INTERIOR WEST FOREST INVENTORY & ANALYSIS

P2 FIELD PROCEDURES

March, 2019
(V8.00)

Table of Contents

RM Changes from Manual Version 7.0 to 8.0

Significant changes from version 7.0 printed in January, 2016 to version 8.0 printed in January, 2019 are listed below.

RM Regional Changes (**RM**) from Version 7.0 to 8.0

- **RM** Changes from the Manual Version 7.0 to 8.0 - added to manual
- **RM** Changes to Regional (**RM**) sections from Version 7.0 to 8.0 - added to manual.
- **RM** Changes to National sections from Version 7.2 to 8.0 - added to manual.
- 0.1.2**RM** Plot Packet Contents and Information – added to manual
- 0.1.2.1**RM** Plot Packet Label – added to manual
- 1.1.2.2**RM** Plot Packet Truck Distance – added to manual
- 0.1.3.1**RM** Establishing PC with the Garmin GPS Receiver
    - » Changed title to "Establishing New Plot Locations with the GPS Receiver"
    - » Updated to reflect current protocols
- 0.1.5**RM** Finding the Plot Center – Remeasurement Locations
    - » Added – Navigating directly to the PC using the GPS
    - » Added – section on "Old Stake Missing"
- 0.1.5.3**RM** Plot Center Incorrectly Placed or Not Found - Deleted reference to "shifted woodland" plots
- 0.1.5.6**RM** Moving the Pinprick – Deleted these outdated procedures.
- 0.3.2**RM** Plots with Accessible Forest Land Present - Added to the list of specific items to record including GPS, Seedling Data, Site Tree Data, Owner, and Soils.
- 0.3.3**RM** Plots with No Accessible Forest Land Present - Added "Owner" to the list of specific items to record.
- 0.3.4**RM** Remeasurement, All Condition Inventory Plots (ACI), Soils - Deleted reference to "P3" and "accounting plots".
- 0.4**RM** Tree Sampling Procedures - Deleted "Previous fixed-radius plot" and "Previous other tree land plot"
- 1.7 PLOT NONSAMPLED REASON code 03 Hazardous - added RM note: **RM** A mandatory Plot level note is required describing the access route(s) attempted and reason the plot is being called Hazardous.
- 1.7.1RM CONDITION CLASS CHANGE- Added: "Include changes in CONDITION CLASS STATUS (see 2.1.1) and changes within the delineating variables that further subdivide forest land (see 2.1.2)." to the description.
- 1.8 NONFOREST PLOT NONSAMPLED REASON code 03 Hazardous - added **RM** note: **RM** A mandority Plot level note is required describing the access route(s) attempted and reason the plot is being called Hazardous.
- 1.18.4**RM** PLOT PHOTOS TAKEN - Changed 12.8**RM** to 11.8**RM**
- 2.5 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND - Added clarifying **RM** text: (**RM** "within forest" includes a forested condition on one side only).
- 2.6**RM** CONDITION STATUS CHANGE - Added to manual.
- 2.6.1 CONDITION FUELBED TYPE - Removed the variable description and added note: "**RM** Collected in Utah only. See the FUELBED TYPE

reference publication hand-out titled *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with the Rothermel's Surface Fire Spread Model."*

- 5.7.2 STANDING DEAD – added **RM** note to Code 0: "RM includes trees that shrank below the 5.0 inch threshold".
- 5.9.2 DIAMETER AT BREAST HEIGHT (DBH) under Special DBH situations, # 1 Forked Tree - Added **RM** clarification: (**RM** the stem must be at least 1.0 inch in diameter at the fork with the main stem and must also be 1.0 inch in diameter at diameter measurement point to qualify as a fork).
- 5.9.4 DIAMETER AT ROOT COLLAR (DRC) - added detail to **RM** note: **RM –** If a previously tallied woodland tree was *killed, cut or removed* 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.
- 5.20.1 DAMAGE AGENT 1 - Combined the specific damage codes from Appendix 11 into the table of General Agent Damage Codes, Damage Thresholds, and Descriptions.
- 7.1.1**RM** Site Tree Requirements – added < 50% UNCOMPACTED CROWN RATIO under 2. Unsuitable site trees.
- 7.2.4.2**RM** SITE TREE METHOD – added to manual
- 8.4 Vegetation Structure - Vegetation Structure Growth Habits - NT tree species - Deleted **RM** comment "(**RM** All Non-tally tree species, regardless of size, will be considered Shrubs for this inventory)".
- Appendix 1 State and County, Parish, or Borough FIPS Codes - Deleted
- Appendix 3 FIA Tree Species Codes: Updated – All CORE tree species are now valid in RMRS. There is no longer a Regional Tree Species list.
- Appendix 7 Tolerance/MQO/Value/Units Table: Updated "when collected" to include "(**RM** and down)".
- Appendix 6 Glossary - Updated Crown Ratio definition where it is based on Length not Height.
- Appendix 7 **RM** Root Disease Severity Rating - Updated from 1-9 to 0-9.
- Appendix 9 Invasive Plant List - Added the species list for each state.
- Appendix 10 Unknown Plant Specimen Collection - Corrected Darin Toone's address
- Appendix 11 Damage Codes - Moved to 5.20.1 DAMAGE AGENT 1
- Added Appendix G: Habitat Type Publications used in RMRS

RM Changes to National sections from Version 7.2 to 8.0

- 1.12 FIELD GUIDE REVISION. Changed the value from 7.2 to 8.0.
- 2.5.4 STAND SIZE CLASS. Corrected wording of code 3 as follows: 9.0 – 19.9 inches (softwoods) / 11.0 – 19.9 inches (hardwoods) : At least 10 percent stocking (or 10 percent canopy cover if stocking standards are not available) in trees, seedlings, and saplings; and at least 1/3 of the canopy cover is in trees greater than 5.0 inches DBH/DRC and the plurality of the canopy cover is in softwoods between 9.0 – 19.9 inches diameter and/or hardwoods between 11.0 – 19.9 inches DBH, **and/or** woodland trees 9.0 – 19.9 inches DRC.
- 2.5.28 LAND COVER CLASS. Variable title changed from "LAND COVER CLASS" to "COVER CLASS". Modified the introductory text. Deleted the

following Full Cover Class Definitions: Natural vegetation; Semi-natural vegetation; and Anthropic Vegetation. Simplified the Cover Classification Key by deleting codes 06 (Agricultural Vegetation) and 07 (Developed, Vegetated). Also changed the following code names: "01 Treeland" to "01 Tree Cover"; "02 Shrubland" to "02 Shrub Cover"; "03 Grassland" to "03 Herbaceous Cover"; and "09 Developed" to "09 Impervious". Added text for clarification to codes 01, 02, 03, 08, and 09.

- 5.7.2 STANDING DEAD. The second sentence in paragraph 2 was deleted: "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."
- 5.9 DIAMETER. Updated this section to signal the changes in the text and figures about the forking rules for measuring diameter. Additional text was added to the first paragraph, and as two new paragraphs under the heading "Remeasurement trees".
- 5.9.2 DIAMETER AT BREAST HEIGHT (DBH). Additional text was added under special DBH situations: 1. Forked tree – general text and under "Trees forked between 1.0 foot and 4.5 feet. New figures were added: 23, 24, 25, 26, 27, 30, 31, and 32. Replacement figures were added (new numbers): 28, 29, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, and 45

Note: the rest of the figures in the document following this section were renumbered.

- 5.24 LENGTH TO DIAMETER MEASUREMENT POINT. Changed from CORE OPTIONAL to CORE.
- Appendix 3. FIA Tree Species Codes New download of PLANTS database for the non-Caribbean species in the species code list dated September 15,, 2017.There were only actual changes to the tree species code list in appendix 3.Added code 0376. Also designated code 7532 as woodland.
- Appendix 6. Glossary. Added a definition for Measure Low Approach.
- Appendix 7. Tolerance/MQO/Value/Units/Field Width/When Collected table. Changed Value of Field Guide Version from "7.2" to "8.0".
  Also, changed the designation of 5.24 LENGTH TO DIAMETER MEASUREMENT POINT from Core Optional to Core. Also, changed the name of 2.5.28 from LAND COVER CLASS" to "COVER CLASS" and the Values from "01-10" to "01-05; 08-10".
- A13.6.1 OWNERSHIP CONDITION LIST - Field width digits changed from 4 to 9.
- Appendix 13. Ownership. MERIDIAN, TOWNSHIP, RANGE, SECTION, and QUARTER SECTION now collected in RMRS. Descriptions for each now included.

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

VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

Version 8.0 (**RM** 8.00)

Version History:

1.1	March 1999 (first version implemented, Maine, 1999)
1.2	August 1999
1.3	September 1999 (revised from Bangor, ME Data Acquisition Band meeting, Aug 1999)
1.4	February 2000 (revised from Charleston, SC Data Acquisition Band meeting, Dec 1999)
1.5	January 2001 (revised from Portland, OR Data Acquisition Band meeting, Sept 2000)
1.6	March 2002 (revised from Tucson, AZ Joint Band meeting, Jan 2002)
1.7	February 2003 (revised from Charleston, SC Joint Band Meeting, Feb 2003)
2.0	April 2003 (revised from Atlantic City, NJ, Data Acquisition Band Meeting, Mar 2003)
	October 2003 (revised from Anchorage, AK, Data Acquisition Band Meeting, Aug. 2003)
	January 2004 (revised from Data Acquisition Band conference calls with FIA Management Team Approval)
	August 2004 (revised from Asheville, NC, Data Acquisition Band Meeting, Aug. 2004)
3.0	October 2005 (revised from change management process, change proposals approved by FIA Management Team, from Asheville, NC, Data Acquisition Meeting, Aug. 2004, and from Las Vegas, NV, Data Acquisition Meeting, Mar. 2005)
4.0	October 2007 (revised from change management process, change proposals approved by FIA Management Team, from Flagstaff, AZ, Data Acquisition Band Meeting, Sept. 2006, and from multiple Data Acquisition Band conference calls)
5.0	July 2009 (revised from change management process, change proposals approved by FIA Management Team, from Charleston, SC, Data Acquisition Band Meeting, Mar. 2009, and from multiple Data Acquisition Band conference calls)
	October 2010 (revised from change management process and from Portland, OR, Data Acquisition Band Meeting, Feb. 2010 and subsequent conference calls)
RM 5.00	January, 2011 – Regional Field Guide Version updated to reflect regional changes made through the change proposal process and to fix mistakes discovered after previous printing.

6.0 October 2012 (revised from change management process, change proposals approved by FIA Management Team; from Portland, OR, Data Acquisition Band Meeting, Feb. 2011; and multiple Data Acquisition Band conference calls)
7.0 October 2015 (revised from change management process, change proposals approved by FIA Management Team; multiple Data Acquisition Band conference calls, from Portland, OR, Data Acquisition Band Meeting, Feb. 2015; and from results of a field guide reorganization team)
7.1 October 2016 (revised from multiple Data Acquisition Band conference calls)
7.2 October 2017 (revised from the Pacific Northwest FIA Program's 2017 annual operations meeting and other meetings)
8.0 October 2018 (revised from change management process, change proposals approved by FIA Management Team, and multiple Data Acquisition Band conference calls.)

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 this guide (Volume I of the FIA field methods guide) 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; and vegetation diversity and structure. Note that the down woody materials field procedures are now included only in Volume I. 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), contract crews and state cooperators. 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.

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 6,000 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 Contracting officer Representative.

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-out 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. Be sure to have all the necessary 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. Be sure to have all the necessary equipment needed to conduct the field inventory when leaving the truck.
6. Perform a thorough plot edit before leaving the location. Check for missing data items as well as field gear.
7. Avoid traveling through the woods after dark. If lost, do not panic, but settle down some place and try to make satellite/cell phone contact with the Area Leader or with another agency. Use the inReach to send out your location coordinates and in case of an emergency, activate the SOS feature. Know how to use all the communication equipment.
8. Bring a 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 Level Data
2	Condition Class
3	Subplot Information
4	Boundary References
5	Tree Measurements and Sapling Data
6	Seedling Data
7	Site Tree Information
8	Phase 2 (P2) Vegetation Profile (core optional)
9	Invasive Plants (core optional)
10	Down Woody Materials (core optional)

11 **RM** 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 regional variables collected only in the Interior West. Data elements labeled with "**ACI**" are variables only collected for the All Conditions Inventory. Descriptions of data elements follow in this format:

Data Element Name

***RM** See Appendix 7 for "When Collected", "MQO", and "Tolerance" information for each collected variable. The current field guide layout has "Brief Variable Description" and "Values" information only (except for Appendix 13 Ownership Prefield Procedures).*

Data Variable 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:

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

Macroplot:
Radius = 58.9 feet
Area = 10,899 square feet or 0.25 acre (ac) or 1/4 acre

Annular plot:
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
board foot merchantable top softwoods	7.0 in
board foot merchantable top hardwoods	9.0 in
merchantable top for woodland	1.5 in
minimum conifer seedling length	0.5 ft
minimum hardwood seedling length	1.0 ft
seedling/sapling DBH/DRC break	1.0 in
sapling/tree DBH/DRC break	5.0 in

0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24-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 the National Information Management System [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.

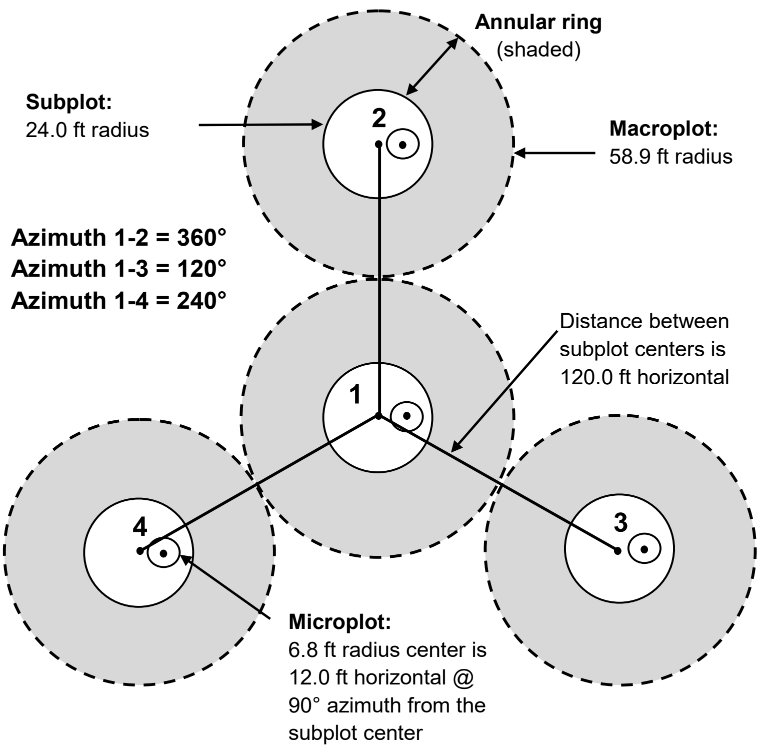


Figure 1. FIA Phase 2 plot diagram. See individual Phase 3 chapters for Phase 3 plot Figures.

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** ± 7 feet) at the previous visit, the current crew should remeasure the subplot in its present location and contact the Area Leader. (**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) (e.g., incorrectly tallied at the previous survey)
- Assign RECONCILE codes 3 or 4 (e.g., 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 not sure about the permission status for a plot check the Ownership database or call the 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 database. 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 and as described in Appendix 13.

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** Plot Packet Contents and Information

Each field location has a corresponding plot packet that contains information to either install a plot for the first time and/or information from the previous visit.

Plot packet contents usually include:

- Field Location Reference Form - where coordinates, witness, RP, and owner information is recorded. The backside is used for a hand-drawn plot map.
- Crown/Ground Cover Supplemental Data Form (Purple Sheet) - where crown cover, % bare soil and Down Woody Material (DWM) information is recorded.
- Topographic map - USGS 1:24,000 scale quadrangle with marked plot location.
- Printed National Geographic 1:24,000 scale map with centered marked plot location.
- Stereo Photography (scale differs) - stereo photographs used for photo work and as a navigational aide. Not available for new plots.
- NAIP imagery 1:16,000 - newest available imagery of the plot area.
- Pre-printed "Green Sheets" that has previously collected Plot, Condition, and Tree information (remeasurements only).
- Copy of previous Field Location Reference Form and plot map (remeasurements only).

Note: It is the responsibility of the Crew Leader to be sure the contents of the plot packet are adequately complete before going into the field.

0.1.2.1**RM** Plot Packet Label

Each plot packet has a pre-printed label on the front upper right corner of the manila envelope. It gives important information on the plot including its GPS coordinates, elevation, and ownership. There is a prefield checklist that ensures all the necessary information is included before it is sent to the field, as well as pre-printed plot location information used to take PC photographs in the cardinal directions.

Plot Packet label example:

State	**County**		**Location**
Inventory Year	Protocol	Truck Distance	Elevation
GPS Datum: Plot center coordinates recorded from the previous visit. These are the coordinates used to find the previously established plot.			
GPS Datum: Plot center Theoretical coordinates (exact point where plot theoretically should be but due to GPS/chaining error, may not be)			
Old GPS Datum in UTM's (provided in case the converted coordinates are inaccurate)			
Owner information			
Legal Description in Township/Range/Section			
BLM Map (Name of BLM Map PC is located on)			

0.1.2.2**RM** Plot Packet Truck Distance

The Truck Distance on the plot packet label describes the approximate distance from the nearest obvious road shown on the topographic map to the PC. It is for rough planning purposes only and may not be correct due to current travel management plans, new/closed roads, or private landowner access, etc.

Code Descriptions:
1 500' to ¼ mile
2 ¼ mile to ½ mile
3 ½ mile to 1 mile
4 1 to 3 miles
5 3 to 5 miles
6 Greater than 5 miles

0.1.3**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 plot center (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, roads can be closed, and crews can make errors.

0.1.4RM 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.

0.1.4.1RM Establishing New Plot Locations with the GPS Receiver

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

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. Navigate to the plot vicinity using the GPS, provided topo map, aerial photos, and imagery.

3. Select a Suitable RP
   The RP will be used for initial plot established to eliminate any plot location bias that could result in only using the GPS. In general, the RP will not be revisited but in some Forest Types (e.g. aspen) or in some circumstances (e.g. disturbance due to fire, clearcut, etc.), it still may have to be re-used to find the old plot center.
   - Designate a RP readily identifiable on both the ground and the photograph/DOQ. For some plot locations this will not be possible so choose a tree that is unique to the area (e.g. unique species, largest tree in the area, etc.). 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 a live tree (if at all possible) not likely 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 chance crews will be able to relocate the plot in the future should significant change occur over time.
   - Pinprick the RP on the aerial photograph with the PC pinprick (if there is one), 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. For new plots with no stereo photographs, pinprick the NAIP imagery. Refer to section 12 – Field Location Reference for instructions on tagging the RP.

4. Find the Position of the RP
   Tolerance: EHE ≤ 70 feet.
   Use the “Averaging” option in the GPS to provide coordinates for the position of the RP using Latitude and Longitude. If the estimated error is > 70 feet after the sample confidence reaches 100%, check map datum,

GPS settings, and battery life, then try again. Refer to Appendix C for more information.

5. Traversing from the RP to the PC
Record the distance and azimuth from the RP to the PC waypoint obtained from the GPS on the Field Location Reference Form. Use a chaining tape/laser and compass for traversing from the RP to PC and correcting for slope. Refer to Appendix C.

6. PC Verification
Tolerance: ±6 feet per 100 feet chained. ± 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 ±6 feet per 100 feet of chaining distance up to ± 30 feet. See 0.1.6.5**RM** for GPS plot placement tolerances.

0.1.5**RM** Photo Work

Once the PC is established on the ground, pinprick the photo that has the RP pinprick on it. Use the terrain, gaps in the crowns, nearby openings, large rocks, etc. to locate where the pinprick should go. When using the NAIP imagery, usually the center of the pre-printed red circle will suffice. Carefully draw a line with a ball point pen on the back of the photo, using the RP and PC as guides for the 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.

For remeasurement plots with new photos – Transfer the old pinpricks and photo information onto the new ones. As of 2018, new aerial photos are generally not included in the plot packets. It is not necessary to pinprick the NAIP imagery.

0.1.6**RM** Finding the Plot Center – Remeasurement Locations

Use the following instructions to find the previously established plot center.

Navigating directly to the PC using the GPS
For most plots, the old PC can be relocated by navigating directly to it using the GPS and previously recorded PC coordinates. This is the fastest and most efficient method and should be tried first. When in the vicinity of the PC, look for the old subplot/microplot stakes, old flagging, nails at DBH for timber species or nails one foot up from the ground on the main stem for woodland species. For reserved land, look for nails at the base of each tree. Also, look for the PC witness tree tags or other landmarks described on the Field Location Reference Form as well as rock cairns. **If the old RP was not visited, record the old diameter on the current Field Location Reference form, copy the old description into the new MIDAS file, and add a note “RP not visited”.**

Navigating from RP to PC:
If it is not possible to find the PC by navigating directly to it, find the previously established RP (see 0.1.4.1**RM**) using directions and GPS coordinates recorded on the old Field Location Record sheet. 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.

Run the traverse from the RP to the PC (see 0.1.6.4**RM**) 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).

Witness Trees:
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. For more information on PC Witness see section 11.1.4**RM**

Old Stake Missing:
To find the previous plot center stake location, triangulate from the witness trees using the recorded slope distances and mark the spot. Be sure to measure along the slope from the base tags (face of the tree) of each witness tree and not the piths. If the old stake is not readily apparent, you may have to remove the duff and litter layer to expose the old stake. If the old stake is still missing, replace it with a new one at the spot marked using the witness tree information. If the witness trees are missing (cut), use tally-trees to triangulate making sure to measure from the pith and correcting for slope.

0.1.6.1**RM** 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 in section 0.1.4**RM** Finding the Plot Center – New Locations.

0.1.6.2**RM** Lack of suitable RP

If no suitable RP landmarks (e.g., tree, large boulder, fence corner, sharp bend in road), are in the vicinity of the plot location, build a small rock cairn (rock pile). Insert a metal stake into the center of the rock cairn and attach an RP tag to the stake. If possible, use a large shrub (e.g., large sagebrush) as the alternative RP landmark and nail an RP tag to the base of the shrub. Describe the RP used in the "RP Description" notes section on the Field Location Reference Form.

0.1.6.3**RM** 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 (check with Ogden office) from the theoretical coordinates listed on the plot packet label.

If a plot center is incorrectly placed (>3,281 feet off from the theoretical coordinates) 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 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.

0.1.6.4**RM** Traversing to the PC

Using a compass and tape, run a traverse (also called chaining) 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 marking the PC location.

0.1.6.5**RM** 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 ≤ 500 feet from the theoretical coordinates.

- For remeasurement plots, the averaged GPS coordinates at the plot center must be ≤ 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.

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 (**RM** not done at RMRS) 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 (**RM** not done at RMRS), 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.

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.

0.3**RM** 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 0.3.1**RM** discusses several situations where the crew may not be able to conduct the inventory; Section 0.3.2**RM** describes the basic parts (data forms) of the inventory to be completed; and Section 0.3.4**RM** 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 0.1.6.3**RM**.

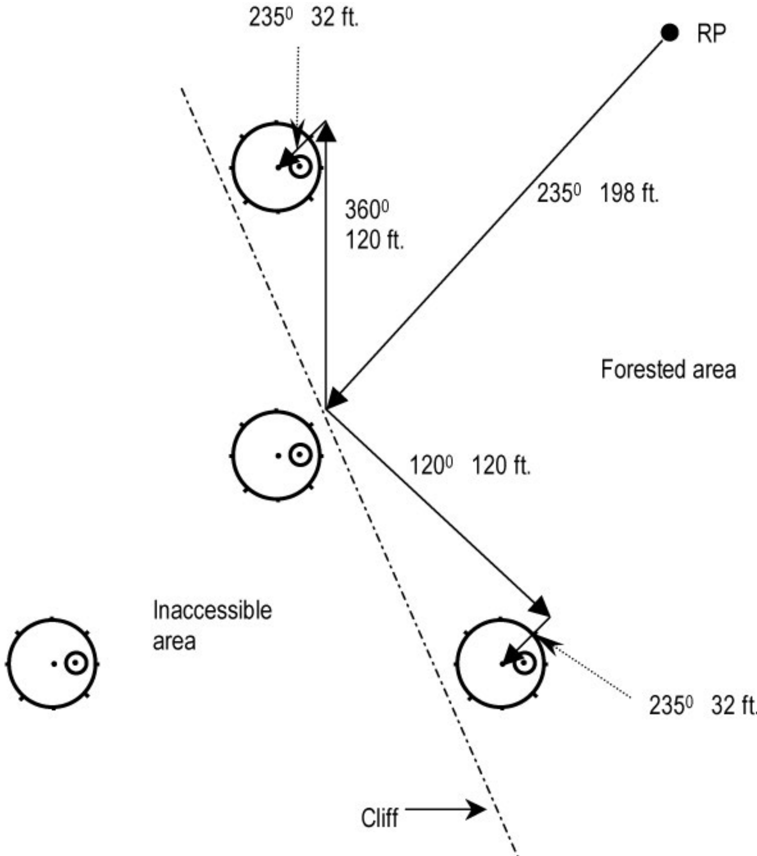
If a previously established subplot was not established in the correct location see Section 3.0 (Subplot Description Items).

0.3.1**RM** 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 235^0 for 230 feet. The cliff is encountered at 198 feet, 32 feet short of the plot center. To establish subplot 2, proceed 360^0 for 120 feet, then proceed on the original azimuth (235^0) 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 120^0 for 120 feet, then go 235^0 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**.

1. **Field Location Reference Form and Plot Monumentation Record** data (Section 11).

2. **Plot Level Data** (Section 1).
3. **Condition Class Data** (Section 2)
4. **Subplot Data** for each of the four subplots (Section 3)
5. **Tree and Sapling Data** - for SAMPLE KIND 2 plots only, assign TREE STATUS 0 with a RECONCILE code of 9 for all previously tallied trees on all four supblots (Section 5).
6. **Down Woody Material** data for nonsampled plots for each of the four subplots (section 10)
7. On the **outside of the plot packet** record the appropriate Condition Status code.

0.3.2**RM** 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 0.1.5.3**RM**, and sample the location using current inventory procedures.

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. **Field Location Reference Form and Plot Monumentation Record data** (Section 11).
2. **GPS Data**
3. **Plot Level Data** (Section 1)**.**
4. **Condition Class Data** (Section 2) for the condition containing the PC and for any additional conditions occurring on the subplots.
5. **Boundary References** data if needed (Section 4).
6. **Subplot Data** (Section 3) for each of the four subplots.
7. **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.
8. **Seedling Data** (Section 6) for any forested subplots.
9. **Site Tree Data** (Section 7) - Two site trees are required for each Forest Type present (timber species only).
10. **Understory Vegetation** data (Section 8), **Invasive Plants** (Section 9) and **Down Woody Material** (Section 10) for each subplot center that occurs in an accessible forest land condition.
11. **Soils** (Appendix F) only completed if a designated plot.
12. On the outside of the plot packet, record the following information:

- Date plot completed
- Crew Number and first initial and last name
- Condition Status

0.3.3**RM** 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. **Field Location Reference Form and Plot Monumentation Record** data (Section 11) only the appropriate information is required (including photographing the location).
2. **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 10 percent tree cover and no regeneration).
3. **Condition Class Data** (Section 2).
4. **Subplot Data** (Section 3) for each of the four subplots.
5. **Owner** (Appendix 13)
6. **Down Woody Material** data for nonforest plots for each of the four subplots (section 10)
7. On the outside of the plot packet, record the following information:
   - Date plot completed
   - Crew Number and First Initial and last name
   - Condition Status

0.3.4**RM** Remeasurement, All Condition Inventory plots (ACI), Soils

During the course of this field inventory, crews will commonly 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, ACI, and Soils 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. Remeasure plots use the same basic layout as the current inventory (refer to Section 0.0), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance – refer to Section 5.0). For locations established prior to 2001, microplots were centered on the subplot stake. Crews will need to establish a new microplot and remeasure the previous one. Old reference and witness trees can be reused if appropriate.

All Condition Inventory (ACI) plots expand the Interior West FIA P2 field inventory to include: (1) sampling on nonforest/water grid locations, and (2) data collection on nonforest/water conditions located at forest land grid locations. ACI plots are only sampled if the plot center is on National Forest land in Regions 1 and 4. Refer to Appendix E for more information.

Soils plots (also known as P3 Soils or P2+)**:** a subset of the P2 plots will have additional Soils information and samples collected (Appendix F).

0.3.5**RM** 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 on Reserved Land/Wilderness Areas: 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 on Reserved Land/Wilderness Areas

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 to 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 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 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.

National Remeasurement Plots: Current National 4-point offset co-located 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 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).

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 2019 - 2020 inventories. In 2021, WY will collect data under National Remeasurement protocols.

Plot Type	State	Current Design	Previous Design
National Remeasure	AZ, CO, ID, NM NV, UT, MT	P2 offset	P2 offset
Regional Remeasure	WY (through 2020)	P2 offset	P2 center P2 offset
ACI	ID, MT, NV, UT, and parts of WY and CO	P2offset	P2 center P2 offset
New	AZ, UT, CO, ID, NM, MT, NV, WY	P2 offset	No past sample/ or woodland fixed-radius/ or other tree land

0.4.1**RM** Sampling Procedures

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

0.4.2**RM** 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

a. 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.

1. 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.
2. 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.
3. 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.

b. Live woodland species (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 species) – 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.

c. 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 measured from the base of the tree to 4.5 feet is < 45 degrees from vertical

d. Standing dead woodland species 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 1.0 foot tall, and standing (STANDING DEAD = 1). For multistemmed trees, 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.

e. 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).

f. Down mortality woodland species 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).

0.4.3**RM** 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 or standing dead 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 or standing dead woodland species, with a single stem between 1.0 and 4.9 inches DRC or a cumulative DRC of 1.0 - 4.9 inches. For multistemmed trees, to qualify, a tree must have at least 1 stem that is least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point.

0.4.4**RM** 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 or less than 1.0 inch in diameter measured at 1 foot in length from the stem diameter measurement point.

Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling. Do not tally any seedlings that sprout from a live tally tree.

Do not tally or count fir “layers” (undetached 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.

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.

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).

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.

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 will be measured on nonforest lands.

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 plot status of the nonforest 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.

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.

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. (**RM** A mandatory Plot level note is required describing the access route(s) attempted and reason the plot is being called Hazardous.)

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.

1.7.1**RM** CONDITION CLASS CHANGE

Record the code that describes the change, if any, in the CONDITION CLASS from the previous inventory. Include changes in CONDITION CLASS STATUS (see 2.1.1) and changes within the delineating variables that further subdivide forest land (see 2.1.2).

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.

Note: With the change in forestland definition (5% vs. 10%) plots were forest last time were evaluated in the office (filtered) and called

either forest or nonforest. For plots filtered as nonforest that should have been filtered as forest, use code 2. For plots filtered as forest that should have been filtered as nonforest, use code 3.

1.8 NONFOREST PLOT NONSAMPLED REASON

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

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. (**RM** A mandatory Plot level note is required describing the access route(s) attempted and reason the plot is being called Hazardous.)

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.

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.

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.

1.10.1**RM** REGIONAL SAMPLE KIND

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

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 (e.g., 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.

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.

Values: 8.0

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.

Values: ≥ 2003

1.13.2 MONTH

Record the month that the plot was completed.

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.

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. (**RM** Not necessarily the road or parking spot used to access the location.) An improved road is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements.

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.

Values:

0 None – no water sources within the accessible forest/nonforest land
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:

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).

Values:

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

1.18.1**RM** 4 X 4

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

Values: “Y” for yes and “N” for no

1.18.2**RM** ATV

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

Values: “Y” for yes and “N” for no

1.18.3**RM** LOCKED GATE

Record if it was necessary to go through a locked gate to access the location. This includes locked gates that use a Forest Service “Yale” key. For future reference, it is helpful to indicate the type of lock in travel notes.

Values: “Y” for yes and “N” for no

1.18.4**RM** PLOT PHOTOS TAKEN

Record if plot photos were taken. A Plot level note must be made (describing the reason) if plot photos were not taken. For more information on taking plot photos, see section 11.8**RM**

Values: “Y” for yes and “N” for no

1.18.5**RM** NEW MAP DRAWN

Record if a new map was drawn. Draw a new map if previous map is poor OR change has occurred since previous map was drawn. See 11.10 RM for details on drawing the map.

Values: “Y” for yes and “N” for no

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

Critical GPS settings such as maximum PDOP, maximum EHE, minimum satellite elevation, minimum SNR, and number of readings to average will be determined by each region based on recommendations from the Mobile Geospatial Technology Advisory Group (MGTAG) where available. These may be collected in a file for post-processing or may be averaged by the GPS unit.

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions 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.
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.

Values:

0 GPS coordinates not collected
2 Models capable of field-averaging
3 Models capable of producing files that can be post-processed
4 Models 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.

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.

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).

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.

Values:

1 Geographic coordinate system
2 UTM coordinate system (**RM** Not collected in RMRS)

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.

Values: 0-90

1.19.8.2 LATITUDE MINUTES

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

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.

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.

Values: 1-180

1.19.9.2 LONGITUDE MINUTES

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

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.

Values: 0.00 – 59.99

1.19.10 UTM ZONE

RM Not collected in RMRS

1.19.11 EASTING (X) UTM

RM Not collected in RMRS

1.19.12 NORTHING (Y) UTM

RM Not collected in RMRS

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.

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.

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.

Values: -00100 to +20000

1.19.17 GPS ERROR

Record the error as shown on the GPS unit to the nearest foot up to 999 feet.
RM see Appendix C.2.3**RM**

Values: 000 to 999

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.
(RM For GPS units (Garmin GPSmap 62s) that give a Sample Confidence percentage and not a number of readings, record 180 if the Sample Confidence reaches 100%. If the unit does not reach 100%, record the percentage of 180 readings, e.g. if the sample confidence reaches 50%, record 90.)

Values: 001 to 999

1.19.19 GPS FILENAME (CORE OPTIONAL)

RM Not collected in RMRS

1.20 MACROPLOT BREAKPOINT DIAMETER (CORE OPTIONAL)

RM Not collected in RMRS

1.20.1**RM** FUTURE FOREST POTENTIAL

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

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 salt cedar, 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.

Values: English language words, phrases and numbers

1.22 P2 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.

1.22.1 P2 VEGETATION SAMPLING STATUS

This plot-level variable determines whether P2 Vegetation data will be recorded on the plot, and the land condition 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.

Values:

0 Not sampling P2 Vegetation
1 P2 Vegetation data collected only on accessible forest land conditions

(CONDITION CLASS STATUS = 1 and NONFOREST SAMPLING STATUS = 0)

2 P2 Vegetation data collected on all accessible land conditions (CONDITION CLASS STATUS=1 or NONFOREST CONDITION CLASS STATUS = 2)

1.22.2 LEVEL OF DETAIL

This plot-level variable determines whether data are collected for Vegetation Structure only or for Species Composition 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 8.5.1).

Values:

1 Collect data for Vegetation Structure only; total aerial canopy cover and canopy cover by layer for tally tree species (all sizes), non-tally tree species (all sizes), shrubs/subshrubs/woody vines, forbs, and graminoids.

2 Collect Vegetation Structure data (LEVEL OF DETAIL = 1) plus understory Species Composition data including up to four most abundant species per SPECIES GROWTH HABIT per subplot of: seedlings and saplings of any tree species (tally or non-tally) <5 inches DBH (DRC for woodland species), Non-tally tree species ≥5 inches DBH, shrubs/subshrubs/woody vines, forbs, and graminoids.

3 Collect Vegetation Structure data, understory Species Composition data (LEVEL OF DETAIL = 2), plus up to four most abundant tree species (tally or non-tally) ≥5 inches DBH (DRC for woodland species) per SPECIES GROWTH HABIT per subplot.

1.23 INVASIVE PLANT SAMPLING STATUS (Plot-level variable)

Determines whether invasive plant data will be recorded on the plot and the land class(es) on which it will be recorded.

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 CLASS STATUS=2)

1.24 INVASIVE PLANT SPECIMEN COLLECTION RULE (Plot-level variable)

Downloaded code to indicate if collection of specimens of unknown invasive species is required.

Values:

0 FIA unit does not require specimen collection for invasive plants

1 FIA unit requires specimen collection for invasive plants

1.25 Plot-Level Variables for DWM Protocol

The codes in this section define the type of variables and transect configuration used for measuring DWM. The variables will help define the design of previously-collected data and directly feed into compilation of expansion factors for measured DWM. These variables are predefined for an inventory and generally will be downloaded to the PDR.

1.25.1 DWM SAMPLING STATUS (BASE)

Record the code that describes whether DWM data will be recorded and which variables will be recorded. If code = 0, no further data collection is required within this manual section.

Values:

0 Not sampling DWM
1 BASE biomass DWM variables collected on measured land conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2).
2 BASE biomass and wildlife/ecological package DWM variables collected on measured land conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2). Required for P3 DWM
3 Rapid assessment DWM variables collected on measured land conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2).

1.25.2 DWM NUMBER OF SUBPLOTS (BASE)

Identify the number of subplots on which DWM is measured. When DWM SAMPLING STATUS = 1 or 2, number of subplots = 4. When DWM SAMPLING STATUS = 3, value can range from 1 to 4.

Values: 1 to 4

1.25.3 DWM NUMBER OF TRANSECTS ON SUBPLOT (BASE)

Identify the number of transects per subplot on which DWM is measured. A “transect” is defined as a line starting from subplot center and ending at or beyond the subplot boundary. When DWM SAMPLING STATUS = 1, number of transects per subplot = 2. When DWM SAMPLING STATUS = 2, number of transects per subplot = 2 or 3. When DWM SAMPLING STATUS = 3, value can range from 1 to 3.

Values: 1 to 3

1.25.4 DWM TRANSECT LENGTH (BASE)

Identifies the length of each transect on which DWM is measured. The minimum transect length when DWM SAMPLING STATUS >0 is 24.0 feet, measured to the nearest 0.1 foot. On plots where the core-optional condition classes are defined and measured on the macroplot, transect length can extend into the 58.9 foot macroplot. When DWM SAMPLING STATUS = 1 or 2, transect length equals 24 feet or 58.9 feet; when DWM SAMPLING STATUS = 3, the length can be some specified value between 24 feet and 58.9 feet (if conditions are mapped on the macroplot).

Values: 24.0 to 58.9 feet

1.25.5 DWM SUBPLOT LIST (BASE)

Identifies the subplots on which DWM is measured. When DWM SAMPLING STATUS = 1 or 2, subplots = 1234. When DWM SAMPLING STATUS = 3, value can range from 1000 to 4000.

Values: 1000 to 4000

1.25.6 DWM NOTES (BASE)

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

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).

2.0.1**RM** 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. Additionally, nonforest land is sampled in some areas of special interest.

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

Any condition class sampled as accessible forest land must 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

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 2.5.30). This allows tracking of land use changes without requiring mapping of all nonforest land condition classes on all plots.

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see Section 2.3.1).

2.1.3 Step 3: When inventorying Nonforest Land, delineate accessible Nonforest Land by 3 delineation variables

Any condition class sampled as accessible nonforest land must 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. PRESENT NONFOREST LAND USE.

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 the following criteria:

   Forest Land has at least 10 percent canopy cover of live tally tree species of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence. 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.

   In contrast to regular mowing, chaining treatments are recognized as long-term periodic or one-time treatments. Although the intent of chaining may be permanent removal of trees, reoccupation is common in the absence of additional treatments and sometimes the treatment does not remove enough to reduce canopy cover below the threshold of forest land. As a result, only live canopy cover should be considered in areas that have been chained; missing (dead or removed) canopy cover is not considered in the forest land call.

   In the cases of land on which either forest is encroaching on adjacent nonforest land, or the land that was previously under a nonforest land use (e.g., agriculture or mining) is reverting to forest naturally, only the live cover criterion applies.

In the case of deliberate afforestation – human-assisted conversion of other land use/land cover to forest land -- there must be at least 150 established trees per acre (all sizes combined) to qualify as forest land. Land that has been afforested at a density of less than 150 trees per acre is not considered forest land (see nonforest land below). If the condition experiences regeneration failure or is otherwise reduced to less than 150 survivors per acre after the time of planting / seeding but prior to achieving 10 percent canopy cover, then the condition should not be classified forest land.

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.

When a forest land condition encroaches into a nonforest land condition, the border between forest and nonforest is often a gradual change in tree cover with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum cover criteria and where it does not. For these situations, determine where the land clearly meets the 10 percent minimum canopy cover, and where it clearly is less than required cover; 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 (fig. 2), using the class criteria above.

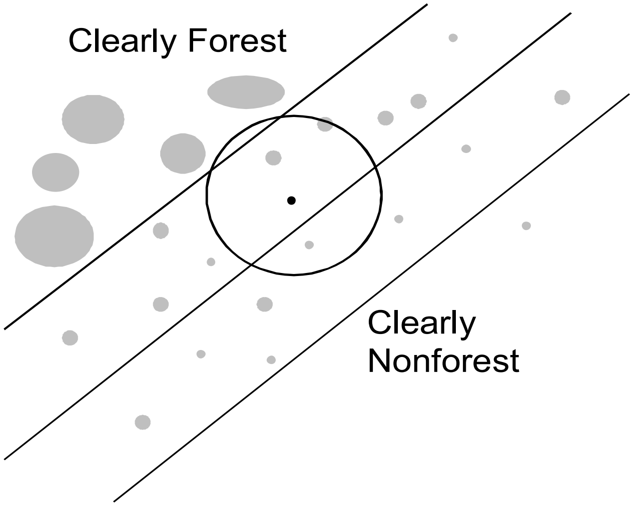


Figure 2. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

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 forest 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 forest and where it is clearly nonforest; divide this zone in half, and classify the entire subplot based on which side of the line the subplot center falls.

<u>Treated strips</u> – 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.

<u>Indistinct boundary due to the condition minimum-width definition</u> – 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.

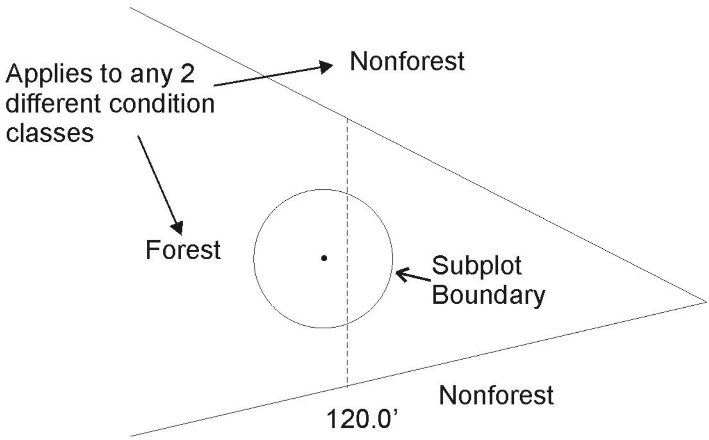


Figure 3. Forest condition narrows within a nonforest land condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

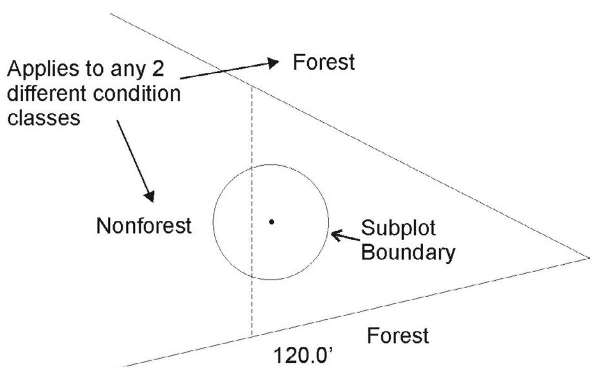


Figure 4. Nonforest land condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

2. Nonforest Land
Land that has less than 10 percent canopy cover of tally tree species of any size (live + missing) and, in the case of afforested land, fewer than 150 established trees per acre; OR land that has sufficient canopy cover or stems, but is classified as nonforest land use (see criteria under PRESENT NONFOREST LAND USE). Nonforest includes areas that have sufficient cover or live stems to meet the Forest Land definition, but do not meet the dimensional requirements. All conditions not meeting the requirements of forest land will be assigned a PRESENT NONFOREST LAND USE CODE.

Other Wooded Land – Other wooded land has at least 5 percent, but less than 10 percent, canopy cover of live tally tree species of any size or has had at least 5 percent, but less than 10 percent, canopy cover of tally species in the recent past, based on the presence of stumps, snags, or other evidence. Other wooded land is recognized as a subset of nonforest land, and therefore is not currently considered a separate condition class. 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. In addition, other wooded land is classified according to the same nonforest land use rules as forest land (e.g., 6 percent cover in an urban setting is not considered other wooded land). Other wooded land is therefore defined as having >5 percent and <10 percent canopy cover at present, or evidence of such in the past, and PRESENT NONFOREST LAND USE CODE = 20, 40, 42, 43 or 45.

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, possibility of forest
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.

2.3 CONDITION CLASS ATTRIBUTES

A CONDITION CLASS NUMBER and a classification for CONDITION CLASS STATUS are required for every condition class sampled on a plot.

2.3.1 Forest Land

For each condition class classified as accessible forest land, a classification is required for each of the following attributes:

2.5.1 RESERVED STATUS
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

Attributes where a change causes a separate condition class

2.5.7 OWNER CLASS
2.5.13 ARTIFICIAL REGENERATION SPECIES
2.5.14 STAND AGE
2.5.15 DISTURBANCE (up to 3 coded)
2.5.16 DISTURBANCE YEAR (1 per disturbance)
2.5.21 TREATMENT (up to 3 coded)
2.5.22 TREATMENT YEAR (1 per treatment)
2.5.27 PHYSIOGRAPHIC CLASS

Ancillary – changes do not delineate a new condition class

2.5.29 PRESENT NONFOREST LAND USE (for area converted from accessible forest land condition class to nonforest land since last inventory).

2.3.2 Nonforest Land

For each condition class classified as nonforest land, a classification is required for each of the following attributes:

2.5.1 RESERVED STATUS
2.5.2 OWNER GROUP
2.5.29 PRESENT NONFOREST LAND USE

Attributes where a change causes a separate condition class

2.5.7 OWNER CLASS
2.5.15 DISTURBANCE (up to 3 coded)
2.5.16 DISTURBANCE YEAR (1 per disturbance)
2.5.21 TREATMENT (up to 3 coded)
2.5.22 TREATMENT YEAR (1 per treatment)
2.5.27 PHYSIOGRAPHIC CLASS

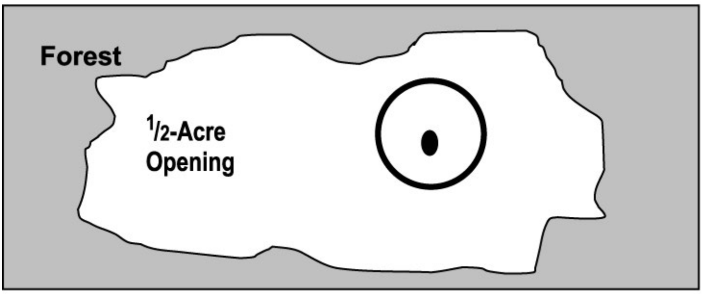
Ancillary – changes do not delineate a new condition class

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-feet 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).

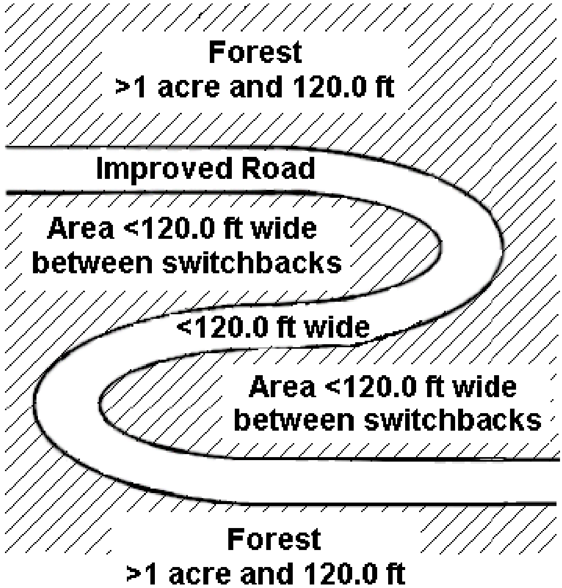
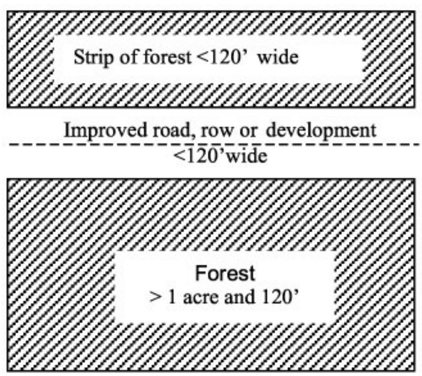
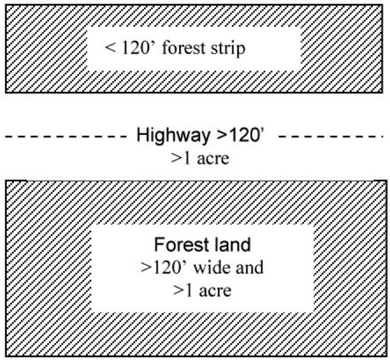


Figure 5. Example of a switchback road. All the cross-hatched area is forest and the improved road is a noforest condition.



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

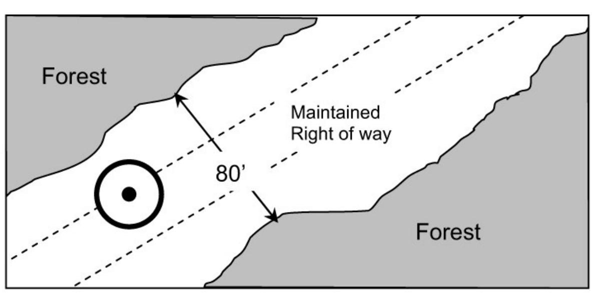


RM Figure 5.2. Example of a nonforest strip >120' wide. Area of forest above highway is not forest land

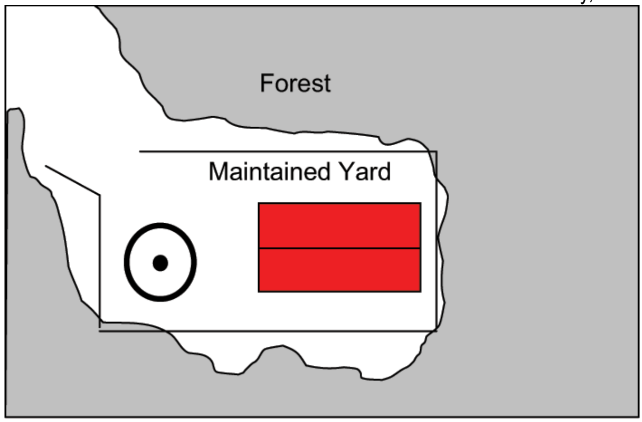
a. Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. Unimproved traces and roads created for skidding logs are not considered improved roads.

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)

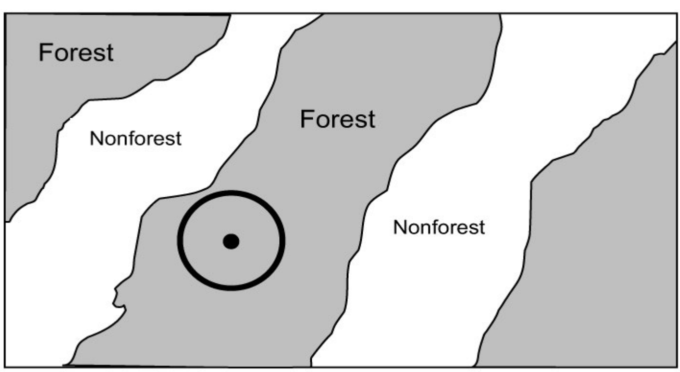


RM Figure 5.3. The subplot falls in a power line right-of-way. Although the right-of-way is less than 120-feet wide, maintained roads and rights-of-way are exemptions to the size rule and are considered NONFOREST LAND regardless of width.



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 5.5)



RM Figure 5.5. The subplot falls in an area of alternating strips of forest and nonforest, none of which meet the 120-feet 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: For 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 6. Figure 6 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 6. 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 7).

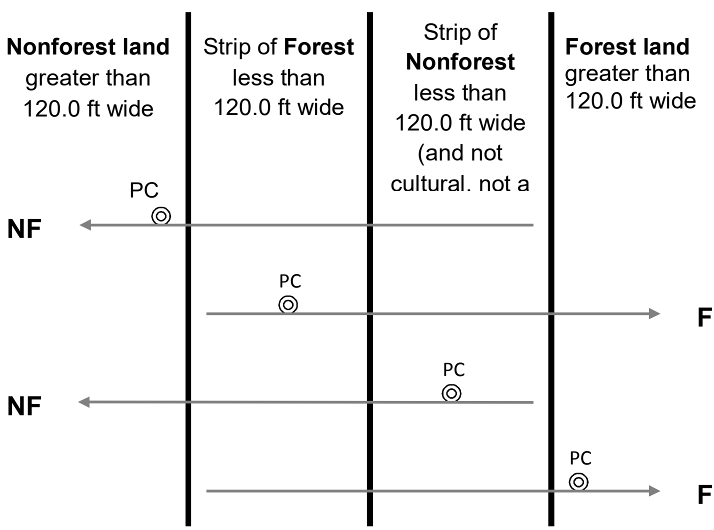


Figure 6. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

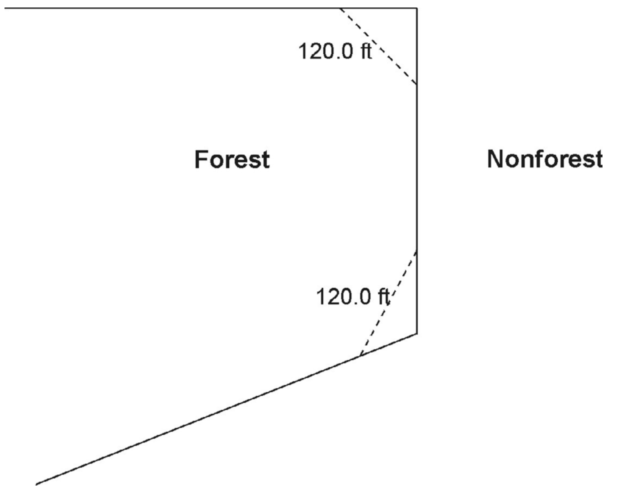
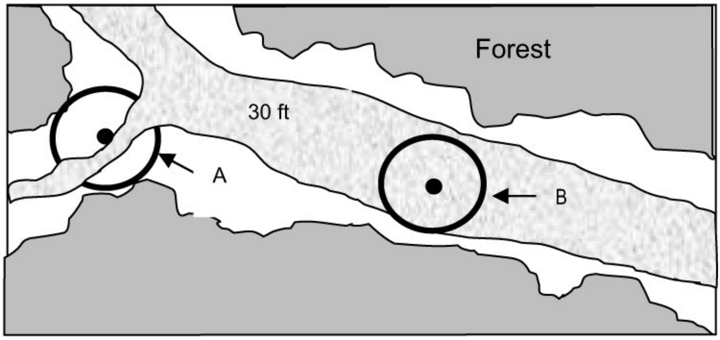


Figure 7. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest land conditions.

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 7.1)

5. Nonsampled conditions are delineated as a separate condition class regardless of size.



RM Figure 7.1. 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.

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.

