cracca	bird vetch		Y					
VIMA	Vinca major	bigleaf periwinkle					Y	Y	12
VIMI2	Vinca minor	common periwinkle					Y	Y	12
WIFL	Wisteria floribunda	Japanese wisteria					Y	Y	13
WISI	Wisteria sinensis	Chinese wisteria					Y	Y	13
ZYFA	Zygophyllum fabago	Syrian beancaper				ID			
<b>Total number of species:</b>			43	44	11	128	40	60	

<sup>a</sup> Northern Research Station (formerly Northeast Research Station and North Central Research Station)

<sup>b</sup> Pacific Northwest Research Station - Alaska

<sup>c</sup> Pacific Northwest Research Station – Region 5 only list

<sup>d</sup> Rocky Mountain Research Station States

<sup>e</sup> Southern Research Station - species recorded in all SRS areas

<sup>f</sup> Southern Research Station – additional species recorded in Florida only

<sup>g</sup> Southern Research Station – species with the same number in this column indicate that the SRS crews are not asked to distinguish among those species. So a code may refer to any species in the group.

- <sup>h</sup> Number corresponds to appendix 3 , the FIA Species Code List
- <sup>i</sup> Consists of *L. maackii*, *L. morrowii*, *L. tatarica*, *L. fragrantissima*, or *L. x bella*
- <sup>j</sup> Species not in PLANTS 2000

## Appendix 10. Unknown Plant Specimen Collection

The following information describes some useful procedures and examples of data-collection aids for collecting plant specimens. The preferred option is to use procedures developed for the P3 Vegetation Indicator protocol which relies on automated data-recorder and database tracking of plant specimens. This protocol also automates the creation of labels for specimens that can be downloaded and printed.

If your unit requires collection of plant specimens for species that:

- 1) may be on the invasive species list for your area that you cannot identify quickly and confidently using field guides but are potentially identifiable, or
- 2) are on the invasive species list for your area but are a new record for the state,

follow these basic steps:

1. Assign a valid SPECIES CODE.
2. Record if a specimen was collected or not in INVASIVE SPECIMEN COLLECTED.
3. When a specimen is collected, enter a SPECIMEN LABEL NUMBER. Place the pre-printed label with the corresponding label number in the bag with the specimen.
4. Describe any newly encountered unknown species in INVASIVE PLANTS NOTES.
5. Record the canopy cover estimates of the unknown species on the condition on the subplot where encountered.

### Example Field Specimen Label

Where specimen collection is part of the protocol, each crew will be issued a set of printed, pre-numbered labels to track unknown specimens. The information to be completed by hand in the field is optional, but may include date, unknown code, unique species number and crew name.

Label Number:1 Date: 8/06/06 Unknown Code:ACANT2    Unique Species Nbr:1 Veg Spec. crew: John Doe
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### Example Specimen Label

Official specimen labels are printed from plot data collected in the data-recorder (PDR) and accompany the unknown specimen as it is pressed, dried and submitted for further identification. Labels will not include sensitive plot identification data – the unique specimen label number is sufficient identification for each specimen.

<b>Specimen Label</b>			
State:	Ohio	County:	Lawrence
Plot:			
Label Number:	21	Resolved Species Code:	
<b>Resolved scientific name:</b>			
Resolved by (name):			
Date Collected:	6/22/2005		
Unknown Code:	2GRAM	Unique Species Nbr:	7
<b>Field collected scientific name:</b>			
Collected by:	(name or number)		
Community type(s)	bottomland, old stripmine		
where found:			
ridgetop with atv trl, stripped yrs ago moist bottom			
Species Notes: delicate, hairy joints			

Collecting and pressing plants

If fewer than 5 individuals of an unknown herbaceous plant species are present do not collect.

Use a digging tool to extract the entire plant, including any underground portions, flowers, fruits, and leaves. If the plant is abundant, collection of two samples will increase the likelihood of a good specimen.

Collected unknown specimens should be transported in the field and from the field in the 1 and/or 2 gallon zip-lock bags provided. Only one species and label may be placed in a single bag. Acceptable methods of transporting collected specimens include:

- Use a 3-hole-punch to punch holes in the bottom of your bags prior to traveling in the field. Place the punched bags into a 2-inch 3-ring binder with the zip-lock portion facing outward. Plants can then be placed with labels into the bag directly in the binder. This method prevents crumpling, tearing, and destroying the specimen during transportation.
- Use a 1-hole-punch to punch a hole in the one upper corner of each bag. The hole should be placed in such a manner that it cannot easily be torn. Place the bags on an aluminum carabineer (available at drug stores) or on heavy twine and fasten to your field vest or backpack. Be careful to seal the plants and labels securely inside the bags to prevent accidental loss.

Press and label the plant if not identified by the end of the day:

- A. After returning to the field office print all of the labels associated with the collected unknown specimens. The printed labels should now have all of the plot information (plot number, state, notes, unknown code, etc.) in addition to the original label number, make sure that the printed information is correct and matches the unknown specimen before including it in the press.

- B. Each specimen representing a unique species should be placed individually inside a single layer of folded newsprint. Each specimen is to be accompanied by its corresponding unknown specimen label. Small plant specimens are to be pressed individually. Large plant specimens may be folded in a “v”, “z”, or “w” arrangement to fit on a single newsprint page. Arrange the specimen so that at least one upper and one lower leaf surface is exposed. Plants may be trimmed to reduce bulk, so long as all diagnostic parts are included. Diagnostic portions include stem sections, petioles, leaves, roots, flowers, and fruits. Bulky fruits or nuts may be stored separately in a paper envelope that is taped to the newsprint and is accompanied by an identical copy of the specimen's unknown label. Unknown codes can be written on the outside of the folded newspaper to aid sorting as specimens are processed.
- C. Stack the specimens in their individual newsprint sleeves between two pieces of cardboard. Bind the cardboard and plants together using a piece of twine or flat cloth ribbon wrapped around the length and width of the cardboard bundle. For mailing numerous specimens, several bundles may be used. Place all bundles inside a cardboard box for shipping.

Package and submit specimens as dictated by your FIA unit or lab. It is suggested that Unknown specimens be packaged and shipped at the end of every work week. Exceptions will be made when extended field excursions prevent the vegetation specialist from reaching a post office.