Values:

1 Accessible forest land
2 Nonforest land
3 Noncensus water
4 Census water
5 Nonsampled – possibility of forest land

2.4.2.1**RM** CONDITION STATUS CHANGE

Record the code that describes the type of Condition Class Change that has occurred since the previous inventory. Record when SAMPLE KIND = 2 and CONDITION CLASS CHANGE = 1.

Values:

Code	Present	Past
1	Accessible Forest Land (CONDITION CLASS STATUS = 1)	All Accessible Forest Land (CONDITION CLASS STATUS = 1)
2	Not Accessible Forest Land (CONDITION CLASS STATUS = 2, 3, 4, 5)	All NOT accessible Forest Land (CONDITION CLASS STATUS = 2, 3, 4, 5)
3	Accessible Forest Land (CONDITION CLASS STATUS = 1	Some portion was NOT accessible Forest Land (CONDITION CLASS STATUS = 2, 3, 4, 5)
4	NOT accessible Forest Land (CONDITION CLASS STATUS = 2, 3, 4, 5	Accessible Forest Land (CONDITION CLASS STATUS = 1)

2.4.3 CONDITION NONSAMPLED REASON

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

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. (**RM** Include a Condition level note describing the hazardous situation.)

05 Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 05. This code is for office use only.

06 Lost plot – Entire plot cannot be found. Used for the single condition that is required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 06. Can be either generated by the data recorder or in the office.

07 Wrong location – Previous plot can be found, but its placement is beyond

the tolerance limits for plot location. Used for the single condition that is required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 07. Can be either generated by the data recorder or in the office.

08 Skipped visit – Entire plot skipped. Used for the single condition that is required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 08. This code is for office use only.

09 Dropped intensified plot – Used for the single condition that is required for this plot. Used only by units engaged in intensification. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 09. 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 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).

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.

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. (**RM** Include a Condition level note describing the hazardous

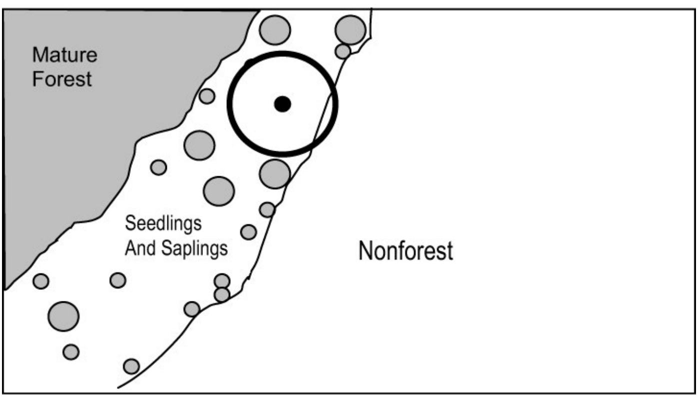
situation.)

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, saplings, and seedlings 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 7.2)



RM Figure 7.2 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, 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. (**RM** If the previous crew recognized a boundary that would now be considered "indistinct", the current crew should remove this indistinct boundary.)

   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-radius subplots that sample distinctly different condition classes – Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed-radius subplots, 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 forest land. 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. (**RM** "within forest" includes a forested condition on one side only). Figures 8-13 provide examples of when to delineate riparian forest area as a separate condition class.

Note: When the width of forest adjacent to a body of water or water course 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.

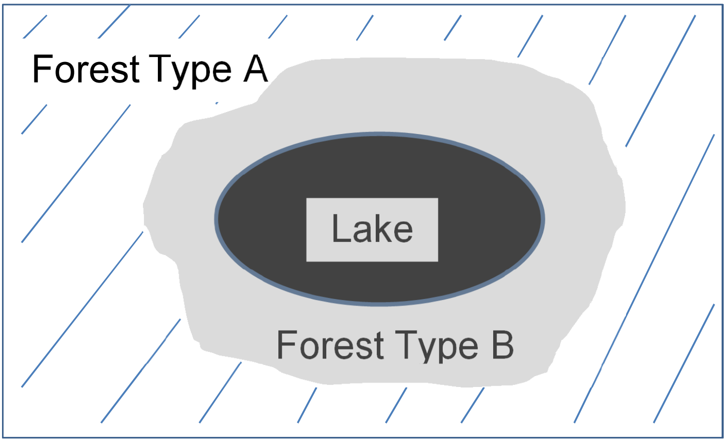


Figure 8. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

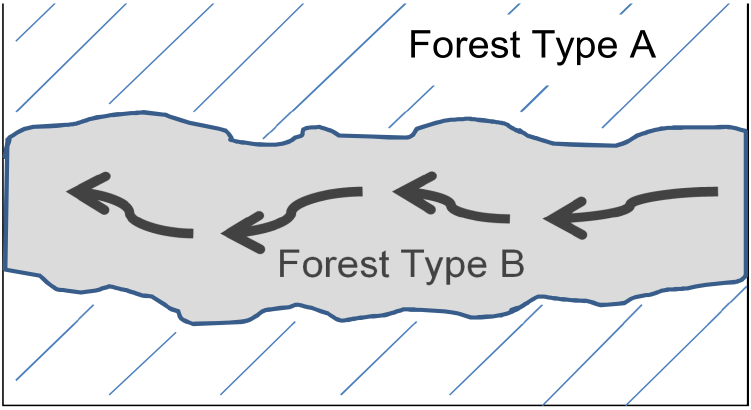


Figure 9. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

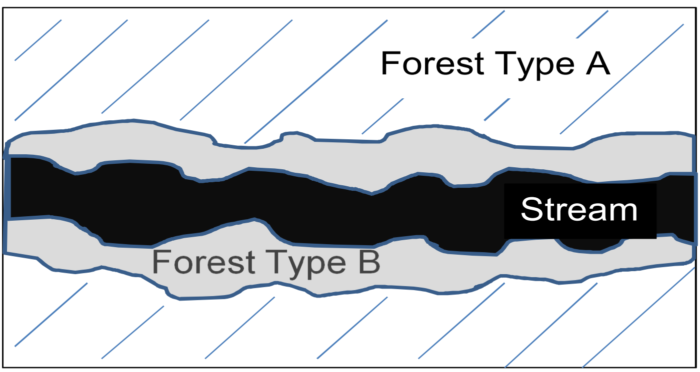


Figure 10. If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands, including the stream falls between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

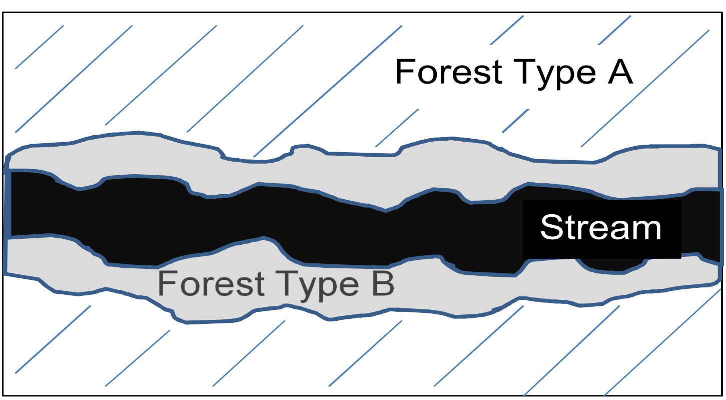


Figure 11. If the stream is > 30.0 feet wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands falls between 30.0 feet and 120.0 feet wide and is > 1.0 acre in size.

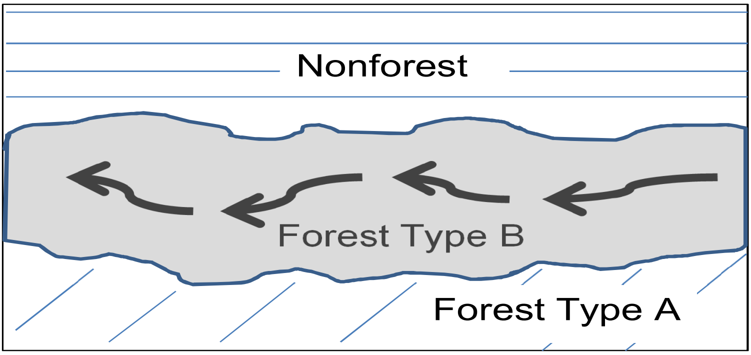


Figure 12. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is > 1.0 acre in size.

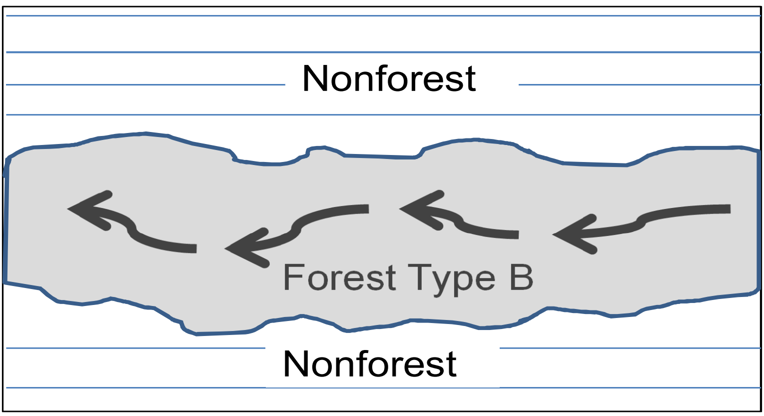


Figure 13. In a nonforested area, a band of forest type B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.

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.

Ownership and the name (designation) of an area are critical for determining reserved status. All private lands (OWNGRPCD = 40) are considered not reserved (due to difficulty in determining legal status); this includes in-holdings, where they can be identified. FIA has adopted a default national list of federal land designations which are considered reserved (see appendix 12). All federally-owned lands managed by the National Park Service or Fish and

Wildlife Service (OWNCD = 21 or 23) are considered reserved. Some lands owned by State or local governments are considered reserved, even in the absence of specific laws covering them, if the agency mandate for that land designation precludes management to produce wood products (e.g., most State Parks). In the absence of State-specific lists of reserved areas, any State or local government land area that includes “park”, “wilderness”, “wild river”, or “reserve”, or “preserve” in the name is by default considered reserved. There are less common designations that are not on the CORE list and units may add exceptions to the list for specific areas that are managed under different legal guidance than is usual for that designation. All designations must be documented using the RESERVED AREA NAME field. Note that harvest can occur in reserved areas, for example for restoration, safety, or recreation.

For the core optional procedure, nonforest areas are reserved if forest lands in the same designated area are considered reserved, or if the area would be considered reserved if forestland was present.

RM Several Native American tribes have designated portions of their land as reserved. Although they cannot be coded as reserved for our study, we still need to respect their designations and use reserved monumenting procedures for these lands.

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.

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. Note: Canopy cover is used to determine whether an area is forest or nonforest. Stocking is used with other variables such as this one.
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.

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, seedlings and saplings in the condition class. Note: Canopy cover is used to determine whether an area is forest or nonforest. Stocking is used with other variables such as this one.

Values:

0 Nonstocked
Meeting the definition of accessible forest land, and one of the following applies:

a. less than 10 percent stocked by trees, seedlings, and saplings, and not classified as cover trees, or

b. for several woodland species where stocking standards are not available, less than 10 percent canopy cover of trees, seedlings, and saplings .

1 < 4.9 inches (seedlings / saplings)
At least 10 percent stocking (or 10 percent canopy cover if stocking standards are not available) in trees, seedlings, and saplings; and at least 2/3 of the canopy cover is in trees less than 5.0 inches DBH/DRC.

2 5.0 – 8.9 inches (softwoods & woodland trees) / 5.0 – 10.9 inches (hardwoods)
At least 10 percent stocking (or 10 percent canopy cover if stocking standards are not available) in trees, seedlings, and saplings; and at least 1/3 of the canopy cover is in trees greater than 5.0 inches DBH/DRC and the plurality of the canopy 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 & woodland trees) / 11.0 – 19.9 inches (hardwoods)
At least 10 percent stocking (or 10 percent canopy cover if stocking

standards are not available) in trees, seedlings, and saplings; and at least 1/3 of the canopy cover is in trees greater than 5.0 inches DBH/DRC and the plurality of the canopy cover is in softwoods between 9.0 – 19.9 inches diameter and/or hardwoods between 11.0 – 19.9 inches DBH, and/or woodland trees 9.0 – 19.9 inches DRC.

4 20.0 – 39.9 inches
At least 10 percent stocking (or 10 percent canopy cover if stocking standards are not available) in trees, seedlings, and saplings; and at least 1/3 of the canopy cover is in trees greater than 5.0 inches DBH/DRC and the plurality of the canopy cover is in trees between 20.0 – 39.9 inches DBH.

5 40.0 + inches
At least 10 percent stocking (or 10 percent canopy cover if stocking standards are not available) in trees, seedlings, and saplings; and at least 1/3 of the canopy cover is in trees greater than 5.0 inches DBH/DRC and the plurality of the canopy cover is in trees >40.0 inches DBH.

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, seedlings, and saplings 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.

When using canopy cover as the surrogate for stocking to determine STAND SIZE CLASS, view the plot from the top down and examine canopy cover. The stand must have at least 10 percent of the canopy 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 canopy cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 1. If less than 2/3 of the canopy 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 canopy cover.

2.5.5 REGENERATION STATUS

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

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 regeneration status.

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, seedlings, and saplings 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. (**RM** For RMRS, low-stocked stands are defined as less than 30% cover. At least one of the two densities must be >30% cover.)

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^2 basal area per acre) while the other portion is undisturbed (with 100 ft^2 basal area per acre).
- **RM** example: the south side of a drainage has 10% cover of pinyon-juniper, while the north side has 35% cover. Recognize the density change.
- **RM** example: the south side of a drainage has 10% cover of pinyon-juniper, while the north side has 25% cover. Do not recognize the change (at least one of the two has to be >30%).

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 occur within a condition class (i.e., within an OWNER GROUP), record the OWNER CLASS closest to the center of the lowest numbered subplot in the condition.

Values:

Owner Classes within Forest Service Lands (Owner Group 10)

11	National Forest
12	National Grassland and/or Prairie
13	Other Forest Service land

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 including state public universities
32	Local (County, Municipality, etc.) including water authorities
33	Other Non Federal Public

Owner Classes within Private lands (Owner Group 40)

- 41 Corporate, including Native Corporations in Alaska and private universities
- 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, churches etc..
- 44 Native American (Indian) – within reservation boundaries
- 45 Individual and Family, including trusts, estates, and family partnerships

2.5.8 OWNER SUB-CLASS (CORE OPTIONAL)

RM Not collected in RMRS

2.5.9 PUBLIC ADMINISTRATIVELY WITHDRAWN STATUS (CORE OPTIONAL)

RM Not collected in RMRS

2.5.10 ADMINISTRATIVELY WITHDRAWN AREA NAME (CORE OPTIONAL)

RM Not collected in RMRS

2.5.11 ADMINISTRATIVELY WITHDRAWN NOTES (CORE OPTIONAL)

RM Not collected in RMRS

2.5.12 RESERVED AREA NAME

Record the specific name of the area that identifies the reserved designation for the condition. If a drop-down list is provided in the PDR, either select the correct name or select “Other” and type the correct name in the notes field.

Values: English language words, phrases, and numbers

2.5.13 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.

Values: See Appendix 3

2.5.14 STAND AGE

Record the average total age, to the nearest year, of the trees (plurality of all live trees, seedlings, and saplings not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for nonstocked stands. Note: Canopy cover is used to determine whether an area is forest or nonforest. Stocking is used with other variables such as this one.

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

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

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

If all of the trees in a condition class are of a species which, by regional standards, 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** Most cores are counted in the field. If an AGE or RADIAL is estimated, record “1” for RADIAL GROWTH AND TREE AGE CHECK (see Section 5.25.7**RM**). STAND AGE is automatically populated in the PDR after all appropriate RADIAL

GROWTH and TREE AGES are entered).

Values: 000 to 997, 998, 999

2.5.14.1**RM** 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.

ACI note: for ACI nonforest conditions, if several types within a condition class are evident, record the type that is occurring at subplot center as the primary type.

See **RM** Appendix G: Habitat Type Publications used in RMRS

2.5.14.2**ACI** RANGE TYPE

(Existing Vegetation Classification)
For each nonforest condition, record the vegetation type from the MIDAS pick list for the predominant existing vegetation that is most representative of the condition. Record code=999 if not enough vegetation to determine a cover type or nothing fits (undefined). The existing vegetation classification is not necessarily the same as habitat type.

Values: See Appendix E.5.1ACI RANGE TYPE for acceptable codes.

2.5.15 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.

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 condition-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

2.5.16 DISTURBANCE YEAR 1

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

Values: Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999

2.5.17 DISTURBANCE 2

Record the second disturbance here. See DISTURBANCE 1 for coding instructions.

2.5.18 DISTURBANCE YEAR 2

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

2.5.19 DISTURBANCE 3

Record the third disturbance here. See DISTURBANCE 1 for coding instructions.

2.5.20 DISTURBANCE YEAR 3

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

2.5.21 TREATMENT 1

Forestry treatments are a form of disturbance. These human disturbances are recorded separately here for ease of coding and analysis. <u>The term treatment further implies that a silvicultural application has been prescribed.</u> 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 (plots SAMPLE 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.

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.

2.5.22 TREATMENT YEAR 1

Record the year in which TREATMENT 1 occurred.

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

2.5.23 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.

2.5.24 TREATMENT YEAR 2

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

2.5.25 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.

2.5.26 TREATMENT YEAR 3

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

2.5.27 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.

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.

2.5.28 COVER CLASS

Record this variable for all mapped conditions. As with 2.4.2 CONDITION CLASS STATUS, COVER CLASSes must meet the minimum area and width requirements (except those cases where the condition has been defined due to one of the exceptions to the size and width requirements. If the condition is less than 1 acre, then apply the key to the condition. In order to assign a single cover class to a mapped condition that contains more than one candidate cover class, proceed as follows: if no prospective cover classes meet the minimum width and area requirements, apply the key to the acre area that is within the condition being evaluated and closest to the lowest numbered subplot center associated with the condition. If multiple cover classes (i.e., those which meet minimum area and width requirements) exist in the condition, assign the first cover class that is encountered to the condition. As with other condition attributes, inclusions (of less than 1 acre) within the condition should be ignored when assigning the COVER CLASS. Therefore, areas of the inclusion within the acre area are ignored when making the relative cover assessments. Apply the key as a guide and/or to verify the COVER CLASS selection.

Assignment of COVER CLASS code is hierarchical in nature, and should be performed using the following hierarchical key. Following the guidance of the key, codes should be examined in succession, and the first definition that describes the area of the condition should be chosen. For example, if an area has 15% tree cover that is taller than the 50% shrub cover, it is classified as class 01 (Tree Cover). Note: Tree Cover is not equivalent to Forestland (e.g., a recent clearcut could be Forestland, but would not be Tree Cover). Vegetative cover, as used below, includes the area of ground covered by the vertical projection of the live plant canopy (or other vegetation components like flowers, basal structures or vines) on the area defined by the condition. If foliage is absent due to senescence or dormancy, the cover should be estimated based on the position of plant remains or other evidence of the foliar distribution during the growing season. If vegetation rooted outside of a condition is hanging over the condition being evaluated, it is considered in the cover calculations. If burned, then classify based on the remaining live vegetation, including the canopy cover of remaining live trees and shrubs. When the surface of a condition is covered by deep non-permanent snow, ice, or water, and/or a condition is defined as CONDITION CLASS STATUS 5 (denied access or hazardous), field crews should use aerial imagery, local knowledge, and field observations to best determine COVER CLASS.

Full Cover Class Definitions

- **Dominant**: Refers to the highest (tallest) life form present, typically trees, then shrubs, then herbaceous layers.
- **Predominant**: Refers to the cover class with the highest percent cover in the condition.
- **Vegetated**: Contains at least 10% live vegetation cover.
- **Sparsely Vegetated**: Does not contain at least 10% live vegetation cover

Cover Classification Key

1. ≥10% live vegetative cover = Vegetated, else 2.

1.1 Areas on which live trees provide 10% or greater canopy cover and are part of the dominant (uppermost) vegetation layer, including areas that have been planted to produce woody crops = 01 Tree Cover

1.2 Areas on which live shrubs provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer = 02 Shrub Cover

1.3 Areas on which live herbaceous vegetation (including seasonally senescent cover) provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer = 03 Herbaceous Cover

1.4 Areas on which non-vascular vegetation provide 10% or greater cover and are part of the dominant vegetation layer = 04 Non-vascular Vegetation Cover

1.5 Areas with 10% or greater live vegetative cover but no one life form has 10% or more cover = 05 Mixed Vegetation Cover

2. <10% live vegetative cover = Sparsely Vegetated

2.1 Areas persistently and predominantly covered by water (census and noncensus water, permanent snow and ice) and with less than 10% cover of emergent vegetation = 10 Water

2.2 Areas predominantly covered with constructed materials with limited plant life = 09 Impervious

2.3 Areas predominantly covered by bare rock, gravel, sand, silt, clay, or other earthen material, which contains <10% vegetation cover regardless of its inherent ability to support life = 08 Barren

Values:

Codes are >10% vegetative cover:	
01	**Tree Cover:** Areas on which live trees provide 10% or greater canopy cover and are part of the dominant (uppermost) vegetation layer, including areas that have been planted to produce woody crops, Christmas trees, orchards, etc. Only include tree species that can be tallied in the region, i.e., that are on the regional species list. Example areas include forests, forest plantations, reverting fields with >10% tree canopy cover, clearcuts with >10% tree canopy cover. This category includes cypress swamps and mangroves (not to be confused with aquatic vegetation).

02	**Shrub Cover:** Areas on which live shrubs or subshrubs provide 10% or greater cover and are part of the dominant (uppermost) vegetation layer, provided these areas do not qualify as Tree Cover. **Shrub/Subshrub** — a woody plant that generally has several erect, spreading, or prostrate stems, which give it a bushy appearance. This includes dwarf shrubs, and low or short woody vines (NVCS 2008) and excludes any species on FIA's tree list. Examples include cranberry bogs, berry crops, and other shrub-dominated wetlands, chaparral, and sagebrush.
03	**Herbaceous Cover**: Areas on which live herbaceous vegetation (including seasonally senescent cover) provides 10% or greater cover and are part of the dominant (uppermost) vegetation layer, provided these areas do not qualify as Tree Cover or Shrub Cover. This includes herbs, forbs, and graminoid species. Examples include meadows, prairies, croplands, and improved pasture. This category also includes emergent wetland vegetation like seasonally flooded grasslands, cattail marshes, etc.
04	**Non-vascular Vegetation Cover**: Areas on which non-vascular vegetation provides 10% or greater cover and are part of the dominant vegetation layer, provided these areas do not qualify as Tree Cover, Shrub Cover, or Herbaceous Cover. Examples include mosses, sphagnum moss bogs, liverworts, hornworts, lichens, and algae.
05	**Mixed Vegetation Cover**: Areas with 10% or greater live vegetative cover but no one life form has 10% or more cover. That is, these areas do not qualify as Tree Cover, Shrub Cover, Herbaceous Cover, or Non-vascular Vegetation Cover, and thus are a mixture of plant life forms. Examples can include early stages of reverting fields and high deserts.
Codes are < 10% cover	
08	**Barren**: Areas predominately covered by bare rock, gravel, sand, silt, clay, or other earthen material, which contains <10% vegetation cover regardless of its inherent ability to support life. Examples include naturally barren areas such as lava fields, gravel bars, sand dunes, salt flats, deserts, playas, and rock outcroppings, as well as areas of bare soil exposed by land clearing, wildfire and other forms of disturbance. Also includes minerals and other geologic materials exposed by surface mining and roads made of dirt and gravel.
09	**Impervious**: Areas predominantly covered with constructed materials that contain < 10% vegetation cover. Examples include paved roads, parking lots, driveways, sidewalks, rooftops and other man-made structures.
10	**Water**: Areas persistently covered and predominated by water and have <10% emergent vegetative cover. Examples include census and noncensus water, and permanent snow and ice. For example, only the open water portion of a bog is to be included.

2.5.29 PRESENT NONFOREST LAND USE

Record this attribute for every nonforest condition class sampled. Recognizing multiple nonforest conditions on a plot is not required unless conducting a nonforest inventory (NONFOREST SAMPLING STATUS = 1); or when areas that were sampled and classified at last inventory as accessible forest land and are now nonforest or partially nonforest land. For those areas that have changed from forest to nonforest, this variable is used to track land use change. Conversions from forest to nonforest become new nonforest conditions whenever they occur, except when a previously defined nonforest condition has expanded into an adjacent previously defined forest condition. This expanded condition will be captured through boundary changes on respective subplots and does not constitute a new separate condition. Instructions in Sections 2.1 and 2.4 apply.

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

2.5.29.1**RM** LAND USE

For each condition, record the current land use.

Values: 1 – 4

1	Condition is not being manipulated by human activities such as regular mowing, intensive grazing, or recreation activities.
2	Condition is being manipulated by human activities that prevent normal regeneration and succession such as regular mowing, intensive grazing, or recreation activities.
3	Condition has been chained in the past.
4	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.

2.5.29.2**RM** 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 ¾ inch (longest dimension). Do not include rocks protruding through the soil or cryptobiotic crusts as bare ground.
If the plot includes a non-forested areas, estimate the percent bare ground in only the forested condition (e.g. 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.

Values: 0-99

2.5.30 CANOPY COVER SAMPLE METHOD

Record the CANOPY COVER SAMPLE METHOD used to determine LIVE CANOPY COVER and LIVE PLUS MISSING CANOPY COVER, 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.)

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

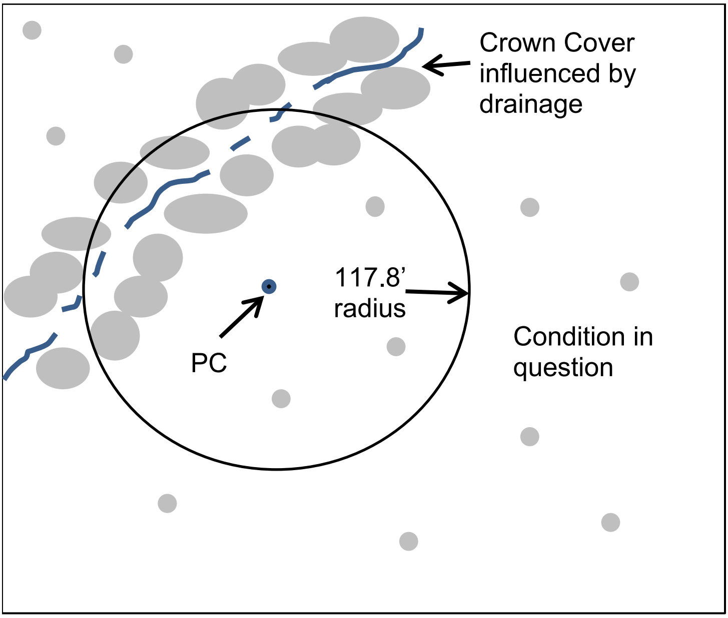
Acre method – The Acre method is used when the Ocular method is not appropriate and when it is safe and practical to sample on the entire acre.

1. To determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached (4356 ft^2), 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

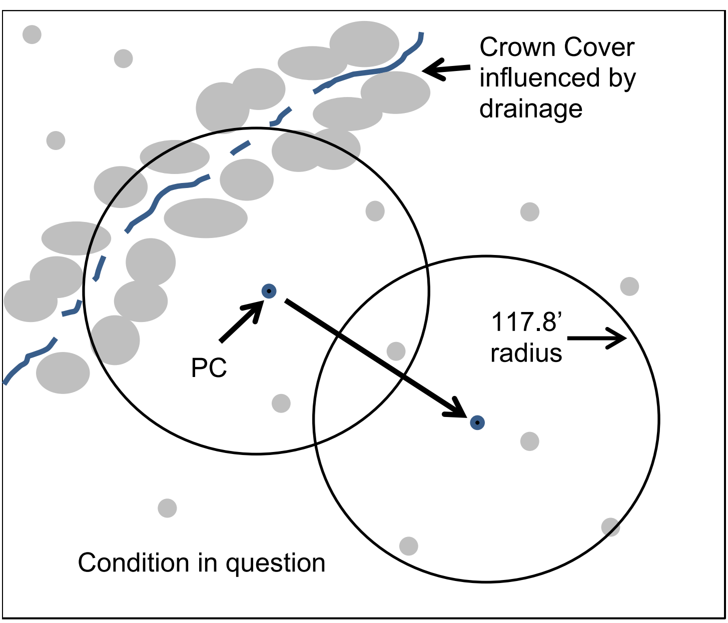
met and there is additional LIVE PLUS MISSING CANOPY COVER on the acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the Ocular method (**RM** In RMRS, if the Acre method is used, do not estimate once the 10% LIVE PLUS MISSING CANOPY COVER threshold has been met. The whole acre must be sampled.)

3. As with the Subplot method, the sample acre (117.75 foot radius plot) must fall entirely in the questionable condition.

   RM In situations where the Plot Center (PC) is located near an area where the CROWN COVER is being influenced by a drainage and it is not certain if the area on either side of the drainage meets the 10% CROWN COVER threshold, it may be necessary to shift your sample acre (for determining crown cover) perpendicularly away from the drainage. In Figure 14a, the PC is located near a drainage where, if the sample acre CROWN COVER was calculated from its current position, it would unfairly represent the condition on either side. By shifting the center of your sample acre perpendicularly away from the drainage (Figure 14b) and keeping your entire sample acre in the condition in question, the CROWN COVER of the area on either side of the drainage can be calculated without any unfair influence. The opposite of this example, where an area of no cover exists, would be treated similarly by moving the area being sampled. **RM Plot establishment still remains in the original location; this movement is only for the purposes of calculating the CROWN COVER of a condition being influenced by a small inclusion that would otherwise unfairly represent the condition.**



RM Figure 14a. Example of an inclusion (area directly related to the drainage) that could unfairly represent CROWN COVER of the "Condition in question" using the Acre Method



RM Figure 14b. Example of shifting the 117.8' radius sample area perpendicularly away from an inclusion that would unfairly represent the "Condition in question" using the Acre Method

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^2.
2. A 1-acre circle has a radius of 117.75 ft.
3. 10% of 1-acre is 4,356 ft^2.

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 Canopy Area = pi*((long axis diameter/2)*(90 degrees axis diameter/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 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 15).

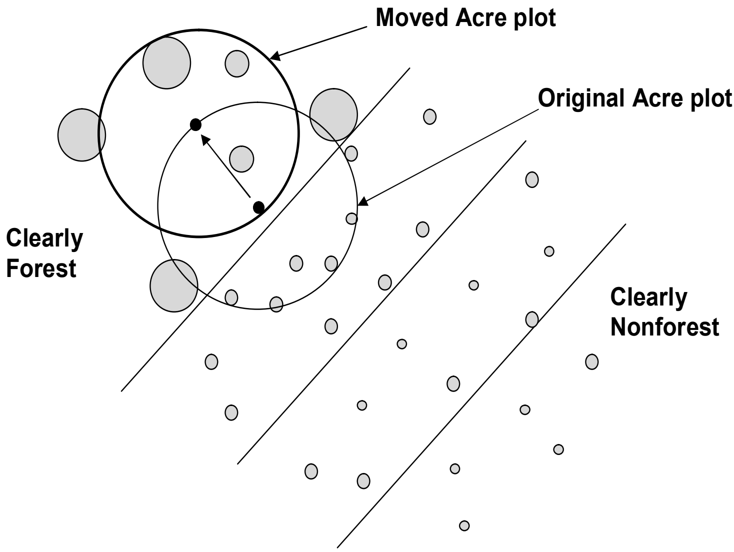


Figure 15. Example of using the Acre plot method when determining CANOPY COVER when the Acre plot is in a transition zone with forest/nonforest encroachment.

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

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)

2.5.30.1**RM** 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 center at the following azimuths:

Subplot	Degrees Transect direction from center of subplot			
1 and 2	090	180	270	360
3 and 4	045	135	225	315

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)
TOTAL	320	108	80	59	

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, occularly 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.

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.

2.5.31 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 16). Canopy area = pi*((long axis diameter/2)*(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.

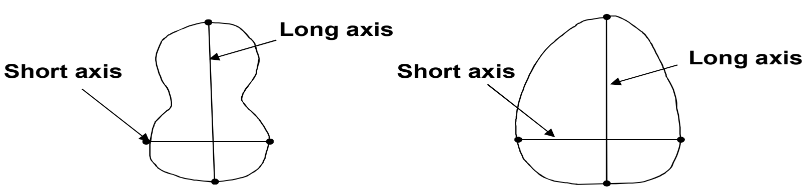


Figure 16. Examples of where to measure canopy widths.

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 CURRENT AFFORESTATION CODE =1 and TOTAL STEMS greater than or equal to 150. For LIVE CANOPY COVER <1 percent (trace), record 01.

Values: 00 – 99 (where 99=99-100 %)

2.5.32 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, etc). Include live and dead and removed tally trees, saplings, and seedlings. Dead trees and dead portions of live trees are not considered as missing unless it is part of the condition disturbance. 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%.

Values: 00 – 99 (where 99=99-100 %)

2.5.33 CURRENT AFFORESTATION CODE

Record the code identifying a condition that has no evidence of prior forest, but does have evidence suggesting deliberate afforestation attempts (planted or prepared to promote tree establishment) to convert to forest in the current inventory cycle or since the last measurement.

Values:

0	No
1	Yes

2.5.34 PREVIOUS AFFORESTATION CODE

Record the code identifying a condition that has no evidence of prior forest, but does have evidence suggesting deliberate afforestation attempts (planted or prepared to promote tree establishment) to convert to forest the prior inventory cycle or prior to the last measurement.

Values:

0	No
1	Yes

2.5.35 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 subplot 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** See Section 2.5.31 for additional sampling options.)

Values: 00000 – 99999

2.5.36 CHAINING CODE

Record the code identifying if a condition has been chained, shear bladed, roller chopped, etc., for the purpose of increased forage production. These treatments contrast with silvicultural removals in that little or none of the woody material is removed from the site and there are few residual live trees.

Values:

0 No
1 Yes

2.6**RM** CONDITION STATUS CHANGE

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

Values:

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.

2.6 Optional Fuels Variables for DWM Protocol

2.6.1 CONDITION FUELBED TYPE (OPTIONAL)

RM Collected in Utah only. See the FUELBED TYPE reference publication hand-out titled *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with the Rothermel's Surface Fire Spread Model.*

3.0 SUBPLOT INFORMATION

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the microplot, since the microplot is contained within the subplot perimeter.

3.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

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 macroplpot, 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.

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.

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.

06 Lost plot – Entire plot cannot be found. Used for the four subplots that are required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 06. Can be either generated by the data recorder or in the office.

07 Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Used for the four subplots that are required for this plot. Used only in conjunction with PLOT NONSAMPLED REASON code 07. Can be either generated by the data recorder or in the office.

08 Skipped visit – Entire plot skipped. Used for the four subplots that are required for this plot. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 08. This code is for office use only.

09 Dropped intensified plot – Used for the four subplots that are required for this plot. Used only by units engaged in intensification. Applied at the time of processing and used only in conjunction with PLOT NONSAMPLED REASON code 09. 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 IWFIA 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.

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.

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.

Values: 1 to 9

3.7 MICROPLOT CENTER CONDITION

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

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.

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 subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SUBPLOT/MACROPLOT STATUS = 1)

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.

Values: 0.0 to 9.9

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.

Values: 1000 to 9876

3.11.1**RM** 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.

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.

3.11.2**ACI** GROUND SURFACE COVER TRANSECTS

Complete sample as specified below. If there are multiple conditions on the subplot area, transects may cross condition lines (i.e., ignore condition boundaries). Only sample subplots with a nonforest/water condition at subplot center. Do not sample any subplots with an “accessible forest land” condition at subplot center (including those with a portion of the subplot classified with a nonforest/water condition) for ground surface transect data.

Procedures:
On each subplot area, lay out four transects (figure 16.1) that extend outward from subplot center at a distance of 25.0 feet, at the azimuth directions listed below. Lay a cloth tape along the slope of the ground; do not correct the slope distance to obtain horizontal distance.

Transect azimuth direction:

Subplot	**Degrees** Transect direction from center of subplot			
1 and 2	090	180	270	360
3 and 4	045	135	225	315

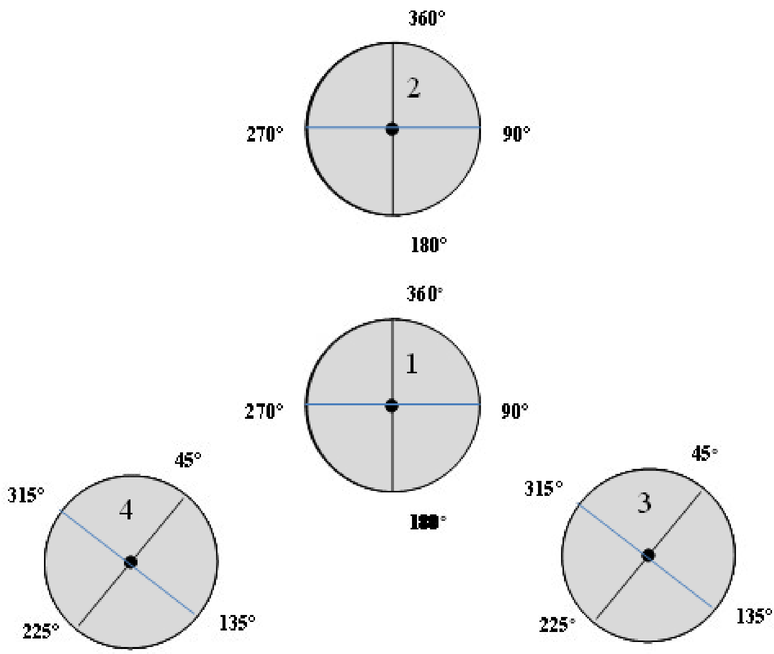


Figure 16.1. Ground Surface Cover Transects diagram

Beginning at the 1-foot mark, place a tip of a plot stake or sharply pointed staff on the ground along the transect line at each 1-foot mark (against the right side of the tape with your back to plot center). Record each point, referred to as a “hit,” on the Ground Surface Cover Transects Form (supplemental form – refer to appendix A.13) by the appropriate ground surface cover type category (categories listed below). If more than one category occurs at a point (e.g., litter on top of a rock), always record the ground cover category that is on top (i.e., the category that the pointed staff touches first). Note: Foliar canopy cover above the soil surface plane is not considered to be ground surface cover. See water exception below.

Repeat procedures for each transect direction. Each of the four transect directions will contain 25 hits (for a total of 100 hits for the entire subplot).

After all four transects on an individual subplot have been sampled, record the total number of hits by category on the supplemental data form and the PDR (each subplot should have a grand total of 100 hits combining all categories).

Note: This item is recorded by individual subplot; do not combine totals from different subplots.

Ground Surface Cover Transect categories:

Code	Description	Definition
BARE	Bare ground	Exposed soil and rock fragments smaller than ¾-inch diameter. Do not include larger rocks protruding through the soil.
ROCK	Rock	Rocks greater than ¾-inch diameter.
WATE	Water (See Category EXCEPTION box below)	Water remaining above the ground surface during the growing season, such as streams, bogs, swamps, marshes and ponds.
TRIS	Transient ice and snow	Surface area covered by ice and snow at the time of plot measurement, considered transient. For use when permanent ice and snow are not differentiated.
PEIS	Permanent ice and snow	Surface area covered with ice and snow at the time of plot measurement, considered permanent. For use when permanent ice and snow are not differentiated.
WOOD	Wood	Woody material, slash and debris; any woody material, small and large woody debris, regardless of depth. Litter and non-continuous litter are not included.
LIT	Litter	Organic debris, freshly fallen or slightly decomposed; includes dead vegetation, animal feces, etc.
VEG	Basal Vegetation	The area outline of a plant near the ground surface; in grass this comprises the shoot system at ground level, while in trees and shrubs it comprises the stem area
CRYP	Cryptogamic crust	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria)
LICH	Lichen	Lichens: an organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in a symbiotic association. For lichen growing on bare soil in dry rangeland conditions, see cryptogamic crusts.

Code	Description	Definition
MOSS	Moss	Nonvascular, terrestrial green plants including mosses, hornworts and liverworts - always herbaceous. This code does not apply to moss growing on bare soils in dry rangeland conditions. For rangeland conditions, see cryptogamic crusts.
DEVP	Developed land/ Residential/ Agricultural	Surface area occupied or covered by: (1) any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure; (2) maintained residential yards; or (3) agricultural crops (not rangeland).
ROAD	Road	Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained or in long-term continuing use. Generally constructed using machinery. Includes cutbanks and fills.
OTHER	Other	Other covers not defined elsewhere – includes trash (describe in notes section).
NONSM	Nonsampled	Use this code if any points along a transect cannot be sampled (describe reason in notes section).

CATEGORY EXCEPTION for areas with water:

Water Category EXCEPTION:	
Areas with permanent water	For transect segments that extend through permanent water, classify points as “water” hits. Use the water-level boundary present at the time of the inventory (not necessarily the high-water mark).
Areas with transient water	For transect segments that extend through water that will not remain throughout the growing season, such as temporary flooding or a puddle, go below the water surface and classify (or estimate) the point using the category that would apply if the water was not there.

3.11.3**RM** COMMUNITY DESCRIPTION FOR SPECIMEN LABEL

See item 8.5.6.1**RM**.

3.12 P2 VEG SUBPLOT SAMPLE STATUS

Record the code to indicate if the subplot was sampled for P2 Vegetation. A subplot may be sampled for P2 Vegetation but not have any vascular plants present. If there is any part of an accessible portion of the subplot where other plot measurements are made but all the P2 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** P2 Vegetation measurements.

Values:

1 Subplot sampled for P2 Vegetation
2 Subplot not sampled for P2 Vegetation

3.13 VEGETATION NONSAMPLED REASON

Record the reason why P2 Vegetation on a subplot cannot be sampled.

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)

3.14 VEGETATION SUBPLOT NOTES

Use this field to record notes pertaining to the subplot, and any unusual conditions encountered.

When plant specimens are collected, use this field to record a community type description for each subplot sampled for P2 Vegetation. The community description is intended to fully automate the specimen collection process by providing a description of the community in which this plant was found. Some examples of community descriptions are as follows:

- 25 year aspen boundary of mature trees. very little slope. a lot of light entry
- Acer saccharum floodplain forest. hummock-hollow microtopography.
- mature mesic hemlock-hardwood forest adjacent to pond

The community type description field is a note that is accessible via Ctrl+E from the P2 Subplot screen for P2VEG.

Values: English language words, phrases, and numbers

3.15 INVASIVE PLANT SUBPLOT SAMPLE 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 cannot be assessed (e.g., because of snow, water, hazardous weather, time limitation), enter code 3 and do not record any invasive plant measurements.

Values:

1 Subplot sampled, invasive plants present
2 Subplot sampled, no invasive plants present
3 Subplot not sampled for invasive plants

3.16 INVASIVE PLANT NONSAMPLED REASON (Subplot-level variable)

Record the reason why a subplot cannot be sampled for invasive plants.

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)

3.17 INVASIVE PLANT DATA NOTES

Use this field to record any notes about the condition on the subplot, particularly any unusual conditions encountered.

Values: English language words, phrases, and numbers

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 17 and 18). 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.

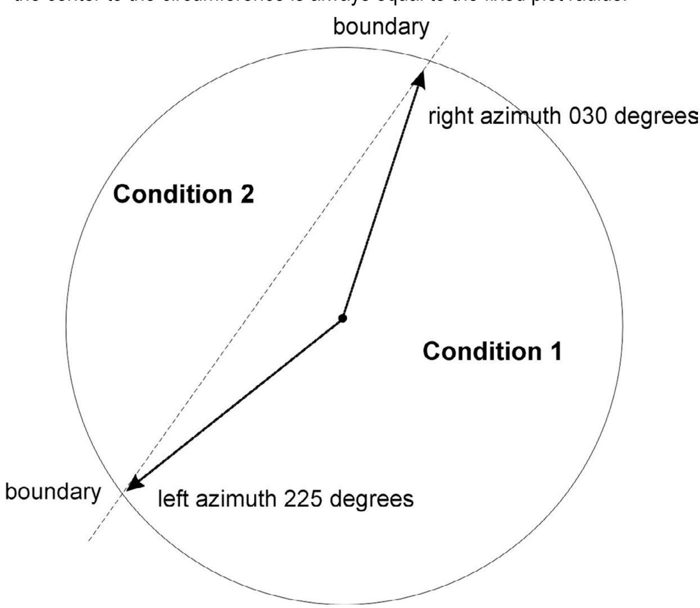


Figure 17. How to measure a straight boundary on a microplot, subplot, or macroplot.

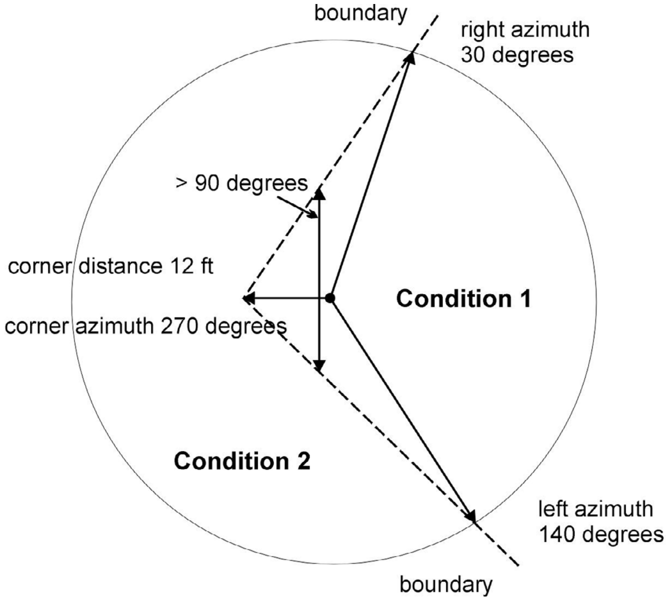


Figure 18. How to measure a boundary with a corner on a subplot or macroplot.

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

Refer to Sections 2.1 and 2.4 for general condition class delineation guidelines. The following additional rules apply when referencing a boundary within a subplot, microplot, or macroplot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water's edge along a stream course, ditch, or canal.
2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge. (**RM** Do not map indistinct boundaries.)
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.(**RM** Do not map indistinct boundaries.)
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. **RM Delete boundaries that are no longer distinct.**

5. Although individual tolerances 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 is 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.

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.

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.

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.

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.

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).

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.

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.

Values: 001 to 360

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 ≥ 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 and standing dead 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 1.0 inch and greater in diameter are tracked until they no longer qualify as standing dead. **Working around dead trees is a safety hazard – crews should exercise extreme caution!** Trees that are deemed unsafe to measure should be estimated.

To qualify as a standing dead tally tree, dead trees must be at least 1.0 inch 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 1.0 inch 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, reconcile one tree and correct the diameter for the remaining tree. Give one of the tree data lines a PRESENT TREE STATUS = 0, RECONCILE = 7, 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.
- **RM** If at the previous visit a multistemmed tree was recorded as two or more separate trees but should have been recorded as one tree, give one of the tree datalines 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.
- **RM** If at the previous visit a multistemmed tree was recorded as one tree but should have been recorded as two or more separate trees, correct the diameter(s) for the remeasured tree to represent one tree, and add the other stem(s) as a missed tree(s). 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.

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 through growth 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 Remeasure plots that were measured as forest last time and were changed to nonforest with the new forest definition. If plot now meets forest definition, do not reuse old tree numbers. Use next available number. Reuse previous azimuths and distances (if correct).

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 ≥ 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 "000" (see Section 7.1.2**RM** for more information).

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 (fig. 19).

Values: 1 to 9

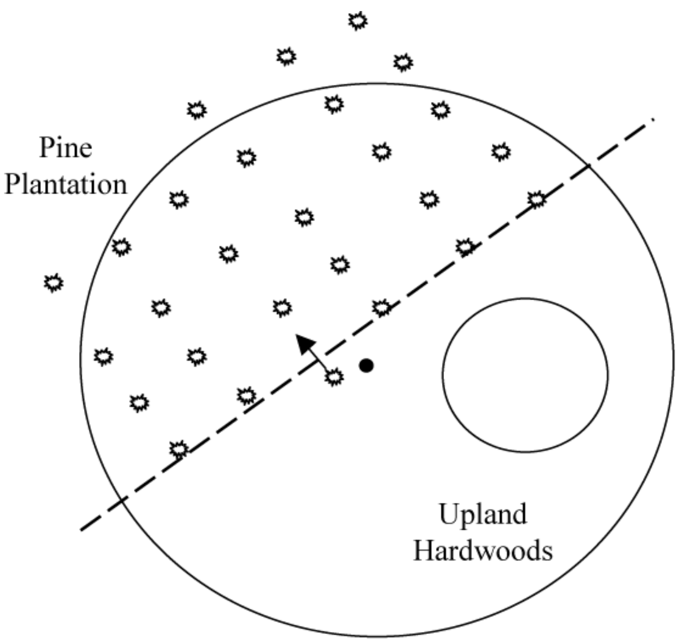


Figure 19. Ragged CONDITION CLASS boundary and tree condition class designation.

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.

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 species (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.

Note: On remeasurement plots (SAMPLE KIND = 2), the current crew is responsible for verifying downloaded data and updating when it is out of tolerance. When the old pin or dowel is not found, the current cruisers should make sure they consider all “edge” trees or saplings that were in or out on the previous occasion when reestablishing the subplot center. For saplings on the microplot that become trees at the time of plot remeasurement, crews must collect new HORIZONTAL DISTANCE information from the subplot center.

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 (e.g. recorded 1.0 feet instead of 10.0 feet), record the distance and make a note on the preprinted form.

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.

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.

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, trees killed by silvicultural or land clearing activity and assumed not to have been utilized, as well as dead trees that may have been present at the time of plot establishment but only tallied now due to procedural change. **(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 or standing dead subplot trees that shrink to become live or dead 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.

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 within the offset microplot.)
3 Missed live – a live tree missed at previous inventory and that is live or dead now. Includes currently tallied trees on previously nonsampled conditions.
4 Missed dead – a dead tree missed at previous inventory that is dead now. Includes currently tallied trees on previously nonsampled conditions.

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 (e.g., 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.

The following table , which is an abbreviated list from appendix 8, describes how to tally standing dead saplings with respective PRESENT TREE STATUS, RECONCILE CODE, and STANDING DEAD, which are being collected for the first time in Field Guide version 7.0:

Dead Sapling Tally – New plots	PRESENT TREE STATUS	RECONCILE CODE	STANDING DEAD	CAUSE of DEATH
Standing dead 1.0 – 4.9 DBH/DRC	2	Null	Auto-populated	Core optional

Dead Sapling Tally – Remeasure plots	PRESENT TREE STATUS	RECONCILE CODE	STANDING DEAD	CAUSE of DEATH
Previous live <1.0 and has grown to ≥1.0 and died	2	1	1	10-80
Previous live 1.0+; now standing dead 5.0+ DBH/DRC	2	Null	1	10-80
Previous ≥ 1 inch and <5 inches and was dead and is still standing dead	2	4	1	Null
Previous live 1+ missed; now 1+ DBH/DRC and dead	2	3	1	10-80
Previous live 5.0+ DBH/DRC; now tree shrank <5.0 but ≥1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot).	2	Null	0	10-80
Previous dead 5.0+ DBH/DRC; now tree shrank <5.0 but ≥1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot).	2	Null	0	Null
Previous live 5.0+ DBH/DRC; now tree shrank <5.0 but ≥1.0 (e.g., bark loss) and is standing dead located on the microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center.	2	Null	1	10-80
Previous dead 5.0+ DBH/DRC; now tree shrank <5.0 but ≥1.0 (e.g., bark loss) and is standing dead located on the microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center.	2	Null	1	Null

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 1.0 inch in diameter, have a bole that 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 20-22 for examples.

"Unbroken" is defined as at least 50 percent attached to the original source of growth.

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.

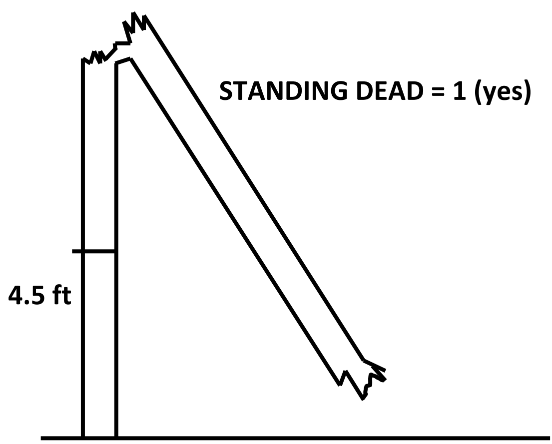
For woodland species (Appendix 3) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 1.0 inch 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.

Values:

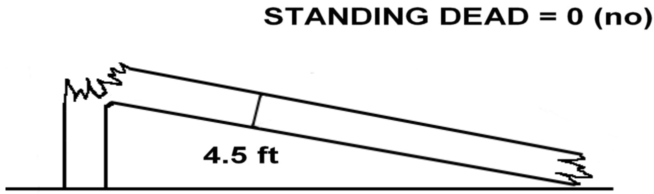
0 No – tree does not qualify as standing dead. **RM** includes trees that shrank below the 5.0 inch threshold.

1 Yes – tree does qualify as standing dead.



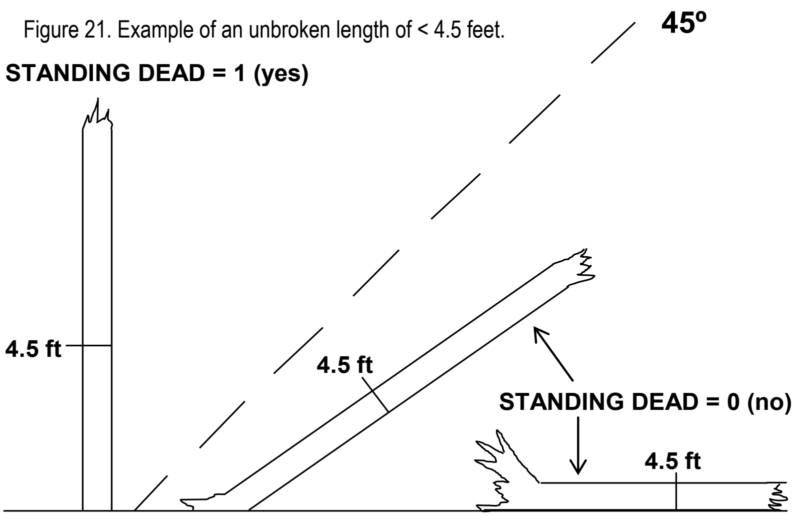
(**Tree is at least 1.0 inch at 4.5 feet and is at least 4.5 feet in unbroken ACTUAL LENGTH)**

Figure 20. Example of an unbroken bole to 4.5 feet.



(Tree is at least 1.0 inch at 4.5 feet, but does not have 4.5 feet in unbroken ACTUAL LENGTH)

Figure 21. Example of an unbroken length of < 4.5 feet.



(Trees are at least 1.0 inch at 4.5 feet and are at least 4.5 feet in unbroken ACTUAL LENGTH)

Figure 22. 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 volume information to the proper component of volume change.

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.

5.22 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. **RM** Item number purposely out of order to correspond with data collection flow.

Values: 1994 or higher

5.8 SPECIES

Record the appropriate SPECIES code from the list in Appendix 3. 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 Bontanist) 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 horizontalus) 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., Alaska, and the Caribbean. 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.”