All packaged specimens are to be accompanied by a legible completed label. Unknown Spreadsheets tracking collected unknown plants are generated from the PDR plot file.

**RM** All specimens collected in ID, MT, ND, SD, and WY are sent to:

Eric Vanderbeek:  
c/o Lewistown BLM Field Office  
920 NE Main St  
Lewistown, MT 59457

All specimens collected in AZ, CO, NM, NV, and UT are sent to:  
Darin Toone  
USDA Forest Service  
507 25th Street  
Ogden, UT 84401

**Send the unknowns as soon as possible to avoid being lost or destroyed during the field season and to be identified while the sample is still in good shape.**

RM Appendix A. Field Forms

Appendix A.1 Field Location Reference Record

Field Location Reference										
STATE _____		COUNTY _____		P2 PLOT # _____						
FIELD CREW (first initial, last name, crew number)										
RECORDER _____		CREW 1 _____		CREW 2 _____		CREW 3 _____				
crew # _____		crew # _____		crew # _____		crew # _____				
APPROXIMATE GPS DISTANCE AND AZIMUTH TO PC FROM PARKING SPOT:										
DISTANCE _____		AZIMUTH _____								
COORDINATES										
	GPS #	ERROR	# READINGS	ELEVATION	LAT. DEG.	LAT. MIN.	LAT. SEC.	LONG. DEG.	LONG. MIN.	LONG. SEC.
TRUCK										
ATV										
RP										
OTHER*										
PC										
OTHER*										
If Coordinates not taken at the PC: DISTANCE TO PC _____ AZIMUTH TO PC _____										
* Examples of other helpful coordinates could be trail intersections, Hellspits, Campsites, etc.										
REFERENCE POINT DESCRIPTION AND TRAVERSE INFO. TO PC										
AZIMUTH _____		H. DISTANCE _____		SLOPE DIST. _____		RP SPECIES _____		DIAMETER _____		
RP DESCRIPTION:										
PC WITNESS TREES										
X AZIMUTH _____		X SLOPE DIST. _____		X SPECIES _____		X DIAMETER _____				
Y AZIMUTH _____		Y SLOPE DIST. _____		Y SPECIES _____		Y DIAMETER _____				
NOTES:										
OWNER INFORMATION (do not put private land owner info. In PDR) - include all relevant owner info. to get to the PC										
ACCESS INFORMATION (yes or no)										
OWNER CONTACTED? _____		4X4 NEEDED? _____		ATV RECOMMENDED? _____		LOCKED GATE? _____				
FIELD CREW EDIT:										
NAME: _____					DATE: _____					
MISC. NOTES:										
Revised 11/9/10										

### Appendix A.2 Field Location Map and Condition Boundary Map

<p><b>FIELD LOCATION MAP</b> (Draw roads/landmarks/features helpful to the next crew)</p> <p style="text-align: right;">↑ N</p>
<p><b>PC REFERENCE &amp; CONDITION BOUNDARY MAP</b></p> <p style="text-align: right;">↑ N</p> <div style="text-align: center;"><p>The diagram shows three circular plots, each with a central square and seven tick marks around the perimeter. The tick marks are labeled with angles: 360, 45, 90, 135, 180, 225, and 270. The top plot is centered, the middle plot is slightly below it, and the bottom two plots are positioned to the left and right of the middle plot.</p></div>

### Appendix A.3 Field Location and Subplot Description Record

Field Location Description and Subplot Description Record					
<b>PLOT LEVEL DATA</b>					
State	County	Plot Number	Plot Status		
Nonforest Samp. Stat.	Nonforest Plot Stat.	Nonsampled Reason	NF Nonsampled reason		
Subplots Examined	Sample Kind	Reg. Sample Kind	Previous Plot #		
Date	Hor. Dist. to Imp.Rd	Water on Plot	QA Status		
Recorder	Crew 1	Crew 2	Crew 3		
Addtl Owner Contact?	4x4?	ATV?	Locked Gate?		
Past # Points Acc.	Actual # Points Acc.	Past # Micros Acc.	Actual # Micros Acc.		
Accounting Land Use	Co-Located?	Future Forest Pot.	Condition Class Change		
<b>PC COORDINATES</b>					
GPS Type	GPS Serial #	GPS Error	# of Readings		
GPS Elevation	Azimuth to PC	Dist. to PC			
Lat. Degrees	Lat. Minutes	Lat. Seconds			
Long. Degrees	Long. Minutes	Long. Seconds			
<b>NOTES:</b>					
<b>SUBPLOT DESCRIPTION</b>					
	SUBPLOT 1	SUBPLOT 2	SUBPLOT 3	SUBPLOT 4	NOTES:
Subplot Status					
Nonsampled Reason					
NF Subplot Status					
NF Subplot Nonsampled Reason					
Subplot Condition List					
Subplot Cntr Cond.					
Micro Cntr Cond.					
% Slope					
Aspect					
Water Depth					
Root Disease (MT.ID)					
P2 Veg Subplot Sampled Stat.					
<b>BOUNDARY INFORMATION</b>					
	SUBPLOT 1	SUBPLOT 2	SUBPLOT 3	SUBPLOT 4	Notes:
Plot Type					
Bndry Change					
Contrasting Cond #					
Azimuth left					
Corner Azimuth					
Corner Dist					
Azimuth Right					
<b>PLOT NOTES:</b>					
11/10/2010					

Appendix A.4 Condition Class Description Record

Condition Class Description Record					
State	County	Plot Number			
	Condition 1	Condition 2	Condition 3	Condition 4	
Condition Class Status					
Condition Nonsampled Reason					
Nonforest Condition Class Status					
Nonforest Cond. Nonsampled Reas.					
Present Nonforest Land Use					
Reserved Status					
Owner Group					
Owner Class					
Forest Type					
Stand Size					
Regeneration Status					
Regeneration Species					
Tree Density					
Private/Industrial Status					
Physiographic Class					
Stand Age					
Habitat Type 1					
Habitat Type 2					
Crown Cover					
Percent Bare Ground					
Live Crown Cover					
Live Plus Missing Crown Cover					
Total Seedlings					
Land Use					
Tree Form					
Disturbance 1					
Dist. Year 1					
Disturbance 2					
Dist. Year 2					
Disturbance 3					
Dist. Year 3					
Treatment 1					
Treatment Year 1					
Treatment 2					
Treatment Year 2					
Treatment 3					
Treatment Yr 3					
Canopy Cover Sample Method					
Live Canopy Cover					
Live Plus Missing Canopy Cover					
Total Stems					
Condition Class Comments:					











Appendix A.9 Crown/Ground Cover Supplemental Data Form

CROWN/GROUND COVER SUPPLEMENTAL DATA FORM															1/07			
(Note: Save this record. Transfer percentages to Condition Description record)																		
STATE: _____				COUNTY: _____				LOCATION: _____				HEX: _____						
* Method 2 is optional in determining % bare ground. Use if % bare ground is very high, as a calibration tool, or if crew is uncomfortable with an estimate.																		
<b>Subplot</b>																		
COND # _____	1				2				3				4				TOTAL	COND. %
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W		
Feet of Crown Intercept																		→ =
Total Feet in Transect																		→ =
To calculate Condition % Crown Cover - Divide the total crown intercept by the total length of transect for each condition																		
Bare Ground (Method 2)*																		→ =
Total Points in Transect																		→ =
To Calculate Condition % Bare Ground (Method 2) - Divide the total number of bare ground "points" by the total number of "points" in the condition																		
% Bare Ground (Method 1)																		→ =
To Calculate Condition % Bare Ground (Method 1) - Divide the visually estimated total % bare ground by the number of subplots sampled																		
<b>Subplot</b>																		
COND # _____	1				2				3				4				TOTAL	COND. %
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W		
Feet of Crown Intercept																		→ =
Total Feet in Transect																		→ =
To calculate Condition % Crown Cover - Divide the total crown intercept by the total length of transect for each condition																		
Bare Ground (Method 2)*																		→ =
Total Points in Transect																		→ =
To Calculate Condition % Bare Ground (Method 2) - Divide the total number of bare ground "points" by the total number of "points" in the condition																		
% Bare Ground (Method 1)																		→ =
To Calculate Condition % Bare Ground (Method 1) - Divide the total % bare ground by the number of subplots sampled																		
Notes:																		

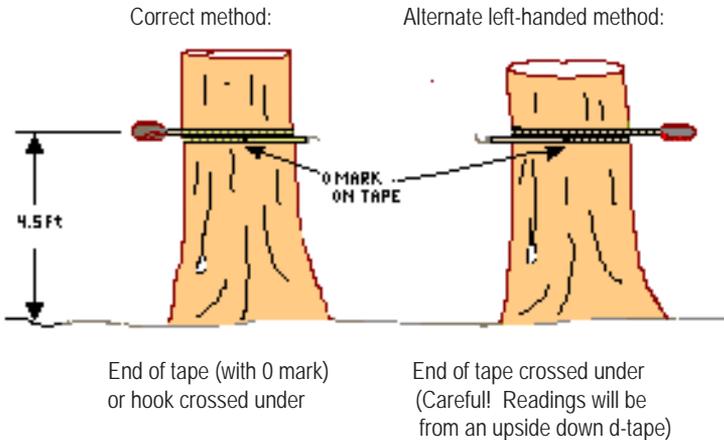




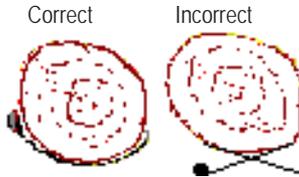


## RM Appendix B. Tree Data Techniques

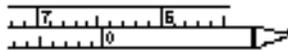
### RM Appendix B.1 Diameter Measurement Techniques for Timber Species



Press tape firmly against the tree; Do not pull it out at a tangent to the tree at the point of measurement.

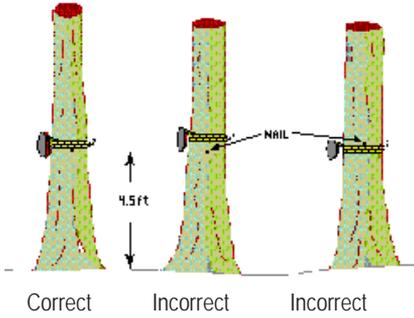


The diameter must be read at the exact point marked -- above the 0 mark.  
Always round down to the nearest 0.1 inch:

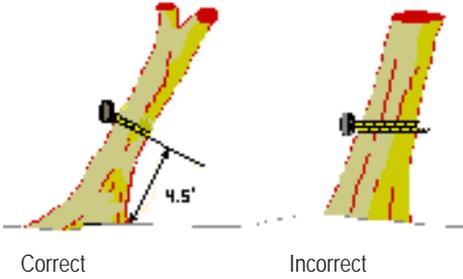


In this example, the diameter reading is 6.4-inches. Be carefull not to incorrectly read 7.5-inches. Examine the digits preceding and following the point above the 0 mark.

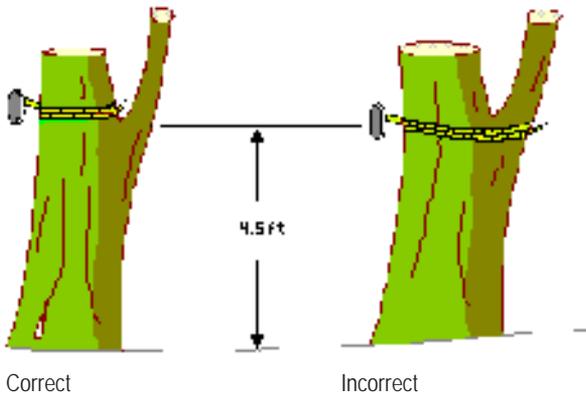
Place the diameter tape directly above the nail:



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



Do not place the tape at an abnormal location on the stem/bole:



## RM Appendix B.2 Boring for Radial Growth and Age

Despite their appearance, increment borers are delicate and expensive equipment items. Extreme care must be exercised in their use.

Borers consist of three parts: a handle, bit, and an extractor.