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 microplots. 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). Previous diameter measurement locations should not be moved due to the loss or addition of a forked stem. Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

For remeasurement of a group of multiple forks (3+) that originate from approximately the same point on the main stem at Time 1 that are now recorded as a single tree using the Measure Low Approach (see appendix 6) at Time 2, select one of the group to represent the resulting single tree (choose the "most representative" of the group in relation to the resulting tree) to measure at Time 2, and record a current diameter based on the Measure Low Approach guidelines and assign with: (**RM** note: Timber species only)

- DIAMETER CHECK = 2
- LENGTH TO DIAMETER MEASUREMENT POINT

The remaining forks that were measured at Time 1 are now considered part of this single tree (branches). The tree records for these are retired with:

- PRESENT TREE STATUS = 0
- RECONCILE = 8

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 (e.g. 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. For close trees that are “out” due to size or distance, make notes in the Suplot notes field.

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 apen 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 3/4 – 1 inch or more, do not re-nail. If the old nail is protruding from the tree < 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 ≥ 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 ½ 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 (figs. 23-26), AND must be judged to have, or have the potential to assume an obvious “tree like” form and function as opposed to an obvious “branch like” form and function. (**RM** the stem must be at least 1.0 inch in diameter at the fork with the main stem and must also be 1.0 inch in diameter at diameter measurement point to qualify as a fork). If there is any doubt as to the form and function of a potential fork, call it a fork instead of a branch. Figure 27 provides examples where the form and function are considerations. 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.

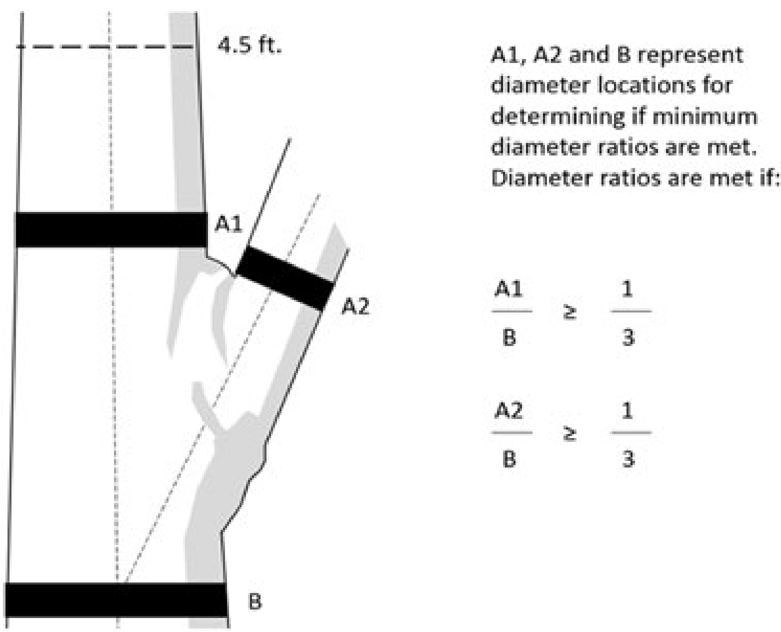


Figure 23. **Determining diameter ratio of forks.** When determining if a fork meets the 1/3 diameter requirement for qualifying as a fork, the diameter of the potential fork taken at locations A1 and A2 must be 1/3 of the diameter at location B.

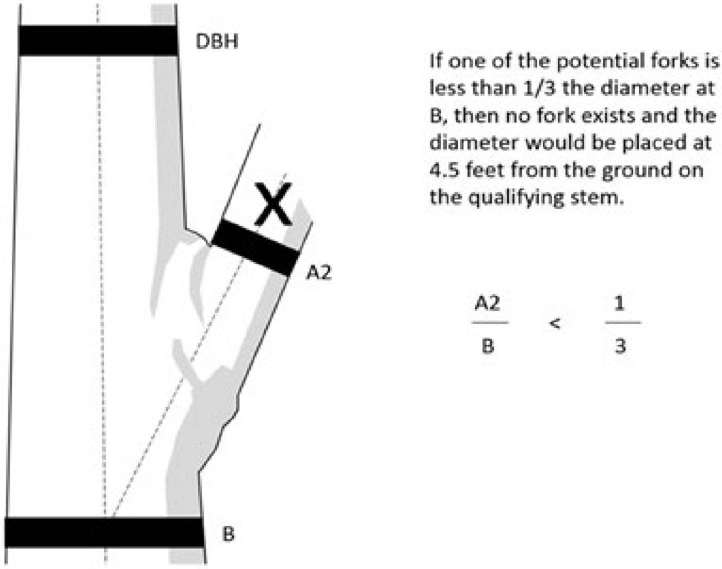


Figure 24. **A single non-qualifying fork.** If one of the forks does not meet the minimum ratio, then no fork exists and the diameter is placed at the normal location on the dominant stem.

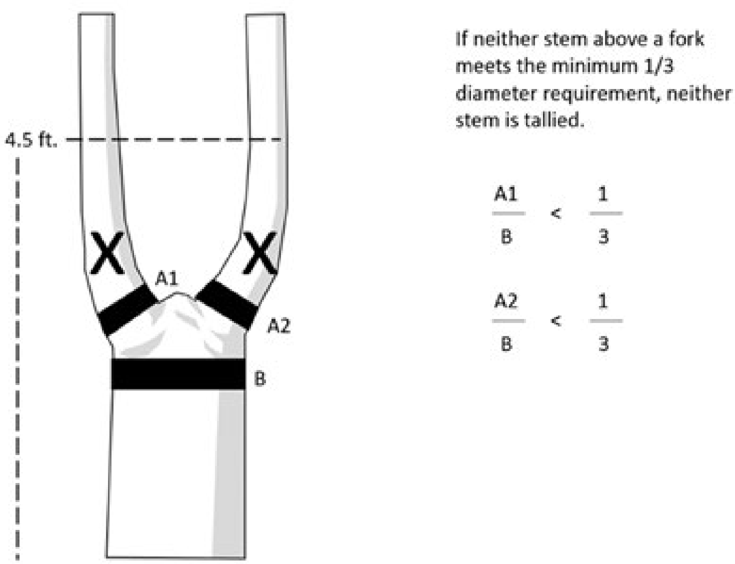


Figure 25. Two non-qualifying stems. If neither stem meets the 1/3 diameter requirement, neither is tallied. This is often associated with broken tops and is consistent with the point at which a stem is considered recovered from a break.

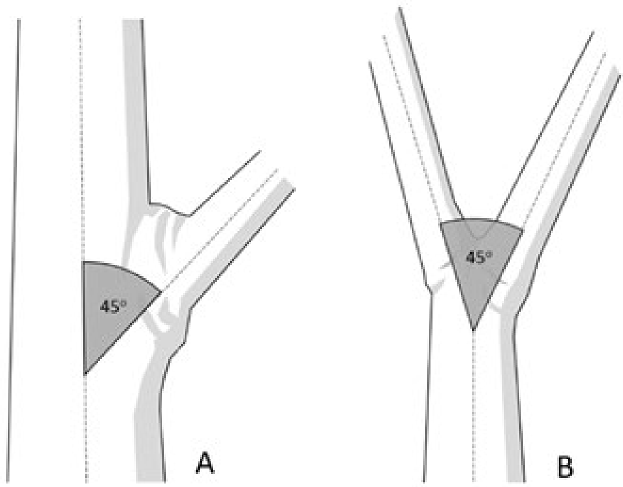


Figure 26. Forking angle. In order to qualify as a fork, the piths must diverge at an angle not exceeding 45 degrees from the main stem (A). In cases where there is no obvious main stem (B), consider the angle of pith separation between the two stems.

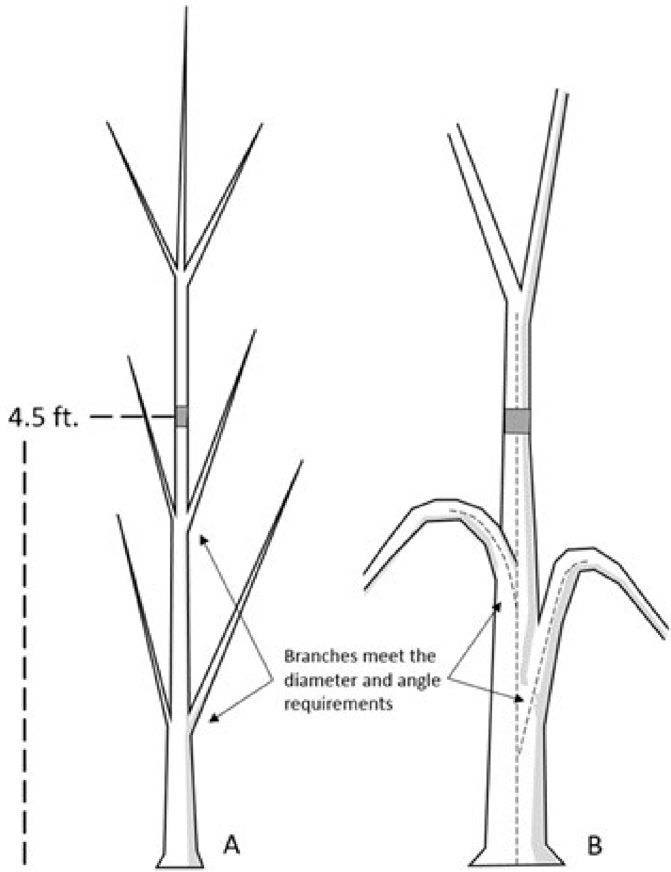


Figure 27. Forks that have branch-like form and function, leading to the tally of a single tree instead of multiple trees. In example A, although the potential fork is currently 1/3 the diameter of the main bole and is within 45 degrees of the main bole at the point of attachment, it appears to be serving as a branch as opposed to an additional independent tree. In addition, as the main bole continues to grow, the “branch” may reach the point where it is no longer 1/3 the main bole, dropping out of the inventory based on definition. Such potential forks would be ignored and the main bole would be tallied as a single tree with diameter measured at 4.5 feet. The tree is evaluated at each future visit and tallied following standard remeasurement procedures. In example B, although the potential fork is 1/3 the diameter of the main bole and is within 45 degrees of the main bole at point of attachment, it deviates drastically beyond 45 degrees about 1 inch from the main bole, taking on the form and function of a branch. This should be tallied as a single tree with diameter measured at 4.5 feet.

- **Trees forked below 1.0 foot.** Trees forked below 1.0 foot are treated as distinctly separate trees (fig. 28). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (fig. 34 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 (fig. 34 E), the rules in the next paragraph apply.

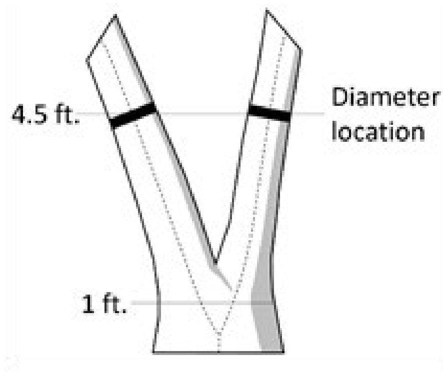


Figure 28. Forked below 1.0 foot.

- **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 (fig. 29), but only one distance and azimuth (to the central stump) is recorded for each stem (fig. 34 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.

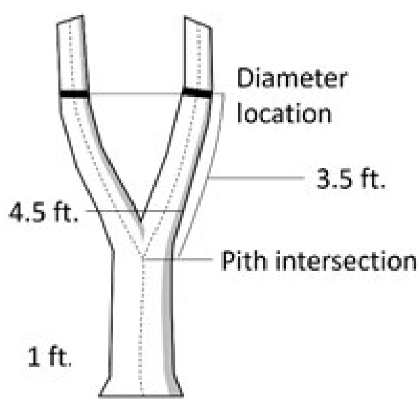


Figure 29. Forked between 1.0 foot and 4.5 feet.

Measure Low Approach

Crews may encounter trees of any species (**RM** note: timber species only) displaying growth forms with multiple forks that make applying traditional forking rules very difficult. In some instances these growth forms are species specific and in others they are the result of either the immediate growing conditions or the fact that the trees have been bred, pruned, or managed in a way that promotes multiple stems resulting in a specific crown shape.

In cases where such multiple forks all originate from approximately the same point on the main stem, follow the Measure Low Approach, where the diameter is taken at the highest, most repeatable location between the 1-foot stump and initial pith separation. This approach is applicable in instances where any of the following are present between the 1-foot stump and DBH (4.5 feet):

(1) Multiple forks (fig. 30).
(2) Prolific branching originating from approximately the same location that prevents accurate and repeatable diameter (fig. 31). This is a rare situation that should not be confused with normal branching patterns that allow for accurate diameter placement.
(3) Any combination of multiple forks and prolific branching originating at approximately the same location.
(4) The stems of a forked tree are grown together in such a fashion that an accurate DBH cannot be measured or estimated due to deformation resulting from the presence of the above mentioned criteria (fig. 32).

Figures 30, 31, and 32 illustrate a combination of forks and or branches all originating at the approximate same location will trigger a measure low approach.

Figure 30. Multiple forks originating from the same area. In cases such as this the diameter is taken low and all stems are treated as one tree.

Figure 31. Multiple forks and branches originating from the same area. Similar to having multiple forks, when there are multiple forks and branches, the diameter is taken low and all stems are treated as one tree.

A tree can only fork once. Following are specific procedures to secondary forking:

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 (or potential forks) that may occur on that stem. When such secondary forks are encountered, measure/estimate the diameter of such stems at the most repeatable location below stem separation but above the first pith separation (fig. 34 F-I) while attempting to avoid measuring double piths (fig. 40) where possible (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).

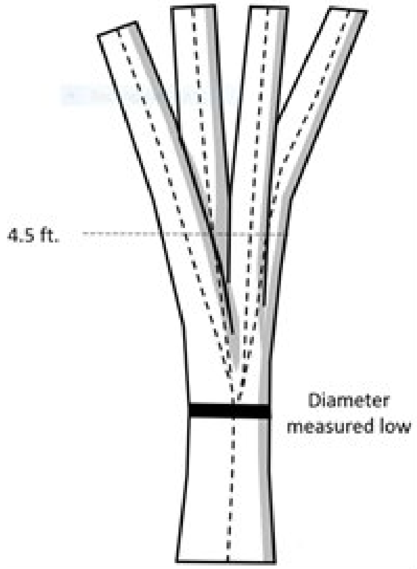


Figure 32. Using pith separation to determine diameter locations. In this example it is clear that all piths appear to separate from approximately the same location; this triggers the "Measure Low Approach". In cases where the piths do NOT originate within approximately the same location, normal forking rules are applied as demonstrated in figures 34 A-D and F-I.

- **Trees forked at or above 4.5 feet.** Trees forked at or above 4.5 feet count as one single tree (fig. 33). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH

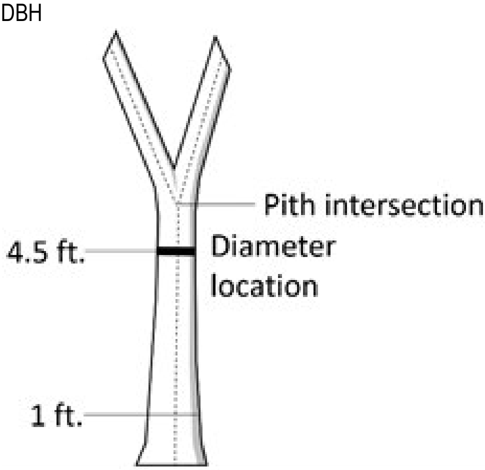


Figure 33. One Tree.

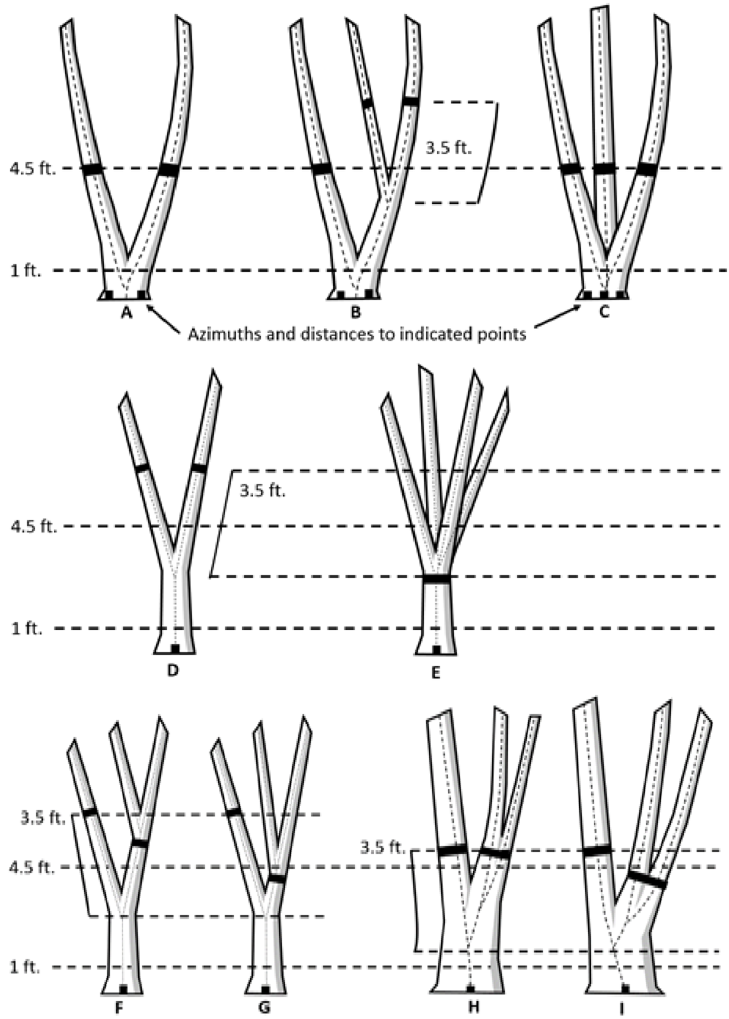


Figure 34. Summary of where to measure diameter, distance and azimuth on trees that fork below 1.0 foot (A, B, C) and trees that fork above 1.0 foot (D, E, F, G, H, I). Figure E represents the "Measure Low Approach". Figures F and G represent secondary forks with abnormal diameters at stem separation. Figures H and I represent secondary forks with normal diameters at stem separation.

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.

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 (fig.35).

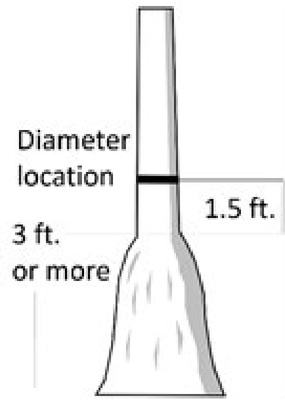


Figure 35. Bottleneck tree

4. **Tree with irregularities at DBH:** On trees with swellings (fig. 36), bumps, depressions, and branches (fig. 37) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

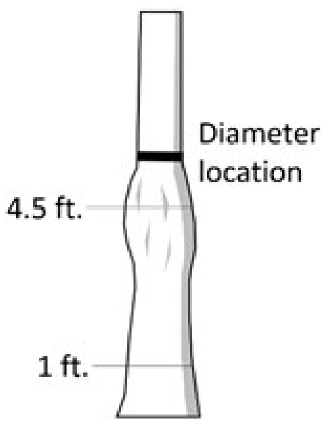


Figure 36. Tree with Swelling

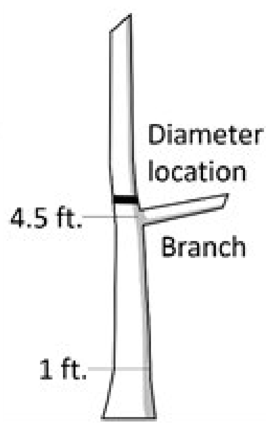


Figure 37. Tree with branch

5. **Tree on slope:** Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (fig. 38).

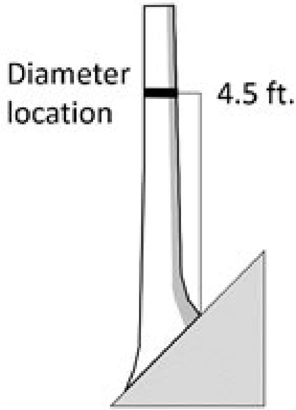


Figure 38. Tree on a slope

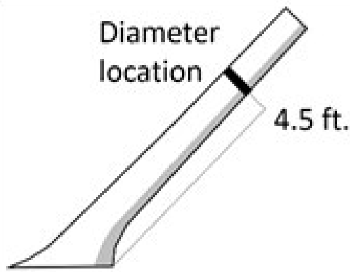


Figure 39. Leaning tree

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 (fig. 39).

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.

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. (fig. 40)

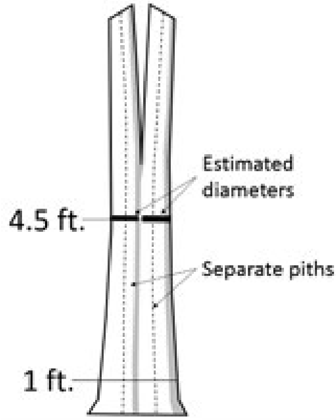


Figure 40. Independent trees grown together.

9. **Missing wood or bark.** Do not reconstruct the DBH of a tree that is missing wood or bark 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 (fig. 41). If a tree has a localized abnormality (gouge, depression, etc.) at the point of DBH, apply the procedure described for trees with irregularities at DBH (fig. 36).

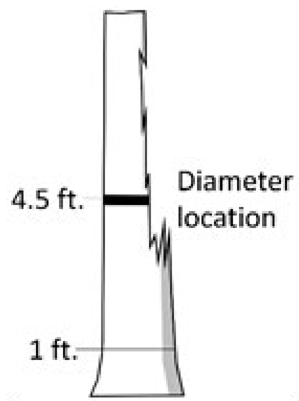


Figure 41. Tree with part of stem missing

10. **Live windthrown tree.** Measure from the top of the root collar along the length to 4.5 feet (fig. 42).

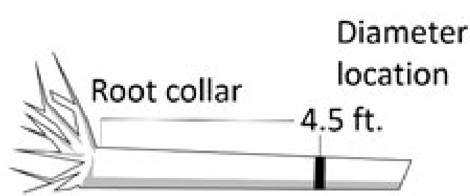


Figure 42. Tree on the ground.

11. **Down live tree with tree-form branches growing vertical from main bole.** When a down live tree, touching the ground, has vertical (less than 45 degrees from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.

    - If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (fig. 43).

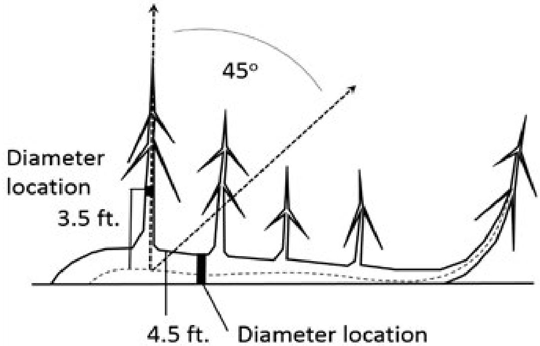


Figure 43. Down tree with pith above the duff.

- 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 (fig 44). 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.

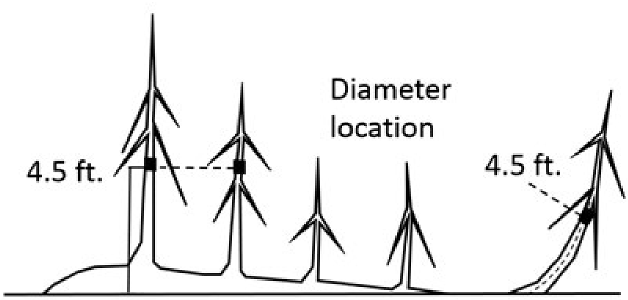


Figure 44. Down tree below duff.

12. **Tree with curved bole (pistol butt tree.** Measure along the bole on the uphill side (upper surface) of the tree (fig. 45).

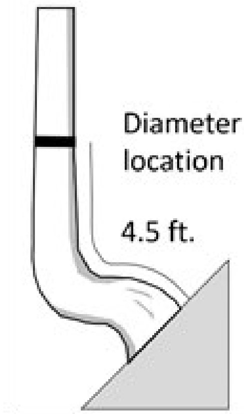


Figure 45. Tree with curved bole (pistol butt tree).

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 (e.g. 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 species, 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 46. 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:

DRC = SQRT [SUM (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:
DRC = 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 killed, cut or removed 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 that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point 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 that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point 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 species, 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 species, 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 figures 46 and 46a.

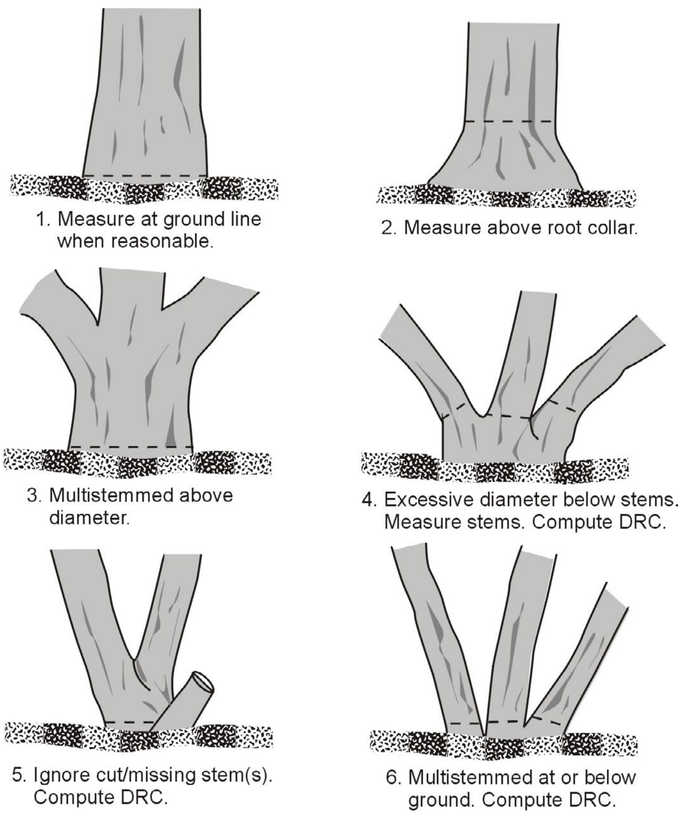
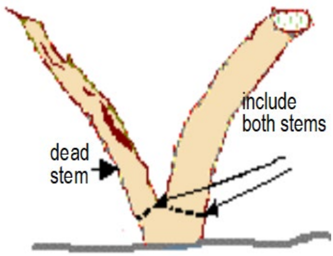
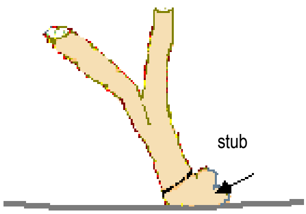


Figure 46. How to measure DRC in a variety of situations.

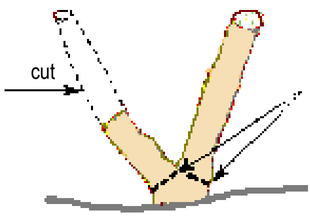
RM The cut stem in example number 5 is < 1 foot in length



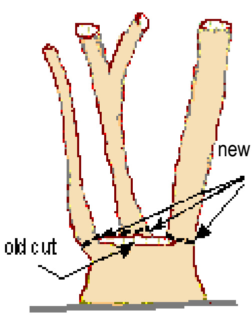
1. Measure the diameter of a dead stem if it is essentially intact, the volume is sound, and the stem represents a portion of the main tree form. Include the stem diameter in the DRC computation and record the appropriate percent of dead volume.



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 ≥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 46a. How to measure DRC in a variety of situations

RM – Recording DRC. Record the calculated DRC as a three-digit code to the nearest whole 0.1 inch. If using field forms, record individual stem diameters for multistemmed woodland species 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.

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.

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.

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.

Values: 1 to 99

5.12 DIAMETER CHECK

Record this code to identify the accuracy of the diameter measurement (due to factors such as abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.
RM – At initial plot establishment, 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.

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.
Note: If either code 1 or code 2 is used, a tree-level note is required.

5.24 LENGTH TO DIAMETER MEASUREMENT POINT

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. **RM** Item number purposely out of order to correspond with data collection flow.

Values: 00.1 – 15.0

5.13 ROTTEN/MISSING CULL

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.

RM 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.** ≥ 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. When using a hatchet to "sound" a tree, if possible strike the bole in a spot where there is no bark. 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.

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.

Values: 001 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 "upright" 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.

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.

5.14.1**RM** 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.

Values: 001 to 400

5.14.2**RM** ABNORMAL TERMINATION

For all standing trees, record the code indicating whether the tree length was terminated early due to a broken top (top on live trees is completely detached; top on dead trees is greater than 50 percent detached from the tree).

Values:

0 Stem is not abnormally terminated
1 Stem is abnormally terminated

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.

Note: Some regions will measure ACTUAL LENGTH differently due to growth form. Some examples are swamp tupelo, cypress, and trees growing off of old high stumps with stilted roots in the West. Check regional field guides for regional guidance.

Values: 001 to 400

5.15.1**RM** 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.

Values: 001 to 400

5.16 LENGTH METHOD

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

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 (fig. 47). Base the assessment on the position of the crown at the time of observation. Example: a formerly overtopped tree that is now dominant due to tree removal is classified as dominant.

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.

RM When a conflict occurs between crown position and the amount of light the crown is receiving, make selection based on light.

Figure 47. 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 (fig. 48). 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

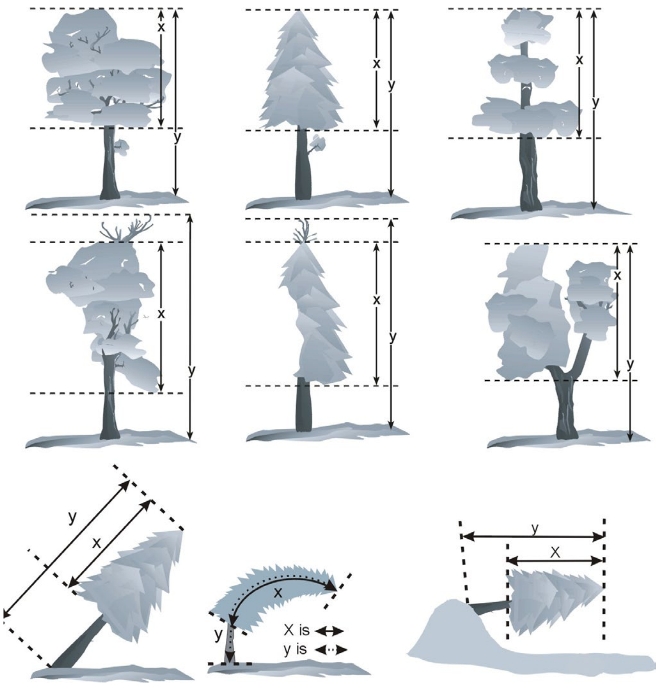


Figure 48. UNCOMPACTED LIVE CROWN RATIO examples.

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 (fig. 49).

Values: 00 to 99 percent

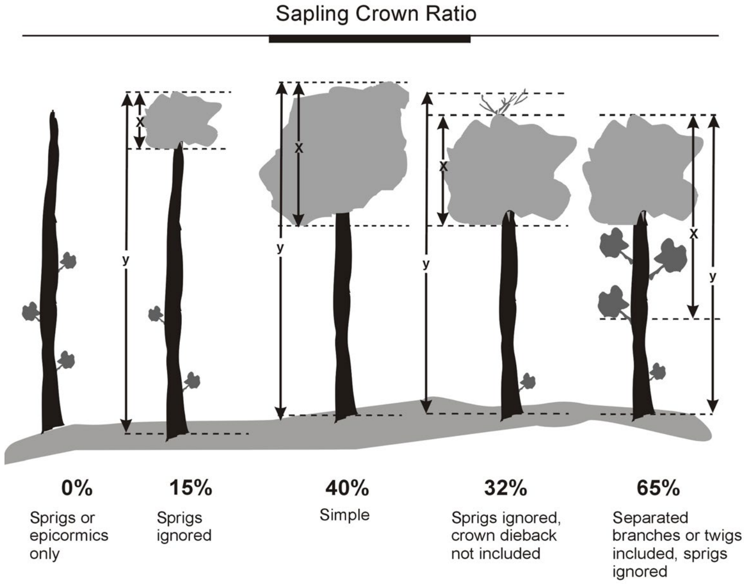


Figure 49. Sapling ratio determination examples.

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 (fig. 50). Figure 51 shows an example of COMPACTED CROWN RATIO on a leaning tree.

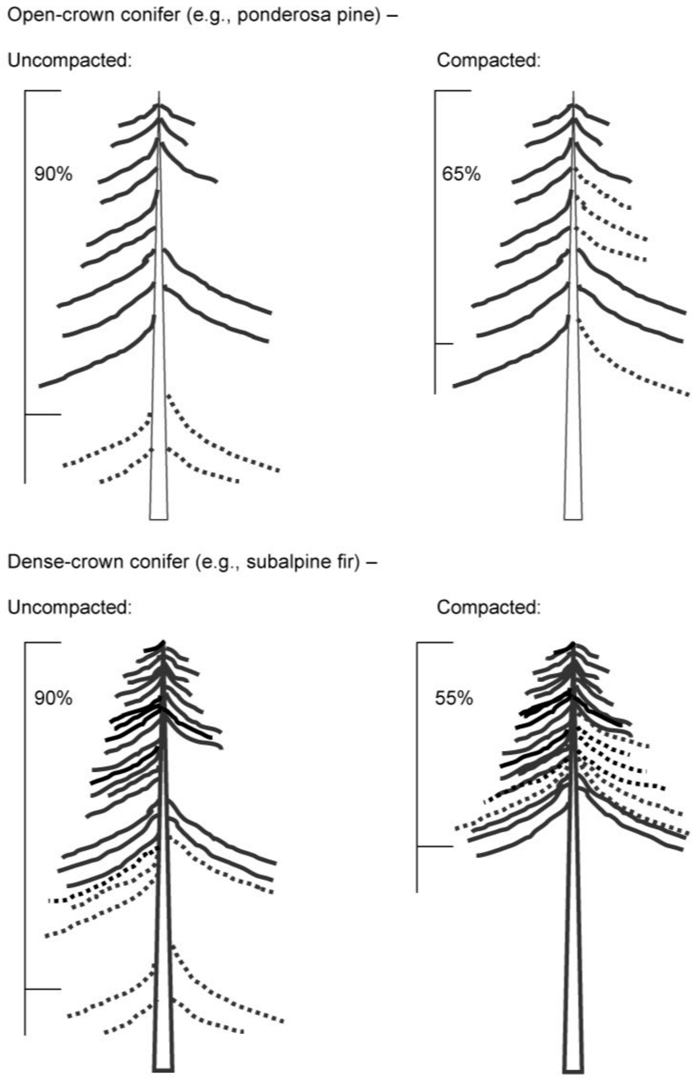


Figure 50. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED CROWN RATIO of conifers.

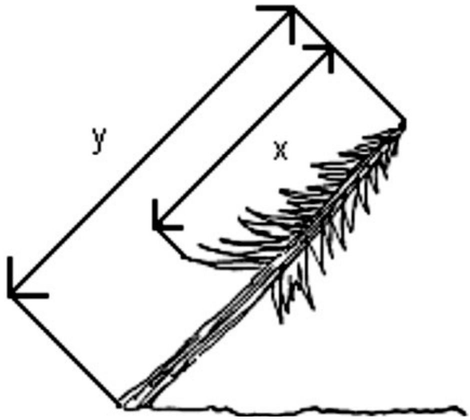


Figure 51. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO = (x/y)100.

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 (fig. 52).

Values: 00 to 99

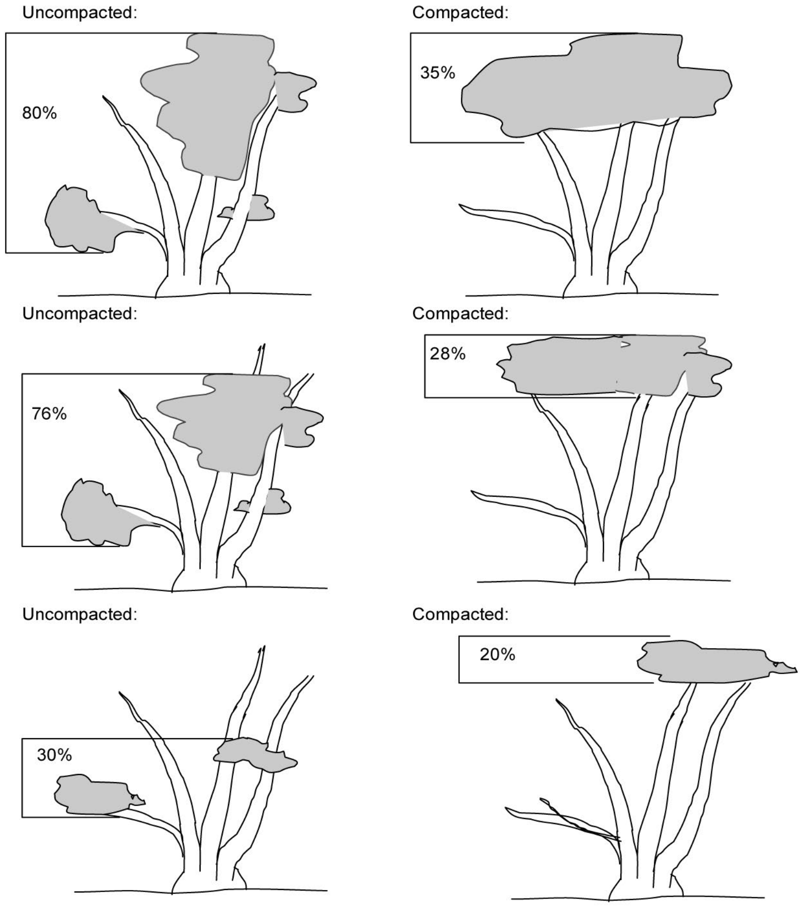


Figure 52. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of woodland species**.**

5.20 TREE DAMAGE (CORE)

Damage is a composite variable. Up to three damaging agents may be recorded per tree. Many damaging agents are host specific and their potential for damage could vary by region. In general, a recorded damage is likely to:

1. Prevent the tree from surviving more than 1-2 years
2. Reduce the growth of the tree in the near term
3. Negatively affect a tree's marketable products (cubic, BF, or other)

It is not necessary to record damage agents in order of their severity unless there are more than three agents. If there are more than three agents, record only the most important ones using the list of impacts above as a guide (i.e., agents threatening survival are more important than agents that reduce wood quality). In general, agents that affect the roots or bole tend to be most threatening, because they have the capacity to affect the entire tree; damage to peripheral parts of the tree may be temporary because leaves, shoots, and reproductive structures may be replaced.

Codes used for this variable come from a January 2012 Pest Trend Impact Plot System, (PTIPS) list from the Forest Health Technology Enterprise Team (FHTET) that has been modified to meet FIA needs. This list is made up of General Agents and then further subdivided into specific agents. Not every General Agent PTIPS code will be available for use for this variable; some do not cause tree damage as defined above while others are better recorded in a different General Agent. Regions will decide which specific agents they will identify in their areas.

Record the general agent unless the Region opts to collect specific agents. Specific agents can later be collapsed into the general agent categories for cross-region comparisons. In the unusual instance when more than one specific agent in the same general category occurs on the same tree, record them both. If a specific agent is identified on that plot but that agent is not on the regionally recognized list of codes for damage agents, use its General Agent code. Appendix 11 contains the regionally recognized list of codes for damage agent based on the modified PTIPS list from FHTET. Only the specific agent codes from appendix 11 may be used instead of the general codes listed under DAMAGE AGENT 1. Any damage code in appendix 11 may be used for DAMAGE AGENT 1, DAMAGE AGENT 2, or DAMAGE AGENT 3

5.20.1 DAMAGE AGENT 1

Inspect the tree from bottom to top – roots, bole, branches, foliage (including buds and shoots), Record the first damage agent observed from the list of agents (unless you observe more than 3 damages). If there are more than three agents, record only the most important ones using the list of impacts listed in section 5.20 as a guide (i.e., agents threatening survival are more important than agents that reduce wood quality). The general agent codes, damage thresholds, and general agent descriptions are listed here. Specific agents within the general categories, if required by your Region, are listed in appendix 11, along with their associated thresholds. These codes can be collapsed into the national core general codes. Note: in some cases, thresholds for specific agents may be different from the threshold for the corresponding general agent. If a region is collecting a specific insect agent and no one is collecting the general agent, then the specific insect agent is collapsed into the general insect category 10000.

Values:
General Agent Damage Codes, Damage Thresholds, and Descriptions.
RM note: For version 8.0, the specific Damage Codes recorded in **RM** from Appendix 11 have been combined into the table below. The General agents are highlighted in grey.

Code	General Agent	Damage Threshold*	Descriptions
10000	General insects	Any damage to the terminal leader; damage >20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Insect damage that cannot be placed in any of the following insect categories.
11000	Bark beetles	Any evidence of a successful attack (successful attacks generally exhibit boring dust, many pitch tubes and/or fading crowns).	Bark beetles (Dendroctonus, Ips, and other genera) 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. They inflict damage or destroy all parts of trees at all stages of growth by boring in the bark, inner bark, and phloem. Visible signs of attack include pitch tubes or large pitch masses on the tree, dust and frass on the bark and ground, and resin streaming. Internal tunneling has various patterns. Most have tunnels of uniform width with smaller galleries of variable width radiating from them. Galleries may or may not be packed with fine boring dust.
11006	mountain pine beetle	Any evidence of a successful attack.	
11009	spruce beetle	Any evidence of a successful attack	

Code	General Agent	Damage Threshold*	Descriptions
11030	Ips engraver beetles	Any evidence of a successful attack.	
12000	Defoliators	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	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, browning foliage, extensive branch mortality, or dead tree tops.
12040	western spruce budworm	Any damage to the terminal leader; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	
13000	Chewing insects Note: this is only collected by IW and SRS	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	Insects, like grasshoppers and cicadas that chew on trees (those insects not covered by defoliators in code 12000).
14000	Sucking insects	Any damage to the terminal leader; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	Adelgids, scales and aphids feed on all parts of the tree. Often they cause galling on branches and trunks. Some appear benign but enable fungi to invade where they otherwise could not (e.g., beech bark disease). The most important ones become conspicuous because of the mass of white, cottony wax that conceals eggs and young nymphs.
14003	balsam woolly adelgid	Any occurrence	
14004	hemlock woolly adelgid	Any occurrence	
15000	Boring insects	Any damage to the terminal leader; damage ≥20% of the roots, stems, or branches.	Most wood boring insects attack only severely declining and dead trees. Certain wood boring insects cause significant damage to trees, especially the exotic Asian longhorn beetle, emerald ash borer, and Sirex wood wasp. Bark beetles have both larval and adult galleries in the phloem and adjacent surface of the wood. Wood borers have galleries caused only by larval feeding. Some, such as the genus Agrilus (including the emerald ash borer) have galleries only in the phloem and surface of the wood. Other wood borers, such as Asian longhorn beetle bore directly into the phloem and wood. Sirex adults oviposit their eggs through the bark, and developing larvae bore directly into the wood of pines.

Code	General Agent	Damage Threshold*	Descriptions
19000	General diseases	Any damage to the terminal leader; damage >20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Diseases that cannot be placed in any of the following disease categories.
21000	Root/butt diseases	Any occurrence.	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. A rot is a wood decay caused by fungi. Rots are characterized by a progression of symptoms in the affected 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. Rot can lead to mortality, cull, an increased susceptibility to other agents (such as insects), wind throw, and stem breakage.

Code	General Agent	Damage Threshold*	Descriptions
22000	Cankers (non-rust)	Any occurrence.	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. Cankers may be caused by various agents but are most often caused by fungi. A necrotic lesion begins in the bark of branches, trunk or roots, and progresses inward killing the cambium and underlying cells. The causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider. There are two types of cankers, annual and perennial. Annual cankers enlarge only once and do so within an interval briefer than the growth cycle of the tree, usually less than one year. Little or no callus is associated with annual cankers, and they may be difficult to distinguish from mechanical injuries. Perennial cankers are usually the more serious of the two, and grow from year to year with callus forming each year on the canker margin, often resulting in a target shape. The most serious non-rust cankers occur on hardwoods, although branch mortality often occurs on conifers.
22500	Stem decays	Any visual evidence (conks; fruiting bodies; rotten wood)	Rot occurring in the bole/stems of trees above the roots and stump.
23000	Parasitic / Epiphytic plants	Dwarf mistletoes with Hawksworth rating of ≥3; true mistletoes and vines covering ≥ 50% of crown.	Parasitic and epiphytic plants can cause damage to trees in a variety of ways. The most serious ones are dwarf mistletoes, which reduce growth and can cause severe deformities. Vines may damage trees by strangulation, shading, or physical damage. Benign epiphytes, such as lichens or mosses, are not considered damaging agents.
23020	true mistletoe (other)	True mistletoe covering ≥50% of crown	
23023	dwarf mistletoe	Hawksworth rating of ≥3	
24000	Decline Complexes/ Dieback/Wilts	Damage ≥ 20 % dieback of crown area.	Tree disease which results not from a single causal agent but from an interacting set of factors. Terms that denote the symptom syndrome, such as dieback and wilt, are commonly used to identify these diseases.

Code	General Agent	Damage Threshold*	Descriptions
25000	Foliage diseases	Damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	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.
26000	Stem rusts	Any occurrence on the bole or stems (on multi-stemmed woodland species), or on branches ≤1 foot from boles or stems; damage to ≥20% of branches	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. Stem rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls or cankers. Heavy resinosis is usually associated with infections. 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).
27000	Broom rusts	≥50% of crown area affected.	Broom rust is a disease caused by fungi that kill or deform all or a portion of the branches of a tree. Broom rusts are obligate parasites and host specialization is very common. They infect and develop on fast-growing tissues and cause accelerated growth of infected tissues resulting in galls. Symptoms of rusts include galls, an abnormal and pronounced swelling or deformation of plant tissue that forms on branches or stems.
30000	Fire	Damage ≥ 20% of stem circumference; ≥ 20% of crown affected.	Fire damage may be temporary, such as scorched foliage, or may be permanent, such as in cases where cambium is killed around some portion of the bole. The location and amount of fire damage will determine how the damage may affect the growth and survival of the tree. Fire often causes physiological stress, which may predispose the tree to attack by insects of other damaging agents.

Code	General Agent	Damage Threshold*	Descriptions
41000	Wild animals	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Wild animals from birds to large mammals cause open wounds. Some common types of damage include: sapsucker bird peck, deer rub, bear clawing, porcupine feeding, and beaver gnawing.
41003	big game	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥ 50% of the leaf/needle affected	
41005	pocket gophers	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	
41006	porcupines	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	

Code	General Agent	Damage Threshold*	Descriptions
41008	sapsuckers	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	
42000	Domestic animals	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Open wounds caused by cattle and horses occur on the roots and lower trunk. Soil compaction from the long term presence of these animals in a woodlot can also cause indirect damage.
50000	Abiotic	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Abiotic damages are those that are not caused by other organisms. In some cases, the type and severity of damage may be similar for different types of agents (e.g., broken branches from wind, snow, or ice).
50001	air pollutants	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; > 20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/ needle affected.	

Code	General Agent	Damage Threshold*	Descriptions
50003	drought	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	
50004	flooding/high water	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	
50005	frost	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	
50008	lightning	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	

Code	General Agent	Damage Threshold*	Descriptions
50010	radiation	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	
50011	snow/ice	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	
50013	wind	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥ 20% of the foliage with ≥50% of the leaf/needle affected.	
50014	winter injury	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	

Code	General Agent	Damage Threshold*	Descriptions
50015	avalanche	Any damage to the terminal leader; damage ≥20% of the roots or boles with >20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected	
60000	Competition	Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC).	Suppression of overtopped shade intolerant species. Trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC).
60001	Suppression	Overtopped shade intolerant trees that are not expected to survive for 5 years or saplings not expected to reach tree size (5.0 inches DBH/DRC).	
70000	Human activities	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	People can injure trees in a variety of ways, from poor pruning, to vandalism, to logging injury. Signs include open wounds or foreign embedded objects.
70007	logging damage	Any damage to the terminal leader; damage ≥20% of the roots or boles with > 20% of the circumference affected; damage > 20% of the multiple-stems (on multi-stemmed woodland species) with > 20% of the circumference affected; >20% of the branches affected ; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	

Code	General Agent	Damage Threshold*	Descriptions
71000	Harvest	Removal of ≥10% of cubic volume	Only recorded for woodland species trees that have partial cutting
71001	Woodland cutting	Removal of ≥10% cubic volume	
90000	Other damage	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	**RM** See Appendix 11 for specific damages.
90001	broken top	When actual length is less than total length Not recorded for multi-stemmed trees	
90002	dead top	Any occurrence	
90003	limby-wolf tree	Damage when board foot defect is > 10%. Not recorded for non sawlog trees	
90005	forked below merch top	Damage when board foot defect is > 10%. Not recorded for non sawlog trees	
90006	crook or sweep	Damage when board foot defect is > 10%. Not recorded for non sawlog trees	
90008	foliage discoloration	Damage > 20% of crown affected.	
90010	dieback	Damage > 20% of crown affected.	
90011	open wound	Damage ≥20% of bole circumference (in a running 3-foot section) at point of occurrence.	

Code	General Agent	Damage Threshold*	Descriptions
99000	Unknown damage	Any damage to the terminal leader; damage ≥20% of the roots or boles with> 20% of the circumference affected; damage >20% of the multiple-stems (on multi-stemmed woodland species) with >20% of the circumference affected; >20% of the branches affected; damage ≥20% of the foliage with ≥50% of the leaf/needle affected.	Use this code only when observed damage cannot be attributed to a general or specific agent.
99999	No Data		

* Some Regional specific damage agents within a category may have differing damage thresholds.

5.20.2 DAMAGE AGENT 2

Follow procedures described for DAMAGE AGENT 1

Values: See 5.20.1

5.20.3 DAMAGE AGENT 3

Follow procedures described for DAMAGE AGENT 1

Values: See 5.20.1

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.

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

Description moved after 5.7.3 MORTALITY.

5.23 DECAY CLASS

Record for each standing dead tally tree, 1.0 inch in diameter and larger, the code indicating the tree's stage of decay.

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

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

5.24 LENGTH TO DIAMETER MEASUREMENT POINT

Variable moved after 5.12 DIAMETER CHECK

5.24.1**RM** 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 species, record 0.

Values: 00-99

5.25 ROUGH CULL (CORE OPTIONAL)

RM Not collected in RMRS

5.25.1**RM** 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 than1.5 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, ≥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 ≥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.

Values: 00 to 99

5.25.2**RM** FORM DEFECT

For each live timber species ≥9.0 inches diameter softwoods and ≥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** See Appendix B.4 Defect Chart and

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.

Values: 00 to 99

5.25.3**RM** 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.

Values: See 5.25.4**RM**

5.25.4**RM** CURRENT TREE CLASS

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

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).

5.25.5**RM** RADIAL GROWTH/ AGE CODE

Record whether radial Growth and/or Age information is required.

Values:

0 No. Do NOT collect radial growth or age information. This is not a site tree nor an age and/or growth tree.
1 Yes. Collect only radial growth; this is a timber spp. growth tree only.
2 Yes. Collect both radial growth and age information; this tree is either a site tree or an age/growth tree. Also use this code for 2" class saplings that get age only.
3 Yes. Collect radial growth, age will be determined from the core. Use this code where it is required to collect tree cores. (Cannot be used for Site Trees)
4 Yes. Use Past/Current Diameters for growth (Replaces just radial).
5 Yes. Collect age information. Use Past/Current Diameters for growth (Replace radial).

5.25.6**RM** RADIAL GROWTH and
5.25.7**RM** 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 species group for the entire plot, not 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)

			Diameter Class	Bore for:	
Subplot 1:	DBH	Species		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
	12.9	Doug fir	11”		
	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.					
			Diameter Class	Bore for:	
Subplot 2:	DBH	Species		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
	12.9	Doug fir	11”		
	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
	10.4	Aspen	10”		
	5.2	Oak	8”	X	X

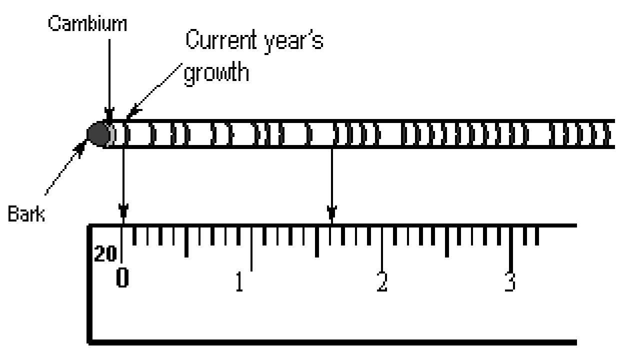
Table 2: Age and Radial coding guide

Note:
When a new diameter class or species is encountered, 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** 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 (Fig. 52a).



RM Figure 52a. 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**

- **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.

Values: 1-99

5.25.8**RM** RADIAL GROWTH AND TREE AGE CHECK

Record the code that best describes the RADIAL GROWTH AND TREE AGE.

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.

3 Age measured from a collected tree core (for cores collected and sent into the office for aging)

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 (Fig. 53):

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.

Note: In addition to these requirements, longleaf pine (0121) seedlings must be greater than or equal to 0.5 inches DRC.

Values: 0 to 6

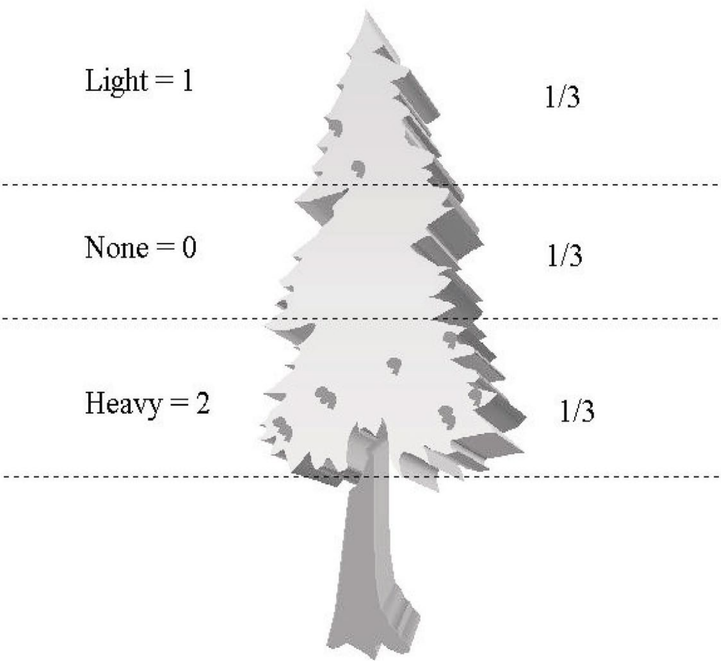


Figure 53. Example of the Hawksworth six class rating system

5.27 TREE NOTES

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

6.0 SEEDLING DATA

Regeneration information is 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 (**RM** or less than 1.0 inch diameter measured up one foot from the stem diameter measurement point). 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.

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 (**RM** or less than 1.0 inch diameter measured up one foot from the stem diameter measurement point).

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.

Values: 001 through 999

6.4.1**RM** COUNT CHECK

Record this code for seedling counts that are estimated.

Values:

0 seedlings counted accurately.
1 seedling count estimated.

6.4.2**RM** SEEDLING AGE

Record this code to identify which seedlings were aged.

Values:

0 Do not collect age information for this Seedling count.
1 Collect total age information for this seedling count.

6.4.3**RM** 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**.

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 below. 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. (**RM** See section 7.1.1**RM** for regional requirements.) 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.

7.1.1**RM** 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
   - < 50% UNCOMPACTED CROWN RATIO
   - Intermediate CROWN CLASS
   - relicts
   - over rotation age but less than 200 years (DBH age);
   - rough trees.

7.1.2**RM** 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

7.2.0**RM** 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.)

Values: 1000 to 9876

7.2.2 SPECIES

Use the same procedures described in Section 5.8. Ideally, site trees in the eastern U.S. should be between 20-70 years old. If preferred trees cannot be found in this age range, expand the age range to 15-120 years. Reject trees outside the 15-120 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, and trees with rotten cores. 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 eastern 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 eastern region.

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.

When Collected: All site trees
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time for genus, at least 95% of the time for species
Values:

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
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

7.2.3 DIAMETER

Use the same procedures described in Section 5.9.

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.

Values: 005 to 999

7.2.4.2**RM** SITE TREE METHOD

Record the code indentifying the method for determining site index or estimated site productivity class

Values

1 Tree measurement (length, age, etc.) collected during this inventory.
2 Tree measurement (length, age, etc.) collected during a previous inventory.

7.2.4.1**RM** 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:

Values:

1 Suitable site tree
2 Unsuitable site tree

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

See procedures in section RM 5.25.7

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.

Values: 001 to 999

7.2.6 SITE TREE NOTES

Record notes pertaining to an individual site tree.

7.2.7 SUBPLOT NUMBER (CORE OPTIONAL)

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

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.

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.

Values: 0001 to 2000

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

The Phase 2 (P2) Vegetation data are collected to describe 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 about 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 describe plant communities and to predict associated forest stand characteristics. Accurately representing the species present on a site and monitoring 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 collection include P2 VEGETATION SAMPLING STATUS and LEVEL OF DETAIL. P2 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 accessible 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 also recorded; and whether tally tree species 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 abundant species per SPECIES GROWTH HABIT per subplot. The four most abundant species must each have a total aerial canopy cover of at least 3 percent on the subplot and within the SPECIES GROWTH HABIT to be recorded. Most tally tree species 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 canopy cover for them. Regardless of the LEVEL OF DETAIL, the protocols for the P2 Vegetation Profile 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 P2 Vegetation Profile includes measurements of Vegetation Structure (8.4) – canopy cover by layer and total aerial canopy cover of each growth habit – with additional options to collect Species Composition (8.5) data on the (up to) 4 most abundant species in each SPECIES GROWTH HABIT.

P2 Vegetation is sampled on accessible condition classes within the 24.0-foot radius subplot. Inventory units implementing the P2 Vegetation Profile determine if they will include accessible forestland conditions, or any accessible land conditions (P2 VEGETATION SAMPLING STATUS). If the area of an accessible condition class is less than 100 percent on a subplot, P2 Vegetation measurements are recorded only on the portion that is in the accessible condition class(es). If multiple accessible condition classes are present on the subplot, separate estimates are made for each accessible condition class 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 the P2 Vegetation Profile will collect LEVEL OF DETAIL = 1, Vegetation Structure. LEVEL OF DETAIL = 2 and 3 are optional and include Species Composition data.

The P2 Vegetation Profile 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. Notes can be added to subplot records indicating unusual phenological conditions. Crews should not collect P2 Vegetation data when snow covers the subplot (see 1.22.1 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 (fig. 45), without subtracting any normal spaces occurring between the leaves of plants (Daubenmire 1959). Overlapping crowns are not double-counted (visualize the canopy cover collapsed into a 2-dimensional space); the maximum possible canopy cover is the percentage of the subplot area within the accessible condition.

All canopy cover estimates are focused on foliage within the sampled accessible condition class(es) within the subplot perimeter (24.0-foot radius, horizontal distance). Canopy cover is estimated for each sampled accessible condition of the subplot. If multiple sampled accessible 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 canopy cover **value is always estimated as a percentage of an entire subplot**. That is, if the canopy cover within the accessible condition is about equal to a circle with a radius of 5.3 feet, the canopy cover estimate will always be 5 percent, even if only 30 percent of the subplot is in the accessible condition on which the canopy cover is being measured.

Canopy cover is collected by height layer and as a total (aerial view) across all layers for each growth habit in Vegetation Structure (8.4). For each layer, examine the canopy cover of each Structure Growth Habit as if the other growth habits and other layers do not exist. If a Structure Growth Habit does not have foliage in a layer, enter 0 (do not count tree boles as cover). For total aerial canopy cover by Structure Growth Habit, examine each growth habit individually as if the other growth habits do not exist. Total aerial canopy cover is collected for each most abundant species in Species Composition (8.5); examine each species individually, as if the other species do not exist.

Canopy cover is estimated to the nearest 1 percent. For Vegetation Structure assessments, canopy cover >0 and ≤1 percent is coded as 1 percent (i.e. trace amounts are coded as 1%). For Species Composition assessments, a species must have at least 3 percent total aerial canopy cover (i.e. do not round total aerial canopy cover <3% up to 3%).

Canopy cover is vertically projected from the outline of the foliage **at the time of plot visit**. All foliage that is or was alive during the current growing season is included in the cover estimates. Canopy cover from broken tops and stems is included, unless completely detached. Do not ocularly upright leaning trees.

See tabulation below for canopy cover to area relationships for a 1/24 acre subplot and figure 54 for additional visual calibrations.

[1]Daubenmire. R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

Cover	Area (ft^2)	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

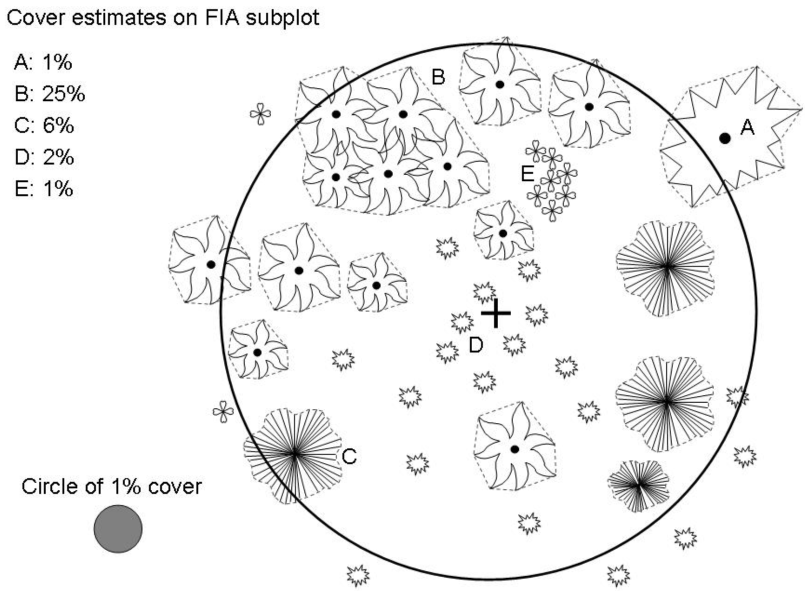


Figure 54. Assessing canopy cover.

Growth Habits – P2 Vegetation data are collected by growth habits at each LEVEL OF DETAIL. In general, growth habits for vascular plants include trees, shrubs/subshrubs/woody vines, forbs, and graminoids.

However, depending on the LEVEL OF DETAIL, trees are grouped in different ways. Vegetation Structure (8.4) tree Structure Growth Habits are determined by regional core/core-optional tree species lists; Species Composition (8.6) tree SPECIES GROWTH HABITs are determined by DBH/DRC. See sections 8.4 and 8.5 for more detail.

Layer Codes – Structure Growth Habits are assessed by layers in Vegetation Structure (8.4), and one of the following layer codes will be assigned to individual plant species' SPECIES GROWTH HABITs in Species Composition (8.5). Measure the layer height from ground level; see figure 55 for examples of measuring layer heights on sloping and uneven ground.

.

Layer 1	0 to 2.0 feet
Layer 2	2.1 to 6.0 feet
Layer 3	6.1 to 16.0 feet
Layer 4	Greater than 16 feet

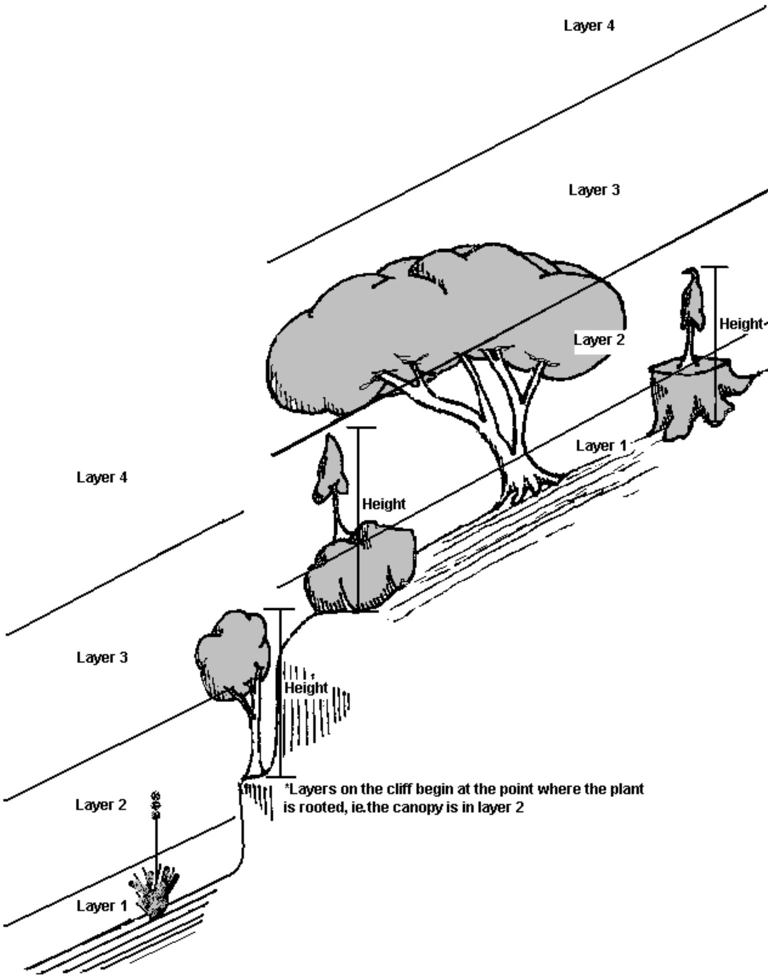


Figure 55. To determine the layer of a plant, measure the height of the layer from the ground.

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 (including growth habits), images, crop information, automated tools, onward Web links, and references:

USDA, NRCS. 2017. The PLANTS Database (http://plants.usda.gov, October 2017). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
FIA currently uses a stable code set downloaded in October of 2017.

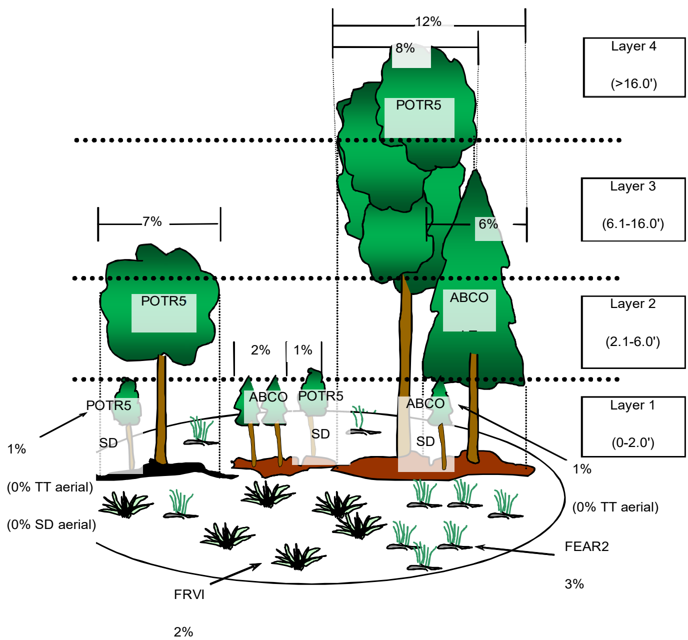


Figure 56. Example of growth habit by layer and species composition.

Table 1-Estimation of canopy cover by layer and aerial view of each Structure Growth Habit in figure 56

Vegetation Structure Growth Habit	**Layer 1 (0-2.0 ft)**	**Layer 2 (2.1-6.0 ft)**	**Layer 3 (6.1-16.0ft)**	**Layer 4 (>16.0 ft)**	**Aerial**
	Percent canopy cover				
Tally tree sp (TT)	005	013	019	008	022
Non-tally tree sp (NT)	000	000	000	000	000
Shrub/Subshrub/ Woody 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 total aerial canopy cover by species in figure 56

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	2

Note: FRVI, estimated at 2%, was not recorded, and ABCO and POTR5 are present as two different SPECIES GROWTH HABITs (seedling/sapling and large tree) with at least 3% total aerial canopy cover within the SPECIES GROWTH HABIT on the subplot.

8.3 Vegetation Data Collection Location – Subplot-Level Variables

8.3.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

Values:

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

8.3.2 CONDITION CLASS NUMBER

Record the number for the sampled accessible condition class in which the vegetation is found. If multiple sampled accessible conditions occur on the same subplot, data will be collected for each accessible condition separately.

Values: 1 to 9

8.4 Vegetation Structure

In this section, use ocular methods to estimate canopy cover by layer and aerial view cover for each Structure Growth Habit, and record to the nearest percent (canopy cover >0 and <1% is coded as 1%; i.e., trace amounts are coded as 1%.)

Canopy cover by layer:

Estimate the canopy cover in each Structure Growth Habit for each of the four layers. Include Structure Growth Habits with foliage present on the accessible condition and with foliage overhanging the accessible condition. For each layer canopy cover, examine the canopy cover of each Structure Growth Habit as if the other growth habits and other layers do not exist. Do not double-count overlapping crowns within a Structure Growth Habit; visualize the canopy cover within the layer collapsed into a 2-dimensional space. If a Structure Growth Habit does not have foliage in a layer, enter 0 (do not count tree boles as cover).

Aerial View Coverage:
Determine the total aerial canopy cover by Structure Growth Habit. .Examine each Structure Growth Habit individually as if the other growth habits do not exist. Do not double-count overlapping crowns within a Structure Growth Habit (maximum cover = the percentage of the subplot area in the accessible condition.)

The total aerial canopy cover for a Structure Growth Habit must be equal to or greater than the highest canopy cover recorded for an individual layer in that growth habit, but cannot be greater than the sum of the canopy 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 Structure Growth Habits on the same subplot-condition.) If a tree species has been selected as a tally tree species 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 species 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. Seedlings (any length, no minimum), 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 well-defined, dominant main 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 (any length, no minimum), saplings, and mature plants are included.

SH **Shrubs/Subshrubs/Woody Vines (SH)**: Woody, multiple-stemmed plants of any size, subshrubs (low-growing shrubs under 1.5 feet tall at maturity), and woody vines. Most cacti are included in this category.

FB **Forbs (FB)**: Herbaceous, broad-leaved plants; includes non-woody-vines, ferns (does not include mosses and cryptobiotic crusts).

GR **Graminoids (GR)**: Grasses and grass-like plants (includes rushes and sedges).

8.4.1 TALLY TREE SPECIES COVER LAYER 1

Record canopy cover for all tally tree species in layer 1 (0-2.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC.

Values: 000-100

8.4.2 TALLY TREE SPECIES COVER LAYER 2

Record canopy cover for all tally tree species in layer 2 (2.1- 6.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.3 TALLY TREE SPECIES COVER LAYER 3

Record canopy cover for all tally tree species in layer 3 (6.1- 16.0 feet) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.4 TALLY TREE SPECIES COVER LAYER 4

Record canopy cover for all tally tree species in layer 4 (16.1 feet and above) to the nearest percent. Canopy cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.5 TALLY TREE SPECIES COVER – AERIAL VIEW

Record the total aerial canopy cover for all tally tree species over all layers. Canopy 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.

8.4.6 NON-TALLY TREE SPECIES COVER LAYER 1

Record canopy cover for species not on the tally tree species list with tree growth habit in layer 1 (0-2.0 feet) to the nearest percent. Canopy cover includes all non-tally tree species present, regardless of DBH or DRC.

Values: 000-100

8.4.7 NON-TALLY TREE SPECIES COVER LAYER 2

Record canopy cover 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. Canopy 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.

8.4.8 NON-TALLY TREE SPECIES COVER LAYER 3

Record canopy cover for species not on the tally tree species list with tree growth form in layer 3 (6.1- 16.0 feet) to the nearest percent. Canopy 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.

8.4.9 NON-TALLY TREE SPECIES COVER LAYER 4

Record 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. Canopy 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.

8.4.10 NON-TALLY TREE SPECIES COVER – AERIAL VIEW

Record the total aerial canopy cover for species not on the tally tree species list with tree growth habit over all layers. Canopy 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.

8.4.11 SHRUB, SUBSHRUB, and WOODY VINE COVER LAYER 1

Record canopy cover for shrubs/subshrubs/woody vines in layer 1 (0-2.0 feet) to the nearest percent.

Values: 000-100

8.4.12 SHRUB, SUBSHRUB, and WOODY VINE COVER LAYER 2

Record canopy cover for shrubs/subshrubs/woody vines in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.13 SHRUB, SUBSHRUB, and WOODY VINE COVER LAYER 3

Record canopy cover for shrubs/subshrubs/woody vines in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.14 SHRUB, SUBSHRUB, and WOODY VINE COVER LAYER 4

Record canopy cover for shrubs/subshrubs/woody vines in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1.

8.4.15 SHRUB, SUBSHRUB, and WOODY VINE COVER—AERIAL VIEW

Record the total aerial canopy cover for the shrub/subshrub/woody vine growth habit over all layers. Follow the same procedures as for SHRUB, SUBSHRUB, AND WOODY VINE COVER LAYER 1, but include all layers.

8.4.16 FORB COVER LAYER 1

Record canopy cover for forbs in layer 1 (0-2.0 feet) to the nearest percent.

Values: 000-100

8.4.17 FORB COVER LAYER 2

Record canopy cover for forbs in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.18 FORB COVER LAYER 3

Record canopy cover for forbs in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.19 FORB COVER LAYER 4

Record canopy cover for forbs in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.20 FORB COVER—AERIAL VIEW

Record the total aerial canopy cover for the forb growth habit over all layers. Follow the same procedures as for FORB COVER LAYER 1, but include all layers.

8.4.21 GRAMINOID COVER LAYER 1

Record canopy cover for graminoids in layer 1 (0-2.0 feet) to the nearest percent.

Values: 000-100

8.4.22 GRAMINOID COVER LAYER 2

Record canopy cover for graminoids in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.23 GRAMINOID COVER LAYER 3

Record canopy cover for graminoids in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.24 GRAMINOID COVER LAYER 4

Record canopy cover for graminoids in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.25 GRAMINOID COVER—AERIAL VIEW

Record the total aerial canopy cover for the graminoid growth habit over all layers. Follow the same procedures as for GRAMINOID COVER LAYER 1, but include all layers.

8.5 Species Composition

Species are recorded when LEVEL OF DETAIL = 2 or 3. Identify the (up to) four most abundant species within each SPECIES GROWTH HABIT (tree seedlings and saplings, shrubs/subshrubs/woody vines, forbs, graminoids, and large trees) that occupy 3 percent or greater total aerial canopy cover on the subplot and within the SPECIES GROWTH HABIT (do not round total aerial canopy cover <3% up to 3%.) Although up to four species per SPECIES 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 P2 Vegetation Profile data.

When there are multiple accessible conditions within a subplot, the species must be present at 3 percent or more total aerial canopy cover on the full 24-foot radius subplot and within the SPECIES GROWTH HABIT in order to be recorded. If part of the subplot is a non-sampled condition (e.g., nonforest condition, not sampled for P2 Vegetation because 8.3.1 P2 VEGETATION SAMPLING STATUS = 1; or inaccessible condition, not sampled because 2.1.1 CONDITION CLASS STATUS = 5), estimate total aerial canopy cover for the full subplot if possible; otherwise assume the species canopy cover is the same on the non-sampled portion. If a species is present at 3 percent total aerial canopy cover or more on the full subplot and within the SPECIES GROWTH HABIT, record SPECIES GROWTH HABIT, SPECIES CANOPY COVER, and SPECIES VEGETATION LAYER separately for each accessible condition,. SPECIES CANOPY COVER values less than 3 percent for an accessible condition are valid as long as the total aerial canopy cover of the species on the full subplot and within the SPECIES GROWTH HABIT is at least 3 percent. See figure 57 for an example of species total aerial canopy cover estimation. See figure 58 for a Species Composition subplot flow.

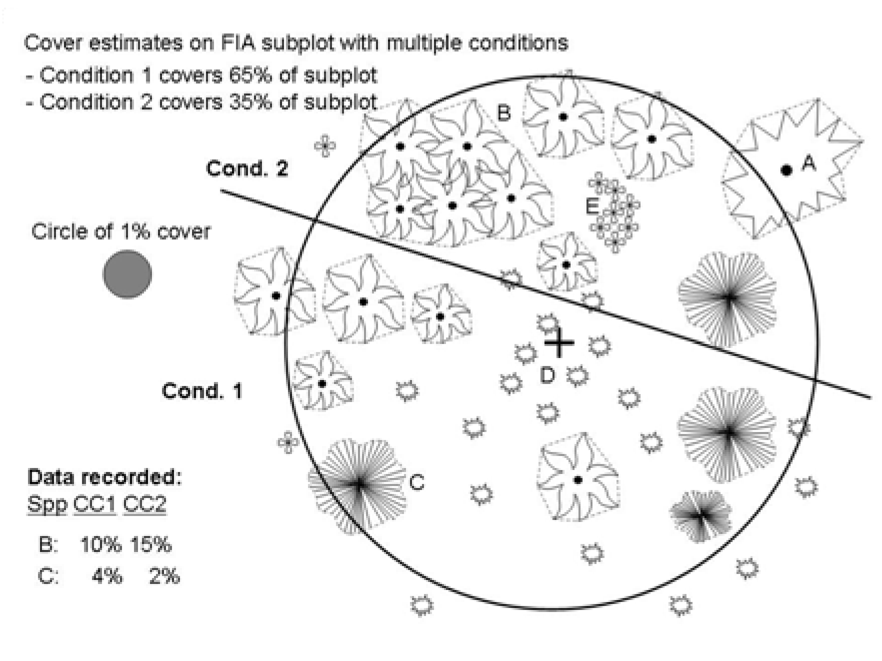


Figure 57. Example of species total aerial canopy cover estimation on a subplot with 2 accessible conditions. See figure 54 for total aerial canopy cover across the subplot. In figure 54, species A, D, and E would be included in estimates of Vegetation Structure by Structure Growth Habit, but not recorded for Species Composition. Note that species with subplot total aerial canopy cover <3% are not recorded, but that SPECIES CANOPY COVER recorded on an accessible condition can be less than 3%.

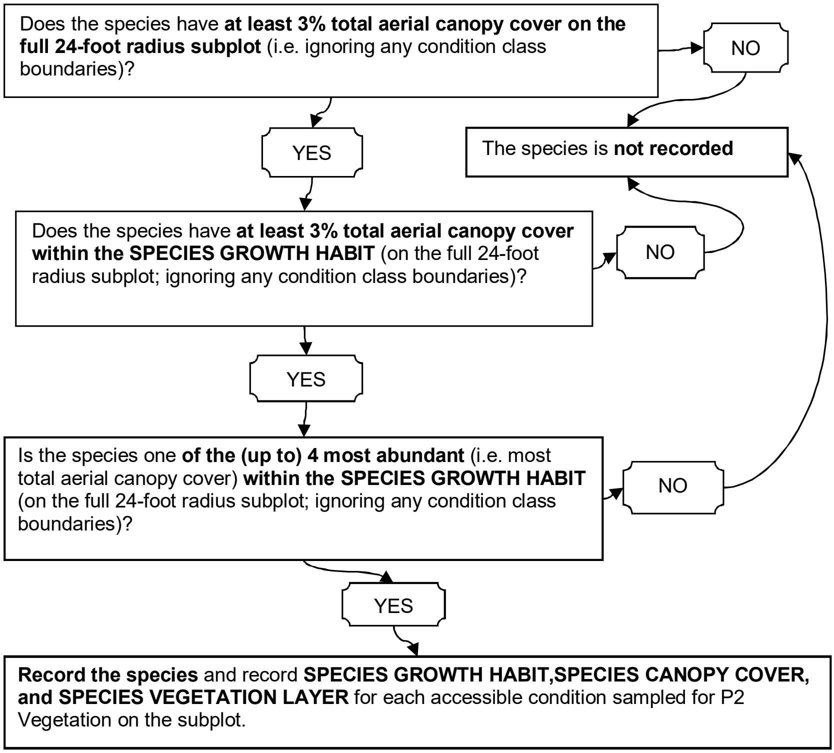


Figure 58. Species Composition subplot flow chart.

8.5.1 SPECIES GROWTH HABIT

Record the growth habit of the species. Because many species can exhibit more than one growth habit, it is important to note which growth habit each recorded species is demonstrating on each accessible condition in a subplot (subplot-condition).

Tally tree species[2] are always recorded as seedling/sapling (SD) and/or large tree (LT) SPECIES GROWTH HABITs, even when they exhibit a shrub-like growth habit in some environments.

Non-tally tree[3] species are recorded as seedling/sapling (SD) and/or large tree (LT) SPECIES GROWTH HABITs when they exhibit a tree-like growth habit; and are recorded as shrub (SH) SPECIES GROWTH HABIT when they exhibit a shrub-like growth habit.

A species may be recorded with a different SPECIES GROWTH HABIT on a different subplot-condition on the same subplot. If a species has more than one growth habit on an accessible condition in a subplot, record the one SPECIES GROWTH HABIT that is most prevalent within the subplot-condition (except for tally and non-tally tree species).

For tally and non-tally tree species, both tree SPECIES GROWTH HABITs (SD and LT) are coded for the same species within the subplot-condition the species has a total aerial canopy cover of at least 3% in each SPECIES GROWTH HABIT.

---

[2]All core tree species and any core optional tree species selected by a particular FIA unit.
[3]Tree species not on a particular FIA unit's tree tally list that are woody plants with a single well-defined dominant stem, not supported by other vegetation or structures (not vines), and which are, or are expected to become, greater than 13 feet in height.

Values:

SD Seedlings and Saplings: Small trees less than 5 inches DBH or DRC (refer to field guide sections 5.9.2 and 5.9.4), including tally and non-tally tree species. Seedlings of any length are included (i.e., no minimum.) Up to four species are recorded if individual species total aerial canopy cover is at least 3% on the subplot and within the SPECIES GROWTH HABIT.

SH Shrubs/Subshrubs/Woody Vines: Woody, multiple-stemmed plants of any size, subshrubs (low-growing shrubs under 1.5 feet tall at maturity), and woody vines. Most cacti are included in this category. Subshrub species are usually included in this category. However, there are many species that can exhibit either subshrub or forb/herb growth habits. Each FIA region will develop a list of common species that can exhibit either growth habits (according to the NRCS PLANTS database) with regional guidance as to which growth habit the species should normally be assigned, while still allowing species assignments to different growth habits when the species is obviously present in a different growth habit. Up to four species are recorded if individual species total aerial canopy cover is at least 3% on the subplot and within the SPECIES GROWTH HABIT.

FB Forbs: Herbaceous, broad-leaved plants; includes non-woody-vines, ferns (does not include mosses and cryptobiotic crusts). Up to four species are recorded if individual species total aerial canopy cover is at least 3% on the subplot and within the SPECIES GROWTH HABIT.

GR Graminoids: Grasses and grass-like plants (includes rushes and sedges). Up to four species are recorded if individual species total aerial canopy cover is at least 3% on the subplot and within the SPECIES GROWTH HABIT.

LT Large Trees: Large trees greater than or equal to 5 inches DBH or DRC (refer to field guide sections 5.9.2. and 5.9.4). For LEVEL OF DETAIL = 2, include only non-tally tree species; for LEVEL OF DETAIL = 3, include tally and non-tally tree species. Up to four species of large trees (DBH or DRC at least 5 inches) are recorded if individual species aerial canopy cover is at least 3% on the subplot and within the SPECIES GROWTH HABIT.

8.5.2 SPECIES CODE

Record a code for each most abundant (see section 8.5) vascular plant species. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database (currently January 2010 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 most abundant species.

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 (8.5.8) 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. See appendix 10, Unknown Specimen Collection.

ACI For the ACI study on R4 NFS lands, crews need to be able to identify (or collect specimens if can’t identify) all species of grasses and all species/varieties of sage brush (Artemesia) on the “Region 4 Habitat Type Indicator List” provided.

ACI For the ACI study on R1 NFS lands, crews are responsible for identifying indicator grasses, used for habitat typing, to the species level.

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 (>0.5m)
2SUBS	Subshrub (<0.5m)
2TREE	Tree
2VH	Vine, herbaceous
2VW	Vine, woody

Values: Accepted NRCS species code when the species is known, or an accepted NRCS genus or unknown code when the species is not known

8.5.3 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.

Values: 1-99, assigned in sequential numbers

8.5.4 SPECIES CANOPY COVER

For each species recorded, estimate and record the total aerial canopy cover present on the subplot-condition to the nearest 1 percent. Examine each species individually as if the other species do not exist. When recording SPECIES CANOPY COVER for seedlings and saplings (SPECIES GROWTH HABIT = SD), do not include any canopy cover from trees greater than or equal to 5 inches DBH (DRC for woodland species), regardless of how close to the ground the canopy cover extends. A separate estimate is made for the SPECIES CANOPY COVER of trees greater than or equal to 5 inches DBH/ DRC. (SPECIES GROWTH HABIT = LT).

Values: 001-100

8.5.5 SPECIES VEGETATION LAYER

For each individual species recorded, assign one of the vegetation layers. These layers illustrate the vertical diversity of the most abundant species found on the subplot.

Assign each plant species record to only one of the vegetation layers per SPECIES GROWTH HABIT per subplot-condition. If a plant species is found in more than one layer, assign the species to the layer where most of the canopy 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.

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

8.5.6 SPECIMEN OFFICIALLY COLLECTED

Record a code to indicate whether or not a specimen was collected 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.)

Values

0 No, a specimen was not collected
1 Yes, a specimen was collected

8.5.6.1**RM** Community Description for Specimen Label

Once a collected specimen is identified to be present on a subplot, then that subplot record requires a "Community Description" to be entered for the unknown specimens found on that subplot. The community description is intended to fully automate the specimen collection process by providing the herbarium of a description of the community in which this plant was found. Some examples of community description are as follows:
25 yr aspen boundary of mature trees. very little slope. a lot of light entry
Acer saccharum floodplain forest. hummock-hollow microtopography.
mature mesic hemlock-hardwood forest adjacent to pond.

This field is a note that is accessible via Ctrl+E from the P2 Subplot screen for P2VEG.

RM note: The field crew collecting the unknown sample must include a print out of the voucher with the SPECIMEN LABEL NUMBER. The voucher and specimen(s) are then sent to the appropriate person listed in appendix 10.

Values: English language words, phrases, and numbers

8.5.7 SPECIMEN LABEL NUMBER

Record the label number for the collected specimen. Pre-numbered labels are provided to each crew by the regional coordinator or auto-generated with the data collection software.

Values: 1 to 99999, as pre-printed and assigned by region or auto-generated in the PDR

8.5.8 P2 SPECIMEN NOT COLLECTED REASON CODE

Record the code that describes why a specimen has not been collected.

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)

8.5.9 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.

Values: English language words, phrases, and numbers

9.0 INVASIVE PLANTS (CORE OPTIONAL)

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). 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 foliage that is or was alive during the current growing season is 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 canopy 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 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

Values:

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

9.4 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.

Values: 1-9

9.5 SPECIES CODE

Record the code for any species listed in your region's invasive plant species list 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 October 2017 version maintained by the FIA IM group (USDA, NRCS. 2017. 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

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.

9.6 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.

Values: 1-99, assigned in sequential numbers

9.7 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-feet 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 ft²			
Cover	Area (ft²)	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

Values: 001 to 100

9.8 INVASIVE SPECIMEN COLLECTED

Record a code to indicate whether or not a specimen was collected for each species genus or unknown code entered as a new unique species. 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 in 9.10, INVASIVE PLANT NOTES.

Values:

0 No, a specimen was not officially collected
1 Yes, a specimen was officially collected

9.9 SPECIMEN LABEL NUMBER

Record the label number for the collected specimen. Where plant specimen collection is required, numbered labels are provided to each crew.

Values: 1 to 99999, as pre-printed and assigned by FIA unit.

9.10 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.

Values: English language words, phrases, and numbers

9.11 References

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

10 DOWN WOODY MATERIALS (Phase 2 – CORE OPTIONAL)

10.0 Introduction

Down woody materials (DWM) are important components of forest ecosystems across the country. DWM is dead material on the ground in various stages of decay. Wildlife biologists, ecologists, mycologists, foresters, and fuels specialists are some of the people interested in DWM because it helps describe the:

- Quality and status of wildlife habitats.
- Structural diversity within a forest.
- Fuel loading and fire behavior.
- Carbon sequestration – the amount of carbon tied up in dead wood.
- Storage and cycling of nutrients and water – important for site productivity.

Down wood components and fuels estimated by the FIA program are coarse wood, slash, fine wood, and litter and duff depth. The DWM protocol includes the following three suites of measurement options:

<u>OPTION I. BASE:</u>
(**RM** This option used in the Interior West.)
The BASE option provides a minimum set of variables necessary to produce estimates for volume, biomass, carbon, and fuel load per acre on a broad scale. Base variables are required any time DWM is measured, and are labeled “BASE” in this chapter. Measurements include:

<u>OPTION I: BASE Variables</u>

<u>BASE Layout:</u> DWM SAMPLING STATUS, DWM NUMBER OF SUBPLOTS, DWM NUMBER OF TRANSECTS ON SUBPLOT, DWM TRANSECT LENGTH, DWM NOTES

<u>BASE Transect Line Segmenting:</u> SUBPLOT NUMBER,TRANSECT, SEGMENT CONDITION CLASS NUMBER, SEGMENT BEGINNING DISTANCE (HD), SEGMENT ENDING DISTANCE (HD), DWM TRANSECT SEGMENT SAMPLE STATUS, DWM TRANSECT NONSAMPLED REASON

<u>BASE CWD:</u> SUBPLOT NUMBER, TRANSECT, CWD CONDITION CLASS, PIECE ON SUBPLOT OR ANNULAR PLOT?, CWD DECAY CLASS, SPECIES, DIAMETER AT POINT OF INTERSECTION, DIAMETER OF HOLLOW AT POINT OF INTERSECTION, CWD LENGTH >=3 FEET

<u>BASE Pile:</u> PILE SUBPLOT NUMBER, PILE TRANSECT, PILE CONDITION CLASS NUMBER, PILE BEGINNING DISTANCE, PILE ENDING DISTANCE, COMPACTED HEIGHT OF CWD IN PILE, PILE DECAY CLASS, PILE SPECIES

<u>BASE FWD:</u> FWD SUBPLOT NUMBER, FWD TRANSECT, FWD CONDITION CLASS NUMBER, FWD TRANSECT SEGMENT SAMPLE STATUS, FWD TRANSECT NONSAMPLED REASON, SMALL FWD COUNT, MEDIUM FWD COUNT, LARGE FWD COUNT, HIGH COUNT REASON

BASE Duff/Litter Depth: DUFF/LITTER SUBPLOT NUMBER, DUFF/LITTER TRANSECT, DUFF/LITTER CONDITION CLASS NUMBER, DUFF/LITTER SAMPLE STATUS, DUFF/LITTER NONSAMPLED REASON, DUFF DEPTH, LITTER DEPTH, DUFF AND LITTER METHOD

OPTION II. WILDLIFE/ECOLOGICAL
This option includes all the BASE Option variables plus additional CWD structural variables. These additional measurements allow users to quantify wildlife habitat. This option is required when measuring P3 DWM.

OPTION II: WILDLIFE / ECOLOGICAL
BASE Layout Variables
BASE Transect Line Segmenting Variables
BASE CWD Variables plus the following variables required for P3 DWM:CWD HORIZONTAL DISTANCE, DIAMETER AT SMALL END, DIAMETER AT LARGE END, CWD TOAL LENGTH
BASE Pile Variables
BASE FWD Variables
BASE Duff/Litter Depth Variables

OPTION III. RAPID ASSESSMENT (CUSTOMIZED PROTOCOL)
Rapid assessments may be desired to quantify down wood abundance in specific instances (for example, following a hurricane or volcanic eruption). Because information needs and funds will vary depending on the situation, a rapid assessment option is available where the transect configuration (number of transects and subplots and transect length) can be defined by the FIA unit. However, the base variables needed to estimate biomass are still required for rapid assessments.

Additional variables found to be useful by FIA units in the past are also defined in this protocol to ensure consistency if additional information is desired by different FIA units. FIA units may also choose to classify the fuelbed conditions that determine fire behavior on each condition class using standardized national fuel models. These variables are labeled “OPTIONAL” in this chapter.

ADDITIONAL OPTIONAL VARIABLES
Optional CWD Variables (for all OPTIONs): IS THE PIECE HOLLOW?, PIECE INCLINATION, CWD HISTORY, PERCENT OF LOG CHARRED BY FIRE, LARGE END DIAMETER CLASS
Optional Fuels Variable: CONDITION FUELBED TYPE (Scott and Burgan 2005; RMRS-GTR-153)

DWM is sampled on accessible forest conditions intersected by a transect, and on accessible nonforest conditions if they are being measured on the plot (NONFOREST CONDITION CLASS STATUS = 2). If a transect crosses a condition boundary, the boundary locations on the transect are recorded. All 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 Coarse Woody Debris (CWD, ≥3 inches diameter and ≥0.5 foot long) or Fine Woody Debris (FWD, <3 inches diameter) are tallied if the central axis of the piece is intersected by the plane of the transect.

Note: DWM is a CORE OPTIONAL indicator on all Phase 2 plots. When measured on Phase 2 plots, all the BASE data items must be measured and other data items can be added as desired (designated as P2 OPTIONAL on data items.) However, DWM is a CORE indicator on all Phase 3 plots, and both BASE and WILDLIFE/ECOLOGICAL data items must be measured (**RM** does not apply in RMRS) (see table 3).

Table 3. DWM Protocol Options Variables

OPTION I: BASE	OPTION II: WILDLIFE / ECOLOGICAL	ADDITIONAL OPTIONAL VARIABLES
REQUIRED: BASE Layout Variables	REQUIRED: BASE Layout Variables	
REQUIRED: BASE Transect Line Segmenting Variables	REQUIRED: BASE Transect Line Segmenting Variables	
REQUIRED: BASE CWD Variables		
P2 OPTIONAL: CWD HORIZONTAL DISTANCE, DIAMETER AT SMALL END, DIAMETER AT LARGE END, CWD TOTAL LENGTH	REQUIRED: BASE CWD Variables, CWD HORIZONTAL DISTANCE, DIAMETER AT SMALL END, DIAMETER AT LARGE END, CWD TOTAL LENGTH, IS THE PIECE HOLLOW?	OPTIONAL CWD Variables (for all OPTIONs): IS THE PIECE HOLLOW?, PIECE INCLINATION, CWD HISTORY, PERCENT OF LOG CHARRED BY FIRE, LARGE END DIAMETER CLASS
REQUIRED: BASE Pile Variables	REQUIRED: BASE Pile Variables	
REQUIRED: BASE FWD Variables	REQUIRED: BASE FWD Variables	
REQUIRED: BASE Duff/ Litter Depth Variables	REQUIRED: BASE Duff/ Litter Depth Variables	
		Optional Fuels Variable: Photo-series (Scott & Burgan 2005 RMRS-GTR-153)

10.1 Definition of Down Woody Materials

Coarse Woody Debris – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are ≥3 inches in diameter and severed from their original source of growth. CWD also includes dead tally species trees or single-stemmed woodland species trees (either self-supported by roots, severed from roots, or uprooted and supported by other objects) that are leaning >45 degrees from vertical and not considered part of the standing tree inventory. Portions of dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in the CWD inventory (see discussion and diagrams in section 5.7.2 - Standing Dead). For multi-stemmed woodland species (Appendix 3) such as juniper, only tally stems that are dead and detached. Include as CWD all dead multi-stemmed woodland tree stems that do not qualify as standing dead if they meet the size requirements for CWD pieces. Also included are non-machine processed round wood such as fence posts and cabin logs.

CWD is measured primarily using intersect diameter. In rare instances when pieces are in a pile and it is impossible to estimate the size of individual pieces, use the pile protocol.

CWD does not include:

1. Woody pieces <3.0 inches in diameter at the point of intersection with the transect.
2. Dead trees leaning 0 to 45 degrees from vertical (see discussion and diagrams in section 5.7.2 - Standing Dead).
3. Dead shrubs, self-supported by their roots.
4. Trees showing any sign of life.
5. Stumps that are rooted in the ground (i.e., not uprooted).
6. Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
7. Roots or main bole below the root collar.

Fine Woody Debris – In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles <3 inches in diameter 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 >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)

10.2 Locating and Establishing Line Transects

Transects are established on each subplot if the subplot center is accessible (i.e., not census water, access denied, or hazardous), and there is at least one forest or measured nonforest land condition class mapped within the 24.0-foot radius subplot (CONDITION CLASS STATUS = 1 or (NONFOREST

CONDITION CLASS STATUS = 2)). Transects begin at the subplot center and extend 24.0 feet to the edge of the subplot. The location of condition class boundaries are recorded along the transect, starting at the subplot center and working towards the fixed radius plot boundary. It is extremely important to lay out the transect in a straight line to avoid biasing the selection of pieces and to allow the remeasurement of transect lines and tally pieces for QA purposes.

Transect lines should be marked with a pin or small piece of flagging at the end of the line (24.0 feet, horizontal distance) to help the QA staff identify the path of the transect during the check-plot procedure. Because the tolerance for the transect azimuth is +/- 2 degrees, the line might have been laid down in a slightly different direction from the check-plot crew. This could affect the location of diameter measurements for CWD pieces as well as identifying whether a CWD piece is a valid tally piece. It is also helpful to mark the point where the FWD transect begins (14 feet, horizontal distance).

10.2.1 CWD Transects

Two transects are established that originate at the subplot center and extend out 24.0 feet horizontal distance (the radius of the subplot) (fig. 59). This transect configuration was chosen to avoid sampling bias on sloped land, where it is possible that CWD may be oriented in one direction. This configuration of transects should pick up CWD logs that are lying parallel to the slope, perpendicular to the slope, and across slope. On plots where the macroplot is measured and mapped for condition classes, FIA units have the option of extending transects up to 58.9 feet from subplot center. In addition, an optional third transect on each subplot provides the ability to add or retain transect length on P3 plots.

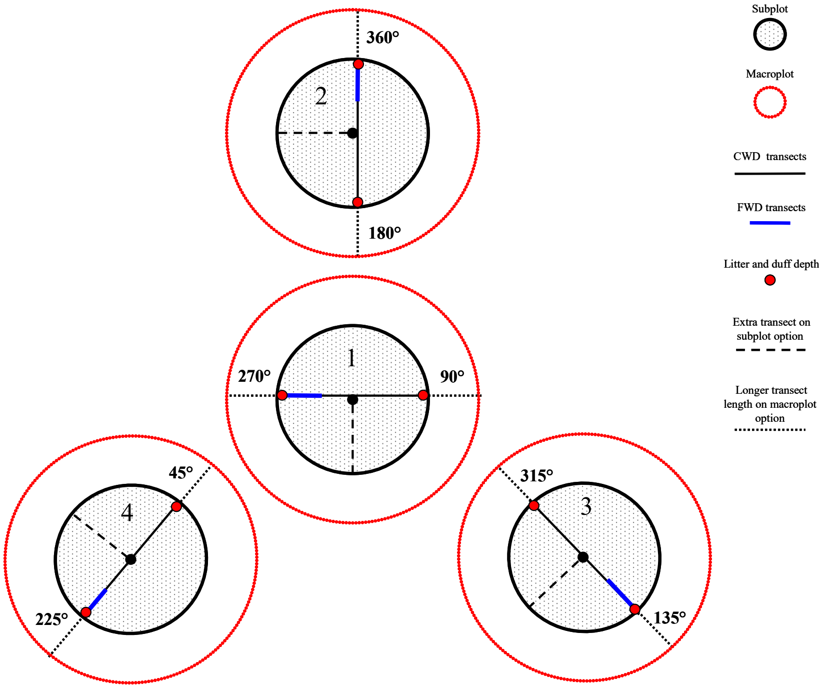


Figure 59. Plot layout for sampling CWD, FWD, and litter and duff depth. CWD transects include two 24-foot transects per subplot (starting at subplot center designated by its azimuth as labeled), optional extension onto condition mapped macroplots, and optional third transect for CWD.

10.2.2 FWD Transects

On a portion of one CWD transect on each subplot, FWD is tallied within 3 size classes. Because FWD is generally present in high densities, a shorter transect will pick up an acceptable amount of tally. The transect begins at 14 feet (horizontal distance) from the subplot center and extends out either 6 or 10 feet (horizontal distance) depending on the FWD size class, as follows:

Category of FWD	**Size Class**	**Diameter range**	**Transect length (horizontal distance)**	**Transect location (horizontal distance)**
Small FWD	1	0 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

It is helpful to have a size gauge available until your eye is 'trained' to recognize the 3 FWD 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.

10.3 Transect Line Segmenting

Transect lines are segmented to determine the length of transect that occurs within each mapped condition class intersecting the line. These lengths determine the expansion factors for the measured DWM. It is important that any changes or corrections to condition identity, location and size mapped on the subplot/macroplot spatially match the segmentation done on the transects.

A segment is a length of transect that is in one condition. Segments are identified by recording the BEGINNING DISTANCE and ENDING DISTANCE from subplot center towards the end of the transect.

If any part of the transect segment is in a measured condition but the CWD is not measurable (e.g., snow or water), do not measure any DWM (CWD, FWD, or duff/litter depth) on that transect segment and set DWM TRANSECT SEGMENT SAMPLE STATUS = 0.

Starting at the subplot center and working towards the fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record. The horizontal BEGINNING DISTANCE and ENDING DISTANCE are recorded for each condition class encountered (fig. 60). The first record for each transect will have a BEGINNING DISTANCE of 0 feet. If only one condition class occurs on the transect line, only one segment is recorded. The last segment on all transects must have an ENDING DISTANCE of 24.0 feet horizontal distance if sampling the subplot, or up to DWM TRANSECT LENGTH if sampling on the macroplot. All condition segments on the transect must be defined and all transect length recorded and accounted for, either by condition, or by DWM TRANSECT SEGMENT SAMPLE STATUS.

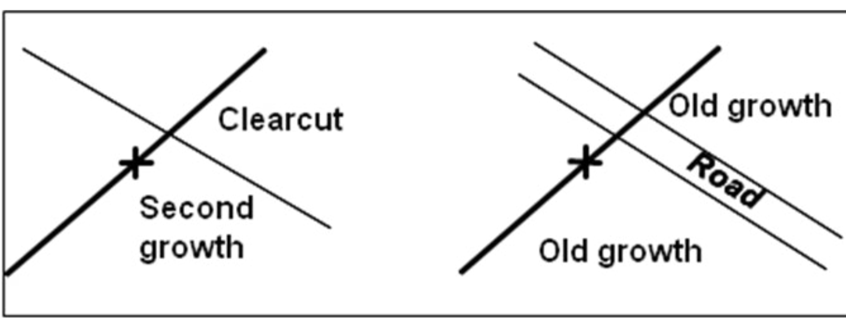


Figure 60. Transects are installed across condition class boundaries.

10.3.1 SUBPLOT NUMBER (BASE)

Record the code indicating the subplot center from which the transect originates.

Values:

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

10.3.2 TRANSECT (BASE)

Record the transect azimuth (degrees) on which a condition class is being delineated. These transects, when being installed, have a tolerance of +/- 2 degrees.

Values:

Subplot	Transect direction (degrees) from center of subplot		
1	090	270	180 (Extra optional transect)
2	360	180	270 (Extra optional transect)
3	135	315	225 (Extra optional transect)
4	045	225	315 (Extra optional transect)

10.3.3 SEGMENT CONDITION CLASS NUMBER (BASE)

Record the code indicating the number of the condition class for the transect segment. Use the same code assigned to the condition class on the subplot or elsewhere on the plot. The first segment recorded for each transect will have the same CONDITION CLASS NUMBER as assigned to the subplot center.

Values: 1 to 9

10.3.4 SEGMENT BEGINNING DISTANCE (BASE)

Record the location (using horizontal distance to nearest 0.1 foot) on the transect line where the transect intersects the boundary with the adjacent condition class nearer to the subplot center. The first record for each transect will have a BEGINNING DISTANCE of 0 ft. Each subsequent record will have a BEGINNING DISTANCE equal to the ENDING DISTANCE of the previous record.

Values: 00.0 to 58.9 horizontal feet

10.3.5 SEGMENT ENDING DISTANCE (BASE)

Record the location (using horizontal distance to nearest 0.1 foot) on the transect line where the transect exits the condition class being delineated and intersects the boundary with a different condition class further away from the subplot center. If no other condition classes are encountered, record the location (using horizontal distance) of the end of the transect line.

Values: 00.1 to 58.9 horizontal feet

10.3.6 DWM TRANSECT SEGMENT SAMPLE STATUS (BASE)

Record the sample status for the transect segment. If any part of the segment is in an accessible condition that would be measured (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2), but the CWD is not measurable due to an obstruction such as snow or water, do not measure DWM on any part of the transect segment, and set code to 0 for that segment. In all other situations, set the code to 1. For conditions on which DWM would not be measured regardless (CONDITION CLASS STATUS = 3 or NONFOREST CONDITION CLASS STATUS = 2), will automatically be coded 1; those conditions should be identified in the transect segmenting.

Values:

0 Transect segment not sampled
1 Transect segment sampled

10.3.7 DWM TRANSECT SEGMENT NONSAMPLED REASON (BASE)

Record the reason that DWM cannot be measured on the transect.

Values:

04 Time Limitation
05 Lost data (office use only)
10 Other (for example, snow or water covering CWD that is supposed to be sampled). “Note required” when using this code.

10.4 Sampling Methods for COARSE WOODY DEBRIS (CWD)

10.4.1 Tally Rules for Coarse Woody Debris (CWD)

1. Coarse woody debris (CWD) is sampled on accessible forest conditions, and on accessible nonforest conditions if they are being measured on the plot (i.e., NONFOREST CONDITION CLASS STATUS = 2). Tally CWD by starting at the subplot center and working towards the fixed radius plot boundary. Measurements should not be taken along transects moving inward toward subplot center. Tally a piece if its central longitudinal axis intersects the transect, and the condition class is measured at the point of intersection (fig. 61). The entire piece is assigned to this condition.

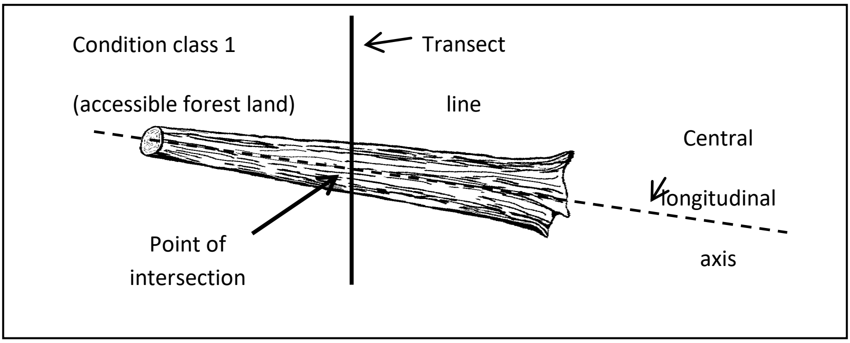


Figure 61. Tally rules for CWD.

2. Tally dead trees and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees and tall stumps that are still upright and leaning < 45 degrees from vertical. Follow the same rules for down trees as outlined in section 5.0 ‘Tree and Sapling Data’ for determining what qualifies as standing and down dead trees and portions/ tops of trees. Most CWD will be laying on the ground.

   Note: In order to avoid double counting or totally missing trees or portions in either protocol, once a decision is made on whether a tree or portion/top of a tree is considered standing or down it is important to include it in either one or the other protocol (standing tree or CWD), but not both. See additional diagrams in section 5.7.2 – Standing Dead.

3. The minimum length for any tally piece is 0.5 feet and it needs to meet the minimum transect diameter guidelines.

4. Decay class of the piece determines whether or not the piece is tallied (see section 10.4.3.6).

<u>For decay classes 1 to 4:</u> tally a piece if it is >3.0 inches in diameter at the point of intersection with the transect (fig. 62).

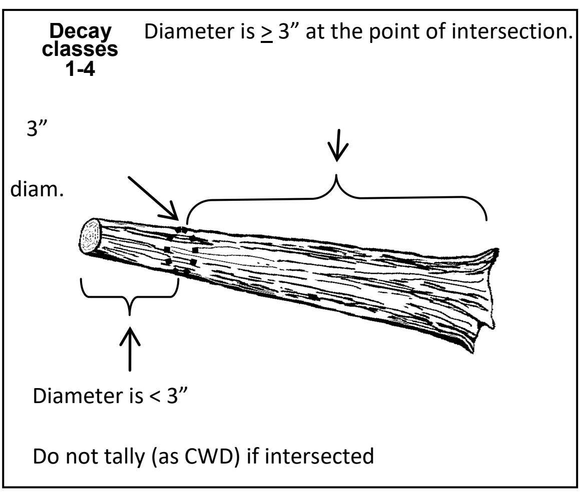


Figure 62. Tally rules for CWD decay classes 1-4.

<u>For decay class 5:</u> tally a piece if it is >5.0 inches in diameter at the point of intersection and >5.0 inches high from the uphill side of the ground. 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.

5. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting. In some cases it may be impossible to measure or estimate individual pieces—for example when CWD pieces are in machine-piled slash piles or windrows, or are part of jumble from flooding, landslide or avalanche. In these situations, piles are described using the instructions in section 10.5 'Sampling Residue Piles'. Because biomass estimates from piles have great uncertainty associated with them, pieces should be measured individually if at all possible.

6. Tally a piece only if the point of intersection occurs above the ground. If one end of a piece is buried in the litter, duff, or mineral soil, the piece ends at the point where it is no longer visible. Measure the diameter and length at this point.

7. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see fig. 63).

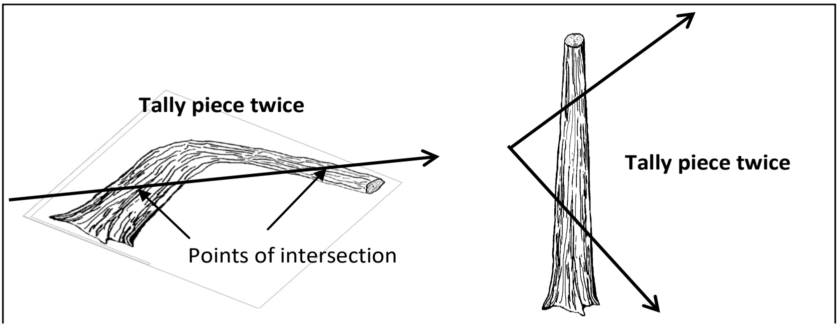


Figure 63. CWD tally rules: intersections.

8. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece. Tally the piece on the smallest azimuth degree 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 requirements.

12. In the case of forked trees, consider the “main bole” to be the piece with the largest diameter at the fork. Variables for this fork such as TOTAL LENGTH and DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (see figure 64).

13. If a transect intersects a non-measured condition (e.g., a road when NONFOREST CONDITION CLASS STATUS = 5, or an inaccessible condition class, or a non-sampled code for CWD), CWD is not tallied.