The tip of the bit is made of fine, thin steel and is easily damaged. Because the bit of an increment borer narrows at the tip, the resulting wood cores are smaller than the internal tube of the borer and can be easily extracted. If the cutting edge on the bit is nicked, it is not possible to adequately sharpen the bit because of this small tapering. For this reason, the following rules must be observed:

1. Keep the bit stored inside the bore handle when not in use.
2. Do not allow the tip of the bit to contact hard objects such as the ground or other field equipment.
3. If a core becomes jammed, do not use a nail or other hard object to attempt to push it out. Trying to push the core out through the narrowed tip will only cause further jamming. The best means for removing a severely jammed core is to place it in a low heat oven (200 degrees) for a couple of hours. This will reduce the moisture content of the wood, causing it to shrink without ruining the temper of the steel.
4. If, while boring a tree, the borer suddenly becomes very easy to turn, STOP! The bit may have contacted rotted wood, which is very difficult to remove from the bit. Extract the bit and examine it for signs of rot (dark, crumbled wood).
5. Be careful not to bore completely through small trees or the increment bore may get stuck in the tree.
6. Be careful when boring woodland trees; they are often very hard. Do not bore cercocarpus species.
7. Do not dull the bit by boring hard, dead wood.
8. Avoid drilling into obviously rotten stems especially on bigger tree species such as Western Red Cedar

When boring for age start the increment borer immediately below the point of diameter measurement and bore into the center of the tree. Every effort must be made to reach the pith (center). When boring for growth, start with the increment borer immediately below the point of diameter measurement and bore into the tree just a few turns

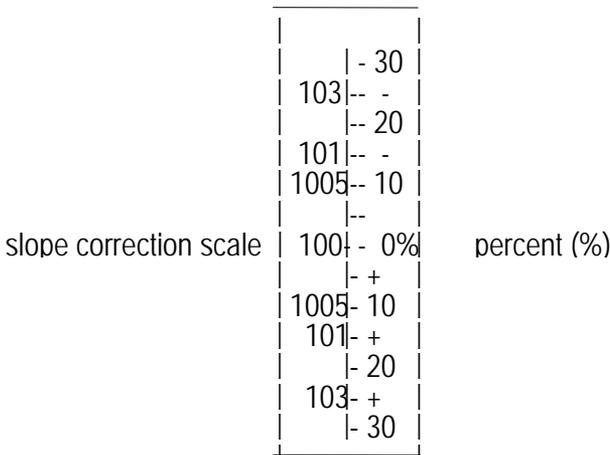
(note: for timber species, bore for growth on the side of the tree facing the point center, where reasonable, to reduce bias).

## RM Appendix B.3 Determining Tree Height

Whenever possible, take tree height measurements standing on a level plane approximately even with the base of the tree or on a level above the tree base. It is also very important when measuring tree height with a clinometer or laser to be as far from the tree as the tree is tall. The most important factor, however, is to be able to see both the tree base and the tree top. If the tree is

leaning, stand perpendicular to the plane of the tree's lean. For trees with an excessive lean, visually "upright" the tree, and measure the top of the tree as if it were standing straight. If a tree has a missing top or has several leaders as a result of a broken top, estimate the height that the tree would have been had this loss of height not occurred. Record the estimate, and make a note on the data record indicating that tree height was estimated.

Determine tree height using a clinometer. The following examples are based on using a Suunto "percent / slope" clinometer. The clinometer wheel, as viewed internally, contains a percent (%) scale on the right side of the wheel and a "slope correction" (SC) scale on the left side of the wheel. Use the percent scale when making tree readings of the top or base of the tree (note: the percent scale may also be used to determine % slope on the ground). If it is necessary to determine tree height on a slope (i.e., cruiser not on a level plane with the tree base), use the slope correction scale to determine a SC factor (refer to the tree height formula below). The clinometer scales are illustrated below (internal view of clinometer):



The formula for tree height with a "percent / slope" clinometer is as follows:

$$\text{Tree Height} = \frac{[T + B] \times (D/100)}{\text{SC}}$$

where:

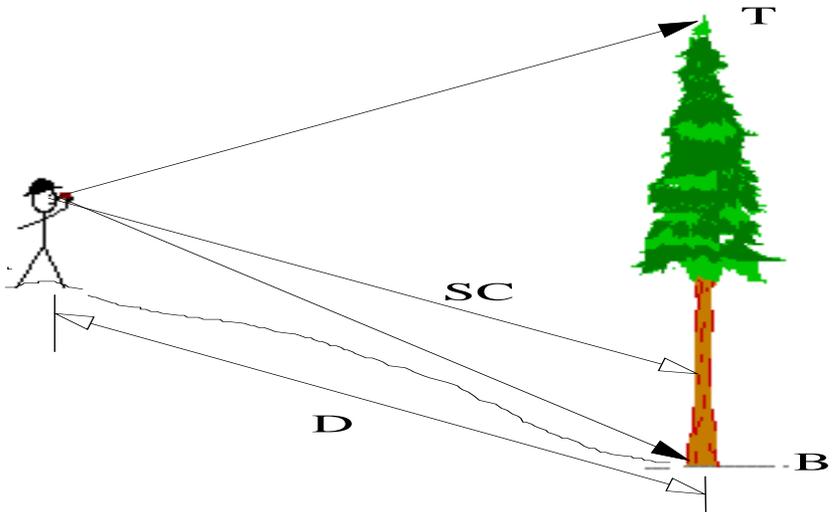
- T = percent scale reading for the top of the tree.
- B = percent scale reading for the base of the tree at ground level.
- D = slope ground distance (between cruiser and tree, to the nearest foot).
- SC = slope correction factor, taken to two decimal places.  
 For example, a number of 103 on the SC scale (associated with

25% slope) would be converted to 1.03 for use in the formula.  
Note: The number 1005 (10% slope) on the SC scale would be converted to 1.005. Also, the SC factor is 1.00 if on a level plane (0% slope) with the tree.

Numbers or tree readings from the percent scale can be either positive (+) or negative (-). As shown by the above formula, add T and B if the two readings are opposite signs (+ and -); on the other hand, subtract T and B if both readings are the same sign (+ and +, or - and -).

To determine a SC factor, look through the clinometer at eye level on the tree along the slope and distance used to obtain tree height (e.g., if your eye level is at 5 feet, then look through the clinometer at a level of 5 feet above the ground on the tree); look at the SC scale and read the SC factor directly. This slope correction must be parallel to the slope of the measured distance.

The following example illustrates tree height calculation:



Distance (D) = 120 feet  
SC = 1.03 (25 percent slope)

$$\text{Tree Height} = \frac{[T + B] \times (D/100)}{SC}$$

$$\text{Tree Height} = \frac{[28 + 30] \times (120/100)}{1.03}$$

Tree Height = 67 feet

**RM Appendix B.4 - DEFECT CHART and GUIDELINES**

Total Height	Defect Height										
	20	34	50	67	83	100	116	133	149	166	
179			1				0.5		0.2	0.1	
163			1				0.5	0.2	0.1		
147	2		1			0.5	0.2		0.1		
131	2		1			0.5		0.2			
115	2		1					0.5			
98	2		1					0.5			
82	2						1				
65	3	2					1				
49	4						2				
32						5					

**Examples of Defect Chart Use:**

1. Find the total height of the tree on the Y axis.
2. Find the minimum and maximum height of the defect on the tree on the X axis (e.g., a heartwood scar runs from 2 feet to 15 feet up the bole).
3. At the intersection of the tree length and defect height is the % of volume loss for a linear foot at that height in the tree. For example, in a 60 foot tree a defect from 10 to 15 feet would be equivalent to 20% volume loss (5 feet x 4% volume/foot = 20%).
4. If a tree has more than one % volume loss number over the length of the defect, then account for that in the calculation. For example, in a 60 foot tree a defect from 18 to 23 feet would be equivalent to 14% volume loss [(2 feet x 4%) + (3 feet x 2%) = 14%].
5. Some guidelines are provided for each type of defect. If the guidelines indicate using a fraction, multiply the fraction by the % volume/foot. For example, a minor frost crack specifies using a 1/4 pie cut fraction (e.g., 5 feet x 4% volume/foot x 1/4 = 5%). The guidelines may also specify adding length to the defect (e.g., 2 feet above and below the wound) in calculating the total % volume loss. Add this extra length to the defect before calculating the % volume loss.

**Defect Chart Guidelines**

**BROKEN TOP**

- Allow 2 additional feet of defect below break

**DEAD TOP**

- Highest set of live limbs is the defect height

**HEARTWOOD SCARS**

- Severity Indicators

Grey wood, Worm Holes, Long Cracks, Rot = Bad Scar

Pitched over and healed = Minor Scar

- Use simple Pie Cut fractions
- True fir and Aspen = cull entire section
- 3 or more severity indicators = double pie cut fraction

#### **WOUNDS AT BASE**

- Allow 2 additional feet of defect above wound

#### **WOUNDS NOT AT BASE**

- Allow 2 additional feet of defect above and below wound
- Use % per foot value at the center of the wound

#### **FROST CRACKS**

- Severity indicators
  - Closed wounds with no pitch or moisture = Minor Wound
  - Open cracks with pitch, moisture or rot = Severe Wound
- Use simple pie cut fractions
- Allow 2 additional feet of defect above wound
- Minor wound =  $\frac{1}{4}$  pie cut fraction
- Severe wound = double pie cut fraction
- Multiple frost cracks = cull entire section of tree

#### **LIGHTNING SCARS**

- Allow 2 additional feet of defect above and below wound

#### **CROOKS**

- Severe crook = top to bottom deduction
- Minor crook = Use a simple fraction
- 8 feet of straight material must be between crooks not to cull

#### **SWEEP**

- Determine severity of sweep
- Severe sweep = no straight 8 foot material
- Use a simple fraction

#### **FORKS**

- Simple fork = small bark seam, straight logs above
- Complex fork = multiple bark seams, related defects such as crook etc.
- Simple forks = 2 foot deduction
- Complex forks = 4 foot deduction
- Other defects occurring on a fork
- Divide the defect % by the number of merch. stems at defect height

#### **CONKS**

- Fomes Pini = 4 feet above, 8 feet below (DF,SP)
- Indian Paint = 8 feet above, 8 feet below (TF,SP)
- Velvet Top/Cow Dung = Look for scar or butt swell (ALL SPECIES)
  - Scar = 2 feet above
  - Butt swell = Use this height
  - No butt swell = 4 feet

#### **CANKERS**

- 2 To 4 foot deduction at canker (TF,ASPEN)

## RM Appendix C. Garmin Operating Instructions

Use the instructions below for setting up and operating the Garmin GPSMAP 76S GPS and the GPSmap 62s receiver. Before verifying the initial settings and navigating with the unit, become familiar with installing batteries, the function of each key/rocker, and using/connecting the external antenna and power source by reading the owner's manual and quick start guide.

The purpose of this appendix is not to rewrite the owner's manual, but to document the initial settings and enable crews to collect the necessary data for plot establishment. Please refer to Section 00 (General Description) and Section 12 (FIELD LOCATION REFERENCE FORM and PLOT MONUMENTATION RECORDS) for more details on what data is collected.

### 1.0RM Verify Garmin Settings

The proper initial settings are necessary for positioning and navigational accuracy and once selected, become the default values each time the GPS is turned on.

#### 1.0.1RM Settings for the Garmin GPSmap 76s:

With fresh batteries, turn the unit on and once the WARNING screen appears, press the PAGE key. The unit now starts "Acquiring Satellites" and will display the satellite strength signals, date, time, and UTM coordinates.

Press MENU twice to navigate to the Main Menu

Toggle down using the rocker pad to "Setup" and press ENTER

At the top of this screen there are 8 "tabs" that can be navigated through using the rocker pad. Verify the GPS settings using the information below:

With the "General" tab highlighted:

- Mode = Normal
- WAAS = Enabled
- Backlight Timeout = 15 seconds
- Beeper = On or Off (user preference)
- Language = English

With the "Altimeter" tab highlighted:

- Altimeter Auto Cal. = On
- Altimeter = On
- Pressure Units = Millibars
- Barometer Mode = Variable Elevation

With the "Compass" tab highlighted:

- Compass = On
- Use GPS if Speed is Above = 10 mph
- Use Compass if Below 10 mph for at least = 1 ½ minutes

With the "Time" tab highlighted:

- Time Format = 12 Hour
- Time Zone = Mountain
- Daylight Savings Time = Auto (Arizona does not observe daylight saving time)
- Current Date = (Correct Current Date)
- Current Time = (Correct Current Time)

With the "Units" tab highlighted:

- Elevation = Feet
- Vertical Speed = ft/min
- Distance and Speed = Statute
- Depth = Feet
- Temperature = Fahrenheit
- Direction Display = Numeric Degrees
- Speed Filter = Auto

With the "Location" tab highlighted:

- Location Format = hddd°mm'ss.s"
- Map Datum = NAD83
- North Reference = Magnetic
- Magnetic Variation = Automatically changes with new location.