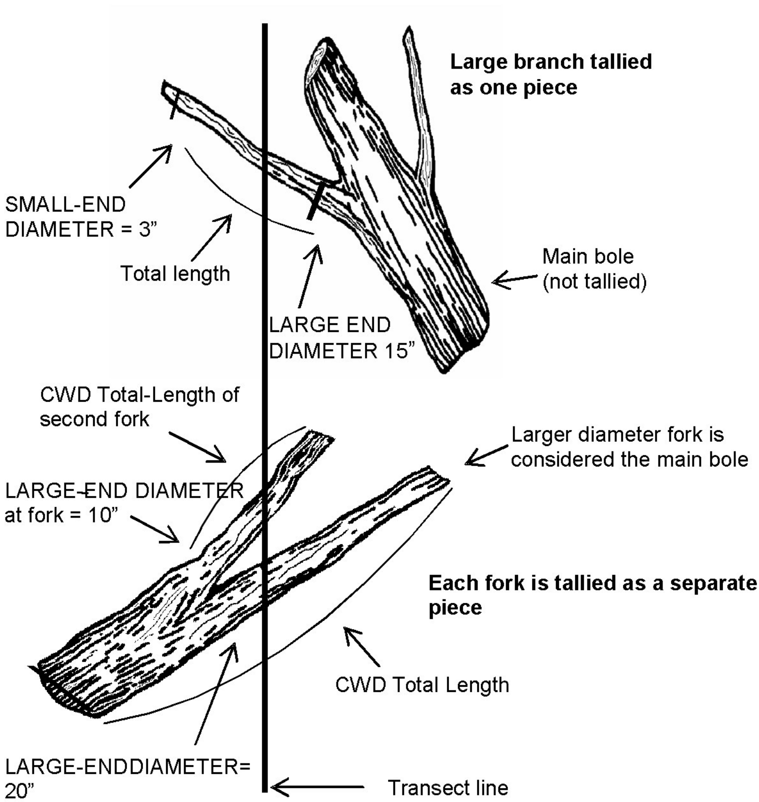


Figure 64. CWD tally rules for forked trees.

10.4.2 Marking CWD (OPTIONAL)

Marking CWD is highly recommended if allowed by the land owner—wax crayon is a good option or nails can be used as well. Marked CWD is an aid to future crews returning to the plot for a QA check.

10.4.3 Recording Procedures for CWD

10.4.3.1 SUBPLOT NUMBER (BASE)

Record the code indicating the number of the subplot center from which the transect originates.

Values:

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

10.4.3.2 TRANSECT (BASE)

Record the azimuth of the transect on which the CWD piece is sampled.

Values:

Subplot	Transect direction (degrees) from center of subplot		
1	090	270	180 (Extra optional transect)
2	360	180	270 (Extra optional transect)
3	135	315	225 (Extra optional transect)
4	045	225	315 (Extra optional transect)

10.4.3.3 CWD CONDITION CLASS (BASE)

Record the condition class number for each CWD piece at the point where the central longitudinal axis of the piece intersects the transect. If there is only one condition on the plot all CWD pieces will be assigned to CWD condition class = 1. If more than one condition has been identified and/or mapped on the plot/subplot, record the appropriate condition based on the location of the transect diameter measurement. All CWD pieces require a condition class and only classes that have been identified and/or mapped are valid. If extending the transect onto the macroplot the entire macroplot needs to be mapped for conditions.

Values: 1 to 9

10.4.3.4 PIECE ON SUBPLOT OR ANNULAR PLOT? (BASE)

Identify whether point of transect intersection with piece is on the subplot or macroplot. If not extending transects onto annular plots all pieces will be assigned code = 1.

Values:

1 Central longitudinal axis of piece intersects the transect on the subplot (<= 24.0 horizontal feet)
2 Central longitudinal axis of piece intersects the transect on the macroplot (24.1 – 58.9 horizontal feet)

10.4.3.5 CWD HORIZONTAL DISTANCE (WILDLIFE OPTION)

RM Not collected in RMRS

10.4.3.6 CWD DECAY CLASS (BASE)

Record a 1-digit code indicating the decay class of the piece. Code the decay class that predominates along the observed length of the piece. Use the guide below to determine CWD DECAY CLASS.

Values:

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound, freshly fallen, intact logs	Intact, no rot; conks of stem decay absent	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand	Original color	Absent	If branches are present, many fine twigs are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports its own weight	Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent	Reddish-brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten; piece does not support its own weight, but maintains its shape	Soft, small blocky pieces; a metal pin can be pushed into heartwood	Reddish or light brown	Through-out	Branch stubs pull out

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
5	None, piece no longer maintains its shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Through-out	Branch stubs and pitch pockets have usually rotted down

Note: CWD DECAY CLASS 5 pieces can be difficult to identify because they often blend into the duff and litter layers. They must still resemble a log; therefore, the first tally rule is that they must be >5.0 inches in diameter and > 5.0 inches from the surface of the ground. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

CWD DECAY CLASS: The chart above was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other charts available to use to describe decay classes for other species or locations. Concentrate on the structural integrity and texture when estimating a decay class for CWD logs.

If a log is case hardened (hard, intact outer sapwood shell) but the heartwood is rotten, code this log as a CWD DECAY CLASS 2. CWD DECAY CLASS 1 should be reserved for 'freshly fallen' logs that are completely intact (i.e., recent windfalls, or harvest).

10.4.3.7 SPECIES (BASE)

Record the code indicating the species of the piece. Since CWD pieces are not necessarily always tally species, record the most detailed available species code (see appendix 3). 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. For shrubs or vines enter unknown softwood (0299) or hardwood (0998).

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 dead conifer or 0998 for unknown dead hardwood. If all else fails, enter the unknown SPECIES code (0999).

10.4.3.8 Diameters

If possible, the best way to measure diameter is to wrap the tape perpendicular to the longitudinal axis at the point of transect intersection (fig. 65). If that is not possible it is useful to carry a steel carpenters retracting tape to measure diameters. Other methods include wrapping a tape around the bole if possible, holding a straight-edge ruler above the piece, or using calipers.

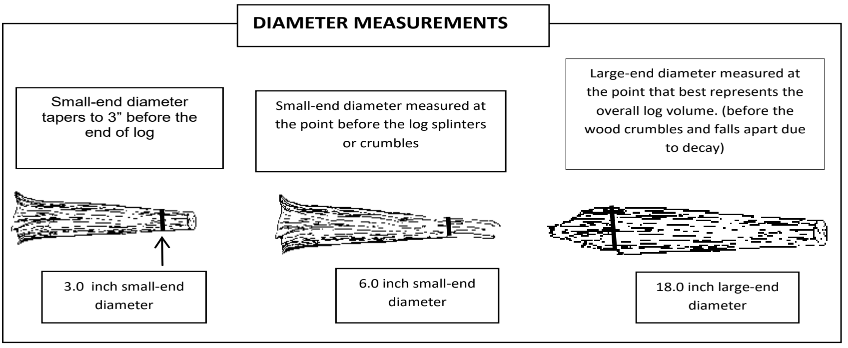


Figure 65. Diameter measurements

For pieces that cannot be taped and 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 66), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

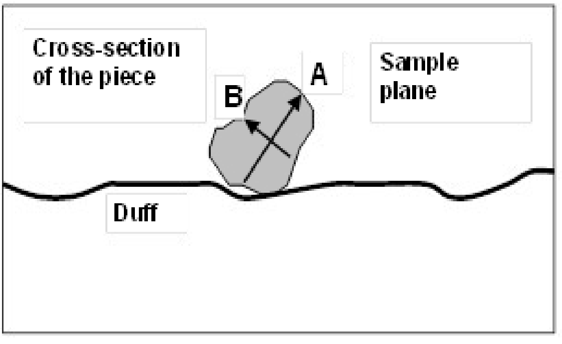


Figure 66. Estimating the diameter of pieces that are not round in cross-section

If the transect intersects the log at the decayed or splintered end (fig. 67), record the diameter at this location as the intersect diameter. Record the large end and small end diameters on the same side of the transect diameter as illustrated. Record the small end diameter as 3 inches if it tapers below 3 inches. If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – in this situation treat it as one log and take a diameter around the end (take two measurements if it is odd shaped.

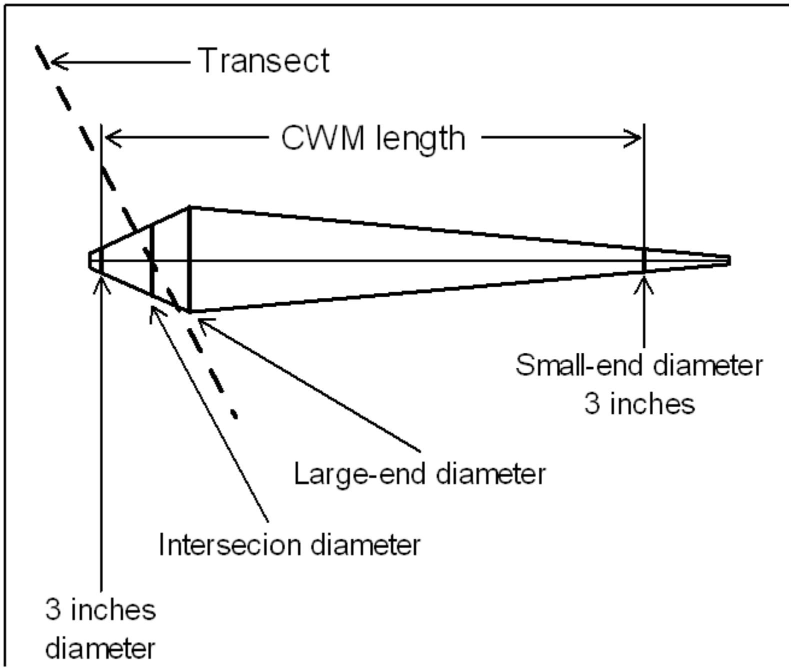


Figure 67. Example of decayed end intersecting the transect

10.4.3.8.1 DIAMETER AT POINT OF INTERSECTION (BASE)

Record the piece's diameter at the point where the transect intersects the longitudinal center of the piece. Record the diameter to the nearest inch. 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.

Values: 003 to 200 inches

10.4.3.8.2 DIAMETER OF HOLLOW AT POINT OF INTERSECTION (BASE)

Record the diameter of hollow at the point of intersection. This variable contributes to reducing bias in biomass estimate and only applies to the point of intersection. If it can be ascertained that the piece is hollow at the transect diameter location, measure or estimate the diameter of hollow to the nearest inch, otherwise record as 0. Diameter of hollow must be less than the transect diameter. Note: Record a hollow diameter only when it is obvious that a piece is hollow at the point of intersection (a hole or crack in the piece, evidence of hollow as observed from the end, etc.). Unlike 10.4.3.10, there is no hollow size requirement for this variable.

Values: 000, 001 to 200 inches

10.4.3.8.3 DIAMETER AT THE SMALL END (WILDLIFE OPTION)

RM Not collected in RMRS

10.4.3.8.4 DIAMETER AT THE LARGE END (WILDLIFE OPTION)

RM Not collected in RMRS

10.4.3.9 Length Measurements

Measure the length of the piece (to the nearest foot) along its centerline, either to the end of the piece or to the point where the diameter reaches 3 inches. If the piece tapers at both sides, due to decay or breakage, the length is measured for the 3-inch diameter cutoff at both ends, regardless of where the large end-diameter may be (see fig. 67). No length is recorded for pieces <3 feet long.

10.4.3.9.1 CWD LENGTH >= 3 FEET (BASE)

Record the code that indicates whether the CWD TOTAL LENGTH is less than 3 feet long (and at least 0.5 foot long). Distinguished length orientation by direction of the pith. Note: the diameter of a small piece may be larger than its length. Total length of the log is measured between the physical ends of the log.

Values: 1 to 2

1 CWD TOTAL LENGTH ≥ 3 feet
2 CWD TOTAL LENGTH ≥ 0.5 foot and < 3 feet

10.4.3.9.2 CWD TOTAL LENGTH (WILDLIFE OPTION)

RM Not collected in RMRS

10.4.3.10 IS THE PIECE HOLLOW? (OPTIONAL)

RM Collected in the Interior West

Record the code indicating whether or not the piece is hollow (see figure 68). This definition of hollow is different from the definition used in 10.4.3.8.2 DIAMETER OF HOLLOW AT POINT OF INTERSECTION. This variable provides information for wildlife assessment.

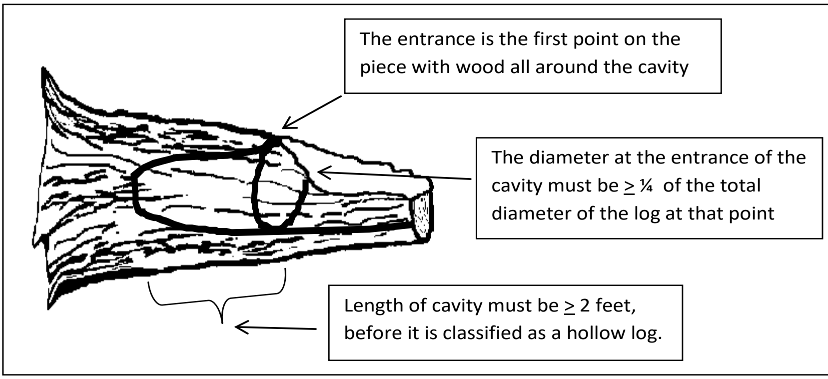


Figure 68. Determining if the piece is hollow

Values:

0 Does not meet criteria for being a hollow log
1 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. This definition of hollow is different from the definition used in 10.4.3.8.2 DIAMETER OF HOLLOW AT POINT OF INTERSECTION.

10.4.3.11 PIECE INCLINATION (OPTIONAL)

RM Not collected in RMRS

10.4.3.12 CWD HISTORY (OPTIONAL)

RM Not collected in RMRS

10.4.3.13 PERCENT OF LOG CHARRED BY FIRE (OPTIONAL)

RM Not collected in RMRS

10.4.3.14 LARGE END DIAMETER CLASS (OPTIONAL)

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. Use the same established rules for determining the large end diameter point (see figure 67).

Values:

1 3.0 to 4.9 inches
2 5.0 to 8.9 inches
3 9.0 to 14.9 inches
4 15.0 to 20.9 inches

5 21.0 to 39.9 inches
6 40.0+ inches

10.5 SAMPLING RESIDUE PILES

A pile is an accumulation of large woody material in which individual pieces are impossible to tally separately. Piles may be created by human activity or natural causes. However, loose piles created by windthrow, landslides, fires or other natural causes, or by thinning or logging operations, should be tallied using the regular CWD protocols unless it is physically impossible to separate individual pieces. The pile protocol should only be used as a last resort, when the regular CWD protocols cannot be used.

Piles are tallied only if intersected by a transect and located in an accessible forest condition class (CONDITION CLASS STATUS = 1) or a measurable nonforest condition (NONFOREST CONDITION CLASS STATUS = 2). An estimate of the length and depth of the pile, species composition and decay class are recorded:

1. Tally individual pieces along the transect until it is not possible to measure them separately and record the horizontal transect distance to this point. Then, record the horizontal transect distance to the point where individual pieces can again be tallied separately (see figure 69).

2. If the pile straddles two condition classes, assign it to the condition class that is closest to subplot center along the transect.

3. Estimate the average height of the pile along the transect. Visually compact the pile to estimate the height of wood, excluding air, rocks, debris and pieces of wood less than 3 inches in diameter at the plane of intersection with the transect. There is a tendency to overestimate the proportion of the cross-section of the pile made of wood. Note that when packing perfect circles of equal diameter, the maximum attainable packing ratio is less than 90% (see figure 70).

4. Record the predominant species in the pile. If it is not possible to identify the species, or if there is an even mixture of several species, record the genus, or hardwood / softwood code.

5. Record the predominant decay class of the pieces in the pile.

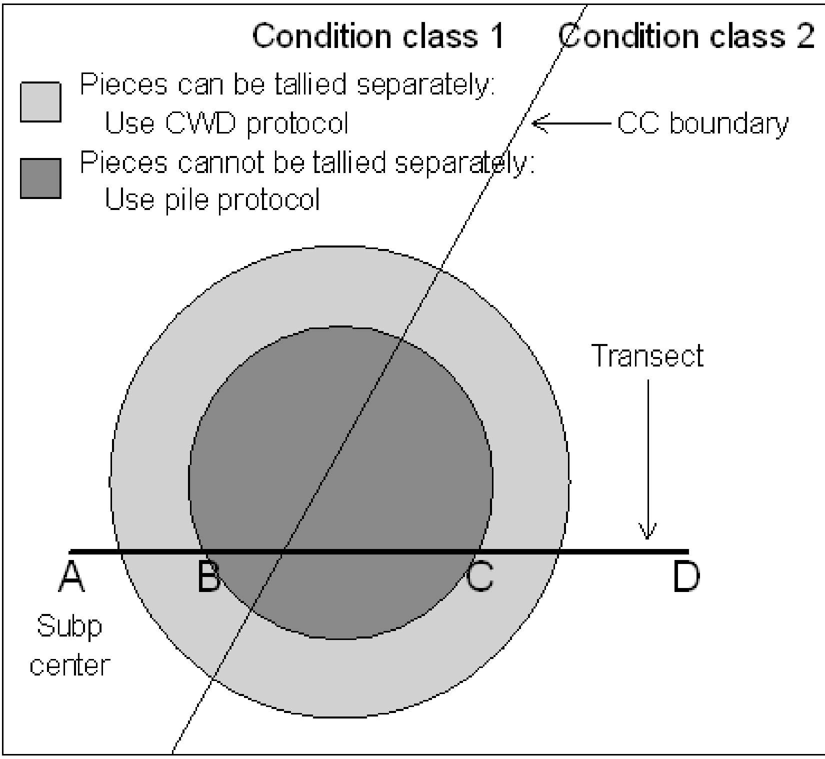


Figure 69. Example for measuring a pile. Pieces can be identified and tallied separately between points A-B and C-D, so the CWD protocols are used, even though part of the transect may be within the pile. Between points B and C, pieces cannot be tallied separately and the pile protocol is used. Enter the horizontal distance at B as the pile beginning distance, the horizontal distance at C as the pile ending distance, and estimate the compacted height of wood, predominant species, and predominant decay class between B and C. Assign the entire pile to condition class 1.

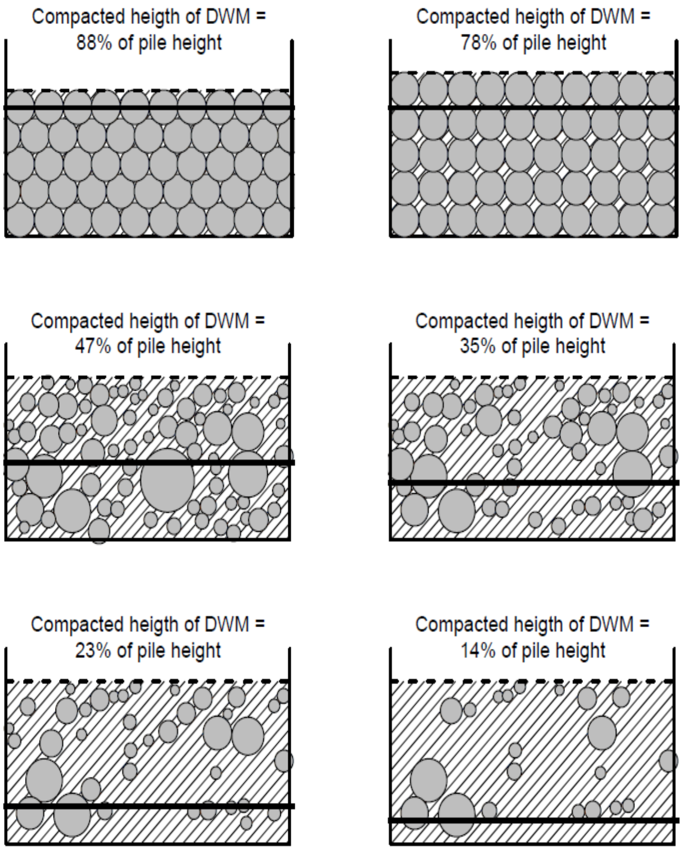


Figure 70. Calculating compacted height of CWD. The dashed line represents the height of the pile, the solid, thick line the compacted height of wood. Grey circles are cross sections of woody pieces greater than 3 inches of diameter and the fill represents debris, air and smaller pieces of wood.

10.5.1 PILE SUBPLOT NUMBER (BASE)

Record the code indicating the number of the subplot center from which the transect originates.

Values:

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

10.5.2 PILE TRANSECT (BASE)

Record the azimuth of the transect on which the pile is sampled.

Values:

Subplot	Transect direction (degrees) from center of subplot		
1	090	270	180 (Extra optional transect)
2	360	180	270 (Extra optional transect)
3	135	315	225 (Extra optional transect)
4	045	225	315 (Extra optional transect)

10.5.3 PILE CONDITION CLASS NUMBER (BASE)

Record the code indicating the number of the condition class. If the pile straddles two condition classes, assign it to the one closest to subplot center along the transect.

Values: 1 to 9

10.5.4 PILE BEGINNING DISTANCE (BASE)

Record the horizontal length of the transect to the beginning of the pile (to the nearest 0.1 foot), defined as the point when pieces cannot be tallied individually. If the pile occupies subplot center, record 00.0 for the beginning distance.

Values: 00.0 to 58.8 feet

10.5.5 PILE ENDING DISTANCE (BASE)

Record the horizontal length of the transect to the end of the pile, defined as the point when pieces can be tallied individually again. If the transect ends within the pile, record DWM TRANSECT LENGTH.

Values: 00.1 to 58.9 feet

10.5.6 COMPACTED HEIGHT OF CWD IN PILE (BASE)

Record average height of wood pieces greater than 3 inches in diameter at the intersection of the transect with the pile. Record value to the nearest foot. Visually compact the pile to estimate the height of wood, excluding air, debris and pieces of wood less than 3 inches in diameter at the point of intersection with the transect. If the transect starts or ends within a pile, only consider the portion of cross-section of the pile above the measured transect.

Values: 1 to 99 feet

10.5.7 PILE DECAY CLASS (BASE)

Record a 1-digit code indicating the predominant decay class in the pile. Use the guide below to determine CWD DECAY CLASS.

Values: See item 10.4.3.6 CWD DECAY CLASS for values

10.5.8 PILE SPECIES (BASE)

Record the code indicating the predominant species / species group in the pile. If it is not possible to identify the species, or if there is an even mixture of several species, record the genus, or hardwood / softwood code.

Values: See species codes in appendix 3

10.6 Sampling Methods for Fine Woody Debris (FWD)

1. Fine Woody Debris (FWD) is only sampled on accessible forest land conditions (CONDITION CLASS STATUS = 1) and measurable nonforest conditions (NONFOEST CONDITION CLASS STATUS = 2) intersected by the transect. FWD is tallied on the outer portion of the following transects: 270°on subplot 1, 360°on subplot 2, 135°on subplot 3, and 225°on subplot 4. The length of FWD transects is measured in horizontal distance, starting at 14.0 feet and extending for 6.0 or 10.0 feet depending on FWD size class.
2. If the start of the FWD transect segment is in a measured condition (see item 1 above) but a portion of the transect segment is not visible due to the presence of snow or standing water, consider the entire transect segment not measurable. In this situation, do not sample anything on the transect segment--set FWD TRANSECT SEGMENTSAMPLE STATUS code = 0 and record the reason in FWD TRANSECT SEGMENT NONSAMPLED REASON.
3. Only sample FWD that intersects the transect in a plane from the ground to a height of 6 feet.
4. FWD is sampled in three size classes, along transect azimuths described in item 1 above (see section 10.2 for details on transects). Pieces in two 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 horizontal distance. Pieces in the largest size class (1.0 to 2.9 inches) are counted on a 10-foot transect, from 14 to 24 feet. These transects overlap. Note: individual diameters are not recorded for FWD.
5. Count a piece of FWD if it intersects the transect. Be sure to count only woody material such as a twig, branch, wood fragment, or small shrub or tree bole Do not count material that is actually litter, such as pine or fir needles, non-woody parts (e.g., petiole and rachis) of a shrub or tree, etc.
6. 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. If the transect is not measured (FWD TRANSECT SAMPLE STATUS = 0) the count is null.
7. 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 sub-sampled 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.

8. If a transect intersects a large pile of material such as a wood rat's nest, recently fallen tree (with many attached fine branches), or a residue pile, crews should estimate a count based on # 7 above, but also enter a code indicating that this is an unusual situation (see section 10.3.7). In the case of a residue pile on the transect, estimate a count by looking at the transect just before and after the pile along with assessing what's inside the pile, and enter a count for the whole transect.
9. If rocks or logs are present along the transect (14- to 24-foot section) include any FWD that is present on top of these things 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.
10. If a transect crosses a condition class boundary, record the condition class number and enter a count for each condition on separate records. Transect lengths within each condition class will be obtained from the transect segmenting data entered for the plot.

10.6.1 FWD SUBPLOT NUMBER (BASE)

Record the code indicating the subplot center from which the transect originates.

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

10.6.2 FWD TRANSECT (BASE)

Record the azimuth (degrees) of the transect on which FWD is sampled.

Values: degrees

Subplot	Transect direction (degrees) from center of subplot
1	270
2	360
3	135
4	225

10.6.3 FWD CONDITION CLASS NUMBER (BASE)

Record the code indicating the number of the condition class at the start of the transect (14.0 feet horizontal distance from subplot center).

-

Values: 1 to 9

10.6.4 FWD TRANSECT SEGMENT SAMPLE STATUS (BASE)

Record the sample status for FWD on the transect. There may be situations where the CWD is measurable, but the FWD is hidden from view by snow or water and not measurable. If any part of the FWD transect segment is on a measured condition but the FWD is not measurable, do not count any FWD and set the STATUS code to 0 and the FWD TRANSECT NONSAMPLED REASON code to 10.

In all other situations, set the code to 1. Conditions on which FWD would not be measured regardless (CONDITION CLASS STATUS = 3 or CONDITION CLASS STATUS = 2 AND NONFOREST CONDITION CLASS STATUS = 5) should always be coded 1.

Values:

0 FWD transect segment not sampled
1 FWD transect segment sampled

10.6.5 FWD TRANSECT SEGMENT NONSAMPLED REASON (BASE)

Record the reason that FWD cannot be measured on the transect.

Values:

04 Time Limitation
05 Lost data (office use only)
10 Other (for example, snow or water covering CWD that is supposed to be sampled). "Note required" when using this code.

10.6.6 SMALL FWD COUNT (BASE)

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 sub-sampled to estimate a total count for the transect length (see 10.6, #8).

Values: 000 to 999 pieces

10.6.7 MEDIUM FWD COUNT (BASE)

Record the number of pieces counted in this size class (0.25 to 0.99-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 sub-sampled to estimate a total count for the transect segment (see 10.6, # 8).

Values: 000 to 999 pieces

10.6.8 LARGE FWD COUNT (BASE)

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 sub-sampled to estimate a total count for the transect segment (see 10.6, # 8).

Values: 000 to 500 pieces

10.6.9 HIGH COUNT REASON (BASE)

Enter a code that applies to the situation encountered on the transect. Enter a code if any of the counts on the transect are greater than 100 pieces.

Values:

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
5 Residue pile

10.7 DUFF AND LITTER DEPTH MEASUREMENTS

Depth measurements are sampled in accessible forest land conditions (and accessible nonforest conditions, where nonforest conditions are measured). The depth of the duff layer and litter layer are important components of carbon tracking and fire models that estimate fire behavior, fire spread, fire effects, and smoke production. These measurements are taken at the 24-foot location on each transect. If an object such as a rock, log, or residue pile is present at the sample point, depths will be estimated by examining the surface of the object or the area surrounding the object. In the office, an average depth will be calculated and stored with other information about the condition class on the plot.

10.7.1 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 which is undecomposed or only partially decomposed organic material. The components of the litter layer can still be readily identified (e.g., plant leaves, twigs, and peat, etc.).
   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 located just above the A-horizon (or uppermost soil mineral horizon). Duff is a dark soil layer dominated by organic material derived from the decomposition of plant and animal litter (pine straw, leaves, twigs, etc) and deposited on top of an organic or mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that

the source of this material (e.g., individual plant parts) can no longer be identified. You should see no recognizable plant parts. When moss is present, the top of the duff layer is just below the green portion of the moss.

If peat is present in your part of the country, record it with the duff layer. Peat is an accumulation of partially decayed vegetation matter that forms under conditions of poor drainage such as those found in wetlands or bogs. A layer of peat develops when dead plant material is inhibited from decaying fully because of acidic or anaerobic conditions. In some areas of the U.S. the depth of this layer can be extensive.

10.7.2 Overview of Measurements

Depth measurements will be taken at the 24-foot (horizontal distance) location on each transect. If a log, rock, or residue pile occurs at the sample location, record the depth of the litter on top and below these objects and estimate the duff depth as close to the object as possible. Examine the area around the object to develop an average depth for these layers.

DUFF/LITTER SAMPLE STATUS identifies whether or not the duff and litter depth could be measured or reasonably estimated. Examples of situations where measurement is not possible include the presence of snow or standing water at the sample location. In this case, the STATUS code is set to 1 with the DUFF/LITTER NONSAMPLED REASON code set to 10.

The DUFF AND LITTER METHOD variable has three options for indicating if duff and litter were measured or estimated at each sample location. The default value for this variable is 1, indicating that both depths were measured and recorded. A code of 2 means that litter depth was measured, but duff depth was estimated and a code of 3 indicates that both duff and litter depths were estimated.

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 subsurface rock, root, or buried log – stop the depth measurement at this point. If there is a log, rock, or residue pile on the surface at the sample point, and there appears to be duff and litter under it (or litter on top of it), record a reasonable estimate for each depth. Most likely, the area immediately adjacent to the obstruction will have to be examined to determine an average depth. Depths of zero are perfectly valid: for example if the point falls on bedrock or on top of a log that it resting on mineral soil.

As a general rule, duff depth should rarely exceed a few inches (except when a peat layer is present). 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). If the layer includes a substantial amount of peat, stop the measurement at 2 feet.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect (or nearby if an obstruction exists). 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.

10.7.3 DUFF/LITTER SUBPLOT NUMBER (BASE)

Record the code indicating the number of the subplot center from which the transect originates.

Values:

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

10.7.4 DUFF/LITTER TRANSECT (BASE)

Record the azimuth (degrees) of the transect on which duff/litter is sampled.

Values:

Subplot	**Transect direction (degrees) from center of subplot**	
1	090	270
2	360	180
3	135	315
4	045	225

10.7.5 DUFF/LITTER CONDITION CLASS NUMBER (BASE)

Record the code indicating the number of the condition class at the sample point (24.0 feet horizontal distance from subplot center)

Values: 1 to 9

10.7.6 DUFF/LITTER SAMPLE STATUS (BASE)

Record the sample status for duff and litter depth on the transect. There may be situations where the CWD is measurable (e.g., shallow depth of snow or water), but the duff and litter are not measurable. If the measurement point is on a measured condition but the duff/litter is not measurable, do not measure duff/litter and set code to 0 with the DUFF/LITTER NONSAMPLED REASON code set to 10.

In all other situations (including where duff and litter depth = 0), set the code to 1. For example, conditions on which duff/litter would not be measured regardless (CONDITION CLASS STATUS = 3 or NONFOREST CONDITION CLASS STATUS = 5) should always be coded 1.

Values:

0 Duff and litter point not sampled
1 Duff and litter point sampled

10.7.7 DUFF/LITTER NONSAMPLED REASON (BASE)

Record the reason that duff/litter cannot be measured on the transect.

Values:

04 Time Limitation
05 Lost data (office use only)
10 Other (for example, snow or water covering measurement point that is supposed to be sampled). "Note required" when using this code

10.7.8 DUFF DEPTH (BASE)

Record the code indicating the depth of the duff layer to the nearest 0.1 inch. Record 24.0 inches when DUFF DEPTH is >24.0 inches and enter Code #4 (Litter depth was measured, duff (peat) depth exceeds 24.0 inches) for 10.9.8 DUFF AND LITTER METHOD.

Values: 00.0 to 24.0 inches

10.7.9 LITTER DEPTH (BASE)

Record the code indicating the depth of the litter layer to the nearest 0.1 inch.

Values: 00.0 to 99.9 inches

10.7.10 DUFF AND LITTER METHOD (BASE)

Record the code indicating whether duff and litter depths were measured or estimated.

Values:

1 Both duff and litter depth were measured
2 Litter depth was measured, duff depth (≤ 24.0 inches) was estimated
3 Both duff and litter depth were estimated
4 Litter depth was measured, duff (peat) depth exceeds 24.0 inches (note required)

10.8 References

Scott, J.E.; Burgan, R.H. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model. General Technical Report RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

10.9 Contact Information

Contact information for the National Advisor for this indicator is: Chris Woodall, USDA Forest Service, Northern Research Station, 1992 Folwell Ave, St. Paul, MN 55108, cwoodall@fs.fed.us,
http://www.ncrs.fs.fed.us/4801/national-programs/indicators/dwm/
(Note: this web address may be revised in the future. Please visit the Northern Research Station web site for an updated link www.nrs.fs.fed.us .)

11.0RM 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 tab 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.

11.1**RM** 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.

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)

11.1.1**RM** 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. For remeasurement locations it is not necessary to collect new coordinates, past coordinates can be re-used if referenced areas are unchanged.

Refer to Appendix C for use on the Garmin GPS unit.

11.1.1.1**RM** 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.

11.1.2**RM** 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 location 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 "Select a Suitable RP" (section 0.1.3.1**RM**) as well as "Lack of suitable RP" (section 0.1.5.2**RM)**.

Remeasurement locations: use the reference point from the previous inventory and if the old RP is not visited, use the previous RP description and Diameter.

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 leaving the vicinity. For plots within sight of trails or roads, it may be required to spray paint metal tags gray or brown on both sides. With less monumentation on reserved land, the RP must be carefully selected and described to provide adequate means for future relocation. For more information, see section 0.3.5**RM**.

11.1.3**RM** PC Witness Trees/Landmarks

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 species 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 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 if required) with the appropriate letter (X or Y) and location number inscribed on it only at the base of the tree facing subplot center.

11.1.4**RM** Lack of Suitable Witness Trees/Landmarks

If no live trees are within the vicinity of the PC or other subplot being witnessed, select alternative witness landmarks that are likely to be present in 10 years (e.g., a sound snag, large stump, prominent rock). If no suitable landmarks can be found, build small rock cairns approximately 5-10 feet from the PC and at right angles to each other. If possible, use a large shrub (e.g., large sagebrush) as the alternative witness landmark and nail a witness tag to the base of the shrub.. Describe the alternative landmarks selected in the “Witness Trees” notes section on the Field Location Reference Form.

11.1.5**RM** Subplot/Microplot Monumentation

Each subplot center is marked with a metal stake, bent in half to form a “U” shape, and wrapped with orange flagging. The metal stake should be driven into the ground far enough so the top of the “U” is exposed approximately two to 3 inches. It is recommended to place a short (four to five inch) stick (or other object found in the area, e.g. a rock) under the stake so it cannot be driven under ground and will be visible for the next crew.

On established subplots where there are no tally trees, to aid in future relocation it is helpful to witness subplot center stakes by using off subplot trees or other landmarks and describe in subplot level notes.

Repeat the procedure at the microplot location except wrap the metal stake with blue and white striped flagging.

Reserved locations: do not leave any flagging on the subplot/microplot stake.

11.1.6**RM** Subplot/Microplot Monumentation for locations with bedrock

If a subplot center metal stake cannot be placed in the ground because of bedrock, etc., build a small rock cairn (rock pile) around the stake with the appropriate colored flagging attached. If a subplot center cannot be monumented at all (e.g., in a river, on a paved road), place a stake where possible (e.g., off the road), and attach a tag to the stake with the subplot number labeled. In the SUBPLOT-LEVEL NOTES, reference the azimuth and distance from the offset stake to the correct subplot center. Take all measurements from the correct subplot/microplot center location, not the offset stake.

11.2**RM** MONUMENT TYPE Data

Depending on what MONUMENT TYPE is being described, items 11.2.1**RM** -11.2.17**RM** may be required.

11.2.1**RM** SUBPLOT REFERENCED

Record the subplot number to which the MONUMENT TYPE is referenced. The goal of monumentation is to re-locate the plot. On some locations referencing your witness trees to another subplot (2-4) may aid in relocation. Examples include when subplot one is not sampled or has no trees.

Values:

1 Subplot 1
2 Subplot 2
3 Subplot 3
4 Subplot 4

11.2.2**RM** 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.

Values: 1 - 360 degrees

11.2.3**RM** 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.

Values: .01 - 999 feet

11.2.4**RM** 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.

Values: .01 - 999 feet

11.2.5**RM** REFERENCE TYPE

Record whether the MONUMENT TYPE is a tree or some other type of reference.

Values:

1 Tree (Tally species)
2 Other Reference (rock, bush...)

11.2.6**RM** SPECIES

Record the tally FIA species code (see Appendix 3) of the RP or witness tree.

Values: Valid TREE SPECIES codes found in Appendix 3

11.2.7**RM** 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 (e.g. ROCK, FORK, or CORNER, and further provide more details in the NOTES.

Value: English language

11.2.8**RM** DIAMETER

When a tree is used as the RP or for the 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.

Values: .1 - 999 inches

11.2.9**RM** GPS TYPE (GPS UNIT): See Section 1.19.3

11.2.10**RM** GPS ERROR: See Section 1.19.17

11.2.11**RM** NUMBER OF READINGS: See Section 1.19.18

11.2.12**RM** LATITUDE DEGREES: See Section 1.19.8.1

11.2.13**RM** LATITUDE MINUTES: See Section 1.19.8.2

11.2.14**RM** LATITUDE SECONDS: See Section 1.19.8.3

11.2.15**RM** LONGITUDE DEGREES: See Section 1.19.9.1

11.2.16**RM** LONGITUDE DEGREES: See Section 1.19.9.2

11.2.17**RM** LONGITUDE SECONDS: See Section 1.19.9.3

11.3**RM** 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

11.4**RM** OWNER INFORMATION

If a plot is located on private land or it is required to travel through private land to access the location, record the landowner(s) name, address and telephone number, on the Field Location Reference form under OWNER INFORMATION (this information is used for future crew access and remains confidential). See Appendix 13 for PDR data entry instructions.

Values: English Laguage

11.5**RM** 4 X 4

See item 1.18.1**RM**

11.6**RM** ATV

See item 1.18.2**RM**

11.7**RM** LOCKED GATE

See item 1.18.3**RM**

11.8**RM** 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 (or lowest numbered established subplot if the PC is inaccessible) using digital field cameras.

Procedure: At plot center (or subplot center if not the PC), stand over the center stake and take one photograph in each of 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).

11.8.1**RM** PLOT PHOTO TAKEN

See item 1.18.4**RM**

11.9**RM** 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.

11.10**RM** Field Location and Boundary Map

On the top of the backside of the Field Location Reference form, draw a map of the general area of the PC including any helpful landmarks (old jeep roads, hiking/game trails, the RP, slope, cliffs, or openings) to aid future crews in relocating the PC.

When Condition Class boundaries dissect a subplot, use the plot diagram on the bottom of the backside of the Field Location Reference form to draw in the approximate boundary locations and label each of the Condition Classes. Also, record the boundary azimuths (and distance if the boundary has a corner) from subplot center as described in sections 4.2.5 - 4.2.8.

APPENDICES

1. State and County, Parish or Borough FIPS Codes

   These are the standard federal 2- and 3-digit codes for States and Counties, Parishes, or Boroughs, respectively.
   ***RM** Note: Due to space limitations, not included in version 8.0.

2. FIA Forest Type Codes

   These are the codes that correspond to the National FIA forest typing algorithm. Units may choose to also add local forest type groupings.

3. FIA Tree Species Codes

   This list includes all species deemed to be tally trees with woodland trees measured for DRC indicated.
   *Note: Due to space limitations, only valid RMRS tree species codes are included.

4. Was previously: Site Tree Selection Criteria and Species List

5. Determination of Stocking Values for Land Use Classification
   ***RM** Note: Due to space limitations, only valid RMRS tree species included.

6. Glossary

7. Tolerance / MQO / Value / Units Table
   *Note: Due to space limitations, MQO and Units not included.

8. Tree Coding Guide

9. Invasive Plant List

10. Unknown Plant Specimen Collection

11. Damage Codes **RM** note: moved the codes to section 5.20.1 DAMAGE AGENT 1

12. Reserved and Administratively Withdrawn Status by Owner and Land Designation

13. Ownership Prefield Procedures

14. FIA Pacific Islands Tree Species Codes
    ***RM** Note: Due to space limitations, this appendix not included.

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

RM note: State and County FIPS codes not included in version 8.0.

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.

RM Note: Due to space limitations, only Forest Type codes valid in the West are included.

East	West	Code	Species Type
			Spruce / Fir Group
E	W	125	Black spruce
			Pinyon / Juniper Group
	W	182	Rocky Mountain juniper
	W	184	Juniper woodland
	W	185	Pinyon-juniper woodland
			Douglas-fir Group
E	W	201	Douglas-fir
	W	202	Port-Orford-cedar
	W	203	Bigcone Douglas-fir
			Ponderosa Pine Group
E	W	221	Ponderosa pine
	W	222	Incense-cedar
	W	224	Sugar pine
	W	225	Jeffrey pine
	W	226	Coulter pine
			Western White Pine Group
	W	241	Western white pine
			Fir / Spruce / Mountain Hemlock Group
	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
			Lodgepole Pine Group
	W	281	Lodgepole pine

East	West	Code	Species Type
			Hemlock / Sitka Spruce Group
	W	301	Western hemlock
	W	304	Western redcedar
	W	305	Sitka spruce
			Western Larch Group
	W	321	Western larch
			Redwood Group
	W	341	Redwood
	W	342	Giant sequoia
			Other Western Softwoods Group
	W	361	Knobcone pine
	W	362	Southwestern white pine
	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
			California Mixed Conifer Group
	W	371	California mixed conifer
			Exotic Softwoods Group
E	W	383	Other exotic softwoods
			Other Softwood Group
		391	Other softwoods
			Elm / Ash / Cottonwood Group
E	W	703	Cottonwood
E	W	704	Willow
E	W	709	Cottonwood / willow
	W	722	Oregon ash
			Aspen / Birch Group
E	W	901	Aspen
E	W	902	Paper birch
E	W	904	Balsam poplar
E	W	905	Pin cherry
			Alder / Maple Group
	W	911	Red alder
	W	912	Bigleaf maple

East	West	Code	Species Type
			Western Oak Group
	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)
			Tanoak / Laurel Group
	W	941	Tanoak
	W	942	Califonia laurel
	W	943	Giant chinkapin
			Other Hardwoods Group
	W	961	Pacific madrone
	W	962	Other hardwoods
			Woodland Hardwoods Group
	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
			Tropical Hardwoods Groups
E	W	983	Palms
			Exotic Hardwoods Group
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).

SPRUCE/FIR GROUP

These types are mostly in the Eastern United States. See FIR SPRUCE/ MOUNTAIN HEMLOCK for Western United States.

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.

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.

LODGEPOLE 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 torreya, 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 torreya.

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

383 Other exotic softwoods; Austrian pine

OTHER SOFTWOODS GROUP

391 Other softwoods: All softwood species identified to genus level only, except cypress, baldcypress, and larch.

ELM/ASH/COTTONWOOD GROUP

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.

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.

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.

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 hardwood species identified only to the genus level, with the exception of the following species (Note: This code primarily applies to a mapped subplot, where only one or two “uncommon” tree species are tallied): 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, Allegany 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, course-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 HARDWOODS GROUPS

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.

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".

RM Due to space limitations, only the **CORE** FIA Tree Species Codes are included. **All are valid in RMRS.**

Species commonly found in the West:

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
	W		11	ABAM	Pacific silver fir	Abies	amabilis
E	W		12	ABBA	balsam fir	Abies	balsamea
	W		14	ABBR	Santa Lucia fir, bristlecone fir	Abies	bracteata
	W		15	ABCO	white fir	Abies	concolor
	W		17	ABGR	grand fir	Abies	grandis
	W		18	ABLAA	corkbark fir	Abies	lasiocarpa var. arizonica
	W		19	ABLA	subalpine fir	Abies	lasiocarpa
	W		20	ABMA	California red fir	Abies	magnifica
	W		21	ABSH	Shasta red fir	Abies	shastensis
	W		22	ABPR	noble fir	Abies	procera
	W		41	CHLA	Port-Orford-cedar	Chamaecyparis	lawsoniana
	W		42	CHNO	Alaska yellow-cedar	Chamaecyparis	nootkatensis
	W		51	CUAR	Arizona cypress	Cupressus	arizonica
	W		52	CUBA	Baker cypress, Modoc cypress	Cupressus	bakeri
	W		53	CUFO2	tecate cypress	Cupressus	forbesii
	W		54	CUMA2	Monterey cypress	Cupressus	macrocarpa
	W		56	CUMA	MacNab's cypress	Cupressus	macnabiana
	W	w	58	JUPI	Pinchot juniper	Juniperus	pinchotii
	W	w	59	JUCO11	redberry juniper	Juniperus	coahuilensis
	W	w	62	JUCA7	California juniper	Juniperus	californica
	W	w	63	JUDE2	alligator juniper	Juniperus	deppeana
	W		64	JUOC	western juniper	Juniperus	occidentalis
	W	w	65	JUOS	Utah juniper	Juniperus	osteosperma
E	W	w	66	JUSC2	Rocky Mountain juniper	Juniperus	scopulorum
	W	w	69	JUMO	oneseed juniper	Juniperus	monosperma
E	W		71	LALA	tamarack (native)	Larix	laricina
	W		72	LALY	subalpine larch	Larix	lyallii

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
	W		73	LAOC	western larch	Larix	occidentalis
	W		81	CADE27	incense-cedar	Calocedrus	decurrens
	W		92	PIBR	Brewer spruce	Picea	breweriana
	W		93	PIEN	Engelmann spruce	Picea	engelmannii
E	W		94	PIGL	white spruce	Picea	glauca
E	W		95	PIMA	black spruce	Picea	mariana
E	W		96	PIPU	blue spruce	Picea	pungens
	W		98	PISI	Sitka spruce	Picea	sitchensis
	W		101	PIAL	whitebark pine	Pinus	albicaulis
	W		102	PIAR	Rocky Mountain bristlecone pine	Pinus	aristata
	W		103	PIAT	knobcone pine	Pinus	attenuata
	W		104	PIBA	foxtail pine	Pinus	balfouriana
	W	w	106	PIED	Common pinyon, two-needle pinyon	Pinus	edulis
	W		108	PICO	lodgepole pine	Pinus	contorta
	W		109	PICO3	Coulter pine	Pinus	coulteri
	W		112	PIEN2	Apache pine	Pinus	engelmannii
	W		113	PIFL2	limber pine	Pinus	flexilis
	W		114	PIST3	southwestern white pine	Pinus	strobiformis
	W		116	PIJE	Jeffrey pine	Pinus	jeffreyi
	W		117	PILA	sugar pine	Pinus	lambertiana
	W		118	PILE	Chihuahuan pine	Pinus	leiophylla
	W		119	PIMO3	western white pine	Pinus	monticola
	W		120	PIMU	bishop pine	Pinus	muricata
E	W		122	PIPO	ponderosa pine	Pinus	ponderosa
	W		124	PIRA2	Monterey pine	Pinus	radiata
	W		127	PISA2	gray pine, California foothill pine	Pinus	sabiniana
E	W		130	PISY	Scotch pine	Pinus	sylvestris
	W	w	133	PIMO	singleleaf pinyon	Pinus	monophylla
	W	w	134	PIDI3	border pinyon	Pinus	discolor
	W		135	PIAR5	Arizona pine	Pinus	arizonica
	W		137	PIWA	Washoe pine	Pinus	washoensis
	W	w	138	PIQU	four-leaf pine, Parry pinyon pine	Pinus	quadrifolia
	W		139	PITO	Torrey pine	Pinus	torreyana
	W	w	140	PICE	Mexican pinyon pine	Pinus	cembroides
	W		142	PILO	Great Basin bristlecone pine	Pinus	longaeva
	W	w	143	PIMOF	Arizona pinyon pine	Pinus	monophylla var. fallax

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
	W		201	PSMA	bigcone Douglas-fir	Pseudotsuga	macrocarpa
	W		202	PSME	Douglas-fir	Pseudotsuga	menziesii
	W		211	SESE3	redwood	Sequoia	sempervirens
	W		212	SEGI2	giant sequoia	Sequoiadendron	giganteum
	W		231*	TABR2	Pacific yew	Taxus	brevifolia
	W		242	THPL	western redcedar	Thuja	plicata
	W		251	TOCA	California torreya (nutmeg)	Torreya	californica
	W		263	TSHE	western hemlock	Tsuga	heterophylla
	W		264	TSME	mountain hemlock	Tsuga	mertensiana
E	W		299	2TE	unknown dead conifer	Tree	evergreen
	W		312	ACMA3	bigleaf maple	Acer	macrophyllum
E	W		313	ACNE2	boxelder	Acer	negundo
	W	w	322*	ACGR3	bigtooth maple	Acer	grandidentatum
E	W		341	AIAL	ailanthus	Ailanthus	altissima
E	W		345	ALJU	mimosa/silktree	Albizia	julibrissin
	W		351	ALRU2	red alder	Alnus	rubra
	W		352	ALRH2	white alder	Alnus	rhombifolia
	W		353	ALOB2	Arizona alder	Alnus	oblongifolia
	W		361	ARME	Pacific madrone	Arbutus	menziesii
	W		362	ARAR2	Arizona madrone	Arbutus	arizonica
E	W		374	BEOC2	water birch	Betula	occidentalis
E	W		375	BEPA	paper birch	Betula	papyrifera
	W		376	BENE4	paper birch	Betula	neoalaskana
	W		378	BEUT	northwestern paper birch	Betula	X utahensis
E	W		424	CAMO83	Chinese chestnut	Castanea	mollissima
E	W		461	CELA	sugarberry	Celtis	laevigata
E	W		462	CEOC	hackberry	Celtis	occidentalis
	W	w	475*	CELE3	curlleaf mtn. mahogany	Cercocarpus	ledifolius
	W		492	CONU4	Pacific dogwood	Cornus	nuttallii
	W		511	EUGL	Tasmanian bluegum	Eucalyptus	globulus
	W		542	FRLA	Oregon ash	Fraxinus	latifolia
	W		547	FRVE2	velvet ash	Fraxinus	velutina
E	W		561	GIBI2	Ginkgo, maidenhair tree	Ginkgo	biloba
E	W		602	JUNI	black walnut	Juglans	nigra
	W		604	JUCA	Southern California black walnut	Juglans	californica

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
	W		606	JUMA	Arizona walnut	Juglans	major
	W		631	LIDE3	tanoak	Lithocarpus	densiflorus
	W		661	MAFU	Oregon crabapple	Malus	fusca
	W		7211	PEAM3	avocado	Persea	americana
	W		730	PLRA	California sycamore	Platanus	racemosa
	W		732	PLWR2	Arizona sycamore	Platanus	wrightii
E	W		741	POBA2	balsam poplar	Populus	balsamifera
E	W		745	PODEM	plains cottonwood	Populus	deltoides ssp. monilifera
E	W		746	POTR5	quaking aspen	Populus	tremuloides
	W		747	POBAT	black cottonwood	Populus	balsamifera ssp. trichocarpa
	W		748	POFR2	Fremont cottonwood	Populus	fremontii
	W		749	POAN3	narrowleaf cottonwood	Populus	angustifolia
E	W	w	756	PRGL2	honey mesquite	Prosopis	glandulosa
E	W	w	757	PRVE	velvet mesquite	Prosopis	velutina
E	W	w	758	PRPU	screwbean mesquite	Prosopis	pubescens
	W	w	803	QUAR	Arizona white oak	Quercus	arizonica
	W		807	QUDO	blue oak	Quercus	douglasii
	W	w	810	QUEM	Emory oak	Quercus	emoryi
	W		811	QUEN	Engelmann oak	Quercus	engelmannii
	W	w	814	QUGA	Gambel oak	Quercus	gambelii
	W		815	QUGA4	Oregon white oak	Quercus	garryana
	W		818	QUKE	California black oak	Quercus	kelloggii
	W		821	QULO	California white oak	Quercus	lobata
	W	w	829	QUOB	Mexican blue oak	Quercus	oblongifolia
	W		839	QUWI2	interior live oak	Quercus	wislizeni
	W	w	843	QUHY	silverleaf oak	Quercus	hypoleucoides
	W	w	846	QUGR3	gray oak	Quercus	grisea
	W	w	847	QURU4	netleaf oak	Quercus	rugosa
E	W		901	ROPS	black locust	Robinia	pseudoacacia
	W		981	UMCA	California laurel	Umbellularia	californica
E	W		998*	2TB	unknown dead hardwood	Tree	broadleaf
E	W		999*	2TREE	other, or unknown live tree	Tree	unknown
Species most commonly found in the East but can occur in the West							
E			16	ABFR	Fraser fir	Abies	fraseri
E			43	CHTH2	Atlantic white-cedar	Chamaecyparis	thyoides
E		w	61	JUAS	Ashe juniper	Juniperus	ashei

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
E			68	JUVI	eastern redcedar	Juniperus	virginiana
E			91	PIAB	Norway spruce	Picea	abies
E			97	PIRU	red spruce	Picea	rubens
E			105	PIBA2	jack pine	Pinus	banksiana
E			107	PICL	sand pine	Pinus	clausa
E			110	PIEC2	shortleaf pine	Pinus	echinata
E			111	PIEL	slash pine	Pinus	elliottii
E			115	PIGL2	spruce pine	Pinus	glabra
E			121	PIPA2	longleaf pine	Pinus	palustris
E			123	PIPU5	Table Mountain pine	Pinus	pungens
E			125	PIRE	red pine	Pinus	resinosa
E			126	PIRI	pitch pine	Pinus	rigida
E			128	PISE	pond pine	Pinus	serotina
E			129	PIST	eastern white pine	Pinus	strobus
E			131	PITA	loblolly pine	Pinus	taeda
E			132	PIVI2	Virginia pine	Pinus	virginiana
E			136	PINI	Austrian pine	Pinus	nigra
E			144	PIELE2	Caribbean pine	Pinus	elliottii var. elliottii
E			221	TADI2	baldcypress	Taxodium	distichum
E			222	TAAS	pondcypress	Taxodium	ascendens
E			232	TAFL	Florida yew	Taxus	floridana
E			241	THOC2	northern white-cedar	Thuja	occidentalis
E			252	TOTA	Florida torreya (nutmeg)	Torreya	taxifolia
E			261	TSCA	eastern hemlock	Tsuga	canadensis
E			262	TSCA2	Carolina hemlock	Tsuga	caroliniana
E			311	ACBA3	Florida maple	Acer	barbatum
E			314	ACNI5	black maple	Acer	nigrum
E			315	ACPE	striped maple	Acer	pensylvanicum
E			316	ACRU	red maple	Acer	rubrum
E			317	ACSA2	silver maple	Acer	saccharinum
E			318	ACSA3	sugar maple	Acer	saccharum
E			323	ACLE	chalk maple	Acer	leucoderme
E			331	AEGL	Ohio buckeye	Aesculus	glabra
E			332	AEFL	yellow buckeye	Aesculus	flava
E			337	AESY	painted buckeye	Aesculus	sylvatica
E			355	ALGL2	European alder	Alnus	glutinosa
E			367	ASTR	Pawpaw	Asimina	triloba