With the "Alarms" tab highlighted:

- Anchor Drag = Off
- Approach and Arrival = Auto
- Off Course = Off
- Shallow Water = Off
- Deep Water = Off

With the "Interface" tab highlighted:

- Serial Data Format = Garmin

Once all the settings have been verified, the GPS unit can be used for plot navigation and data collection.

### 1.0.2RM

#### Settings for the GPSmap 62s:

Turn the unit on using the button on its right side.

Press the MENU button twice to access the Main Menu

- Select "Profile Change" and change the profile to "Classic"

From the Main Menu screen, find and select "Setup"

Select "System" and change the following fields:

GPS = WAAS/EGNOS

- Language = English
- Battery Type = Select if using either Alkaline, Lithium, or rechargeable
- Interface = Garmin Serial
- Press QUIT after these settings are selected.

Select "Position Format" and change the following fields:

- Position format = hddd°mm'ss.s"
- Map Datum = NAD83

Press QUIT and select any other icon to custom your settings

## **2.0RM Data Collection**

Averaged coordinates will be collected in 3 different locations; at the truck parking spot, Reference Point (RP), and Location Center (PC).

### **2.0.1RM Obtaining an averaged location on the GPSmap 76s:**

- With the unit on, press and hold the ENTER/MARK key for 2 seconds until the Mark Waypoint screen appears.
- Press the MENU key and a separate screen appears with Average Location highlighted.
- Press ENTER and the Average Location screen appears and if there is good satellite reception, the Measurement Count will start.
- Record on the Field Location Reference sheet the Location coordinates after the count reaches 180.
- Repeat this process at the Truck parking spot, RP, and PC and record on the Field Location Reference Record.

### **2.0.2RM Obtaining an averaged location on the GPSmap 62s:**

- With the unit on, press the MARK key.
- Press the MENU key and select "Average Location"
- Select "Start", select "yes" to continue, and wait until the Sample Confidence reaches 100% and "save" these readings.
- You can rename this waypoint as needed.

## **3.0RM Using Waypoints:**

A waypoint is a specific location entered in the GPS unit for future reference. Examples of potential waypoints include the location of the truck, a trailhead, a critical junction on a travel route to the plot, the reference point, or the plot center location. There are three ways to enter waypoints into the Garmin: by uploading the waypoints from a laptop computer using the Map Source software (not described below), by using the MARK key, or by manual input of the coordinates. Use generic waypoint names like RP, PC, TRUCK, or GENERAL, so future waypoints can be edited instead of adding a new one and renaming it (see Editing Waypoints).

Instructions for using the MARK key and manual input of the coordinates for establishing a waypoint:

### **3.0.1RM Using the MARK key (both units)**

- Once you are standing at a desired waypoint (i.e. RP, trail intersection, prominent landmark, or important navigational aid), press and hold the MARK key until the Mark Waypoint screen appears.
- If the GPS unit is receiving satellite reception, the coordinates will be shown

in the Location block.

- Once the unit has established reception, change the name of the waypoint (using the rocker) as desired.
- Save the waypoint by highlighting OK and press ENTER.
- You will now be able to use this waypoint for navigational purposes in the future.

### 3.0.2RM Manually entering Waypoints - both GPS units (also see Editing Waypoints)

- From the "Map Page", press and hold the ENTER/MARK key until the Mark Waypoint screen appears.
- Use the rocker until the coordinates are highlighted, press ENTER, and change the coordinates as needed.
- Once the coordinates are correctly entered, use the rocker to highlight the name of the waypoint and change as desired.
- Save the waypoint by scrolling down until OK or Goto (or "Map" and "Done" on the 62s) are highlighted and press ENTER.

### 3.0.3RM Acquiring Distance and Azimuth between two waypoints (GPSmap 76s)

To acquire the distance and azimuth from, as an example, the RP to PC use the "Routes" function.

- In order to use the "Route" function, waypoints for the RP and PC have to already be saved in the unit (see 1,2, and 5).
- From the "Map Page" or any page after turning the unit on, press the MENU key twice.
- The Main Menu will appear and from here, use the rocker and scroll down to "Routes" and press the ENTER key.
- The "Routes" screen now appears. With "New" highlighted, press ENTER.
- A new "Route" screen appears and use the rocker to select the empty field below Waypoint, and press the ENTER key.
- A separate "Points" screen appears, highlight and select "Waypoints".
- The "Nearest Waypoints" screen appears and select "RP" (or the waypoint you named representing the RP).
- The Waypoint screen comes up with the "OK" tab highlighted and press ENTER.
- The "Route" screen appears again, toggle down to the empty field below the RP waypoint name, and press ENTER.
- Select "Waypoints" again (as above)
- Select the PC waypoint (as above)
- Select the OK tab (as above)
  - o The "Route" screen should now say RP-PC. The GPS unit can now calculate the distance and azimuth between the two waypoints selected.
- Toggle down to PC and then toggle to the right to switch between Distance (in ft. or miles) and Course (in degrees). To do this, keep toggling to the right to switch fields.

Helpful Suggestion: Once desired routes are established in the GPS unit (ie.

RP - PC, TRUCK - PC, PC - Truck, etc.), edit the waypoints on the next plot (see Editing Waypoints) using the same waypoint names so new routes do not have to set up again.