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
E			371	BEAL2	yellow birch	Betula	alleghaniensis
E			372	BELE	sweet birch	Betula	lenta
E			373	BENI	river birch	Betula	nigra
E			377	BEUB	Virginia roundleaf birch	Betula	uber
E			379	BEPO	gray birch	Betula	populifolia
E			391	CACA18	American hornbeam, musclewood	Carpinus	caroliniana
E			401	CAAQ2	water hickory	Carya	aquatica
E			402	CACO15	bitternut hickory	Carya	cordiformis
E			403	CAGL8	pignut hickory	Carya	glabra
E			404	CAIL2	pecan	Carya	illinoinensis
E			405	CALA21	shellbark hickory	Carya	laciniosa
E			406	CAMY	nutmeg hickory	Carya	myristiciformis
E			407	CAOV2	shagbark hickory	Carya	ovata
E			408	CATE9	black hickory	Carya	texana
E			409	CAAL27	mockernut hickory	Carya	alba
E			410	CAPA24	sand hickory	Carya	pallida
E			411	CAFL6	scrub hickory	Carya	floridana
E			412	CAOV3	red hickory	Carya	ovalis
E			413	CACA38	southern shagbark hickory	Carya	carolinae-septentrionalis
E			422	CAPU9	Allegheny chinkapin	Castanea	pumila
E			451	CABI8	southern catalpa	Catalpa	bignonioides
E			452	CASP8	northern catalpa	Catalpa	speciosa
E			471	CECA4	eastern redbud	Cercis	canadensis
E			481	CLKE	yellowwood	Cladrastis	kentukea
E			491	COFL2	flowering dogwood	Cornus	florida
E			512	EUCA2	river redgum	Eucalyptus	camaldulensis
E			513	EUGR12	grand eucalyptus	Eucalyptus	grandis
E			514	EURO2	swamp mahogany	Eucalyptus	robusta
E			521	DIVI5	common persimmon	Diospyros	virginiana
E			522	DITE3	Texas persimmon	Diospyros	texana
E			531	FAGR	American beech	Fagus	grandifolia
E			541	FRAM2	white ash	Fraxinus	americana
E			543	FRNI	black ash	Fraxinus	nigra
E			544	FRPE	green ash	Fraxinus	pennsylvanica
E			545	FRPR	pumpkin ash	Fraxinus	profunda
E			546	FRQU	blue ash	Fraxinus	quadrangulata
E			548	FRCA3	Carolina ash	Fraxinus	caroliniana
E			549	FRTE	Texas ash	Fraxinus	texensis

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
E			551	GLAQ	waterlocust	Gleditsia	aquatica
E			552	GLTR	honeylocust	Gleditsia	triacanthos
E			555	GOLA	loblolly bay	Gordonia	lasianthus
E			571	GYDI	Kentucky coffeetree	Gymnocladus	dioicus
E			581	HACA3	Carolina silverbell	Halesia	carolina
E			582	HADI3	two-wing silverbell	Halesia	diptera
E			583	HAPA2	little silverbell	Halesia	parviflora
E			591	ILOP	American holly	Ilex	opaca
E			601	JUCI	butternut	Juglans	cinerea
E			611	LIST2	sweetgum	Liquidambar	styraciflua
E			621	LITU	yellow-poplar	Liriodendron	tulipifera
E			641	MAPO	Osage-orange	Maclura	pomifera
E			651	MAAC	cucumbertree	Magnolia	acuminata
E			652	MAGR4	southern magnolia	Magnolia	grandiflora
E			653	MAVI2	sweetbay	Magnolia	virginiana
E			654	MAMA2	bigleaf magnolia	Magnolia	macrophylla
E			655	MAFR	mountain magnolia, Fraser magnolia	Magnolia	fraseri
E			657	MAPY	pyramid magnolia	Magnolia	pyramidata
E			658	MATR	umbrella magnolia	Magnolia	tripetala
E			662	MAAN3	southern crabapple	Malus	angustifolia
E			663	MACO5	sweet crabapple	Malus	coronaria
E			664	MAIO	prairie crabapple	Malus	ioensis
E			681	MOAL	white mulberry	Morus	alba
E			682	MORU2	red mulberry	Morus	rubra
E			684	MONI	black mulberry	Morus	nigra
E			691	NYAQ2	water tupelo	Nyssa	aquatica
E			692	NYOG	Ogeechee tupelo	Nyssa	ogeche
E			693	NYSY	blackgum	Nyssa	sylvatica
E			694	NYBI	swamp tupelo	Nyssa	biflora
E			701	OSVI	eastern hophornbeam	Ostrya	virginiana
E			711	OXAR	sourwood	Oxydendrum	arboreum
E			712	PATO2	paulownia, empress-tree	Paulownia	tomentosa
E			721	PEBO	redbay	Persea	borbonia
E			722	PLAQ	water-elm, planertree	Planera	aquatica
E			731	PLOC	American sycamore	Platanus	occidentalis
E			742	PODE3	eastern cottonwood	Populus	deltoides
E			743	POGR4	bigtooth aspen	Populus	grandidentata
E			744	POHE4	swamp cottonwood	Populus	heterophylla

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
E			752	POAL7	silver poplar	Populus	alba
E			753	PONI	Lombardy poplar	Populus	nigra
E			762	PRSE2	black cherry	Prunus	serotina
E			765	PRNI	Canada plum	Prunus	nigra
E			766	PRAM	American plum	Prunus	americana
E			771	PRAV	sweet cherry (domesticated)	Prunus	avium
	W		801	QUAG	California live oak	Quercus	agrifolia
E			802	QUAL	white oak	Quercus	alba
E			804	QUBI	swamp white oak	Quercus	bicolor
E			806	QUCO2	scarlet oak	Quercus	coccinea
E			808	QUSIS	Durand oak	Quercus	sinuata var. sinuata
E			809	QUEL	northern pin oak	Quercus	ellipsoidalis
E			812	QUFA	southern red oak	Quercus	falcata
E			813	QUPA5	cherrybark oak	Quercus	pagoda
E			816	QUIL	scrub oak	Quercus	ilicifolia
E			817	QUIM	shingle oak	Quercus	imbricaria
E			819	QULA2	turkey oak	Quercus	laevis
E			820	QULA3	laurel oak	Quercus	laurifolia
E			822	QULY	overcup oak	Quercus	lyrata
E			823	QUMA2	bur oak	Quercus	macrocarpa
E			824	QUMA3	blackjack oak	Quercus	marilandica
E			825	QUMI	swamp chestnut oak	Quercus	michauxii
E			826	QUMU	chinkapin oak	Quercus	muehlenbergii
E			827	QUNI	water oak	Quercus	nigra
E			828	QUTE	Nuttall oak, Texas red oak	Quercus	texana
E			830	QUPA2	pin oak	Quercus	palustris
E			831	QUPH	willow oak	Quercus	phellos
E			832	QUPR2	chestnut oak	Quercus	prinus
E			833	QURU	northern red oak	Quercus	rubra
E			834	QUSH	Shumard's oak	Quercus	shumardii
E			835	QUST	post oak	Quercus	stellata
E			837	QUVE	black oak	Quercus	velutina
E			838	QUVI	live oak	Quercus	virginiana
E			840	QUMA6	dwarf post oak	Quercus	margarettae
E			841	QUMI2	dwarf live oak	Quercus	minima
E			842	QUIN	bluejack oak	Quercus	incana
E			844	QUOG	Oglethorpe oak	Quercus	oglethorpensis
E			856	CAGL11	gray sheoak	Casuarina	glauca

East	West	Wood-land	FIA Code	PLANTS Code	Common Name	Genus	Species
E			857	CALE28	Australian pine	Casuarina	lepidophloia
E			912	SAPA	cabbage palmetto	Sabal	palmetto
E			925	SACA5	coastal plain willow	Salix	caroliniana
E			926	SAPY	balsam willow	Salix	pyrifolia
E			929	SASE10	weeping willow	Salix	sepulcralis
E			931	SAAL5	sassafras	Sassafras	albidum
E			936	SOAU	European mountain ash	Sorbus	aucuparia
E			937	SODE3	northern mountain ash	Sorbus	decora
E			951	TIAM	American basswood	Tilia	americana
E			971	ULAL	winged elm	Ulmus	alata
E			972	ULAM	American elm	Ulmus	americana
E			973	ULCR	cedar elm	Ulmus	crassifolia
E			974	ULPU	Siberian elm	Ulmus	pumila
E			975	ULRU	slippery elm	Ulmus	rubra
E			976	ULSE	September elm	Ulmus	serotina
E			977	ULTH	rock elm	Ulmus	thomasii
E			989	RHMA2	American mangrove	Rhizophora	mangle
E			992	MEQU	melaleuca	Melaleuca	quinquenervia
E			993	MEAZ	chinaberry	Melia	azedarach
E			994	TRSE6	Chinese tallowtree	Triadica	sebifera
E			995	VEFO	tungoil tree	Vernicia	fordii
E			996	COOB2	smoketree	Cotinus	obovatus

* Code only valid for CWD SPECIES (see 10.4.3.7 SPECIES (BASE))
** Denotes CORE OPTIONAL species valid in RMRS

Appendix 4. Was previously: Site Tree Selection Criteria and Species List (This information is now located in 7.2.2 SPECIES)

Appendix 5. Determination of Stocking Values for Land Use Classification

(This appendix is left in the field guide to assist in determining FOREST TYPE and STAND SIZE CLASS.)

RM Only the FIA Tree Species Codes valid in RMRS are included in these tables.

Stocking values are required to determine if a CONDITION CLASS STATUS = 1 (accessible forest land) exists on a plot. This will determine which data items must be recorded for the condition. When the CONDITION CLASS STATUS is in question (usually a nonforest area that is in the process of reverting to forest land or a marginal site that can only support a low number of trees), the crew must determine if there is sufficient stocking to classify the condition as forest. A minimum stocking value of 10 percent is required for accessible forest land (unless the condition was previously forested, such as a recent clearcut).

The following tables show the stocking values to assign to trees or the number of trees per acre to determine if a plot meets the minimum stocking to be considered forest land. In the determination of stocking for this purpose, the field crew should consider the condition over its entire area, not just the trees and seedlings that would be tallied on the subplots and microplots, especially when the plot straddles conditions. Also, for stocking purposes, consider a clump of trees (e.g., stump sprouts) less than 5 inches DBH to be a single tree.

The number of trees per acre needed to obtain minimum stocking depends on the DBH of the largest tree on the plot in the condition being evaluated, and the species and DBH of each of the tally trees. If the condition occurs on all four subplots and the trees are distributed fairly evenly over the entire condition area, the following steps can be used to determine if the condition has the minimum number of trees per acre for forest land.

Observe all of the trees on the plot and classify the condition, based on the tree with the largest DBH, into one of the following groups; the largest tree observed has a DBH of 5 inches or greater, 4.0-4.9 inches, 3.0-3.9 inches, 2.0-2.9 inches, 1.0-1.9 inches or less than 1.0 inch DBH. If you are using the Stocking Values table to determine if the condition meets minimum stocking, use table 5a, 5b, 5c, 5d, 5e, or 5f. If you are using the Number of Trees table to determine if the condition meets minimum stocking, use table 5g.

When using a Stocking Values table, begin a tally of each subplot and microplot and sum the stocking values for each tree tallied based upon its species and size class. When the stocking values for the tallied trees equals or exceeds 10, the condition meets the minimum stocking requirement for forest land.

For example, a condition that was formerly nonforest is no longer being maintained as nonforest and has begun to revert. A check of all four subplots and microplots confirms that the largest tree there is in the 3.0 – 3.9 inches DBH class. The tally of microplot 1 is one red maple (species code = 316) seedling. The sum of the stocking value (table 5a) to this point is 2.4 and the tally continues on microplot 2.

Subplot Number	Plot Type	Species	Size Class	Number Tallied	Stocking Value
1	2	316	< 1.0	1	2.4
Total					2.4

The tally at microplot 2 is two red maple seedlings. The stocking value for the two seedlings is 4.8. The cumulative stocking value to this point is 7.2. Since the minimum value of 10 percent stocking has not been reached, the tally continues to subplot 3.

Subplot Number	Plot Type	Species	Size Class	Number Tallied	Stocking Value
1	2	316	< 1.0	1	2.4
2	2	316	< 1.0	2	4.8
Total					7.2

At microplot 3 one sugar maple (species code = 318) sapling in the 1.0 – 1.9-inch DBH class is tallied. The cumulative stocking value is now 13.1 and the condition meets the minimum stocking to be considered forest land.

Subplot Number	Plot Type	Species	Size Class	Number Tallied	Stocking Value
1	2	316	< 1.0	1	2.4
2	2	316	< 1.0	2	4.8
3	2	318	1.0 – 1.9	1	5.9
Total					13.1

When trees of more than one diameter class are present, their contribution towards meeting the minimum must be combined. For example:

In a lodgepole pine stand (species code = 108), the largest tree in the condition is 5.0+ inches DBH. If at least 20 trees that are 5.0-6.9 inches DBH are found on the four subplots, the minimum stocking of 10 percent (table 5b: 5th row, 1st column) is met. In the same condition only 5 tally trees in the 13.0-14.9-inch DBH class are needed to meet minimum stocking of 10 percent. If the tally were three 5.0-6.9-inch trees and two 13.0-14.9-inch DBH class trees (total stocking of 3 x 0.5 + 2 x 2.2 = 5.9), the combined stocking would not meet the minimum 10 percent (5.9 < 10) and the condition would be classified nonforest.

When using the Number of Trees table (table 5g), estimate the number of trees per acre by the diameter classes. When a condition exists on all 4 of the 24-ft radius subplots, each tally tree (DBH > 5.0 inches) represents 6 trees per acre and each sapling (DBH > 1.0 inch to < 5.0 inches) or seedling observed on the 4 microplots represents 75 trees per acre.

In sparse stands of smaller trees, a more accurate observation of trees per acre can be determined by observing trees < 5.0 inches DBH on the 24-ft radius subplot. In many forest types no more than 180 trees per acre of the largest diameter class are needed to meet the minimum stocking requirements, a total of 30 trees on all 4 subplots, 7 or 8 smaller trees on each subplot, will provide minimum stocking.

Other things observed on the plot will influence the determination of condition class status. In the last lodgepole pine example, evidence of a recent disturbance that reduced the stocking (cutting, fire, etc.) should be considered. Also, a very uneven distribution of the trees across the condition can greatly change the observed number of trees per acre on plots installed across the condition.

If the condition does not cover all four subplots entirely, trees per acre must be expanded using an expansion factor. The expansion factor is equal to 400/sum of the percent of subplot area (%ARE) for the condition. The trees per acre value of every diameter class is multiplied by this expansion factor.

If the trees are not uniformly distributed throughout the condition or the condition occurs on only a small portion of the plot (half the plot or less), use your best judgment in assigning status. You may place several additional temporary subplots in the condition in order to get a larger sample to base stocking on. When additional temporary subplots or judgment is used to assign land use, a note should be made on the plot sheet. Use the following procedure to establish these temporary subplots in a condition:

A. Consider locations 120.0 feet horizontal distance from the highest numbered subplot in the condition. First consider the location 0°azimuth from the subplot center. If this location is unsuitable, consider in order locations at azimuth 120°, and 240°. When a suitable location has been found, establish the temporary subplot. Temporary subplots should be entirely within the condition (locations should not be within 24.0 feet of a mapped boundary).

B. If Step A fails to yield a suitable subplot location, repeat Step A at each of the next highest-numbered regular subplots in the condition.

C. If Steps A and B have been exhausted and a suitable temporary subplot still has not been found, repeat Step A at each temporary subplot in turn, beginning with the first temporary subplot that was established.

If more than one temporary subplot is to be established, repeat Steps A and B to establish the second lowest- numbered temporary subplot next, and continue in order until you have enough temporary subplots established in the condition to get a good, representative estimate of stocking. The general rule for establishing temporary subplots is:

- Install the lowest temporary subplot off the highest established subplot, until all the established subplots have been exhausted.
- Then establish the lowest temporary subplot yet to be established off the lowest one already established (lowest off highest, then lowest off lowest).

If there is a transition zone between two conditions use your best judgment to be sure that trees tallied in the transition zone do not have too much weight in the assignment of a land use.

Table 5a. Stocking values for all tallied trees on the four subplots and microplots

	DBH of the largest tally tree in the condition																				
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seed-ling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seedl-ing	Seed-ling
18, 19, 93, 94, 96	0.7	6.9	5.2	4.0	2.6	1.2	7.9	6.2	4.6	3.0	1.4	7.6	5.7	3.7	1.8	7.4	4.9	2.3	7.2	3.5	7.0
72, 73	0.6	5.6	4.3	3.3	2.1	1.0	6.4	5.1	3.8	2.5	1.1	6.3	4.6	3.0	1.4	6.1	4.0	1.9	5.9	2.9	5.7
68, 130,	1.0	9.1	6.9	5.3	3.4	1.6	10.4	8.3	6.1	4.0	1.9	10.1	7.5	4.9	2.3	9.9	6.5	3.1	9.6	4.7	9.3
108	0.5	5.0	3.7	2.9	1.9	0.8	5.7	4.5	3.3	2.2	1.0	5.5	4.1	2.7	1.3	5.4	3.5	1.7	5.2	2.5	5.1
103, 104, 119	0.4	4.2	3.1	2.4	1.6	0.7	4.7	3.8	2.8	1.8	0.8	4.6	3.4	2.2	1.1	4.5	2.9	1.4	4.4	2.1	4.2
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847,	0.5	5.0	3.8	2.9	1.9	0.9	5.7	4.6	3.4	2.2	1.0	5.6	4.1	2.7	1.3	5.4	3.6	1.7	5.3	2.6	5.1
136	0.7	6.8	5.1	4.0	2.6	1.2	7.7	6.1	4.6	3.0	1.4	7.5	5.6	3.7	1.7	7.3	4.8	2.3	7.1	3.5	6.9
15, 202	0.7	6.8	5.1	4.0	2.6	1.2	7.7	6.2	4.6	3.0	1.4	7.5	5.6	3.7	1.7	7.3	4.8	2.3	7.1	3.5	6.9
17, 20, 21, 22, 81, 231, 242, 251, 263, 264	0.5	4.8	3.6	2.8	1.8	0.8	5.4	4.3	3.2	2.1	1.0	5.3	3.9	2.6	1.2	5.1	3.4	1.6	5.0	2.4	4.8
999	1.0	9.6	7.2	5.6	3.6	1.6	10.9	8.7	6.4	4.2	2.0	10.6	7.9	5.2	2.4	10.3	6.8	3.3	10.0	4.9	9.8

Table 5a. Stocking values for all tallied trees on the four subplots and microplots

	DBH of the largest tally tree in the condition																			
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seed-ling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seedl-ing	Seed-ling
351, 352, 353, 492	1.3	11.7	8.8	6.8	4.4	2.0	13.3	10.6	7.9	5.1	2.4	13.0	9.6	6.3	3.0	12.6	8.3	4.0	12.3	5.9	11.9
552	1.2	10.9	8.2	6.3	4.1	1.8	12.4	9.8	7.3	4.8	2.2	12.1	9.0	5.9	2.8	11.7	7.7	3.7	11.4	5.5	11.1
374, 375	1.1	10.5	7.9	6.1	4.0	1.8	12.0	9.5	7.1	4.6	2.1	11.6	8.7	5.7	2.7	11.3	7.4	3.6	11.0	5.3	10.7
361, 362, 404, 901	1.2	11.6	8.8	6.8	4.4	2.0	13.2	10.5	7.8	5.1	2.4	12.9	9.6	6.3	3.0	12.5	8.2	3.9	12.2	5.9	11.8
602, 606	1.4	12.7	9.6	7.4	4.8	2.2	14.5	11.5	8.5	5.6	2.6	14.1	10.5	6.9	3.2	13.7	9.0	4.3	13.3	6.5	12.9
741, 746	1.2	10.9	8.3	6.4	4.1	1.9	12.5	9.9	7.3	4.8	2.2	12.1	9.0	5.9	2.8	11.8	7.8	3.7	11.5	5.6	11.1
547	1.0	9.3	7.0	5.4	3.5	1.6	10.6	8.4	6.3	4.1	1.9	10.3	7.7	5.0	2.4	10.0	6.6	3.2	9.8	4.7	9.5
313, 461, 462, 544, 732, 742, 745, 747, 748, 749, 974	1.2	10.8	8.1	6.3	4.1	1.8	12.3	9.8	7.2	4.7	2.2	12.0	8.9	5.8	2.7	11.6	7.6	3.7	11.3	5.5	11.0

Table 5b. Stocking values for all trees tallied on the subplot only

Species	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
18, 19, 93, 94, 96,	0.7	1.1	1.6	2.1	2.6	3.2	3.8	4.4	5.1	5.8	6.5	7.2	8.0
72, 73	0.6	1.0	1.5	2.0	2.6	3.3	4.0	4.9	5.7	6.7	7.6	8.7	9.8
68, 130	1.0	1.5	2.2	3.0	3.8	4.7	5.6	6.6	7.7	8.9	10.1	11.4	12.7
103, 104, 119	0.4	0.7	1.1	1.5	1.9	2.4	3.0	3.6	4.2	4.9	5.6	6.4	7.2
51, 58, 59, 62, 63, 64, 65, 66, 69, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	0.5	1.0	1.5	2.2	2.9	3.8	4.9	6.0	7.3	8.6	10.1	11.8	13.5
136	0.7	1.2	1.7	2.3	3.0	3.7	4.6	5.4	6.4	7.4	8.4	9.5	10.7
15, 202	0.7	1.1	1.6	2.1	2.7	3.3	4.0	4.7	5.4	6.2	7.0	7.8	8.7
17, 20, 21, 22, 231, 242, 263, 264	0.5	0.8	1.2	1.6	2.1	2.6	3.2	3.8	4.5	5.2	5.9	6.7	7.5
999	1.0	1.6	2.2	3.0	3.8	4.6	5.5	6.5	7.5	8.6	9.7	10.9	12.1
351, 352, 353, 492	1.3	1.9	2.6	3.3	4.1	5.0	5.9	6.8	7.8	8.9	9.9	11.0	12.1
552	1.2	2.0	3.0	4.2	5.6	7.2	9.0	11.0	13.1	15.4	17.8	20.5	23.3
374, 375	1.1	1.9	3.0	4.2	5.6	7.2	9.0	11.0	13.1	15.5	18.0	20.7	23.6
361, 362, 404, 901	1.2	2.0	2.9	3.9	5.0	6.2	7.5	8.9	10.4	11.9	13.6	15.3	17.2
600, 601, 602, 603, 604, 605, 606	1.4	2.1	2.9	3.9	4.9	5.9	7.1	8.3	9.6	10.9	12.3	13.7	15.2
741, 746	1.2	1.8	2.5	3.2	4.0	4.9	5.8	6.8	7.8	8.9	10.0	11.1	12.3
547	1.0	1.4	1.8	2.2	2.6	3.0	3.5	3.9	4.3	4.8	5.2	5.7	6.2
313, 461, 462, 544, 732, 742, 745, 747, 748, 749, 972, 974	1.2	2.0	3.0	4.2	5.6	7.2	8.9	10.9	13.0	15.2	17.7	20.3	23.1

Table 5c. Stocking values for all trees < 7 inches, observed on the four subplots only

	DBH of the largest tally tree in the condition																				
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seedling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seed-ling	Seed-ling
18, 19, 93, 94, 96	0.74	0.55	0.42	0.32	0.21	0.09	0.63	0.50	0.37	0.24	0.11	0.61	0.45	0.30	0.14	0.59	0.39	0.19	0.58	0.28	0.56
72, 73	0.60	0.45	0.34	0.26	0.17	0.08	0.51	0.41	0.30	0.20	0.09	0.50	0.37	0.24	0.11	0.49	0.32	0.15	0.47	0.23	0.46
68, 130	0.98	0.73	0.55	0.43	0.28	0.12	0.83	0.66	0.49	0.32	0.15	0.81	0.60	0.39	0.19	0.79	0.52	0.25	0.77	0.37	0.74
108	0.53	0.40	0.30	0.23	0.15	0.07	0.45	0.36	0.27	0.17	0.08	0.44	0.33	0.21	0.10	0.43	0.28	0.13	0.42	0.20	0.40
103, 104, 119	0.45	0.33	0.25	0.19	0.13	0.06	0.38	0.30	0.22	0.15	0.07	0.37	0.27	0.18	0.08	0.36	0.24	0.11	0.35	0.17	0.34
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	0.54	0.40	0.30	0.24	0.15	0.07	0.46	0.36	0.27	0.18	0.08	0.45	0.33	0.22	0.10	0.43	0.29	0.14	0.42	0.20	0.41
136	0.73	0.54	0.41	0.32	0.20	0.09	0.62	0.49	0.36	0.24	0.11	0.60	0.45	0.29	0.14	0.59	0.39	0.18	0.57	0.28	0.55
15, 202	0.73	0.54	0.41	0.32	0.20	0.09	0.62	0.49	0.36	0.24	0.11	0.60	0.45	0.29	0.14	0.59	0.39	0.18	0.57	0.28	0.55
17, 20, 21, 22, 231, 242, 263, 264	0.51	0.38	0.29	0.22	0.14	0.06	0.43	0.34	0.26	0.17	0.08	0.42	0.31	0.21	0.10	0.41	0.27	0.13	0.40	0.19	0.39
999	1.03	0.77	0.58	0.45	0.29	0.13	0.87	0.69	0.52	0.34	0.16	0.85	0.63	0.41	0.20	0.83	0.54	0.26	0.80	0.39	0.78
351, 352, 353, 492	1.25	0.93	0.71	0.55	0.35	0.16	1.07	0.85	0.63	0.41	0.19	1.04	0.77	0.50	0.24	1.01	0.66	0.32	0.98	0.48	0.95
374, 375	1.13	0.84	0.63	0.49	0.32	0.14	0.96	0.76	0.56	0.37	0.17	0.93	0.69	0.45	0.21	0.91	0.60	0.28	0.88	0.43	0.85

Table 5c. Stocking values for all trees < 7 inches, observed on the four subplots only

	DBH of the largest tally tree in the condition																				
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seedling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seed-ling	Seed-ling
361, 362, 404, 901	1.25	0.93	0.70	0.54	0.35	0.16	1.06	0.84	0.62	0.41	0.19	1.03	0.77	0.50	0.24	1.00	0.66	0.32	0.97	0.47	0.95
602, 606	1.36	1.01	0.77	0.59	0.38	0.17	1.16	0.92	0.68	0.44	0.21	1.13	0.84	0.55	0.26	1.10	0.72	0.34	1.07	0.52	1.03
741, 746	1.17	0.87	0.66	0.51	0.33	0.15	1.00	0.79	0.59	0.38	0.18	0.97	0.72	0.47	0.22	0.94	0.62	0.30	0.92	0.45	0.89
547	1.00	0.74	0.56	0.43	0.28	0.13	0.85	0.67	0.50	0.33	0.15	0.83	0.61	0.40	0.19	0.80	0.53	0.25	0.78	0.38	0.76
313, 461, 462, 544, 732, 742, 745, 747, 748, 749, 972, 974	1.16	0.86	0.65	0.50	0.32	0.15	0.98	0.78	0.58	0.38	0.18	0.96	0.71	0.47	0.22	0.93	0.61	0.29	0.90	0.44	0.88

Table 5d. Stocking values for all trees 5.0 inches and greater observed on the four subplots only

Species	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
18, 19, 93, 94, 96	0.7	1.1	1.6	2.1	2.6	3.2	3.8	4.4	5.1	5.8	6.5	7.2	8.0
72, 73	0.6	1.0	1.5	2.0	2.6	3.3	4.0	4.9	5.7	6.7	7.6	8.7	9.8
68, 130	1.0	1.5	2.2	3.0	3.8	4.7	5.6	6.6	7.7	8.9	10.1	11.4	12.7
108	0.5	0.9	1.3	1.7	2.2	2.8	3.4	4.1	4.8	5.6	6.4	7.3	8.2
103, 104, 119	0.4	0.7	1.1	1.5	1.9	2.4	3.0	3.6	4.2	4.9	5.6	6.4	7.2
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	0.5	1.0	1.5	2.2	2.9	3.8	4.9	6.0	7.3	8.6	10.1	11.8	13.5
136	0.7	1.2	1.7	2.3	3.0	3.7	4.6	5.4	6.4	7.4	8.4	9.5	10.7
15, 202	0.7	1.1	1.6	2.1	2.7	3.3	4.0	4.7	5.4	6.2	7.0	7.8	8.7
17, 20, 21, 22, 81, 231, 242, 263, 264	0.5	0.8	1.2	1.6	2.1	2.6	3.2	3.8	4.5	5.2	5.9	6.7	7.5
999	1.0	1.6	2.2	3.0	3.8	4.6	5.5	6.5	7.5	8.6	9.7	10.9	12.1
351, 352, 353, 492	1.3	1.9	2.6	3.3	4.1	5.0	5.9	6.8	7.8	8.9	9.9	11.0	12.1
374, 375	1.1	1.9	3.0	4.2	5.6	7.2	9.0	11.0	13.1	15.5	18.0	20.7	23.6
361, 362, 404, 901	1.2	2.0	2.9	3.9	5.0	6.2	7.5	8.9	10.4	11.9	13.6	15.3	17.2
602, 606	1.4	2.1	2.9	3.9	4.9	5.9	7.1	8.3	9.6	10.9	12.3	13.7	15.2
741, 746	1.2	1.8	2.5	3.2	4.0	4.9	5.8	6.8	7.8	8.9	10.0	11.1	12.3
547	1.0	1.4	1.8	2.2	2.6	3.0	3.5	3.9	4.3	4.8	5.2	5.7	6.2
313, 461, 462, 544, 732, 742, 747, 748, 749, 972, 974	1.2	2.0	3.0	4.2	5.6	7.2	8.9	10.9	13.0	15.2	17.7	20.3	23.1

Table 5e. Stocking values for all trees < 7 inches observed on one acre

	DBH of the largest tally tree in the condition																			
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seed-ling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seed-ling	Seed-ling
18, 19, 93, 94, 96	0.12	0.092	0.069	0.054	0.035	0.016	0.105	0.083	0.062	0.040	0.019	0.102	0.076	0.050	0.023	0.099	0.065	0.031	0.096	0.047	0.094
72, 73	0.10	0.075	0.057	0.044	0.028	0.013	0.086	0.068	0.050	0.033	0.015	0.083	0.062	0.041	0.019	0.081	0.053	0.025	0.079	0.038	0.076
68, 130	0.16	0.122	0.092	0.071	0.046	0.021	0.139	0.110	0.082	0.053	0.025	0.135	0.100	0.066	0.031	0.131	0.086	0.041	0.128	0.062	0.124
108	0.09	0.066	0.050	0.039	0.025	0.011	0.075	0.060	0.044	0.029	0.013	0.073	0.055	0.036	0.017	0.071	0.047	0.022	0.069	0.034	0.067
103, 104, 119	0.07	0.055	0.042	0.032	0.021	0.009	0.063	0.050	0.037	0.024	0.011	0.062	0.046	0.030	0.014	0.060	0.039	0.019	0.058	0.028	0.056

Table 5e. Stocking values for all trees < 7 inches observed on one acre

	DBH of the largest tally tree in the condition																				
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seedling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seedling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seedling	3.0-3.9	2.0-2.9	1.0-1.9	Seedling	2.0-2.9	1.0-1.9	Seedling	1.0-1.9	Seedling	Seedling
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	0.09	0.067	0.051	0.039	0.025	0.011	0.077	0.061	0.045	0.029	0.014	0.074	0.055	0.036	0.017	0.072	0.048	0.023	0.070	0.034	0.068
136	0.12	0.090	0.068	0.053	0.034	0.015	0.103	0.082	0.061	0.040	0.018	0.100	0.075	0.049	0.023	0.098	0.064	0.031	0.095	0.046	0.092
15, 202,	0.12	0.090	0.068	0.053	0.034	0.015	0.103	0.082	0.061	0.040	0.018	0.100	0.075	0.049	0.023	0.098	0.064	0.031	0.095	0.046	0.092

Table 5e. Stocking values for all trees < 7 inches observed on one acre

	DBH of the largest tally tree in the condition																		
	5.0+						4.0-4.9					3.0-3.9				2.0-2.9			1.0-1.9		Seed-ling
	DBH of tally tree						DBH of tally tree					DBH of tally tree				DBH of tally tree			DBH of tally tree		
Species	5.0-6.9	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	4.0-4.9	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	3.0-3.9	2.0-2.9	1.0-1.9	Seed-ling	2.0-2.9	1.0-1.9	Seed-ling	1.0-1.9	Seed-ling	Seed-ling
17, 20, 21, 22, 81, 231, 242, 263, 264	0.09	0.063	0.048	0.037	0.024	0.011	0.072	0.057	0.043	0.028	0.013	0.070	0.052	0.034	0.016	0.068	0.045	0.022	0.067	0.032	0.065
999	0.17	0.128	0.097	0.075	0.048	0.022	0.146	0.116	0.086	0.056	0.026	0.142	0.105	0.069	0.033	0.138	0.091	0.043	0.134	0.065	0.130
351, 352, 353, 492	0.21	0.156	0.118	0.091	0.059	0.026	0.178	0.141	0.105	0.068	0.032	0.173	0.128	0.084	0.040	0.168	0.111	0.053	0.163	0.079	0.159
374, 375	0.19	0.140	0.106	0.082	0.053	0.024	0.160	0.127	0.094	0.061	0.028	0.155	0.115	0.076	0.036	0.151	0.099	0.047	0.147	0.071	0.142
361, 362, 404, 901	0.21	0.155	0.117	0.090	0.058	0.026	0.176	0.140	0.104	0.068	0.032	0.172	0.128	0.084	0.039	0.167	0.110	0.053	0.162	0.079	0.158
602, 606	0.23	0.169	0.128	0.099	0.064	0.029	0.193	0.153	0.114	0.074	0.034	0.188	0.140	0.091	0.043	0.183	0.120	0.057	0.178	0.086	0.172
741, 746	0.20	0.146	0.110	0.085	0.055	0.025	0.166	0.132	0.098	0.064	0.030	0.162	0.120	0.079	0.037	0.157	0.103	0.049	0.153	0.074	0.148
547	0.17	0.124	0.094	0.072	0.047	0.021	0.141	0.112	0.083	0.054	0.025	0.138	0.102	0.067	0.032	0.134	0.088	0.042	0.130	0.063	0.126
313, 461, 462, 544, 732, 742, 747, 748, 749, 972, 974	0.19	0.143	0.109	0.084	0.054	0.024	0.164	0.130	0.097	0.063	0.029	0.159	0.118	0.078	0.037	0.155	0.102	0.049	0.151	0.073	0.146

Table 5f. Stocking values for all trees 5.0 inches and greater observed on one acre

Species	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
18, 19, 93, 94, 96	0.12	0.19	0.26	0.34	0.43	0.53	0.63	0.73	0.84	0.96	1.08	1.20	1.33
72, 73	0.10	0.17	0.24	0.33	0.44	0.55	0.67	0.81	0.95	1.11	1.27	1.45	1.63
68, 130	0.16	0.26	0.37	0.49	0.63	0.78	0.94	1.11	1.29	1.48	1.68	1.89	2.11
108	0.09	0.14	0.21	0.29	0.37	0.47	0.57	0.69	0.81	0.94	1.07	1.22	1.37
103, 104, 119	0.07	0.12	0.18	0.25	0.32	0.41	0.50	0.60	0.70	0.82	0.94	1.07	1.20
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 109, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	0.09	0.16	0.25	0.36	0.49	0.64	0.81	1.00	1.21	1.44	1.69	1.96	2.25
136	0.12	0.20	0.28	0.39	0.50	0.62	0.76	0.91	1.06	1.23	1.40	1.59	1.78
15, 202	0.12	0.19	0.27	0.35	0.45	0.55	0.66	0.78	0.90	1.03	1.16	1.30	1.45
17, 20, 21, 22, 81, 231, 242, 263, 264	0.09	0.14	0.20	0.27	0.35	0.44	0.53	0.64	0.75	0.86	0.98	1.11	1.25
999	0.17	0.27	0.37	0.49	0.63	0.77	0.92	1.08	1.25	1.43	1.62	1.81	2.01
351, 352, 353, 492	0.21	0.31	0.43	0.56	0.69	0.83	0.98	1.14	1.31	1.48	1.65	1.83	2.02
374, 375	0.19	0.32	0.49	0.70	0.93	1.20	1.50	1.83	2.19	2.58	3.00	3.45	3.93
361, 362, 404, 901	0.21	0.33	0.48	0.64	0.83	1.03	1.24	1.48	1.73	1.99	2.27	2.56	2.86
602, 606	0.23	0.35	0.49	0.64	0.81	0.99	1.18	1.38	1.60	1.82	2.05	2.29	2.54
741, 746	0.20	0.30	0.41	0.54	0.67	0.82	0.97	1.13	1.30	1.48	1.66	1.85	2.05
547	0.17	0.23	0.30	0.36	0.43	0.50	0.58	0.65	0.72	0.80	0.87	0.95	1.03

Table 5f. Stocking values for all trees 5.0 inches and greater observed on one acre

Species	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
313, 461, 462, 544, 732, 742, 747, 748, 749, 972, 974	0.19	0.33	0.50	0.70	0.93	1.19	1.49	1.81	2.16	2.54	2.95	3.38	3.85

Table 5g. Minimum number of trees per acre for forest land based on largest tally tree

Species	DBH of largest tally tree																
	Seed-ling	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
18, 19, 93, 94, 96	106.9	103.8	100.9	98.1	95.5	81.2	53.0	38.1	29.1	23.2	19.0	16.0	13.7	11.9	10.4	9.3	8.3	7.5
72, 73	130.8	127.0	123.4	120.0	116.8	99.3	60.3	41.0	29.9	22.9	18.2	14.8	12.4	10.5	9.0	7.9	6.9	6.1
68, 130	80.6	78.3	76.1	74.0	72.0	61.2	38.7	27.2	20.3	15.9	12.9	10.7	9.0	7.8	6.8	5.9	5.3	4.7
108	148.4	144.1	140.0	136.2	132.6	112.7	69.1	47.3	34.7	26.7	21.3	17.4	14.6	12.4	10.7	9.3	8.2	7.3
103, 104, 119	177.2	172.0	167.2	162.6	158.2	134.5	81.8	55.6	40.5	31.1	24.7	20.1	16.8	14.2	12.2	10.6	9.4	8.3
121	73.0	70.9	68.9	67.0	65.2	55.4	36.6	26.6	20.4	16.4	13.5	11.4	9.8	8.5	7.5	6.7	6.0	5.5
51, 58, 59, 62, 63, 64, 65, 66, 69, 101, 102, 106, 112, 113, 114, 116, 117, 118, 122, 133, 134, 135, 137, 140, 142, 143, 322, 475, 756, 757, 758, 803, 810, 814, 823, 826, 829, 843, 846, 847	146.4	142.1	138.1	134.3	130.7	111.1	62.5	40.0	27.8	20.4	15.6	12.3	10.0	8.3	6.9	5.9	5.1	4.4
136	108.5	105.4	102.4	99.6	96.9	82.4	51.0	35.1	25.9	20.0	16.0	13.2	11.0	9.4	8.1	7.1	6.3	5.6
15, 202	108.5	105.3	102.4	99.6	96.9	82.4	52.9	37.5	28.3	22.3	18.2	15.2	12.9	11.1	9.7	8.6	7.7	6.9
17, 20, 21, 22, 81, 231, 242, 263, 264	154.8	150.3	146.1	142.0	138.2	117.5	72.7	50.1	36.9	28.5	22.8	18.8	15.7	13.4	11.6	10.2	9.0	8.0
999	76.9	74.6	72.5	70.5	68.7	58.4	37.6	26.7	20.2	16.0	13.0	10.9	9.2	8.0	7.0	6.2	5.5	5.0
351, 352, 353, 492	63.0	61.2	59.5	57.8	56.3	47.8	31.9	23.3	18.0	14.5	12.0	10.2	8.8	7.7	6.8	6.1	5.5	4.9
374, 375	70.2	68.1	66.2	64.4	62.7	53.3	30.9	20.3	14.4	10.7	8.3	6.7	5.5	4.6	3.9	3.3	2.9	2.5
361, 362, 404, 901	63.5	61.6	59.9	58.2	56.7	48.2	30.1	20.9	15.6	12.1	9.7	8.0	6.8	5.8	5.0	4.4	3.9	3.5
602, 606	58.0	56.3	54.7	53.2	51.8	44.0	28.6	20.5	15.6	12.3	10.1	8.5	7.2	6.3	5.5	4.9	4.4	3.9
741, 746	67.4	65.4	63.6	61.8	60.2	51.2	33.6	24.3	18.6	14.8	12.2	10.3	8.8	7.7	6.8	6.0	5.4	4.9
547	79.2	76.9	74.7	72.6	70.7	60.1	43.4	33.7	27.5	23.1	19.8	17.4	15.4	13.8	12.5	11.5	10.5	9.8

Table 5g. Minimum number of trees per acre for forest land based on largest tally tree

Species	DBH of largest tally tree																	
	Seedling	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-24.9	25.0-26.9	27.0-28.9	29.0+
313, 461, 462, 544, 732, 742, 747, 748, 749, 972, 974	68.4	66.4	64.5	62.7	61.0	51.9	30.4	20.1	14.3	10.7	8.4	6.7	5.5	4.6	3.9	3.4	3.0	2.6

Appendix 6. Glossary

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 the following criteria:

a. Forest Land has at least 10 percent canopy cover of live tally tree species of any size or has had at least 10 percent canopy cover of live tally species in the past, based on the presence of stumps, snags, or other evidence. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession, such as regular mowing, intensive grazing, or recreation activities.
b. In contrast to regular mowing, chaining treatments are recognized as long-term periodic or one-time treatments. Although the intent of chaining may be permanent removal of trees, reoccupation is common in the absence of additional treatments and sometimes the treatment does not remove enough to reduce canopy cover below the threshold of forest land. As a result, only live canopy cover should be considered in areas that have been chained; missing (dead or removed) canopy cover is not considered in the forest land call
c. In the cases of land on which either forest is encroaching on adjacent nonforest land, or the land that was previously under a nonforest land use (e.g., agriculture or mining) is reverting to forest naturally, only the live cover criterion applies.
d. In the case of deliberate afforestation – human-assisted conversion of other land use / land cover to forest land -- there must be at least 150 established trees per acre (all sizes combined) to qualify as forest land. Land that has been afforested at a density of less than 150 trees per acre is not considered forest land (see nonforest land below). If the condition experiences regeneration failure or is otherwise reduced to less than 150 survivors per acre after the time of planting / seeding but prior to achieving 10 percent canopy cover, then the condition should not be classified forest land.
e. 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.

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.

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.

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

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.

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.

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 total tree length.

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, 4-inch diameter classes are used.

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.

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 - See the definition for "Accessible Forest Land".

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).

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.

Ingrowth trees: Trees that either grew over the 1.0 inch threshold on the microplot or grew onto the subplot.

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.

Measure Low Approach: A method of measuring DBH on trees where the following originate at the approximate same location on the bole preventing accurate and repeatable diameter measurement: multiple forks, prolific branching, or a combination of multiple forks and prolific branching. This method is also applied in situations where forked trees are grown together in such a fashion that an accurate and repeatable diameter cannot be measured OR estimated due to the deformation resulting from the presence of the above mentioned criteria. In such cases a single tree is tallied and the diameter is measured at the highest most repeatable location between the 1-foot stump and the initial pith separation.

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 Portion (woodland species): RM – For woodland species, 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.

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: Land that does not support, or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and noncensus water. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120.0 feet wide, and clearings, etc., more than one acre in size, to qualify as nonforest land.

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

Nonstocked Forest Land: RM – Formerly stocked forest land that currently has less than 10 percent stocking (as represented in the field by 10 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.

Other Wooded Land: An area of Nonforest Land that is between 5% - 9.9% LIVE PLUS MISSING CANOPY COVER and/or has > 40 seedlings per acre now or at the previous inventory. Prior to 2013 this area was considered Forest Land.

Outcrop: RM – Surface exposure of a significant geologic strata.

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.

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.

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.

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.

Subplot: A circular, fixed-area plot with a radius of 24.0 feet. Each subplot represents ¼ 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 (Appendix 3) as timber or woodland species 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.

Through growth: 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.

Timberland: RM – In previous inventories, this was forest land (including areas with mixtures of timber species and woodland species) 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. See Appendix 3 for a detailed list of tree species tallied in RMRS.

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.

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.

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 species, or (2) timber species and woodland species, 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 root collar (DRC); these include pinyon, juniper (except Western juniper), most oak, mesquite, curlleaf 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. “**RM**” identifies additional variables collected by RMRS.

RM note: Due to space limitations, MQO and Units columns not included.

Variable Name	Tolerance	Values	When Collected
General Description			
New Subplot Location	+/- 7 feet	N/A	N/A
New Microplot Location	+/- 1 foot	N/A	N/A
Plot Level Data			
STATE	No errors	Appendix 1	All plots
COUNTY	No errors	Appendix 1	All plots
PLOT NUMBER	No errors	00001 to 99999	All plots
PLOT STATUS	No errors	1 to 3	All plots
NONFOREST SAMPLING STATUS	No errors	0 to 1	All plots
NONFOREST PLOT STATUS	No errors	1 to 3	When PLOT STATUS = 2 and NON-FOREST SAMPLING STATUS = 1
PLOT NONSAMPLED REASON	No errors	01 to 03 and 05 to 11	When PLOT STATUS = 3
RM CONDITION CLASS CHANGE	No errors	0, 1, 2, 3	All SAMPLE KIND 2 plots
NONFOREST PLOT NONSAMPLED REASON	No errors	02, 03, 08, 09, 10	When PLOT STATUS = 2 and NON-FOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 3
SUBPLOTS EXAMINED	No errors	1, 4	All plots
SAMPLE KIND	No errors	1 to 3	All plots
RM REGIONAL SAMPLE KIND	No errors	1, 2, 3	All plots
RM 4 X 4	No errors	Y or N	All plots
RM ATV	No errors	Y or N	All plots
RM LOCKED GATE	No errors	Y or N	All plots
RM PLOT PHOTOS TAKEN	No errors	Y or N	All plots
RM NEW MAP DRAWN	No errors	Y or N	All plots
PREVIOUS PLOT NUMBER	No errors	00001 to 99999	When SAMPLE KIND = 3
FIELD GUIDE VERSION	No errors	8.0	All plots
YEAR	No errors	> 2003	All plots
MONTH	No errors	Jan – Dec (01 – 12)	All plots
DAY	No errors	01 to 31	All plots
DECLINATION	**RM** not collected in RMRS		

Variable Name	Tolerance	Values	When Collected
HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	1 to 9	When PLOT STATUS = 1 or PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1
WATER ON PLOT	No errors	0 to 5, 9	When PLOT STATUS = 1 or PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 1
QA STATUS	No errors	1 to 7	All plots
CREW NUMBER	No errors	RMRS 220001-229999	All plots
GPS UNIT	No errors	0, 2, 3, 4	All field visited plots
GPS SERIAL NUMBER	No errors	000001 to 999999	When GPS UNIT > 0
GPS ENTRY METHOD	No errors	0, 1	GPS UNIT > 0
GPS DATUM	No errors	NAD83	GPS UNIT > 0
COORDINATE SYSTEM	No errors	1, 2	GPS UNIT > 0
LATITUDE DEGREES	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	00-90	When COORDINATE SYSTEM = 1
LATITUDE MINUTES	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	00 – 59	When COORDINATE SYSTEM = 1
LATITUDE SECONDS	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	0.00 – 59.99	When COORDINATE SYSTEM = 1
LONGITUDE DEGREES	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	001 – 180	When COORDINATE SYSTEM = 1
LONGITUDE MINUTES	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	00 – 59	When COORDINATE SYSTEM = 1
LONGITUDE SECONDS	When GPS ENTRY METHOD = 0, no errors in data entry. When GPS ENTRY METHOD = 1, not applicable	0.00 – 59.99	When COORDINATE SYSTEM = 1
AZIMUTH TO PLOT CENTER	+/- 3 degrees	000 at plot center 001 to 360 not at plot center	When GPS UNIT = 2, 3 or 4

Variable Name	Tolerance	Values	When Collected
DISTANCE TO PLOT CENTER	+/- 6 ft.	000 at plot center. 001 to 200 if a Laser range finder not used. 001 to 999 if a Laser range finder is used	When GPS UNIT = 2, 3 or 4
GPS ELEVATION	No errors	-00100 to 20000	When GPS UNIT = 2 or 4
GPS ERROR	No errors	000 to 999	When GPS UNIT = 2
NUMBER OF READINGS	No errors	001 to 999	When GPS UNIT = 2
GPS FILENAME	No errors	English words, phrases and numbers	When GPS UNIT = 3
MACROPLOT BREAK-POINT DIAMETER	No errors	21, 24, and 30	All plots
RM FUTURE FOREST POTENTIAL	No errors	0, 1, 2	When no accessible forest land condition class is present on the location.
PLOT NOTES	N/A	English, alpha-numeric	All plots
P2 VEGETATION SAMPLING STATUS	No errors	0, 1, 2	All plots
LEVEL OF DETAIL	No errors	1, 2, 3	When P2 VEGETATION SAMPLING STATUS = 1 or 2
INVASIVE PLANT SAMPLING STATUS	No errors	0, 1, 2	All plots
INVASIVE PLANT SPECIMEN COLLECTION RULE	No errors	0, 1	Downloaded on all plots where INVASIVE PLANT SAMPLING STATUS = 1 or 2
DWM SAMPLING STATUS (BASE)	No errors	0, 1, 2, 3	All plots
DWM NUMBER OF SUBPLOTS (BASE)	No errors	1 to 4	All plots where DWM SAMPLING STATUS >0
DWM NUMBER OF TRANSECTS ON SUBPLOT (BASE)	No errors	1, 2, 3	All plots where DWM SAMPLING STATUS >0
DWM TRANSECT LENGTH (BASE)	+/- 1 ft.	24.0 to 58.9	All plots where DWM SAMPLING STATUS >0
DWM SUBPLOT LIST	No errors	1000 to 4000	All plots where DWM SAMPLING STATUS >0
DWM NOTES (BASE)	N/A	English language words, phrases, and numbers	All plots where DWM SAMPLING STATUS >0, as needed
Condition Class Information			
CONDITION CLASS NUMBER	No errors	1 to 9	All condition classes
CONDITION CLASS STATUS	No errors	1, 2, 3, 4, 5	All condition classes
CONDITION NONSAMPLED REASON	No errors	01, 02, 03, 05, 06, 07, 08, 09, 10, 11	When CONDITION CLASS STATUS = 5

Variable Name	Tolerance	Values	When Collected
NONFOREST CONDI-TION CLASS STATUS	No errors	2, 5	When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1
NONFOREST CONDI-TION NONSAMPLED REASON	No errors	02, 03, 10	When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST CON-DITION CLASS STATUS = 5
RESERVED STATUS*	No errors	0, 1	CORE: CONDITION CLASS STATUS = 1. CORE OPTIONAL: All condition classes
OWNER GROUP*	No errors	10, 20, 30, 40	CORE: CONDITION CLASS STATUS = 1. CORE OPTIONAL: All condition classes
FOREST TYPE	No errors in group or type	Appendix 2	When CONDITION CLASS STATUS = 1
STAND SIZE CLASS	No errors	0, 1, 2, 3, 4, 5	When CONDITION CLASS STATUS = 1
REGENERATION STATUS	No errors	0, 1	When CONDITION CLASS STATUS = 1
TREE DENSITY	No errors	1, 2, 3	When CONDITION CLASS STATUS = 1
*OWNER CLASS**	*No errors*	*11-13; 21-25; 31-33; 41-45*	*CORE: When CONDITION CLASS STATUS = 1* *CORE OPTIONAL: All condition classes*
OWNER SUB-CLASS	**RM** *not collected in RMRS*		
PUBLIC ADMINISTRA-TIVELY WITHDRAWN STATUS	**RM** *not collected in RMRS*		
ADMINISTRATIVELY WITHDRAWN AREA NAME	**RM** *not collected in RMRS*		
ADMINISTRATIVELY WITHDRAWN NOTES	**RM** *not collected in RMRS*		
RESERVED AREA NAME	No errors	English lan-guage word, phrases, and numbers	All conditions with RESERVED STATUS=1
ARTIFICIAL REGENERA-TION SPECIES	No errors	Appendix 3	When CONDITION CLASS STATUS = 1 and REGENERATION STATUS = 1
STAND AGE	+/- 10%	000 to 997, 998, 999	When CONDITION CLASS STATUS = 1
RM CONDITION HABI-TAT TYPE	Series – No errors	Found in re-gional habitat type guides	CONDITION CLASS STATUS = 1 or NONFOREST PLOT STATUS = 2
ACI RANGE TYPE	No errors	?	NONFOREST PLOT STATUS = 1
DISTURBANCE 1	No errors	00; 10-12; 20-22; 30-32;40-46; 50-54; 60; 70; 80; 90-95	When CONDITION CLASS STATUS = 1 or NONFOREST SAMPLING STATUS = 1 and NONFOREST CON-DITION CLASS STATUS = 2

Variable Name	Tolerance	Values	When Collected
DISTURBANCE YEAR 1	+/- 1 year for 5-year measurement cycles +/ 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	When DISTURBANCE 1 > 00
DISTURBANCE 2	No errors	00; 10-12; 20-22; 30-32;40-46; 50-54; 60; 70; 80; 90-95	When CONDITION CLASS STATUS = 1 or NONFOREST SAMPLING STATUS = 1 and NONFOREST CONDITION CLASS STATUS = 2
DISTURBANCE YEAR 2	+/- 1 year for 5-year measurement cycles +/ 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	When DISTURBANCE 2 > 00
DISTURBANCE 3	No errors	00; 10-12; 20-22; 30-32;40-46; 50-54; 60; 70; 80; 90-95	When CONDITION CLASS STATUS = 1 or NONFOREST SAMPLING STATUS = 1 and NONFOREST CONDITION CLASS STATUS = 2
DISTURBANCE YEAR 3	+/- 1 year for 5-year measurement cycles +/ 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	When DISTURBANCE 3 > 00
TREATMENT 1	No errors	00, 10, 20, 30, 40, 50	When CONDITION CLASS STATUS = 1
TREATMENT YEAR 1	+/- 1 year for 5-year measurement cycles +/- 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time	When TREATMENT 1 > 00
TREATMENT 2	No errors	00, 10, 20, 30, 40, 50	When CONDITION CLASS STATUS = 1
TREATMENT YEAR 2	+/- 1 year for 5-year measurement cycles +/- 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time	When TREATMENT 2 > 00
TREATMENT 3	No errors	00, 10, 20, 30, 40, 50	When CONDITION CLASS STATUS = 1
TREATMENT YEAR 3	+/- 1 year for 5-year measurement cycles +/- 2 years for >5-year measurement cycles	Since the previous plot visit, or the past 5 years for plots visited for the first time	When TREATMENT 3 > 00

Variable Name	Tolerance	Values	When Collected
PHYSIOGRAPHIC CLASS	No errors	xeric: 11, 12, 13, 19 mesic: 21, 22, 23, 24, 25, 29 hydric: 31, 32, 33, 34, 35, 39	When CONDITION CLASS STATUS = 1 or NONFOREST SAMPLING STATUS = 1 and NONFOREST CONDITION CLASS STATUS = 2
COVER CLASS	No errors	01-05; 08-10	All condition classes
PRESENT NONFOREST LAND USE	No errors	10-17; 20; 30-34; 40, 41, 42, 43, 45	CONDITION CLASS STATUS = 2
RM LAND USE	No errors	1-4	All accessible forest land and nonforest condition classes (CONDITION CLASS STATUS = 1 and 2)
RM PERCENT BARE GROUND	+/- 10%	0-99	CONDITION CLASS STATUS = 1
CANOPY COVER SAMPLE METHOD	None	1-4	CONDITION CLASS STATUS = 1, 2, or 5
RM CROWN COVER	+/- 10%	0-99	CONDITION CLASS STATUS = 1
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	00-99 (where 99 = 99-100)	CONDITION CLASS STATUS = 1, 2, or 5
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	00-99 (where 99 = 99-100)	CONDITION CLASS STATUS = 1, 2, or 5
CURRENT AFFORESTATION CODE	No errors	0, 1	CONDITION CLASS STATUS = 1 or 2
PREVIOUS AFFORESTATION CODE	No errors	0, 1	When SAMPLE KIND = 2 and CONDITION CLASS STATUS = 1 or 2
TOTAL STEMS	10%	00000-99999	CURRENT AFFORESTATION CODE = 1 or PREVIOUS AFFORESTATION CODE = 1
CHAINING CODE	No errors	0, 1	When CONDITION CLASS STATUS = 1 or 2
RM CONDITION STATUS CHANGE	No errors	1-4	SAMPLE KIND 2; CONDITION CLASS CHANGE =1

Variable Name	Tolerance	Values	When Collected
CONDITION FUELBED TYPE (OPTIONAL)	*+/- 1 class within a type*	*GR1, GR2, GR3, GR4, GR5, GR6, GR7, GR8, GR9, GS1, GS2, GS3, GS4, SB1, SB2, SB3, SB4, SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, TL1, TL2, TL3, TL4, TL5, TL6, TL7, TL8, TL9, TU1, TU2, TU3, TU4, TU5, NB1, NB2, NB3, NB8, NB9*	*All conditions where DWM SAMPLING STATUS >0*
Subplot Information			
SUBPLOT NUMBER	No errors	1, 2, 3, 4	All subplots
SUBPLOT/MACROPLOT STATUS	No errors	1, 2, 3, 4	All subplots
SUBPLOT NONSAMPLED REASON	No errors	01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11	When SUBPLOT/MACROPLOT STATUS = 3
NONFOREST SUBPLOT/ MACROPLOT STATUS	No errors	1, 2, 3	When NONFOREST SAMPLING STATUS = 1 and SUBPLOT/MACROPLOT STATUS = 2
NONFOREST SUBPLOT/ MACROPLOT NONSAMPLED REASON	No errors	02, 03, 04, 10	When NONFOREST SAMPLING STATUS = 1 and SUBPLOT/MACROPLOT STATUS = 2 and NONFOREST SUBPLOT/MACROPLOT STATUS = 3
SUBPLOT CENTER CONDITION	No errors	1 to 9	All subplots
MICROPLOT CENTER CONDITION	No errors	1 to 9	All microplots
SUBPLOT SLOPE	+/- 10 %	000 to 155	When SUBPLOT/MACROPLOT STATUS = 1 or NONFOREST SUBPLOT/ MACROPLOT STATUS = 1
SUBPLOT ASPECT	+/- 10 degrees	000 to 360	When SUBPLOT/MACROPLOT STATUS = 1 or NONFOREST SUBPLOT/ MACROPLOT STATUS = 1
SNOW/WATER DEPTH	+/- 0.5 ft.	0.0 to 9.9	When SUBPLOT/MACROPLOT STATUS = 1 or NONFOREST SUBPLOT/ MACROPLOT STATUS = 1)
SUBPLOT/ MACROPLOT CONDITION LIST	No errors	1000 to 9876	All plots
RM ROOT DISEASE SEVERITY RATING	No errors	0-9	When SUBPLOT/MACROPLOT STATUS = 1 or NONFOREST SUBPLOT/ MACROPLOT STATUS = 1
ACI GROUND SURFACE COVER TRANSECTS	Transect Azimuth: ± 2 degrees Number of Hits per category: ± 10 percent		

Variable Name	Tolerance	Values	When Collected
P2 VEG SUBPLOT SAMPLE STATUS	*No errors*	*1, 2*	*When P2 VEGETATION SAMPLING STATUS=1 and at least one accessible forest land condition (CONDITION CLASS STATUS = 1) exists within the 24-foot radius subplot, or P2 VEGETATION SAMPLING STATUS=2 and at least one accessible forest condition or measurable nonforest condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) exists within the 24-foot radius subplot.*
VEGETATION NONSAMPLED REASON	*No errors*	*04, 05, 10*	*On all subplots where P2 VEG SUBPLOT SAMPLE STATUS = 2*
VEGETATION SUBPLOT NOTES	*N/A*	*English language words, phrases, and numbers*	*VEGETATION NONSAMPLED REASON = 10 or as needed*
INVASIVE PLANT SUBPLOT SAMPLE STATUS	*No errors*	*1, 2, 3*	*On all subplots where invasive species are being sampled on accessible forest land (INVASIVE PLANT SAMPLING STATUS=1 and at least one accessible forest land condition (CONDITION CLASS STATUS = 1) exists within the 24-foot radius subplot, or invasive species are being sampled on all accessible land conditions (INVASIVE PLANT SAMPLING STATUS=2) and at least one accessible forest condition or measurable nonforest condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) exists within the 24-foot radius subplot*
INVASIVE PLANT NONSAMPLED REASON	*No errors*	*4, 5, 10*	*On all subplots where INVASIVE PLANT SUBPLOT SAMPLE STATUS = 3*
INVASIVE PLANT DATA NOTES	*N/A*	*English language words, phrases, and numbers*	*INVASIVE PLANT NONSAMPLED REASON=10 or as needed*
Boundary Data			
SUBPLOT NUMBER	No errors	1, 2, 3 4	All boundaries
PLOT TYPE	No errors	1, 2, 3, 4	All boundaries
BOUNDARY CHANGE	No errors	0, 1, 2, 3	SAMPLE KIND = 2, All boundaries
CONTRASTING CONDITION	No errors	1 to 9	All boundaries
LEFT AZIMUTH	+/- 10 degrees	001 to 360	All boundaries
CORNER AZIMUTH	+/- 10 degrees	000 to 360	All boundaries
CORNER DISTANCE	+/- 1 ft.	microplot: 001 to 007 (6.8 ft.. actual limiting distance). subplot:001 to 024. macroplot: 001 to 059 (58.9 ft.. actual limiting distance). hectare: 001 to 185	All boundaries when CORNER AZIMUTH > 000

Variable Name	Tolerance	Values	When Collected
RIGHT AZIMUTH	+/- 10 degrees	001 to 360	All boundaries
Tree and Sapling Data			
SUBPLOT NUMBER	No errors	1, 2, 3, 4	All tree records
TREE RECORD NUMBER	No errors	000, 001 to 999	All tree records
CONDITION CLASS NUMBER	No errors	1 to 9	All tree records
AZIMUTH	+/- 10 degrees	001 to 360	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
HORIZONTAL DISTANCE	Microplot:+/- 0.2 ft.; Microplot woodland species: +/- 0.4 ft.; Subplot: +/- 1.0 ft. from 0.1 to 23.0 ft.; Subplot: +/-0.2 ft. from 23.1 to 24.0 ft.; Subplot multi-stemmed woodland species: +/- 2.0 ft.; Annular plot: +/- 3.0 ft. from 24.0 to 55.9 ft.; Annular plot: +/- 1.0 ft. from 55.9 to 58.9 ft.; Annular plot woodland species: +/- 6.0 ft.	Microplot: 00.1 to 06.8. Subplot: 00.1 to 24.0. Annular plot: 24.1 to 58.9	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
PREVIOUS TREE STATUS	No errors	1, 2	On SAMPLE KIND = 2, all previously tallied trees ≥ 1.0 inch DBH
PRESENT TREE STATUS	No errors	0, 1, 2, 3	All new live and standing dead tally trees ≥ 1.0 inch DBH/DRC. On remeasurement plots, all previously tallied trees
RECONCILE	No errors	1 to 4: valid for new trees on the plot; 5 to 9: valid for remeasured trees that no longer qualify as tally	On SAMPLE KIND = 2; all new live and standing dead tally trees and saplings ≥ 1.0 inch DBH/DRC (PRESENT TREE STATUS = 1 or 2 and no PREVIOUS TREE STATUS) and all no status trees (PRESENT TREE STATUS = 0)
STANDING DEAD	No errors	0, 1	SAMPLE KIND = 2 only: All dead tally trees (PRESENT TREE STATUS = 2)
MORTALITY	No errors	0, 1	All standing (**RM** and down) dead trees 1.0 inch 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** Core Optional in WY only.
SPECIES	No errors	Appendix 3	All tree records
DIAMETER	+/- 0.1 inch per 20.0 inch increment of measured diameter on all live trees and standing dead trees with DECAY CLASS = 1, 2; +/-1.0 inch per 20.0 inch increment of measured diameter on standing dead trees with DECAY CLASS = 3, 4, 5; For woodland species: +/- 0.2 inch per stem	001.0 to 999.9	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC

Variable Name	Tolerance	Values	When Collected
DRC STEM DIAMETER	+/- 0.2 inch per stem	001.0 to 999.9	All stems on woodland tree species that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point
DRC STEM STATUS	No errors	1, 2	All stems on woodland tree species that are at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point
PAST NUMBER OF STEMS	No errors	01 to 99	Value is preprinted for SAMPLE KIND = 2 locations
CURRENT NUMBER OF STEMS	No errors	01 to 99	For tallied woodland species with at least one stem 1.0 inch in diameter or larger; includes woodland species tallied on the microplot
DIAMETER CHECK	No errors	0, 1, 2	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
ROTTEN / MISSING CULL*	+/- 10%	00 to 99	CORE: All live tally trees ≥ 5.0 in DBH/DRC. CORE OPTIONAL: All live and standing dead tally trees ≥ 5.0 in DBH/DRC
TOTAL LENGTH	+/- 10% of true length	001 to 400	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
RM PAST TOTAL TREE LENGTH	No errors	001-400	Verify for remeasure trees ≥ 1.0 inch DBH/DRC
RM ABNORMAL TERMI-NATION	No errors	0, 1	All standing trees
ACTUAL LENGTH	+/- 10% of true length	001 to 400	All live and standing dead tally trees (with broken or missing tops) ≥1.0 inch DBH/DRC
RM PAST ACTUAL TREE LENGTH	No errors	001-400	Verify for remeasure trees ≥ 1.0 inch DBH/DRC
LENGTH METHOD	No errors	1,2, 3	All live and standing dead tally trees ≥ 1.0 inch DBH/DRC
CROWN CLASS	No errors	1, 2, 3, 4, 5	All live tally trees ≥ 1.0 inch DBH/DRC
UNCOMPACTED LIVE CROWN RATIO*	+/- 10%	00 to 99	Phase 2 CORE OPTIONAL: All live tally trees ≥ 5.0 inches DBH/DRC. Phase 3 CORE: All live tally trees ≥ 1.0 inch DBH/DRC
COMPACTED CROWN RATIO	+/- 10%	00 to 99	All live tally trees ≥ 1.0 inch DBH/DRC
DAMAGE AGENT 1*	No errors	See Appendix 11	CORE: All live tally trees ≥ 5.0 inches DBH/DRC. CORE OPTIONAL: All live tally trees ≥ 1.0 inch DBH/DRC
DAMAGE AGENT 2*	No errors	See Appendix 11	CORE: All live tally trees ≥ 5.0 inches DBH/DRC. CORE OPTIONAL: All live tally trees ≥ 1.0 inch DBH/DRC
DAMAGE AGENT 3*	No errors	See Appendix 11	CORE: All live tally trees ≥ 5.0 inches DBH/DRC. CORE OPTIONAL: All live tally trees ≥ 1.0 inch DBH/DRC
CAUSE OF DEATH*	No errors	10, 20, 30, 40, 50, 60, 70, 80	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

Variable Name	Tolerance	Values	When Collected
MORTALITY YEAR	+/- 1year for 5-year measure. cycles +/- 2years for > 5-year measure. cycles	1994 or higher	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.
DECAY CLASS	+/- 1 class	1, 2, 3, 4, 5	All standing dead tally trees ≥ 1.0 inch DBH/DRC
LENGTH TO DIAMETER MEASUREMENT POINT	*+/- 0.2 ft.*	*00.1 – 15.0*	*All live and standing dead tally trees (except woodland species) ≥ 1.0 inch DBH*
RM PERCENT VOLUME MISSING TOP	±5% for total deductions <20%, and ±10% for total deductions >20	00-99	All tally trees ≥5.0 inches in diameter, missing a portion of the merchantable top (e.g. missing a portion of the top with a DOB ≥4.0 inches).
ROUGH CULL	**RM** Not collected in RMRS		
RM SOUND DEAD	±5% for deductions <20%. ±10% for deductions >20% for standing trees. ± 20% for down dead trees	00-99	All tally trees ≥ 5.0 inches diameter
RM FORM DEFECT	±5% for deductions <20%. ±10% for deductions >20% for standing trees. ± 20% for down dead trees	00-99	All live tally timber species ≥9.0 inches diameter softwoods and ≥11.0 inches diameter hardwoods. FORM DEFECT is not recorded on woodland species.
RM PAST TREE CLASS	No errors	1-6	Verify for remeasure trees ≥1.0 inch DBH/DRC
RM CURRENT TREE CLASS	No errors	1-6	All tally trees ≥1.0 inch and nontallied site trees, including new trees ≥1.0 in DBH/DRC on the formerly centered microplot
RM RADIAL GROWTH/ AGE CODE	No errors	0-5	Tally tree species ≥ 1.0 inch DBH/DRC
RM RADIAL GROWTH	+/- 1	00-99	All tally trees where RADIAL GROWTH and/or TREE AGE is collected
RM TREE AGE	+/- 10%	001-999	All tally trees where RADIAL GROWTH and/or TREE AGE is collected
RM RADIAL GROWTH AND TREE AGE CHECK	No errors	0-3	All tally trees where RADIAL GROWTH and/or TREE AGE is collected
DWARF MISTLETOE CLASS	*+/- 1 class*	*0 to 6*	*CORE OPTIONAL: All live conifer (except juniper) tally trees ≥ 1.0 inch DBH/DRC*
TREE NOTES	N/A	English, alpha-numeric	All trees
Seedling Data			
SUBPLOT NUMBER	No errors	1, 2, 3, 4	All counts of seedlings
SPECIES	No errors	Appendix 3	All counts of seedlings
CONDITION CLASS NUMBER	No errors	1-9	All counts of seedlings
SEEDLING COUNT	No errors for 5 or less per species. +/- 20% over a count of 5	001-999	Each accessible forest land condition class on each microplot
RM COUNT CHECK	No errors	0, 1	Any time seedlings are recorded

Variable Name	Tolerance	Values	When Collected
RM SEEDLING AGE	No errors	0, 1	All seedling count records
RM TOTAL SEEDLING AGE	+/- 5%	1-999	When SEEDLING AGE = 1
Site Tree Information			
RM TREE RECORD NUMBER	No errors	000, 001 to 999	All site trees
CONDITION CLASS LIST	No errors	1000 to 9876	All site trees
SPECIES	No errors	See code list in text	All site trees
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	001.0 to 999.9	All site trees
SITE TREE LENGTH	+/- 10% of true length	005 to 999	All site trees
RM SITE TREE	No errors	1,2	All site trees
TREE AGE AT DIAMETER	+/- 5 years	001 to 999	All site trees
SITE TREE NOTES	N/A	English, language words, phrases and numbers	All site trees as necessary
SUBPLOT NUMBER	*No errors*	*1, 2, 3, 4*	*All site trees*
AZIMUTH	*+/- 10 degrees*	*001 to 360*	*All site trees*
HORIZONTAL DISTANCE	*+/-5 ft.*	*000.1 to 200.0*	*All site trees*
Phase 2 (P2) Vegetation Profile			
SUBPLOT NUMBER	*No errors*	*1,2 ,3, 4*	*On all subplots where P2 Vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)*
CONDITION CLASS NUMBER	*No errors*	*1 to 9*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS =1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*

Variable Name	Tolerance	Values	When Collected
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
SHRUB, SUBSHRUB, 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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
SHRUB, SUBSHRUB, 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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*

Variable Name	Tolerance	Values	When Collected
SHRUB, SUBSHRUB, 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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
SHRUB, SUBSHRUB, 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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
SHRUB, SUBSHRUB, 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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*

Variable Name	Tolerance	Values	When Collected
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
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%*	*000-100*	*Any accessible measured land condition (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) when P2 vegetation is being sampled on the subplot (P2 VEG SUBPLOT SAMPLE STATUS = 1)*
SPECIES GROWTH HABIT	*No errors*	*SD, SH, FB, GR, LT*	*LEVEL OF DETAIL = 2 or 3, and for each species recorded*
SPECIES CODE	*No errors*	*Accepted NRCS species code when the species is known, or an accepted NRCS genus or unknown code when the species is not known*	*LEVEL OF DETAIL = 2 or 3 and species total aerial canopy cover on the full subplot and within a SPECIES GROWTH HABIT is 3% or greater.*
UNIQUE SPECIES NUMBER	*No errors*	*1-99, assigned in sequential numbers*	*All species recorded*
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%*	*001-100*	*For each plant species present on the subplot with total aerial canopy cover greater than or equal to 3% within a SPECIES GROWTH HABIT. A plant species is defined as a unique SPECIES CODE and UNIQUE SPECIES NUMBER pair.*
SPECIES VEGETATION LAYER	*No errors*	*1, 2, 3, 4*	*For each species recorded*
SPECIMEN OFFICIALLY COLLECTED	*No errors*	*0, 1*	*All species recorded*
RM *Community Description for Specimen Label*	*No errors*	*English language words, phrases, and numbers*	*When SPECIMEN OFFICIALLY COLLECTED = 1*
SPECIMEN LABEL NUMBER	*No errors*	*1 to 99999, as pre-printed and assigned by region or auto-generated in the PDR*	*SPECIMEN OFFICIALLY COLLECTED = 1*
P2 SPECIMEN NOT COLLECTED REASON CODE	*No errors*	*01, 02, 03, 04, 05, 06, 07, 10*	*An unknown code or genus code is entered and SPECIMEN OFFICIALLY COLLECTED = 0*
VEGETATION SPECIES NOTES	*N/A*	*English language words, phrases, and numbers*	*As needed*

Variable Name	Tolerance	Values	When Collected
Invasive Plants			
SUBPLOT NUMBER	*No errors*	*1, 2, 3, 4*	*On all subplots where INVASIVE PLANT SAMPLING STATUS = 1 or 2*
CONDITION CLASS NUMBER	*No errors*	*1-9*	*Any accessible measured land condition within subplots (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS =2) when invasive plants are being sampled on the subplot (INVASIVE PLANT SUBPLOT SAMPLE STATUS=1 or 2)*
SPECIES CODE	*No errors*	*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.*	*Any accessible measured land condition within subplots (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS =2) when invasive plants are being sampled on the subplot (INVASIVE PLANT SUBPLOT SAMPLE STATUS=1 or 2)*
UNIQUE SPECIES NUMBER	*No errors*	*1-99, assigned in sequential numbers*	*All species records*
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%*	*001-100*	*All species records*
INVASIVE SPECIMEN COLLECTED	*No errors*	*0, 1*	*All species records when INVASIVE PLANT SPECIMEN COLLECTION RULE = 1*
SPECIMEN LABEL NUMBER	*No errors*	*1 to 99999, as pre-printed and assigned by FIA unit*	*Where INVASIVE SPECIMEN COLLECTED=1*
INVASIVE PLANT NOTES	*N/A*	*English language words, phrases, and numbers*	*Required for each record with an unknown code and SPECIMEN LABEL NUMBER.*
Down Woody Materials			
SUBPLOT NUMBER	*No errors*	*1, 2, 3, 4*	*All transect segments on plots where DWM SAMPLING STATUS >0*
TRANSECT (BASE)	*No errors*	*Subplot 1: 090, 270, 180* Subplot 2: 360, 180, 270* Subplot 3: 135, 315, 225* Subplot 4: 045, 225, 315* *extra optional transect*	*All transect segments where DWM SAMPLING STATUS > 0*
SEGMENT CONDITION CLASS NUMBER (BASE)	*No errors*	*1 to 9*	*All transect segments where DWM SAMPLING STATUS >0*

Variable Name	Tolerance	Values	When Collected
SEGMENT BEGINNING DISTANCE (BASE)	*+/- 1 ft.*	*00.0 to 58.9*	*All transect segments where DWM SAMPLING STATUS >0*
SEGMENT ENDING DISTANCE (BASE)	*+/- 1 ft.*	*00.1 to 58.9*	*All transect segments where DWM SAMPLING STATUS >0*
DWM TRANSECT SEG-MENT SAMPLE STATUS (BASE)	*No errors*	*0, 1*	*All transect segments where DWM SAMPLING STATUS >0*
DWM TRANSECT SEG-MENT NONSAMPLED REASON (BASE)	*No errors*	*04, 05,10*	*All transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 0*
SUBPLOT NUMBER (BASE)	*No errors*	*1, 2, 3, 4*	*All tally pieces in CONDITION CLASS STATUS = 1 OR NONFOREST CONDITION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
TRANSECT (BASE)	*No errors*	*Subplot 1: 090, 270, 180* Subplot 2: 360, 180, 270* Subplot 3: 135, 315, 225* Subplot 4: 045, 225, 315* *extra optional transect*	*All tally pieces where DWM TRAN-SECT SAMPLE STATUS = 1*
CWD CONDITION CLASS (BASE)	*No errors*	*1 to 9*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST C0NDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PIECE ON SUBPLOT OR ANNULAR PLOT? (BASE)	**RM** *not collected in RMRS*		
*CWD HORIZONTAL DISTANCE (WILDLIFE OPTION)**	**RM** *not collected in RMRS*		
CWD DECAY CLASS (BASE)	*+/- 1 class*	*1, 2, 3, 4, 5*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CONDI-TION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
SPECIES (BASE)	*No errors*	*See appen-dix 3*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CONDI-TION CLASS STATUS = 2 where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and CWD DECAY CLASS = 1 to 4*

Variable Name	Tolerance	Values	When Collected
DIAMETER AT POINT OF INTERSECTION (BASE)	*Pieces <20.0 inches diameter: +/- 1 inch for decay class 1-4, +/- 2 inches for decay class 5. Pieces > 20.0 inches diameter (decay classes 1-4): +/- 2 inches for each 20-inch increment >20.0 inches. Pieces > 20.0 inches diameter (decay class 5): +/- 3 inches for each 20-inch increment above 20.0 inches*	*003 to 200*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
DIAMETER OF HOLLOW AT POINT OF INTER-SECTION (BASE)	*Pieces < 20.0 inches diameter: +/- 1 inch. Pieces > 20.0 inches di-ameter: +/- 2 inches for each 20-inch increment above 20.0 inches*	*000, 001 to 200*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CON-DITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1 and CWD DECAY CLASS = 1 to 4*
DIAMETER AT THE SMALL END (WILDLIFE OPTION)	**RM** *not collected in RMRS*		
DIAMETER AT THE LARGE END (WILDLIFE OPTION)	**RM** *not collected in RMRS*		
CWD LENGTH >= 3 FEET (BASE)	*+/- 20%*	*1, 2*	*All tally pieces >0.5 foot long, where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1*
CWD TOTAL LENGTH (WILDLIFE OPTION)	**RM** *not collected in RMRS*		
IS THE PIECE HOLLOW? (OPTIONAL)	*No errors*	*0, 1*	*All tally pieces in CONDITION CLASS STATUS = 1 or NONFOREST CON-DITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1 and CWD DECAY CLASS = 1 to 4 and CWD LENGTH >=3 FEET = 1*
PIECE INCLINATION (OPTIONAL)	**RM** *not collected in RMRS*		
CWD HISTORY (OP-TIONAL)	**RM** *not collected in RMRS*		
PERCENT OF LOG CHARRED BY FIRE (OPTIONAL)	**RM** *not collected in RMRS*		
LARGE END DIAMETER CLASS (OPTIONAL)	*No errors*	*1, 2, 3, 4, 5, 6*	*All tally pieces where DWM TRAN-SECT SEGMENT SAMPLE STATUS = 1 and CWD DECAY CLASS = 1 to 4*
PILE SUBPLOT NUM-BER (BASE)	*No errors*	*1, 2, 3, 4*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*

Variable Name	Tolerance	Values	When Collected
PILE TRANSECT (BASE)	*No errors*	*Subplot 1: 090, 270, 180** *Subplot 2: 360, 180, 270** *Subplot 3: 135, 315, 225** *Subplot 4: 045, 225, 315** **extra optional transect*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PILE CONDITION CLASS NUMBER (BASE)	*No errors*	*1 to 9*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PILE BEGINNING DIS-TANCE (BASE)	*+/- 10 %*	*00.0 to 58.8*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PILE ENDING DISTANCE (BASE)	*+/- 10%*	*00.1 to 58.9*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
COMPACTED HEIGHT OF CWD IN PILE (BASE)	*+/- 10%*	*1 to 99*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PILE DECAY CLASS (BASE)	*+/- 1 decay class*	*1, 2, 3, 4, 5*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
PILE SPECIES (BASE)	*No errors*	*See appen-dix 3*	*All sampled residue piles on transects in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2, where DWM TRANSECT SEGMENT SAMPLE STATUS = 1 and PILE DECAY CLASS = 1 to 4*
FWD SUBPLOT NUM-BER (BASE)	*No errors*	*1, 2, 3, 4*	*All FWD transect segments where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1*
FWD TRANSECT (BASE)	*No errors*	*Subplot 1: 270* *Subplot 2: 360* *Subplot 3: 135* *Subplot 4: 225*	*All FWD transect segments where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1*
FWD CONDITION CLASS NUMBER (BASE)	*No errors*	*1 to 9*	*All FWD transect segments where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1*
FWD TRANSECT SEG-MENT SAMPLE STATUS (BASE)	*No errors*	*0, 1*	*All FWD transect segments where DWM TRANSECT SEGMENT SAM-PLE STATUS = 1*
FWD TRANSECT SEG-MENT NONSAMPLED REASON (BASE)	*No errors*	*04, 05, 10*	*All FWD transect segments where FWD TRANSECT SEGMENT SAMPLE STATUS = 0*

Variable Name	Tolerance	Values	When Collected
SMALL FWD COUNT (BASE)	*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*	*000 to 999*	*All FWD transect segments in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1*
MEDIUM FWD COUNT (BASE)	*+/- 20% of the total count for the transect*	*000 to 999*	*All FWD transect segments in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1*
LARGE FWD COUNT (BASE)	*+/- 20% of the total count for the transect*	*000 to 500*	*All FWD transect segments in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1*
HIGH COUNT REASON (BASE)	*No errors*	*1, 2, 3, 4, 5*	*All FWD transect segments in CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2 where FWD TRANSECT SEGMENT SAMPLE STATUS = 1 and (SMALL FWD COUNT ≥ 100 or MEDIUM FWD COUNT ≥100 or LARGE FWD COUNT ≥100*
DUFF/LITTER SUBPLOT NUMBER (BASE)	*No errors*	*1, 2, 3, 4*	*All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
DUFF/LITTER TRANSECT (BASE)	*No errors*	*Subplot 1: 090, 270 Subplot 2: 360, 180 Subplot 3: 135, 315 Subplot 4: 045, 225*	*All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
DUFF/LITTER CONDITION CLASS NUMBER (BASE)	*No errors*	*1 to 9*	*All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
DUFF/LITTER SAMPLE STATUS (BASE)	*No errors*	*0, 1*	*All duff/litter transects where DWM TRANSECT SEGMENT SAMPLE STATUS = 1*
DUFF/LITTER NONSAMPLED REASON (BASE)	*No errors*	*04, 05, 10*	*All duff/litter transects where DUFF/LITTER SAMPLE STATUS = 0*
DUFF DEPTH (BASE)	*+/- 0.5 inch*	*00.0 to 24.0*	*All duff/litter transects in measureable conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) where DUFF/LITTER SAMPLE STATUS = 1*
LITTER DEPTH (BASE)	*+/- 0.5 inch*	*00.0 to 99.9*	*All duff/litter transects in measureable conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) where DUFF/LITTER SAMPLE STATUS = 1*
DUFF AND LITTER METHOD (BASE)	*No errors*	*1, 2, 3, 4*	*All duff/litter transects in measureable conditions (CONDITION CLASS STATUS = 1 or NONFOREST CONDITION CLASS STATUS = 2) where DUFF/LITTER SAMPLE STATUS*

Variable Name	Tolerance	Values	When Collected
RM Field Location Reference Items			
RM SUBPLOT REFER-ENCED	No errors	1-4	All plots and when PLOT MONUMENT = 2, 3, or 4
RM AZIMUTH	+/- 2 degrees	1-360	MONUMENT TYPE = 2, 3, or 4
RM HORIZONTAL DISTANCE	Distance ±6 feet per 100 feet of transect, maximum tolerance of 30 feet	000.1-999.9	MONUMENT TYPE = 2
RM SLOPE DISTANCE	When MONUMENT TYPE = 2: ±6 feet per 100 feet of transect, maximum tolerance of 30 feet When MONUMENT TYPE = 3 or 4: ±0.2 feet	000.1-999.9	MONUMENT TYPE = 2, 3, or 4
RM REFERENCE TYPE	No errors	1-2	MONUMENT TYPE = 2, 3, or 4
RM SPECIES	No errors	Appendix 3	REFERENCE TYPE = 1
RM OTHER REFER-ENCE	No errors	Letters and numbers	REFERENCE TYPE = 2
RM DIAMETER	± 0.2 in per 20.0 in increment of measured diameter	00.0-99.9	When MONUMENT TYPE = 2, 3, or 4
RM GPS distance from the Truck to the PC	+/- .2 miles		All field visited plots
RM OWNER INFOR-MATION	No errors		All field visited plots

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			
	Standing dead 1.0+ DBH/DRC	-	2		Null – Office inserts code 1	Core optional
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/ DRC Note: this live tally tree should be referenced with a new distance and azimuth from the subplot center.	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 Note: this live sapling should be referenced with a new distance and azimuth from the microplot center.	1	1			
Live 1.0+	Live but land no longer qualifies as forest	1	1			
Live 1.0+ DBH/DRC	Standing dead 5.0+ DBH/DRC	1	2		1	10-80
Live 5.0+ DBH/DRC	Down dead 5.0+ DBH/DRC	1	2		0	10-80
Live 1.0-4.9 DBH/ DRC on microplot	Dead 5.0+ DBH/ DRC (standing or down) Note: if standing, this dead tally tree should be referenced with a new distance and azimuth from the subplot center.	1	2		0 or 1	10-80

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
RM Live 1.0-4.9” DBH/DRC	Dead tree shrank <1,0”	1	2		0	10-80
Live 1.0+ DBH/DRC	Cruiser unable to locate tree due to a weather, 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 1.0 + DBH/DRC	Dead (standing or down) 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 1.0+ DBH/DRC	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+ DBH/DRC	2	2		0	
Dead 5.0+ DBH/ DRC	Cruiser is unable to locate tree due to a weather, geologic (such as landslide), or fire event & assume it is down dead or you can see tree and it is dead and off the plot	2	2		0	
Dead 5.0+ DBH/ DRC	Tree removed (cut and hauled away)	2	3			
Dead 5.0+ DBH/ DRC	Tree shrank <5.0 but ≥ 1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot)	2	2		0	

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
RM Live 5.0+ DBH/ DRC	Dead tree shrank <5.0"	1	2		0	10-80
Dead 5.0+ DBH/ DRC	Tree shrank <5.0 but ≥ 1.0 (e.g., bark loss) and is standing dead located on microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center	2	2		1	
Live 5.0+ DBH/DRC	Tree shrank <5.0 and live, NOT on microplot	1	0	5		
Live 5.0+ DBH/DRC	(**RM** Live) Tree shrank <5.0 but ≥ 1.0 (e.g., bark loss) and is standing dead, located on subplot (not located on microplot)	1	2		0	10-80
Live 5.0+ DBH/DRC	(**RM** Live) Tree shrank <5.0 but ≥ 1.0 (e.g., bark loss) and is standing dead located on microplot. Note: this dead sapling should be referenced with a new distance and azimuth from the microplot center	1	2		1	10-80
Live 1.0-4.9 DBH/ DRC	Tree shrank <1.0 and live	1	0	5		
Live 1.0 – 4.9 DBH/ DRC	Tree shrank <1.0 and dead	1	2		0	10-80
Live 1 inch +	Nonsampled area now	1	0	9		
Dead 5.0+ DBH/ DRC	No longer a tally soecies	2	0	8		
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		

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
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/microplot 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 1.0+ DBH/DRC	Nonsampled area now	1	0	9		
Dead 5.0+ DBH/ DRC	No longer a tally species	2	0	8		
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 5.0+ DBH/ DRC	Nonsampled area now	2	0	9		
Missed live	Live 1.0+ DBH/ DRC	-	1	3		
< 5.0 live DBH/DRC	5.0+ DBH/DRC live (not on the microplot)	-	1	1		
< 1.0 live DBH/DRC	1.0-4.9 DBH/ DRC live (on the microplot)	-	1	1		
< 1.0 live DBH/DRC	Standing dead 1.0-4.9 DBH/DRC on microplot		2	1	1	10-80
< 1.0 live DBH/DRC	5.0+ DBH/ DRC live (on the microplot) (Through growth)	-	1	2		
Nonsampled area before	Live 1.0 + DBH/ DRC	-	1	3		
Nonforest before	Forest now, Live 1.0+ DBH/DRC	-	1	1		
Missed dead	Dead 1.0+ DBH/ DRC	-	2	4	1	

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Missed live	Dead 1.0+ DBH/ DRC	-	2	3	1	10-80
< 5.0 live DBH/DRC	5.0+ DBH/DRC dead (standing, **RM** or down, not on the microplot)	-	2	1	0 or 1	10-80
< 5.0 live DBH/DRC	5.0+ DBH/DRC dead (standing or down, on the microplot)	1	2		0 or 1	10-80
Nonsampled area before	Standing Dead 1.0+ DBH/DRC	-	2	3 or 4		10-80
Nonforest before	Forest now, Standing Dead 1.0+ DBH/DRC	-	2	1		10-80

Note: After completion of 1 cycle with the new standing dead sapling protocols, additional tree coding combinations will be applicable.

Appendix 9. Invasive Plant List

To obtain a current invasive plant list, contact the local region for the appropriate list.

Appendix 9. RMRS Invasive Plant List

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Abutilon theophrasti	Velvetleaf	ABTH		X						
Achnatherum brachychaetum	Puna grass	ACBR5	X							
Acroptilon repens	Russian knapweed	ACRE3	X	X	X	X	X	X	X	X
Aegilops cylindrica	Jointed goatgrass	AECY	X	X	X			X		
Alhagi maurorum	Camelthorn	ALMA12	X	X			X	X		
Alternanthera philoxeroides	Alligator weed	ALPH	X							
Ambrosia tomentosa	Skeletonleaf bursage	AMTO3			X					X
Anoda cristata	Crested anoda	ANCR2		X						
Anthemis arvensis	Scentless chamomile	ANAR6		X						
Anthemis cotula	Mayweed chamomile	ANCO2		X			X			
Arctium minus	Burdock	ARMI2		X						X
Artemisia absinthium	Absinthium	ARAB3		X						
Asphodelus fistulosus	Onionweed	ASFI2						X		
Bromus tectorum	Downy brome	BRTE		X						
Capsella bursa-pastoris	Shepherds purse	CABU2		X						
Cardaria chalepensis	Lenspod whitetop	CACH10	X							
Cardaria pubescens	Hairy whitetop	CAPU6	X							X
Cardaria draba	Hoarycress	CADR	X	X	X	X	X	X	X	X
Carduus acanthoides	Plumeless thistle	CAAC	X	X						X
Carduus nutans	Musk thistle	CANU4		X	X		X	X	X	X
Carum carvi	Wild caraway	CACA19		X						
Cenchrus echinatus	Southern sandbur	CEEC	X							
Cenchrus spinifex	Coastal sandbur	CESP4	X							

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Centaurea bieber-steinii	Spotted knapweed	CEBI2	X	X	X	X	X	X	X	
Centaurea calcitrapa	Purple starthistle	CECA2	X				X	X		
Centaurea debeauxii	Meadow knapweed	CEDE5		X	X					
Centaurea iberica	Iberian knap-weed	CEIB	X				X			
Centaurea diffusa	Diffuse knap-weed	CEDI3	X	X	X	X	X	X	X	
Centaurea triumfetti	Squarrose knapweed	CETR8	X	X			X		X	
Centaurea melitensis	Malta starthis-tle	CEME2					X	X		
Centaurea solstitialis	Yellow starthistle	CESO3	X	X	X	X	X	X	X	
Centaurea sulphurea	Sicilian starthistle	CESU	X							
Chondrilla juncea	Rush skeleton-weed	CHJU	X	X	X	X	X			
Cirsium arvense	Canada thistle	CIAR4	X	X	X	X	X	X	X	
Cirsium vulgare	Bull thistle	CIVU		X				X		
Cichorium intybus	Chicory	CIIN		X						
Cicuta maculata	Water hemlock	CIMA2					X			
Clematis orien-talis	Chinese clematis	CLOR		X						
Convolvulus arvensis	Field bind-weed	COAR4	X	X	X	X		X	X	
Conium macu-latum	Poison hemlock	COMA2		X	X		X	X		
Crupina vulgaris	Common crupina	CRVU2		X	X	X	X			
Coronopus squamatus	Creeping watercress	COSQ	X							
Cucumis melo	Dudaim melon	CUME	X							
Cuscuta spp.	Dodder	CUSCU	X							
Cynodon dactylon	Bermudagrass	CYDA							X	
Cyperus escu-lentus	Yellow nut-sedge	CYES		X						
Cynoglossum officinale	Houndstongue	CYOF		X		X	X			

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Cytisus scoparius	Scotch broom	CYSC4			X					
Dipsacus fullonum	Teasel	DIFU2		X				X		
Drymaria arenar-ioides	Alfombrilla	DRAR7	X					X		
Eichhornia azurea	Anchored waterhyacinth	EIAZ2	X							
Eichhornia crassipes	Water hyacinth	EICR	X							
Elaeagnus angustifolia	Russian olive	ELAN		X				X		
Elymus repens	Quackgrass	ELRE4	X	X					X	
Euphorbia cypa-rissias	Cyprus spurge	EUCY2		X						
Euphorbia dentata	Toothed spurge	EUDE4			X					
Euphorbia esula	Leafy spurge	EUES	X	X	X	X	X	X	X	
Euphorbia myrsinites	Myrtle spurge	EUMY2		X						
Euryops multif-idus	Hawk's eye	EUMU	X							
Galega officinalis	Goats rue	GAOF					X			
Halogeton glom-eratus	Halogeton	HAGL	X	X				X		
Helianthus ciliaris	Texes blue-weed	HECI	X							
Hesperis ma-tronalis	Dames rocket	HEMA3		X						
Hibiscus trionum	Flower of an hour	HITR		X						
Hieracium auran-tiacum	Orange hawkweed	HIAU		X	X	X				
Hieracium ceaspi-tosum	Meadow hawkweed	HICA10			X	X				
Hieracium pilosel-loides	Tall hawkweed	HIPI2				X				
Hieracium flori-bundum	Yellow devil hawkweed	HIFL3				X				
Hydrilla verticillata	Hydrilla	HYVE3	X	X			X	X		
Hyoscyamus niger	Black henbane	HYNI		X	X		X	X		

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Hypericum perforatum	St. Johnswort	HYPE		X		X	X			X
Ipomoea spp.	Morninglory	IPOMO	X							
Ipomoea triloba	Three lobed morningglory	IPTR2	X							
Iris pseudacorus	Yelloflag iris	IRPS				X				
Isatis tinctoria	Dyers woad	ISTI		X	X	X	X	X	X	X
Kochia scoparia	Mexican-fire-weed	KOSC		X						
Lepidium latifo-lium	Pepperweed	LELA2		X	X	X	X	X	X	X
Lespedeza cuneata	Chinese lespedeza	LECU		X						
Leucanthemum vulgare	Oxeye daisy	LEVU		X		X				X
Linaria dalmatica	Dalmation toadflax	LIDA	X	X	X	X	X	X		X
Linaria genistifolia	Broomleaf toadflax	LIGE		X						
Linaria vulgaris	Butter and eggs	LIVU2		X	X	X	X	X		X
Lythrum salicaria	Purple loostrife	LYSA2	X	X	X	X	X	X	X	X
Lythrum virgatum	Wandlike loosestrife	LYVI3				X	X			
Medicago poly-morpha	Burclover	MEPO3	X							
Milium vernale	Milium	MIVE3			X					
Myriophyllum spicatum	Eurasian watermilfoil	MYSP2		X	X	X	X	X		
Nardus stricta	Matgrass	NAST3			X					
Nassella tricho-toma	Serrated tussock	NATR3	X							
Onopordum acanthium	Scotch thistle	ONAC	X	X	X		X	X	X	X
Onopordum tauricum	Bull cotton-thistle	ONTA		X						
Orobanche ramosa	Hemp broom-rape	ORRA	X							
Panicum milia-ceum	Wild proso millet	PAMI2		X						
Panicum repens	Torpedo grass	PARE3	X							

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Peganum harmala	African rue	PEHA	X	X			X	X		
Pennisetum glaucum	Pearl millet	PEGL2		X						
Pennisetum ciliare	Bufflegrass	PECI	X							
Portulaca oleracea	Common purslane	POOL	X							
Potentilla recta	Sulfer cinque-foil	PORE5		X		X	X			
Ranunculus acris	Tall buttercup	RAAC3				X				
Rorippa austriaca	Austrian fieldcress	ROAU	X				X			
Salvia aethiopis	Mediterranean sage	SAAE		X			X			
Salvinia molesta	Giant salvinia	SAMO5	X	X			X			
Saponaria officinalis	Bouncybet	SAOF4		X						
Senecio jacobaea	Groundsel	SEJA	X	X	X	X				
Senecio vulgaris	Old-man-in-the-spring	SEVU		X						
Setaria viridis	Green foxtail	SEVI4		X						
Sinapis arvensis	Charlock mustard	SIAR4		X						
Solanum carolin-ense	Carolina horsenettle	SOCA3	X				X			
Solanum elaegni-folium	Silverleaf nightshade	SOEL			X		X			
Solanum nigrum	Black night-shade	SONI		X						
Solanum ros-tratum	Buffalobur	SORO			X					
Solanum physali-folium	Hoe night-shade	SOPH		X						
Solanum viarum	Tropical soda apple	SOVI2	X							
Sorghum almum	Perennial sorghum	SOAL					X		X	
Sorghum halep-ense	Johnsongrass	SOHA		X	X				X	
Sonchus arvensis	Perennial sowthistle	SOAR2	X	X	X		X			X

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Sorghum bicolor	Perennial sweet sudan	SOBI2					X		X	
Sorghum propin-quum	Sorghum	SOPR3					X			
Sphaerophysa salsula	Austrian peaweed	SPSA3		X			X			
Striga spp.	Witchweed	STRIG	X							
Taeniatherum caput-medusae	Medusahead	TACA8		X			X		X	
Tamarix aphylla	Athel saltceder	TAAP						X		
Tamarix parviflora	Smallflower tamarisk	TAPA4		X			X	X		
Tamarix ramosis-sima	Saltceder	TARA		X			X	X		
Tamarix ssp.	Tamarisk	TAMAR2				X		X		X
Tanacetum vulgare	Tansy	TAVU		X		X				X
Trapa natans	Waterchestnut	TRNA	X							
Tribulus terrestris	Puncturevine	TRTE	X	X	X		X			
Tripleurospermum perforata	Scentless false mayweed	TRPE21		X						
Ulmus pumila	Siberian Elm	ULPU						X		
Verbascum blattaria	Moth Mullien	VEBL		X						
Verbascum thapsus	Mullein	VETH		X						
Zygophyllum fabago	Syrian bean-caper	ZYFA			X					

List compiled in 2010 from USDA NRCS Plants Database.

AZ: Plant Services Division. 2005. Prohibited, regulated and restricted noxious weeds (1 May 2006). Arizona Department of Agriculture.

CO: Plant Industry Division. 2003. Rules pertaining to the administration and enforcement of the Colorado Noxious Weed Act (23 January 2006). Colorado Department of Agriculture.

ID: Idaho Department of Agriculture. 2006. Noxious weed rules (24 May 2006). Idaho Department of Agriculture.

MT: Montana Department of Agriculture. 2003. Montana noxious weeds list (24 May 2006). Montana Department of Agriculture.

NV: Nevada Administrative Code. 2003. Control of insects, pests, and noxious weeds (20 October 2003). State of Nevada.

NM: Office of the Director/Secretary. 1998. New Mexico noxious weed list (20 October 2003). New Mexico Department of Agriculture.

UT: Utah Department of Agriculture. 2003. Utah noxious weed act (20 October 2003). Utah Department of Agriculture.

WY: Wyoming Department of Agriculture. 2003. Designated noxious weeds and prohibited noxious weeds (20 October 2003). Wyoming Department

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. you cannot identify quickly and confidently using field guides but are potentially identifiable, or
2. are a new record for the state,

   follow these basic steps:

   1. Assign a valid SPECIES CODE.
   2. Record whether or not a specimen was collected in the appropriate SPECIMEN COLLECTED variable.
   3. When a specimen is collected, enter a SPECIMEN LABEL NUMBER. Place a label with the corresponding label number in the bag with the specimen.
   4. Describe any newly encountered unknown species in the appropriate NOTES variable.
   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 may be issued a set of printed 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

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.

Specimen Label			
State: Ohio	**County:** Lawrence		
Plot:			
Label Number:	21	**Resolved Species Code:**	
Resolved scientific name:			
Resolved by (name):			
Date Collected:	6/22/2005		
Unknown Code:	2GRAM	**Unique Species Nbr:**	7
Field collected scientific name:			
Collected by:	(name or number)		
Community type(s) where found:	bottomland, old stripmine		
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:
Fishlake N.F.
c/o Darin Toone
115 E. 900N
Richfield, UT 84701

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.

Appendix 11. Damage Codes

RM For version 8.0, specific Damage Codes have been moved to 5.20.1 DAMAGE AGENT 1

Appendix 12. Reserved and Administratively Withdrawn Status by Owner and Land Designation

RM note: Due to space limitations Appendix 12 will not be included in this guide.

Appendix 13. Ownership Prefield Procedures

A13.1 Introduction

FIA uses ownership information for multiple purposes. Initially, it is used to identify and contact ownerships and gain access to the land. Ownership variables are important for quantifying what types of ownerships own how much land and among other things, the relative differences among the forests owned by different types of ownerships. FIA's National Woodland Owner uses name and address information to contact landowners and invite them to participate in the ownership survey. This chapter describes the variables and protocols for data related to land ownership collected prior to measurement of field (i.e., P2) variables.

The (core) ownership variables described below are required for the first forested condition encountered on a plot. Ownership information is optional for:

- Other ownerships (private or public) on the plot; and
- Other ownerships associated with the plot – e.g., other ownerships who may need to be contacted in order to gain access to the plot.

It is often difficult to know if a plot has a forested condition before it is visited, so it is often more efficient to collect the ownership information for all plots that are likely to have one or more forested conditions. For remeasured plots, ownership information should be auto-filled from history files, verified using current sources, and then, where necessary, changed/modified. A look-up table containing the most common ownerships in a State should be utilized to expedite and improve ownership data collection.

Rules for entering name and address information:

- As a rule of thumb, enter name and address information as it should appear on a mailing label
- Use upper and lower case letters
- Avoid unnecessary punctuation
- If initials are recorded, leave a space between them (e.g., W W)
- Unless part of an official name (e.g., U S Steel), the only acceptable abbreviations are:
    - o Inc, Co (for company), LLC, LLP, and similar business abbreviations
    - o Mr, Ms, Mrs, …
    - o c/o and attn:
    - o Jr, Sr, II, III, …
- Use numbers for street number, e.g., 3rd Ave not Third Ave
- If there is a PO Box and a street address, record the PO Box information in ADDRESS LINE 1 and the street address in ADDRESS LINE 2 and, if necessary, ADDRESS LINE 3.
- If there is an apartment or suite number, record it at end of the street address (on the same line).

Examples are included in section A13.57.1. (**RM** Examples not included in this guide.)

A13.2 STATE

See Core Field Guide variable 1.1.

A13.3 COUNTY

See Core Field Guide variable 1.2.

A13.4 PLOT NUMBER

See Core Field Guide variable 1.3.

A13.5 INVYEAR

RM Not collected in RMRS

A13.6 OWNERSHIP TYPE

Record whether the ownership information corresponds to an ownership that (likely) owns part or all of the plot (OWNER TYPE = 1) or the information was collected for access purposes (OWNER TYPE = 2).

When collected: All ownerships recorded for a plot
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Ownership information corresponds to a potential plot ownership
2 Ownership information collected for plot access purposes

A13.6.1 OWNERSHIP CONDITION LIST

Record each condition number that is present on the defined owner. If OWNER TYPE = 2, then enter 0000 to indicate information is for plot access purposes and none of the plot falls on this respective owner.

When collected: All OWNER CLASSes on CONDITION CLASS STATUS = 1, 2 and 5 (with the exception of rights-of-way owned by Federal, State, or Local gaovernments)
Field width: 9 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: 0000 to 9876

A13.7 PLOT CENTER OWNER (CORE OPTIONAL)

RM Not collected in RMRS

A13.8 OWNER SHORT NAME

RM Not collected in RMRS

A13.9 AGENCY

Record the name of the public agency that owns the forest land as indicated by public tax records or other data sources. "Care of" (e.g., c/o), "attention" (e.g., attn:), and similar information should be recorded in ATTENTION.

When collected: CORE: All public plot ownerships (OWNER CLASS = 11, 12, 13, 21, 22, 23, 24, 25, 31, 32, or 33 and OWNER TYPE = 1)
CORE OPTIONAL: All public agencies recorded for a plot (OWNER CLASS = 11, 12, 13, 21, 22, 23, 24, 25, 31, 32, or 33 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters

A13.10 COMPANY

Record the name of the company or organization that owns the forest land as indicated by public tax records or other data sources. “Care of” (e.g., c/o), “attention” (e.g., attn:), and similar information should be recorded in ATTENTION.

When collected: CORE: All corporate and other private organization plot ownerships (OWNER CLASS = 41, 42, 43, or 44 and OWNER TYPE = 1)
CORE OPTIONAL: All corporate and other organization ownerships and public agencies recorded for a plot (OWNER CLASS = 41, 42, 43, or 44 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters

A13.11 MANAGEMENT UNIT

If available, record the name of the management unit that owns the forest land as indicated by public tax records or other data sources.

When collected: CORE: All public and private plot ownerships (OWNER TYPE = 1)
CORE OPTIONAL: All public and private ownerships recorded for a plot (OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters

A13.12 NAME

Record the name of the ownership. All of the information available in the public tax records or other sources should be included. The name should be formatted as if one were addressing an envelope. “Care of” (e.g., c/o), “attention” (e.g., attn:), and similar information should be recorded in ATTENTION.
When collected: CORE: All individual and family plot ownerships (OWNER CLASS = 45 and OWNER TYPE = 1)
CORE OPTIONAL: All individual and family ownerships recorded for a plot (OWNER CLASS = 45 and OWNER TYPE ≥ 1)

Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters

A13.13 ATTENTION

If applicable, "care of" (e.g., c/o), "attention" (e.g., attn:), and similar information should be recorded here. If available, job title should be included in this field.

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters

A13.14 ADDRESS LINE 1

Record the first line of the mailing address for the ownership. If there is a PO Box and a street address, record the PO Box information in ADDRESS LINE 1 and the street address in ADDRESS LINE 2 and ADDRESS LINE 3. If there is an apartment or suite number, record it at end of the street address (on the same line).

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters

A13.15 ADDRESS LINE 2

Where applicable, record the second line of the mailing address for the ownership.

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters. Null values are permissible

A13.16 ADDRESS LINE 3

Where applicable, record the third line of the mailing address for the ownership.

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters, numbers, and special characters. Null values are permissible

A13.17 ADDRESS CITY

Record the city of the mailing address for the ownership.

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 100 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters

A13.18 ADDRESS STATE

For ownerships with mailing addresses in the United States (including territories and protectorates), record the state of the mailing address for the ownership.

When collected: CORE: All private plot ownerships with mailing addresses in the United States (OWNER CLASS ≥ 41 and OWNER TYPE = 1 and ADDRESS COUNTRY = “US”)
CORE OPTIONAL: All ownerships recorded for a plot with mailing addresses in the United States (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1 and ADDRESS COUNTRY = “US”)
Field width: 2 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: See section A13.57.2

A13.19 ADDRESS PROVINCE

For ownerships with mailing addresses outside of the United States, record the province, state, or other pertinent geographic division of the mailing address of the ownership.

When collected: CORE: All private plot ownerships with mailing addresses outside of the United States (OWNER CLASS ≥ 41 and OWNER TYPE = 1 and ADDRESS COUNTRY ≠ “US”)
CORE OPTIONAL: All ownerships recorded for a plot with mailing addresses outside of the United States (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1 and ADDRESS COUNTRY ≠ “US”)

Field width: 50 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters

A13.20 ADDRESS POSTAL CODE

Record the postal code of the mailing address for the ownership. Postal codes for US and foreign addresses should be included here.

When collected: CORE: All private plot ownerships with mailing addresses in the United States (OWNER CLASS ≥ 41 and OWNER TYPE = 1 and ADDRESS COUNTRY = “US”)
CORE OPTIONAL: All ownerships recorded for a plot with mailing addresses in the United States (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1 and ADDRESS COUNTRY = “US”)
Field width: 10 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Alphanumeric

A13.21 ADDRESS COUNTRY

Record the two-character code for the country of the mailing address for the ownership. The default value is United States (US).

When collected: CORE: All private plot ownerships (OWNER CLASS ≥ 41 and OWNER TYPE = 1)
CORE OPTIONAL: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 2 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: See section A13.57.3

A13.22 OWNERSHIP PHONE NUMBER 1 (CORE OPTIONAL)

When available, record the primary phone number for the ownership, including area code. If available, record the extension in OWNER PHONE NUMBER 1 EXTENSION. It should be formatted as numbers separated by dashes (e.g., “123-456-7890”).

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 12 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Numbers and the special character ‘-’ (dash). Null values are permissible

A13.23 OWNERSHIP PHONE NUMBER 1 EXTENSION (CORE OPTIONAL)

When available, record the extension associated with the primary phone number for the ownership.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 5 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: Numbers. Null values are permissible

A13.24 OWNERSHIP PHONE NUMBER 1 TYPE (CORE OPTIONAL)

When available, record whether the phone number is a work, home, mobile, or other number.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Work
2 Home
3 Mobile
4 Other

Null values are permissible

A13.25 OWNERSHIP PHONE NUMBER 2 (CORE OPTIONAL)

When available, record the secondary phone number for the ownership, including area code. If available, record the extension in OWNER PHONE NUMBER 2 EXTENSION. It should be formatted as numbers separated by dashes (e.g., “123-456-7890”).