### 3.0.4RM Acquiring Distance and Azimuth between two waypoints (GPSmap 62s)

- To acquire the distance and azimuth from, as an example, the RP to PC use the "Route Planner" function.
- In order to use the "Routes" function, the GPS unit must be in **"Simulation Mode"**.
- To put the GPS unit in Simulation Mode, navigate to the "Satellite" page and press MENU. Choose "Use with GPS off". The bottom of the "Satellite" page should now say "Simulating GPS".
- Navigate to the Main Menu and choose "Route Planner".
- Choose "Create Route" and then, "Select First Point"
- On the next screen, choose "Waypoints" and select the waypoint you want to navigate from (i.e. RP). The "Map" page comes up and press ENTER.
- Select the next waypoint (i.e. PC) you want to navigate to by repeating the previous step.
- Once the two waypoints are shown and you have the option to "Select Next Point", press QUIT.
- The route will be shown on the next screen.
- Navigate to the route you just created and press ENTER.
- The next screen brings up route options.
- Choose "View Map" and select "GO".

#### **Suggestion: Customize your "Map" page (GPSmap 62s)**

- Press MENU and select "Setup Map"
- Under Data Fields, choose "4 small"
- Press QUIT and then MENU again
- Choose "Change Data Fields"
- Change the data fields to GPS Accuracy, Heading, Course, and Distance to Destination.

### 3.0.5RM Using Waypoints for Navigation (GPSmap 76s)

Once a waypoint has been named and stored you can then later use that waypoint for navigational purposes.

- From the Map page, press the NAV key.
- A small screen appears - highlight "Go To Point" and press ENTER.
- The "Points" screen appears - select "Waypoints".
- The "Waypoints by Name" screen appears - use the rocker to scroll through the list until the desired waypoint is selected and press ENTER.
- The "Waypoint" screen is now shown - select "Goto".
- This brings you out to the Map page where you can navigate from using the "Bearing" and "Distance to Next".

### 3.0.6RM Using Waypoints for Navigation (GPSmap 62s)

- To acquire a distance and azimuth between your current location and a waypoint, the waypoint must already be saved in the unit (see 3.0.1RM

and 3.0.2RM).

- Press the FIND button and choose "Waypoints".
- Under the waypoint you want to navigate to, the distance and azimuth to that waypoint is displayed.
- Press ENTER on the waypoint and the map page comes up showing your current location and the waypoint.

### 3.0.7RM Editing Waypoints (GPSmap 76s)

Use the "Points" function to edit coordinates of previously named waypoints. This makes using the "Routes" function easier, faster, and more convenient. Some example waypoint names are: TRUCK, RP, PC, and, GENERAL (GENERAL is a generic waypoint and could be a trail intersection, prominent landmark, creek crossing, etc.)

Editing the same waypoints on every plot limits the number of waypoints stored in the GPS and enables you to choose previously used routes without adding a new one.

Some example routes are: TRUCK to PC, RP to PC, GENERAL to PC, PC to TRUCK, etc.

To edit a waypoint using the "Points" function:

- From the "Map Page" or any page after turning the unit on, press the MENU key twice.
- Choose "Points"
- Choose Waypoints in the pop-up screen.
- Select the waypoint you would like to edit and press "Enter".
- The "Waypoint" screen appears for that specific waypoint and you can now edit the coordinates or average the location using the same name.

### 3.0.8 RM Editing Waypoints (GPSmap 62s)

- Navigate to the Main Menu and choose "Waypoint Manager"
- Select the waypoint you want to edit and scroll up to "Location"
- Press ENTER and the editing feature is shown. Edit the Lat/Long as needed.
- The waypoint name can also be edited on this screen in the same manner as editing the "Location" (See "Editing Waypoints (GPSmap 76s) for some example waypoint names).

### 4.0RM Projecting a Waypoint (GPSmap 62s only) - Finding the location of a subplot if the PC is inaccessible:

- From the Main Menu select "Waypoint Manager" and choose the waypoint that has the PC coordinates.
- Press MENU and choose "Project a Waypoint"
- Enter the degrees (360° for subplot 1, 120° for subplot 3, and 240° for subplot 4) and choose done.
- Enter the distance: choose feet for distance units, enter 120.0 for the distance, and select done.
- The GPS will assign the projected waypoint a name.
- Use the "Waypoint manager" to navigate to the new projected waypoint and the new coordinates are shown.

Other GPS Suggestions:

GPS UNIT should be recorded as 2 (both units) – “Other brand capable of field averaging” when using the Garmin and an averaged location has been obtained. See chapter 12, Field Location Description Items for more detail.

Use the external remote antenna (GPSmap 76s) to improve satellite reception when under heavy canopy/cloud cover, north facing slopes, or any other area that may have poor reception. The external antenna will improve the GPS performance by about 15-20%.

## RM Appendix D. Laser 200 Instructions

### 1.0RM Overview

Accurate heights are necessary in our inventory in order to determine volume. The Laser can be used to get fast and accurate tree heights. It can also be used to measure distances and % slope. This instrument is more fragile than the GPS units. Some precautions must be taken with the Lasers to keep them working properly. These are:

1. Never look at the sun through the scope. Looking directly at the sun can permanently damage your eyes.
2. Never point the Laser directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.
3. Do not expose the Laser to extreme temperatures. It is rated for a temperature range of -22 deg. F to +140 deg. F. Don't leave the instrument in the vehicle during the heat of the day.
4. Do not use batteries with "voltage check" features built on the batteries. The battery case of the Laser is too narrow for these batteries, and they could get stuck in the instrument.
5. Do not drop the Laser. Immediately return it to its case when you get back to the vehicle. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

### 2.0RM Basic operation

All directions for using the Laser buttons are given assuming you are holding the instrument with the LCD display screen facing you and the 2 round lenses are facing the object you want to measure. The buttons will be referred to as:

- L1 the left button closest to you
- L2 the left button in the middle
- L3 the left button furthest away from you
- R1 the right button closest to you
- R2 the right button in the middle
- R3 the right button furthest away from you

Turn the Laser on by pushing L1 or R1

Turn it off by pushing L2 and L3 at the same time. The Laser may turn itself off after a period of inactivity. Once the instrument is on, push the R1 button to make the red dot appear in the sighting scope. If there is no red sighting dot, repeatedly push the L2 button until the red dot appears and is the correct brightness. To light up the display screen, press L3. Press L3 again to turn off the light.

### 3.0RM Settings

Make sure the settings are correct before using the Laser. To set the correct measurement units, go into the main menu and:

1. Press R2 or R3 to scroll through the menu until SYS is displayed in the upper right hand corner of the screen.
2. Press R1. ON or OFF will show in the center of the screen. FILTER will flash at the bottom.
3. Press R2 until OFFSET is flashing. The number displayed should be 0000.00.
4. Press R2 until PIVOT is flashing. The number displayed should be 0000.59. When this number is set at 0.00, the Laser is set to calculate heights using a tripod attached to the center of the instrument. The pivot point is the center of the Laser. We use the pivot value at 0.59 because this sets the pivot point at the rear of the instrument, and this allows you to shoot a height while using your head as the pivot point. To change this number, press L1 until the number you want to change is flashing. Press L2 or L3 until the correct number is showing. When the number is set at 0000.59, press R1.
5. Press R2 until UNITS is flashing. Select F (feet) using the R1 button.
6. Press R2 again and D (degrees) should be flashing. If not, press R1 to toggle on D.
7. Press R2 again and % should be flashing. It should say ON. If not, press R1.
8. Press R3 twice to accept the new settings and back out to the main display.

#### 4.0RM Filter and Reflectors

When you are working in areas of dense brush, you need to make sure the Laser is giving you the distance to the correct target. The best way to do this is to use a reflector as a target and use the filter option on the Laser. The Laser will only lock onto the highly reflective targets and ignore the less reflective brush. To use the filter option:

1. Place a reflector (or have someone hold it) on the tree where it can be seen from the required distance. The Laser will not work in the filter mode without a reflector as a target.
2. Go to the main menu on the Laser and push R2 or R3 until SYS is displayed on the screen.
3. Press R1 to select the SYS option. The FILTER option will blink, and it will say the FILTER is OFF or ON.
4. Push R1 to toggle FILTER between ON and OFF.
5. Press R3 to save the desired setting and to back out into the main display. When the FILTER is on, FILTER will appear at the bottom of the screen when the Laser is measuring distances.

#### 5.0RM Distances and % slope

Horizontal distance (HD): Turn the Laser on. The top-middle of the LCD

screen will say HD. Point the red sighting dot at the target. Press R1 and hold it down until the Laser locks on the target, then release. You can tell when the instrument locks onto it's target by sound. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If you get an error message, simply aim again and press R1.

Slope distance (SD) and Vertical distance (VD): Push R2 or R3 until the correct display is shown. Then aim and press R1 until the Laser locks on target. Or, measure a horizontal distance, then push R2 until the correct display is shown.

% slope: Press R2 or R3 until INC is displayed. Then aim and press R1.

## 6.ORM Tree heights

The best way to measure a tree height is to make sure you have a clear shot at the leader or a clear shot of the tree trunk. Make sure you are getting a distance to the tree trunk, and not some branches in front of it. If you can't get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once you are in position with your target in sight, go to the main menu:

1. Push R2 or R3 until HT is displayed in the upper left of the screen.
2. Push R1 once, aim at the target, then push R1 until the Laser locks on target. This will measure the horizontal distance.
3. The down arrow will flash. Aim at the base of the tree and push R1 to get the % slope.
4. The up arrow will flash. Aim at the top of the tree and push R1 again to get another % slope.
5. Press R1 once more and the Laser will display the height. Make sure this height is reasonable before recording it in the PDR.

## 7.ORM Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help you make sure you are hitting the right target when objects near you or just beyond your target might give you false readings. You don't have to set both gates. You will probably only need to set the short gate because of brush or fog between you and your target. You can set a gate by shooting a target or by entering distances into the instrument. To set a short gate by laser, go to the main menu and:

1. Press R2 or R3 until GATE is shown on the display.
2. Push R1 to select the gate option.
3. Press R1 to toggle the gate between ON and OFF.
4. Push R2. The S indicator will flash.
5. Aim at a target that is at the distance you want to set as the short gate and press R1.
6. Now you can either set a long gate, or press R3 to go back to save the short gate and return to the main menu. The S will be

displayed when you are measuring distances to show the short gate is on.

To set a long gate:

7. Push R2. The L indicator will flash.
8. Aim at an appropriate target and press R1
9. Press R3 to save the gate and go back to the main display. The L will be displayed when measuring distances.

The gates are reset to OFF when the Laser is turned off, but gate values are saved in memory. This means that if you have saved a gate and turn off the instrument, when you turn it back on the gate will be set to OFF. If you go back into the gate option and turn the gate ON, it will remember the last distances you shot for the long and short gates.

To clear out a gate value: Display the gate values by following the instructions in this section (section G). When the desired gate value is displayed, press and hold down R3 until the number is deleted.

## 8.0RM Cumulative distances

A cumulative distance measurement allows you to move from one target point to the next, stopping at each one to measure the distance to the next target point. The Laser accumulates the measured distances in both slope and horizontal distances (SD and HD) to give you a running total.

To take a cumulative distance, go to the main menu and:

1. Press R2 or R3 until MULTI is displayed on the screen.
2. Press R1 to enter the MULTI option. DIFF will be displayed.
3. Press R2 once. CUM will be displayed.
4. Press R1. Either SEL or a number will be displayed. If SEL is displayed, HD will flash on and off. Press R1 to toggle between HD and SD. Press R2 when the correct indicator is flashing. If a number is displayed, that means there is already a cumulative distance saved on this instrument. You can either clear out this distance by holding down R3 until 0.00 appears, or continue to add to the distance by going to step 5.
5. Aim at the target and press R1 to fire the laser.
6. If you are not satisfied with the measurement, repeat step 5 to retake the measurement. If you are satisfied with the measurement, and wish to add it to your total, press R2. The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

You can choose whether you want horizontal or slope distances at any time. If a distance has been measured, you can change from slope or horizontal distance by pressing R3 twice. SEL will be displayed. Push

R1 to toggle between SD and HD. Press R2 twice to get back to the total distance. Go to step 5 to add more distances.

The cumulative measurement total is saved in memory even if the instrument is turned off. Turn the instrument on and scroll back to the MULTI-CUM option and resume the procedure with step 5.

To clear out the current total and begin another series of measurements, hold down R3 while the cumulative distance is showing until the number is deleted.

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