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 12 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Numbers and the special character ‘-‘ (dash). Null values are permissible

A13.26 OWNERSHIP PHONE NUMBER 2 EXTENSION (CORE OPTIONAL)

When available, record the extension associated with the secondary phone number for the ownership.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and

OWNER TYPE ≥ 1)
Field width: 5 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: Numbers. Null values are permissible

A13.27 OWNERSHIP PHONE NUMBER 2 TYPE (CORE OPTIONAL)

When available, record whether the phone number is a work, home, mobile, or other number.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Work
2 Home
3 Mobile
4 Other
Null values are permissible

A13.28 OWNERSHIP E-MAIL ADDRESS (CORE OPTIONAL)

RM Not collected in RMRS

A13.29 DATA SOURCE (CORE OPTIONAL)

RM Not collected in RMRS

A13.30 DATA SOURCE OTHER (CORE OPTIONAL)

RM Not collected in RMRS

A13.31 MERIDIAN (CORE OPTIONAL)

Record the Principal Meridian that, in conjunction with TOWNSHIP, RANGE, SECTION, QUARTER SECTION, QUARTER-QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. This information is only applicable to parts of the United States that use the Public Land Survey System (PLSS) Township-Range-Section (TRS) cadastral system: **RM** note: All the RMRS states use the PLSS / TRS cadastral system.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 2 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: See section A13.57.4

A13.32 TOWNSHIP (CORE OPTIONAL)

Record the Township that, in conjunction with MERIDIAN, RANGE, SECTION, QUARTER SECTION, QUARTER-QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. The information should be recorded as the number followed by a cardinal direction (e.g., 4N). This information is only applicable to parts of the United States that use the TRS cadastral system.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 4 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters and numbers

A13.33 RANGE (CORE OPTIONAL)

Record the Range that, in conjunction with MERIDIAN, TOWNSHIP, SECTION, QUARTER SECTION, QUARTER-QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. The information should be recorded as the number followed by a cardinal direction (e.g., 10W). This information is only applicable to parts of the United States that use the TRS cadastral system.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 4 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Letters and numbers

A13.34 SECTION (CORE OPTIONAL)

Record the Section that, in conjunction with MERIDIAN, TOWNSHIP, RANGE, QUARTER SECTION, QUARTER-QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. This information is only applicable to parts of the United States that use the TRS cadastral system.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 2 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: 01 - 36

A13.35 QUARTER SECTION (CORE OPTIONAL)

Record the Quarter Section that, in conjunction with MERIDIAN, TOWNSHIP, RANGE, SECTION, QUARTER-QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. This information is only applicable to parts of the United States that use the TRS cadastral system. **RM** note: QUARTER SECTION AND QUARTER QUARTER SECTION have been combined into one field “QSECT” for V8.0. Include the dash in the PDR data field.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

NE-NE: North East Quarter of the North East Quarter
NE-NW: North East Quarter of the North West Quarter
NE-SE: North East Quarter of the South East Quarter
NE-SW: North East Quarter of the South West Quarter
NW-NE: North West Quarter of the North East Quarter
NW-NW: North West Quarter of the North West Quarter
NW-SE: North West Quarter of the South East Quarter
NW-SW: North West Quarter of the South West Quarter
SE-NE: South East Quarter of the North East Quarter
SE-NW: South East Quarter of the North West Quarter
SE-SE: South East Quarter of the South East Quarter
SE-SW: South East Quarter of the South West Quarter
SW-NE: South West Quarter of the North East Quarter
SW-NW: South West Quarter of the North West Quarter
SW-SE: South West Quarter of the South East Quarter
SW-SW: South West Quarter of the South West Quarter

A13.36 QUARTER QUARTER SECTION (CORE OPTIONAL)

Record the Section that, in conjunction with MERIDIAN, TOWNSHIP, RANGE, SECTION, QUARTER SECTION, and QUARTER-QUARTER-QUARTER SECTION, can be used to relocate the ownership information. This information is only applicable to parts of the United States that use the TRS cadastral system. See **RM** note in A13.35

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values: See **RM** note in A13.35

A13.37 QUARTER QUARTER QUARTER SECTION (CORE OPTIONAL)

RM Not collected in RMRS

A13.38 MAP NUMBER (CORE OPTIONAL)

RM Not collected in RMRS

A13.39 BLOCK NUMBER (CORE OPTIONAL)

RM Not collected in RMRS

A13.40 PARCEL NUMBER (CORE OPTIONAL)

RM Not collected in RMRS

A13.41 TRACT SIZE (CORE OPTIONAL)

RM Not collected in RMRS

A13.42 TRACT PERCENT FOREST COVER (CORE OPTIONAL)

RM Not collected in RMRS

A13.43 OWNER NOTES

Record any notes that should be conveyed about the ownership and/or ownership data.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers. Null values are permissible

A13.44 OWNERSHIP CONTACT NAME (CORE OPTIONAL)

Record the name of the person spoken to or who otherwise responded.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

A13.45 OWNERSHIP CONTACT ATTEMPT NUMBER (CORE OPTIONAL)

Record the contact attempt number.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 2 digits
Tolerance: No errors
MQO: At least 95% of the time
Values: Attempt number

A13.46 OWNERSHIP CONTACT DATE (CORE OPTIONAL)

Record the date of the attempted ownership contact. Date should be in the form DD-MON-YYYY.

When collected: When an ownership contact attempt has been made (OWNERSHIP CONTACT ATTEMPT NUMBER is not null)
Field width: 11 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Date

A13.47 OWNERSHIP CONTACT METHOD (CORE OPTIONAL)

Record the code identifying how the ownership was contacted.

When collected: All ownerships contacted
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1	In person
2	Left voice message
3	Spoke to by phone
4	Sent email
5	Sent postal mail
6	Message received on phone
7	Message received via return email
8	Message received via return mail
9	Other (notes required)

A13.48 LAND POSTED (CORE OPTIONAL)

Record the code identifying if the land is posted prohibiting trespassing.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

0	No
1	Yes

A13.49 ACCESS GRANTED (CORE OPTIONAL)

Record the code identifying if a representative of the ownership granted us access to their land. If the ownership allows access under specific arrangements (ACCESS GRANTED = 2), then record the specific arrangements in ACCESS INFORMATION DETAILS.

When collected: All ownerships contacted
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time

Values:

0 No
1 Yes
2 Conditional yes (record conditions in access notes)

A13.50 ACCESS GRANTED DATE (CORE OPTIONAL)

Record the date access was granted. Date should be in the form DD-MON-YYYY.

When collected: When access has been granted (ACCESS GRANTED = 1 or 2)
Field width: 11 characters
Tolerance: No errors
MQO: At least 95% of the time
Values: Date

A13.51 ACCESS GRANTED BY (CORE OPTIONAL)

Record the name of the person from whom access was granted.

When collected: All ownerships recorded for a plot (OWNER CLASS ≥ 11 and OWNER TYPE ≥ 1)
Field width: 255 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

A13.52 ACCESS NOTES (CORE OPTIONAL)

Record any other information relevant to contacting and accessing the plot.
RM Include any relevant information such as permits and keys.

When collected: All ownerships contacted
Field width: 2,000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers.
Null values are permissible

A13.53 OWNERSHIP REQUESTS NOTICE (CORE OPTIONAL)

Record the code identifying if the ownership wants to be notified before we access their land.

When collected: All ownerships contacted
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

0 No

1 Yes

A13.54 OWNERSHIP REQUESTS INFORMATION (CORE OPTIONAL)

Record the code identifying if the ownership representation wants us to send him or her additional information. If they do (OWNERS REQUESTS INFORMATION = 1), then record what they want in REQUESTS INFORMATION DETAILS.

When collected: All ownerships contacted
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

0 No
1 Yes

A13.55 INFORMATION REQUEST DETAILS (CORE OPTIONAL)

Record any other information relevant to contacting and accessing the plot.

When collected: All ownerships requesting additional information (OWNERS REQUESTS INFORMATION = 1)
Field width: 2,000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers. Null values are permissible

A13.56 INFORMATION REQUEST FULFILLED (CORE OPTIONAL)

RM Not collected in RMRS

A13.57 Supplemental Information for Ownership Prefield Procedures

RM Not collected in RMRS

A13.57.1 FIA Ownership Data Recording Examples

RM Not included in this guide due to space limitations

A13.57.2 Two-letter Abbreviations for U.S. States, Territories, and Protectorates

RM Not included in this guide due to space limitations

A13.57.3 Country Codes

RM Not included in this guide due to space limitations

A13.57.4 Meridian Codes

Source: U.S. Geological Survey. 2003. Public land survey system of the United States. Reston, VA: U.S. Geological Survey. http://nationalatlas.gov/atlasftp.html (last accessed: March 28, 2007). **RM** note: Due to space limitations, only the codes valid in RMRS are included.

Code	Meridian/survey	State(s)
06	Sixth Principal Meridian	Colorado, Kansas, Nebraska, South Dako-ta, and Wyoming
07	Black Hills	South Dakota
08	Boise	Idaho
14	Gila And Salt River	Arizona
20	Montana (Principal)	Montana
21	Mount Diablo	California and Nevada
22	Navajo	Arizona
23	New Mexico	Colorado and New Mexico
26	Salt Lake	Utah
30	Uintah	Utah
31	Ute	Colorado
34	Wind River	Wyoming
99	Not Public Land Survey	

RM Appendix A. Field Forms

A.1 Field Location Reference Record

Field Location Reference

STATE______________ COUNTY______________ P2 PLOT #______________ DATE ________________

FIELD CREW (first intial, 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______________ GPS NUMBER______________

COORDINATES

	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, Helispots, Campsites, etc.

REFERENCE POINT DESCRIPTION AND TRAVERSE INFO. TO PC

SUB REF. ____ AZIMUTH ______ H. DISTANCE________ SLOPE DIST.________ RP SPECIES________ DIAMETER ________

RP DESCRIPTION:

PC WITNESS TREES

SUB REF. ________ X AZIMUTH __________ X SLOPE DIST. __________ X SPECIES __________ X DIAMETER __________

SUB REF. ________ Y AZIMUTH __________ Y SLOPE DIST. __________ Y SPECIES __________ Y DIAMETER __________

NOTES:

OWNER INFORMATION - include all relevant owner info. to get to the PC

ACCESS INFORMATION (yes or no)

OWNER CONTACTED?_____ 4X4 NEEDED?_____ ATV RECOMMENDED? _____ LOCKED GATE?_____ PHOTOS TAKEN?_____

FIELD CREW EDIT:

NAME:______________________ DATE:______________

MISC. NOTES:

Revised 12/2/14

A.2 Field Location Map and Condition Boundary Map

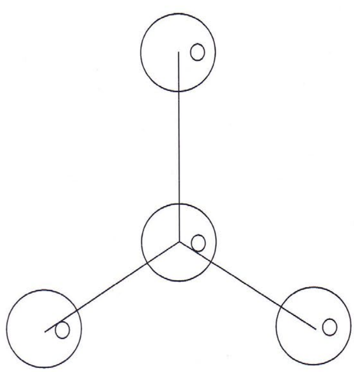
FIELD LOCATION MAP
(Draw roads/landmarks/features helpful to the next crew)

↑ N

PC REFERENCE &
CONDITION BOUNDARY MAP

↑ N

Right Azimuth:_________
Left Azimuth: _________
Corner Azimuth: _______
Corner Dist.: _________



A.3 Field Location and Subplot Description Record

Field Location Description and Subplot Description Record

PLOT LEVEL DATA

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	
Addt'l Owner Contact?		4x4?		ATV?		Locked Gate?	
Photos Taken?		Co-Located?		Future Forest Pot.		Conditon Class Change	
P2 Veg Sample Stat.		Invasive Sample Stat.		DWM Sample Stat.			

PC COORDINATES

GPS Type		GPS Serial #		GPS Error		# of Readings	
GPS Elevation		Azimuth to PC		Dist. to PC		GPS Entry Method	
Lat. Degrees		Lat. Minutes		Lat. Seconds		Long. Degrees	
Long. Minutes		Long. Seconds					

SUBPLOT DESCRIPTION

* indicates for ACI only	SUBPLOT 1	SUBPLOT 2	SUBPLOT 3	SUBPLOT 4	NOTES:
Subplot/Macroplot Status					
Subplot/Macroplot Status*					
Nonsampled Reason					
NF Subplot/Macroplot Status					
Subplot NF/water Land Use*					
NF Subplot Nonsampled Reason					
Subplot Cntr Cond.					
Micro Cntr Cond.					
Subplot Slope					
Subplot Aspect					
Snow/Water Depth					
Subplot Condition List					
Subplot/Macroplot Condition List*					
Root Disease (MT,ID)					
Vegetation Sample Status					
Vegetation Nonsampled Reason					
Invasive Plant Subplot Status					
Invasive Nonsampled Reason					
Subplot Range Type*					
Subplot habitat Type*					
Subplot Reserved Status*					
Subplot Owner Class*					

BOUNDARY INFORMATION

	SUBPLOT 1			SUBPLOT 2			SUBPLOT 3			SUBPLOT4			Notes:
Plot Type													
Bndry Change													
Contrasting Cond #													
Azimuth left													
Corner Azimuth													
Corner Dist													
Azimuth Right													

PLOT NOTES: 10/30/2015

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				
Forest Type				
Stand Size				
Regeneration Status				
Tree Density				
Owner Class				
Public Amin. w/drawn Status				
Admin. w/drawn Area Name				
Reserved Area Name				
Artificial Regeneration Species				
Stand Age				
Conditon Habitat Type				
ACI Range Type				
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				
Physiographic Class				
Land Cover Class				
Present Nonforest Land Use				
Land Use				
Percent Bare Ground				
Canopy Cover Sample Method				
Crown Cover				
Live Canopy Cover				
Live Plus Missing Canopy Cover				
Current Afforestation Code				
Previous Afforestation Code				
Total Stems				
Chaining Code				
Current Condition Status Change				

Condition Class Comments: ________

A.5 Tree Data

STATE: **COUNTY:** **TREE DATA** **P2 PLOT NUMBER:** **PAGE OF**

Subplot Number	Tree Record Number	Horizontal Distance	Azimuth	Condition Class Number	Present Tree Status	Reconcile*	Standing Dead*	Species	Diameter	Diameter Check	Length to Diameter Point	Number of Stems	Total Length	Actual Tree Length	Length Method	Uncompacted Crown	Compacted Crown	Crown Class	Mistletoe Class	Damage Agent 1	Damage Agent 2	Damage Agent 3	Decay Class	Rotten/Missing Cull	% Vol Missing Top	% Sound Dead	% Form Defect	Past Tree Class*	Current Tree Class	Radial Growth	Tree Age	Growth/Age Check	Site Tree	Mortality	Mortality Year	Cause of Death
x	xxx	xxx	xxx	x	x	x	x	xxxx	xxxx	x	xxx	xxx	xxx	xxx	xx	xx	xx	xx	xx	xxxxx	xxxxx	xxxxx	x	xx	xx	xxx	x	x	xx	xx	xxx	x	x	x	xxxx	xx

* = Remeasurement (Sample Kind 2) only

revised 10/30/2015

A.6 Sapling and Seedling Data

Updated 1/4/13

STATE: COUNTY: LOCATION:

SAPLING DATA

Subplot Number	Tree Record Number	Horizontal Distance	Azimuth	Condition Class	Present Tree Status	Reconcile*	Species	Diameter	Length to Diameter Point	Diameter Check	Number of Stems	Total Tree Length	Actual Tree Length	Length Method	Compacted Crown	Crown Class	Mistletoe Class	Tree Class	Radial Growth	Tree Age
x	xxx	xxxx	xxx	x	x	x	xxxx	xxxx	xx	x	xxx	xxx	x	xx	xx	x	x	xx	xx	xxx

SEEDLING DATA

SUBPLOT #	Condition Class	Species	Seedling Count	Count Check	Seedling Age
x	x	xxxx	xx	x	xx

* = Remeasurement (Sample Kind 2) only

Updated 10/30/15

A.7 P2 Vegetation Structure

State ____________ County ____________ P2 Plot Number____________ P2 Vegetation Sampling Status ____________

Vegetation Structure

	P2 Veg SP Sample Status	Veg Nonsampled Reason	Condition Class #		Layer 1	Layer 2	Layer 3	Layer 4	Aerial View
	x	x	x		xxx	xxx	xxx	xxx	xxx
Subplot 1				Tally Tree Species Cover					
				Non-Tally Tree Species Cover					
				SHRUB, SUBSHRUB, AND WOODY VINE					
				Forb Cover					
				Graminoid Cover					
Subplot 2				Tally Tree Species Cover					
				Non-Tally Tree Species Cover					
				SHRUB, SUBSHRUB, AND WOODY VINE					
				Forb Cover					
				Graminoid Cover					
Subplot 3				Tally Tree Species Cover					
				Non-Tally Tree Species Cover					
				SHRUB, SUBSHRUB, AND WOODY VINE					
				Forb Cover					
				Graminoid Cover					
Subplot 4				Tally Tree Species Cover					
				Non-Tally Tree Species Cover					
				SHRUB, SUBSHRUB, AND WOODY VINE					
				Forb Cover					
				Graminoid Cover					

NOTES: ____________________

revised 10/30/15

A.8 P2 Veg Species Composition

State ____________ County ____________ P2 Plot Number____________ P2 Vegetation Sampling Status

Species Compostion

Subplot #	Species Growth Habit	Species Code	Unique Species #	Species Canopy Cover	Species Veg. Layer	Specimen Collected	Specimen Label #	P2 Specimen Not Collected Reason Code
x	xxx	varies	xx	xxx	x	x	xxxxx	xx

Notes:

Revised 10/30/15

A.9 Multistemmed Woodland Species Tally

MULTISTEMMED WOODLAND SPECIES TALLY

STATE _______ P2 Plot # _______ COUNTY _______

SUBPLOT NUMBER	TREE NUMBER	INDIVIDUAL STEM DIAMETERS Place a small "2" next to each dead stem																			NUMBER OF STEMS	COMPUTED DRC

*DRC = the square root of the squared individual stems

A.10 Crown/Ground Cover Supplemental Data Form

CROWN/GROUND COVER SUPPLEMENTAL DATA FORM

(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.

COND # ______	Subplot 1				Subplot 2				Subplot 3				Subplot 4						
	90°	180°	270°	360°	90°	180°	270°	360°	45°	135°	225°	315°	45°	135°	225°	315°	TOTAL		COND. %
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																			

COND # ______	Subplot 1				Subplot 2				Subplot 3				Subplot 4						
	90°	180°	270°	360°	90°	180°	270°	360°	45°	135°	225°	315°	45°	135°	225°	315°	TOTAL		COND. %
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																			

COND # ______	Subplot 1				Subplot 2				Subplot 3				Subplot 4						
	90°	180°	270°	360°	90°	180°	270°	360°	45°	135°	225°	315°	45°	135°	225°	315°	TOTAL		COND. %
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:

13-Jan

A.11 DWM Data Form

DWM Data Form	State		County		Plot		Date	

Transect Segmenting Data - Record if multiple segments present

Subplot	Transect	Cond Class	Seg Status	NS Reason	Beg Dis	End Dis
x	xxx	x	x	xx	xx.y (ft)	xx.y (ft)

Helpful Information

Transect Locations

Subplot	Azimuths
1	90°, 270°
2	360°, 180°
3	135°, 315°
4	45°, 225°

CWD Large End Classes

Class	Dia.Range
1	3.0-4.9"
2	5.0-8.9"
3	9.0-14.9"
4	15.0-20.9"
5	21.0-39.9"
6	>40"

Duff and Litter Depths

Transect Sub/Az.	Duff xx.y (in)	Litter xx.y(in)
1-090°		
1-270°		
2-180°		
2-360°		
3-315°		
3-135°		
4-045°		
4-225°		

FWD Data

Transect Sub/Az.	Small 0.1-0.24"	Medium 0.25-0.99"	Large 1.0-2.99"
	xxx	xxx	xxx
1-270°			
2-360°			
3-135°			
4-225°			

Residue Piles

Subplot	Transect	Cond. Class	Beg. Dist	End Dist	Height	Decay Class	Species

CWD Data

Subplot	Transect	Cond. Class	Dec. Class	Species	Tran. Dia	Hollow Dia.	>=3.0? ft	Hollow ?	LG End Dia.
x	xxx	x	x	xxx	xxx (in)	xxx(in)	x	xxx (in)	x

revised 12/4/17

A.12 Invasive Plants

Invasive Plants

State ________ County _________ P2 Plot Number__________ P2 Invasive Plant Sampling Status_________

Subplot #	Invasive Plant Subplot Status (x)	Invasive Plant Nonsampled Reason (xx)
1		
2		
3		
4		

Subplot #	Condition Class #	Species Code	Unique Species #	Species Canopy C	Invasive Collected	Specimen Label #	Notes
x	x	varies	xx	xxx	x	xxxxx	

11/9/2010

A.13 ACI Ground Surface Cover Transects Form

GROUND SURFACE COVER TRANSECTS

Crew Name(s): ____________

STATE ________ COUNTY ________ PLOT # ________

	Subplot 1					Subplot 2					Subplot 3					Subplot 4				
Categories:	90°	180°	270°	360°	Total	90°	180°	270°	360°	Total	45°	135°	225°	315°	Total	45°	135°	225°	315°	Total
BARE																				
ROCK																				
WATE																				
TRIS																				
PEIS																				
WOOD																				
LIT																				
VEG																				
CRYP																				
LICH																				
MOSS																				
DEVP																				
ROAD																				
OTHER																				
NONSM																				

Procedure: Lay out four 25-foot transects on each subplot using the azimuths given above. Start "hits" at the 1-foot mark (for a total of 25 hits per transect direction, and 100 hits per subplot). From subplot center and facing the subplot perimeter, measure hits to the right side of the transect tape. Record total for category by subplot; enter category totals by subplot on the PDR. Note: If a subplot is not sampled, draw a large X over subplot columns.

BARE - Bare ground; exposed soil and fragments < 3/4-inch diameter
ROCK - Rocks; > 3/4-inch diameter
WATE - Water; remaining above ground surface during the growing season (code all hits within "permanent water" as a water hit; for transient water, or temporary flooding, base hits on ground cover category below water surface as if water was not there)
TRIS - Transient ice and snow
PEIS - Permanent ice and snow
WOOD - Woody material; litter not included
LIT - Organic debris, freshly fallen or slightly decomposed; includes dead vegetation, animal feces, etc.
VEG - Basal vegetation; the area outline of a plant near the ground surface; for grass - shoot system; for tree/shrub - stem area
CRYP - Cryptogamic crust, thin biotically dominated ground or surface crust; for dry rangeland, algae, lichen, mosses or cyanobacteria
LICH - Lichens; for dry rangeland see cryptogamic crust
MOSS - Mosses; for dry rangeland see cryptogamic crust
DEVP - Developed land or man-made structures; maintained residential yards; agricultural crops
ROAD - Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained
OTHER - Other covers not defined elsewhere; includes trash (describe in notes section)
NONSM - Nonsampled (describe reason in notes section)

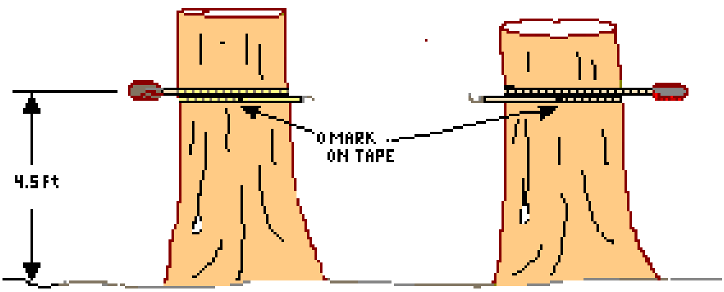
Notes: ____________

ACI 2013

RM Appendix B. Tree Data Techniques

RM Appendix B.1 Diameter Measurement Techniques for Timber Species

Correct method: Alternate left-handed method:

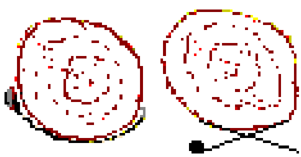


End of tape (with 0 mark) or hook crossed under

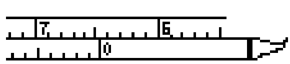
End of tape crossed under (Careful! Readings will be from an upside down d-tape)

Press tape firmly against the tree; Do not pull it out at a tangent to the tree at the point of measurement.

Correct Incorrect

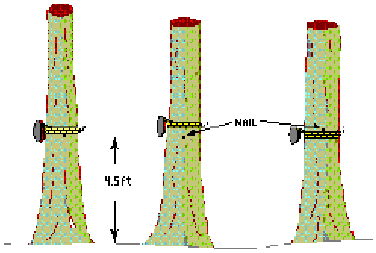


The diameter must be read at the exact point marked — above the 0 mark.
Always round down to the nearest 0.1 inch:



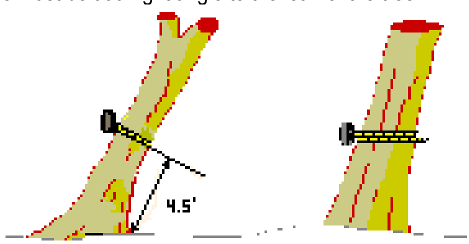
In this example, the diameter reading is 6.4-inches. Be carefull not to incorrectly read 7.5-inches. Examine the digits preceding and following the point above the 0 mark.

Place the diameter tape directly above the nail:



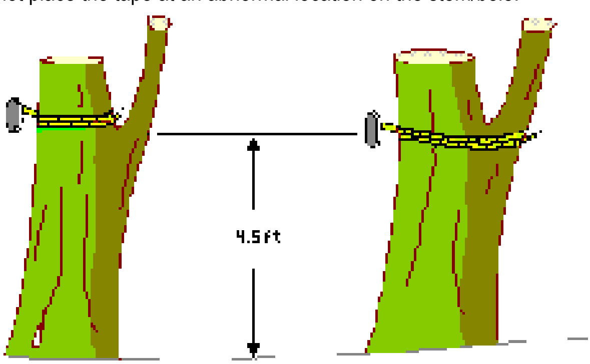
Correct Incorrect Incorrect

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



Correct Incorrect

Do not place the tape at an abnormal location on the stem/bole:



Correct Incorrect

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 resharpen the bit because of this small tapering. For this reason, the following rules must be observed:

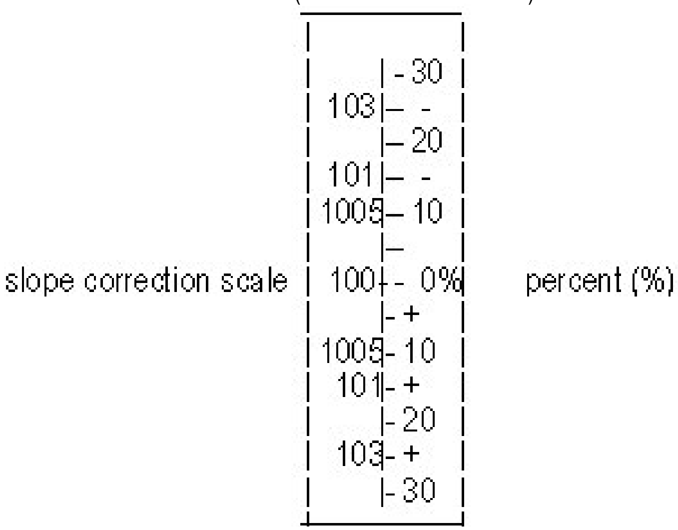
1. Keep the bit stored inside the bore handle when not in use.
2. Do not allow the tip of the bit to contact hard objects such as the ground or other field equipment.
3. If a core becomes jammed, do not use a nail or other hard object to attempt to push it out. Trying to push the core out through the 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 species; 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:

$$\text{Tree Height} = \frac{[T + B] \times (D/100)}{SC}$$

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).

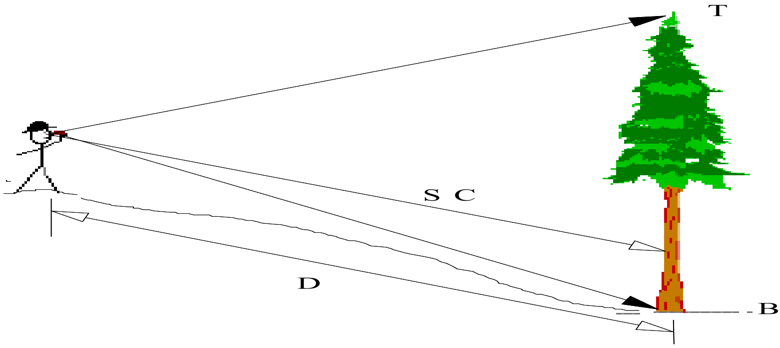
SC = slope correction factor, taken to two decimal places.

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 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

<table>
<tr><th rowspan="2">Total Height</th><th colspan="10">Defect Height</th></tr>
<tr><th>20</th><th>34</th><th>50</th><th>67</th><th>83</th><th>100</th><th>116</th><th>133</th><th>149</th><th>166</th></tr>
<tr><td>179</td><td colspan="6">1</td><td colspan="2">0.5</td><td>0.2</td><td>0.1</td></tr>
<tr><td>163</td><td colspan="6">1</td><td>0.5</td><td>0.2</td><td colspan="2">0.1</td></tr>
<tr><td>147</td><td>2</td><td colspan="4">1</td><td>0.5</td><td>0.2</td><td colspan="3">0.1</td></tr>
<tr><td>131</td><td>2</td><td colspan="3">1</td><td colspan="2">0.5</td><td colspan="4">0.2</td></tr>
<tr><td>115</td><td>2</td><td colspan="3">1</td><td colspan="6">0.5</td></tr>
<tr><td>98</td><td colspan="2">2</td><td colspan="2">1</td><td colspan="6">0.5</td></tr>
<tr><td>82</td><td colspan="2">2</td><td colspan="8">1</td></tr>
<tr><td>65</td><td>3</td><td>2</td><td colspan="8">1</td></tr>
<tr><td>49</td><td>4</td><td colspan="9">2</td></tr>
<tr><td>32</td><td colspan="10">5</td></tr>
<tr><td></td><td>20</td><td>34</td><td>50</td><td>67</td><td>83</td><td>100</td><td>116</td><td>133</td><td>149</td><td>166</td></tr>
</table>

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 ¼ pie cut fraction (e.g., 5 feet x 4% volume/foot x ¼ = 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 = ¼ 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.

C.1**RM** 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.

C.1.1**RM** 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.

C.1.2**RM** 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 customize.

C.2**RM** Data Collection

Averaged coordinates will be collected in three different locations; at the truck parking spot, Reference Point (RP), and Location Center (PC).

C.2.1**RM** 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.

C.2.2**RM** Obtaining an averaged location on the GPSmap 62s:

- With the unit on, press the MENU key twice and select "Create Waypoint".
- From the Create Waypoint screen, select "Create Waypoint"
- The GPS will automatically start averaging.
- Wait untl the Sample Confidence reaches 100% and "save" these readings.
- After saving the coordinates, be sure the "Number of Samples" = 1. If not, repeat the previous steps making sure "Create Waypoint" was selected from the Create Waypoint menu.
- Rename this waypoint as needed.

C.2.3**RM** Obtaining GPS ERROR (GPSmap 62s)

- After averaging the location coordinates (section C.2.2**RM**), PAGE through to the Satellite page.
- The GPS error is shown in the top right corner of the screen next to the coordinates.

C.2.4**RM** Obtaining NUMBER OF READINGS (GPSmap 62S)

See section 1.19.18

C.3**RM** 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:

C.3.1**RM** Using the MARK key (both units)

- Once 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.
- This waypoint can now be used for navigational purposes in the future.

C.3.2**RM** 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.

C.3.3**RM** 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 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)
- Seclect 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.

C.3.4**RM** 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 desired waypoint to navigate from (i.e. RP). The “Map” page comes up and press ENTER.
- Select the next waypoint (i.e. PC) desired to navigate to by repeating the previous step.
- Once the two waypoints are shown, press QUIT.
- The route will be shown on the next screen.
- Navigate to the route just created and press ENTER.
- The next screen brings up route options.
- Choose “View Map” and select “GO”.

Suggestion: Customize the “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.

C.3.5**RM** Using Waypoints for Navigation (GPSmap 76s)

Once a waypoint has been named and stored, it is possible to 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”.
- The Map page is now shown where it is possible to navigate using “Bearing” and “Distance to Next”.

C.3.6**RM** Using Waypoints for Navigation (GPSmap 62s)

- To acquire a distance and azimuth between the current location and a waypoint, the waypoint must already be saved in the unit (see 3.0.1**RM** and 3.0.2**RM**).
- Press the FIND button and choose “Waypoints”.
- Under the waypoint it is desired to navigate to, the distance and azimuth to that waypoint is displayed.
- Press ENTER on the waypoint and the map page comes up showing the current location and the waypoint.

C.3.7**RM** 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 elminatates the need to create a new route.
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 to be edited and press “Enter”.
- The “Waypoint” screen appears for that specific waypoint where the coordinates can now be edited or the averaged location can be obtained using the same name.

C.3.8**RM** Editing Waypoints (GPSmap 62s)

- Navigate to the Main Menu and choose “Waypoint Manager”
- Select the waypoint to be edited 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).

C.4**RM** 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

D.1**RM** Overview

Accurate heights are necessary in the 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 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. When possible, always keep the laser in its case. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

D.2**RM** Basic operation

All directions for using the Laser buttons are given assuming the instrument is being held where the LCD display screen can be read and the two round lenses are facing the object a height is needed for. The buttons will be referred to as:

L1	the left button closest to the front
L2	the left button in the middle
L3	the left button furthest away
R1	the right button closest to the front
R2	the right button in the middle
R3	the right button furthest away

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.

D.3**RM** 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. A pivot value of 0.59 is used which sets the pivot point at the rear of the instrument and allows a height to be shot while using the persons head as the pivot point. To edit this value, press L1 until the pivot point 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.

D.4**RM** Filter and Reflectors

When working in areas of dense brush, be sure the Laser is giving 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.

D.5**RM** 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. A sound is made when the instrument locks onto it’s target. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If an error message is displayed, 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.

D.6**RM** Tree heights

The best way to measure a tree height is to make there is a clear shot at the tree crown leader or a clear shot of the tree trunk. Make sure the laser is shooting the distance to the tree trunk, and not some branches in front of it. If it is not possible to get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once in position with the 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.

D.7**RM** Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help be sure the right target is being hit if there are objects nearby or just beyond the target which might give false readings. It is not required to set both gates. The short gate is most often changed because of brush or fog between the laser and the target. A gate can be set 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 wanted as the short gate and press R1.
6. Now it is possible to 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 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. If it is desired to use the same gate values that were previously saved, go back into the gate option and turn the gate ON, it will remember the last distances 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.

D.8**RM** Cumulative distances

A cumulative distance measurement can be obtained by moving 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 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. 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 not satisfied with the measurement, repeat step 5 to retake the measurement. If satisfied with the measurement, and wish to add it to the total, press R2.
   The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

Horizontal or slope distances can be chosen at any time. If a distance has been measured, horizontal or slope distances can be viewed 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.

RM Appendix E. All Conditions Inventory (ACI)

This appendix outlines the resource inventory procedures to be used for the All Condition Inventory (ACI) study. These plots expand the P2 field inventory to include: (1) sampling on nonforest/water grid locations, and (2) data collection on nonforest/water conditions located at forest land grid locations.

This appendix is only to be used for plot locations that are part of the ACI study, and that have a nonforest and/or water condition on one or more of the subplots.

The primary purpose of this appendix is to outline protocols that differ from the P2 procedures and to list additional sample variables/coding that are necessary for implementation of ACI plots.

E.1**ACI** Types of ACI Locations

Locations where ACI data will be collected include Partial and Nonforest plots.

Partial Plots	Plots that have an accessible forest land condition(s) present on one or more subplots, but also a nonforest/water condition on one or more of the subplots, will simply be referred to as "partial plots" in this document
Nonforest Plots	Plots that do not have any "accessible forest land condition(s)" present on any of the four subplots will simply be referred to as "nonforest plots" in this document. For nonforest plots, sample procedures in this document pertain to the entire plot.

E.2**ACI** General Overview

The ACI study will include the following aspects:

- **Data collection for nonforest/water conditions**: Many of the P2 data items that are currently only collected on subplots with an accessible forest land condition will also be collected on subplots with a nonforest/water condition present. In general, disregard references that specify only to sample subplots, or portions of subplots, that occur within the "accessible forest land" condition classes.

- **Individual data item protocol revisions ("ACI" extension)**: For some of the current P2 data items, it has been necessary to modify procedures beyond the simple instruction to "disregard references only to sample on accessible forest land conditions." Such data items have required further protocol changes, revised instruction, or are collected only on ACI plots. These P2 data items have been listed in this document using an "**ACI**" extension added to the end of the item number (e.g., item 3.11.2**ACI**).

E.3**ACI** Establishing the Plot and Selecting a Reference Point:

Follow procedures in section 0 and 12 for finding/establishing the PC, and for selecting a suitable reference point (RP) and witness trees.

E.4**ACI** Field Location Reference Form

ACI Sample Procedures:

- For partial plots, collect all P2 Field Location Reference items.
- For nonforest plots, collect all P2 Field Location Reference items listed in section 12. Disregard any references to collect data only if there is at least one accessible forested condition on the location. For the noxious weed survey, examine all subplot areas; disregard the reference to “not collect information for the plot if the location is completely nonforest.”

E.5**ACI** Intermountain Region References for Identifying Habitat Types

Vegetation Formation	**Geographic Area**	**References**
Aspen Forests	Intermountain Region	Mueggler 1988
Conifer Forests	Western & Central Idaho	Steele et al. 1981
	Wyoming & Eastern Idaho	Steele et al. 1983
	Northern Utah	Mauk & Henderson 1984
	Southern Utah	Youngblood & Mauk 1985
Conifer Forests (cont’d)	Western Nevada	Fites 1993 Smith 1994 Potter 1998 Tart 2004[1]
	North-Central Nevada	Steele et al. 1981 Tart 2004[1]
	Northeastern Nevada	Mauk & Henderson 1984 (Tart 2004[1])
	Southeastern Nevada	Youngblood & Mauk 1985 (Tart 2004[1])
Evergreen Woodlands Pinyon, juniper, Joshua tree, mtn. mahogany	Northern & Central Nevada	Tart 2004[1]
	Southern Nevada	**Mojave Desert** - Thomas et al. 2004
	Southern Idaho	Rust 1999
	Western Wyoming	Fossil Butte NM – Friesen et al. 2010
	Northern Utah	Dinosaur NM - Coles et al. 2008a Golden Spike NHS - Coles et al. 2011

Vegetation Formation	Geographic Area	References
Evergreen Woodlands Pinyon, juniper, Joshua tree, mtn. mahogany (cont'd)	Southern Utah	**Arches NP** - Coles et al. 2009a Bryce Canyon NP - Tendick et al. 2011a **Capitol Reef NP** - Clark et al. 2009 Cedar Breaks NM - Tendick et al. 2011b Hovenweep NM - Von Loh et al. 2008 Natural Bridges NM – Coles et a. 2008b **Zion NP** - Cogan et al. 2004
Deciduous Woodlands Bigtooth maple, Gamble oak	Northern Utah	Timpanogas Cave NM - Coles et al. 2009b
	Southern Utah	**Arches NP** - Coles et al. 2009a Bryce Canyon NP - Tendick et al. 2011a **Capitol Reef NP** - Clark et al. 2009 Natural Bridges NM – Coles et a. 2008b **Zion NP** - Cogan et al. 2004
Cold Desert Shrublands Sagebrush, Salt Desert, Mountain Brush	Southern Idaho	Hironaka et al. 1983 (using Tart's 2011 key) **Craters of the Moon NM** - Bell et al. 2009 Hagerman Fossil Beds NM – Erixson & Cogan 2009
	Wyoming – Teton & Lincoln Counties	Hironaka et al. 1983 (using Tart's 2011 key) **Grand Teton NP** - Cogan et al 2005

[1]Based on West et al. (1998) and Nachlinger & Reese (1996).

Cold Desert Shrublands Sagebrush, Salt Desert, Mountain Brush	Northern Utah	Hironaka et al. 1983 (using Tart's 2011 key) **Dinosaur NM** - Coles et al. 2008a Golden Spike NHS - Coles et al. 2011 **Ouray Refuge** - Von Loh et al. 2002 Timpanogas Cave NM - Coles et al. 2009b
	West-Central Idaho	Johnson 2004
	Northeastern Idaho	Mueggler & Stewart 1980 Cooper et al. 1999
	Nevada – Douglas, Lyon, & Ormsby Counties	Blackburn et al. 1969d
	Nevada – Elko County	Blackburn et al. 1969c Blackburn et al. 1971Jensen et al. 1988a,b
	Nevada – Eureka County	Blackburn et al. 1969a
	Nevada – Humboldt County	Blackburn et al. 1968b
	Nevada – Lander County	Blackburn et al. 1968c
	Nevada – Lincoln County	Blackburn et al. 1969e
	Nevada – Pershing County	Blackburn et al. 1969b
	Nevada – White Pine County	Blackburn et al. 1968a
	Northern Nevada	Jensen et al. 1988a,b Zamora and Tueller 1973
Cold Desert Shrublands Sagebrush, Salt Desert, Mountain Brush (cont'd)	Western Wyoming	Upper Green River Basin and Wind River Mtns - Tart 1996 Fossil Butte NM – Friesen et al. 2010
	Southern Utah	**Arches NP** - Coles et al. 2009a Bryce Canyon NP - Tendick et al. 2011a **Capitol Reef NP** - Clark et al. 2009 Cedar Breaks NM - Tendick et al. 2011b Hovenweep NM - Von Loh et al. 2008 Natural Bridges NM – Coles et a. 2008b **Zion NP** - Cogan et al. 2004

Vegetation Formation	Geographic Area	References
Warm Desert Shrublands Creosote, blackbrush, etc.	Southern Nevada	**Mojave Desert** - Thomas et al. 2004
	Northern Utah	**Ouray Refuge** - Von Loh et al. 2002
	Southern Utah	**Arches NP** - Coles et al. 2009a **Capitol Reef N**P - Clark et al. 2009 **Zion NP** - Cogan et al. 2004
Grasslands and Forblands	Western Wyoming Eastern Idaho	Mueggler & Stewart 1980 Gregory 1983 Fossil Butte NM – Friesen et al. 2010
	Western Idaho	Tisdale 1986
	Southern Idaho	Hagerman Fossil Beds NM – Erixson & Cogan 2009
	Northern Utah	**Dinosaur NM** - Coles et al. 2008a Golden Spike NHS - Coles et al. 2011 **Ouray Refuge** - Von Loh et al. 2002
Grasslands and Forblands (cont'd)	Southern Utah	**Arches NP** - Coles et al. 2009a Bryce Canyon NP - Tendick et al. 2011a **Capitol Reef NP** - Clark et al. 2009 Cedar Breaks NM - Tendick et al. 2011b Hovenweep NM - Von Loh et al. 2008 Natural Bridges NM – Coles et a. 2008b **Zion NP** - Cogan et al. 2004
	Southern Nevada	**Mojave Desert** - Thomas et al. 2004

Vegetation Formation	Geographic Area	References
Riparian	Southwestern Idaho	Idaho CDC 2011 Janovsky-Jones et al. 2001 Hagerman Fossil Beds NM – Erixson & Cogan 2009
	Southeastern Idaho	Hansen and Hall 2002 Padgett et al. 1989
	Western Wyoming Eastern Idaho	Youngblood et al. 1985 Fossil Butte NM – Friesen et al. 2010
	Northern Utah	Padgett et al. 1989 **Dinosaur NM** - Coles et al. 2008a Golden Spike NHS - Coles et al. 2011 **Ouray Refuge** - Von Loh et al. 2002 Timpanogas Cave NM - Coles et al. 2009b
	Southern Utah	Padgett et al. 1989 **Arches NP** - Coles et al. 2009a Bryce Canyon NP - Tendick et al. 2011a **Capitol Reef NP** - Clark et al. 2009 Cedar Breaks NM - Tendick et al. 2011b Hovenweep NM - Von Loh et al. 2008 Natural Bridges NM – Coles et a. 2008b **Zion NP** - Cogan et al. 2004
	Nevada	Manning and Padgett 1995
Riparian (cont'd)	Northeastern California	Smith 1998 Weixelman et al. 1999
Alpine	Western Wyoming	Thilenius and Smith 1985 Potkin 1991
	Utah	Cedar Breaks NM - Tendick et al. 2011b **Uinta Mountains** - Brown 2006

Vegetation Formation	Geographic Area	References
Alpine (cont'd)	West-Central Idaho	Johnson 2004
	Eastern Idaho	Caicco 1983 Cooper et al. 1997 Urbanczyk 1993 Urbanczyk & Henderson 1994 Richardson & Henderson 1999

E.5.1ACI RANGE TYPE

See 2.5.14.2**ACI** RANGE TYPE for variable description.

Values:

Code	Description
101	Bluebunch Wheatgrass
102	Idaho Fescue
103	Green Fescue
104	Antelope Bitterbrush-Bluebunch Wheatgrass
105	Antelope Bitterbrush-Idaho Fescue
106	Bluegrass Scabland
107	Western Juniper-Big Sagebrush-Bluebunch Wheatgrass
108	Alpine Idaho Fescue
301	Bluebunch Wheatgrass-Blue Grama
302	Bluebunch Wheatgrass-Sandberg Bluegrass
303	Bluebunch Wheatgrass-Western Wheatgrass
304	Idaho Fescue-Bluebunch Wheatgrass
305	Idaho Fescue-Richardson Needlegrass
306	Idaho Fescue-Slender Wheatgrass
307	Idaho Fescue-Threadleaf Sedge
308	Idaho Fescue-Tufted Hairgrass
309	Idaho Fescue-Western Wheatgrass
310	Needle-and-Thread - Blue Grama
311	Rough Fescue-Bluebunch Wheatgrass
312	Rough Fescue-Idaho Fescue
313	Tufted Hairgrass-Sedge
314	Big Sagebrush-Bluebunch Wheatgrass
315	Big Sagebrush-Idaho Fescue
316	Big Sagebrush-Rough Fescue

Code	Description
317	Bitterbrush-Bluebunch Wheatgrass
318	Bitterbrush-Idaho Fescue
319	Bitterbrush-Rough Fescue
320	Black Sagebrush-Bluebunch Wheatgrass
321	Black Sagebrush-Idaho Fescue
322	Curlleaf Mountain Mahogany-Bluebunch Wheatgrass
323	Shrubby Cinquefoil-Rough Fescue
324	Threetip Sagebrush-Idaho Fescue
401	Basin Big Sagebrush
402	Mountain Big Sagebrush
403	Wyoming Big Sagebrush
404	Threetip Sagebrush
405	Black Sagebrush
406	Low Sagebrush
407	Stiff Sagebrush
408	Other Sagebrush Types
409	Tall Forb
410	Alpine Rangeland
413	Gambel Oak
414	Salt Desert Shrub
415	Curlleaf Mountain-Mahogany
416	True Mountain-Mahogany
417	Littleleaf Mountain-Mahogany
418	Bigtooth Maple
419	Bittercherry
420	Snowbrush
421	Chokecherry-Serviceberry-Rose
601	Bluestem Prarie
602	Bluestem-Prarie Sandreed
603	Prarie Sandreed-Needlegrass
604	Bluestem-Grama Prarie
605	Sandsage Prarie
606	Wheatgrass-Bluestem-Needlegrass
607	Wheatgrass-Needlegrass
608	Wheatgrass-Grama-Needlegrass

Code	Description
609	Wheatgrass-Grama
610	Wheatgrass
611	Blue Grama-Buffalograss
612	Sagebrush-Grass
613	Fescue Grassland
614	Crested Wheatgrass
615	Wheatgrass-Saltgrass-Grama
999	undefined

E.5.2**ACI** Habitat Type Reference Bibliography (detailed reference citation): Literature Cited available upon request.

E.6**ACI** Habitat Type Manual Selection Procedure for Region 1

To determine the appropriate, or preferred, Habitat Type manual (Potential Vegetation Classification reference) to use for the ACI study in Region 1, follow the procedure described below. Overall, there are seven valid habitat type reference guides for Montana and Idaho. Refer to the table below, titled “Acceptable Habitat Type Manuals for Region 1” for a detailed reference bibliography.

PROCEDURE:

Refer to the appropriate “Habitat Type Manual Key” table below –Montana or Idaho.

For “Uplands,” start with the reference guide on the same row (to the right) as the general type listed. For example, for “Grassland” in Montana, start with the “Mueggler & Stewart, 1980” reference guide. If that reference guide does not provide an adequate description of the habitat type located at subplot center, go to the next reference guide listed. If necessary, continue down the reference guide column until the appropriate guide is determined.

For “Moist Meadow,” start with the “top most” guide listed.

Note: If a habitat type is described in more than one reference, use the first guide listed. However, it is more important to identify the correct habitat type than it is to identify the “top most” reference guide listed.

Habitat Type Manual Key : MONTANA			
General Type:			**Reference:**
Uplands	Other	Forested (western & central MT)	Pfister et al., 1977
		Combination (Custer NF)	Hansen & Hoffman, 1988
		Grassland	Mueggler & Stewart, 1980
	Alpine (above 8000 feet)		Cooper, 1997
Riparian (non-conifer)			Hansen et al., 1995
Moist Meadow			Mueggler & Stewart, 1980
			Hansen et al., 1995

Habitat Type Manual Key: IDAHO			
General Type:			**Reference:**
Uplands	Other	Forested	Cooper, 1991
		Grassland	Johnson & Simon, 1987
	Alpine (above 8000 feet)		Cooper, 1997
Riparian (non-conifer)			Hansen et al., 1995
Moist Meadow			Johnson & Simon, 1987
			Hansen et al., 1995

Habitat Type Manual Key: South Dakota and North Dakota			
General Type:			**Reference:**
South Dakota	Custer NF	Sioux and Ashland RD (Partially in MT)	Hansen and Hoffman, 1988 OR Jensen et. al., 1992
	Grand River National Grassland		
North Dakota	Little Missouri National Grassland		Jensen et. al., 1992
	Sheyenne National Grassland		Hansen, Kurt (not on bibliography yet)

E.6.1**ACI** Habitat Type Reference Bibliography (detailed reference citation)

Acceptable Habitat Type Manuals for Region 1	
Reference	**Bibliography (detailed citation)**
Cooper, 1991	**Forest Habitat Types of Northern Idaho: A Second Approximation.** 1991 (revision). Cooper, Stephen V.; Neiman, Kenneth E.; Roberts, David W. Gen. Tech. Rep. INT-236. Ogden UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 143 p. Note: Do not use the 1987 version.
Cooper, 1997	**Plant Community Classification for Alpine Vegetation on the Beaverhead National Forest, Montana.** 1997. Cooper, Stephen V.; Lesica, Peter; Page-Dumroese, Deborah. Gen. Tech. Rep. INT-GTR-362. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 61 p.
Hansen & Hoffman, 1988	**The Vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer National Forest: A Habitat Type Classification.** 1988. Hansen, Paul L.; Hoffman, George R. Gen. Tech. Rep. RM-157. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 68 p.
Hansen et al., 1995	**Classification and Management of Montana's Riparian and Wetland Sites**. 1995. Hansen, Paul L.; Pfister, Robert D.; Boggs, Keith L.; Cook, Bradley J.; Joy, John; Hinckley, Dan K. Misc. Pub. No. 54. Missoula, MT: Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana. 646 p.
Jensen et al., 1992	**Ecological Sites and Habitat Types of the Little Missouri National Grassland and Western North Dakota**. 1992. Jensen, Mark; Heisner, Frank; DiBenedetto, Jeff; Wessman, Lynn; Phillipe, Gary. Draft II. U.S. Department of Agriculture, Forest Service, Northern Region.
Johnson & Simon, 1987	Plant Associations of the Wallowa-Snake Province. 1987. Johnson, Charles G.; Simon, Steven A. R6-ECOL-TP-255B-86. Wallowa-Whitman National Forest: U.S. Department of Agriculture, Forest Service, Pacific Northwest Region. 272 p.
Mueggler & Stewart, 1980	**Grassland and Shrubland Habitat Types of Western Montana**. 1980. Mueggler, W.F.; Stewart, W.L. Gen. Tech. Rep. INT-66. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 154 p.
Pfister et al., 1977	**Forest Habitat Types of Montana**. 1977. Pfister, Robert D.; Kovalchik, Bernard L.; Arno, Stephen F.; Presby. Richard C. Gen. Tech. Rep. INT-34. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 174 p.

RM Appendix F. Soil Measurements and Sampling

F.0 INTRODUCTION

The objective of the Phase 3 (P3) Soils Indicator is to assess forest ecosystem health in terms of the physical and chemical properties of the soils. The soil resource is a primary component of all terrestrial ecosystems, and any environmental stressor that alters the natural function of the soil has the potential to influence the vitality, species composition, and hydrology of forest ecosystems. **RM** note: Plots where Soils information is collected will be designated on the front of the plot packet with a sticker that says “Soils”.

Specifically, soils data are collected on P3 plots to assess (Santiago Declaration 1995):

- the potential for erosion of nutrient-rich top soils and forest floors.
- factors relating to the storage and cycling of nutrients and water.
- the availability of nutrients and water to plants (dependent upon soil structure and texture).
- carbon sequestration (the amount of carbon tied up in soil organic matter).
- deposition of toxic metals from pollution.
- acidification of the soil from deposition of pollutants.

Chemical properties of the soil are analyzed in order to develop indices for plant nutrient status, soil organic matter, and acidification. Together, these three factors largely determine the fertility and potential productivity of forest stands. Soil nutrient status refers to the concentration of plant nutrients (e.g., potassium, calcium, magnesium, and sodium) and is a key indicator of site fertility and species composition. The amount of organic matter in the soil largely determines water retention, carbon storage, and the composition of soil biota. Loss of soil organic matter as a result of management practices can alter the vitality of forest ecosystems through diminished regeneration capacity of trees, lower growth rates, and changes in species composition. Finally, increased soil acidity resulting from deposition of atmospheric pollutants has the capacity to reduce nutrient availability, decrease rates of decomposition, promote the release of toxic elements into the soil solution (e.g., aluminum), and alter patterns and rates of microbial transformations.

Nutrient and water availability to forest vegetation is also dependent on the physical capacity of roots to grow and access nutrients, water, and oxygen from the soil. In addition to playing an important role in plant nutrition, the physical properties of the soil largely determine forest hydrology, particularly with regards to surface and ground water flow. Human activities that result in the destruction of soil aggregates, loss of pore space (compaction), and erosion may increase rates of surface runoff and alter historic patterns of stream flow. In some areas, these changes may result in flooding and/or dewatered streams and can reflect on both the health of aquatic ecosystems and the management and conservation of associated forest and agricultural areas.

F.1 SUMMARY OF METHOD

Note: This indicator is CORE OPTIONAL on all phase 2 plots.

The soil measurement and sampling procedures are divided into three parts: soil erosion, soil compaction, and soil chemistry. Data collection for soil erosion assessment consists of estimating the percent of bare soil in each subplot. These measurements are combined with data from other sources and used to parameterize established models for erosion potential (RUSLE – Revised Universal Soil Loss Equation , WEPP – Water Erosion Prediction Project). Soil compaction measurements consist of an estimate of the percentage of soil compaction on each subplot along with a description of the type of compaction. Data are recorded using a handheld computer (PDR) with a preloaded data input program.

The chemical and physical properties of the soil are assessed through the collection of soil samples, which are then submitted to a regional laboratory for analysis. Soil samples are collected from the forest floor (subplots 2, 3, and 4) and underlying mineral soil layers (subplot 2). The entire forest floor layer is sampled from a known area after measuring the thickness of the duff (humus) and litter layers at four locations in a sampling frame of known area. Once the forest floor has been removed, mineral or organic soils are sampled volumetrically by collecting cores from two depths: 0 to 4 inches and 4 to 8 inches. The texture of each layer is estimated in the field and characterized as organic, loamy, clayey, sandy, or coarse sandy. Following soil sampling, the depth to any restrictive horizon within the top 20 inches is estimated using a soil probe. In the case of organic soils (e.g., wetland soils), samples are collected from the litter layer and the 0-4 inch and 4-8 inch organic layers.

Physical and chemical properties of the soil are determined in the laboratory. Analyses of forest floor samples include bulk density, water content, total carbon, and total nitrogen. Analyses of mineral soil samples include bulk density, water content, coarse fragment content, total organic and inorganic carbon, total nitrogen, plant available (extractable) phosphorus and sulfur, exchangeable cations (calcium, magnesium, sodium, potassium, and aluminum), pH, and trace metals such as manganese. These data are used to provide indexes of nutrient status, acidification, and carbon sequestration.

F.2 DEFINITIONS

Cryptobiotic crusts
A layer of symbiotic lichens and algae on the soil surface (common in arid regions)

Duff (Humus)
A soil layer dominated by organic material derived from the decomposition of plant and animal litter and deposited on either an organic or a mineral surface. This layer is distinguished from the litter layer in that the original organic material has undergone sufficient decomposition that the source of this material

(e.g., individual plant parts) can no longer be identified.

Forest floor
The entire thickness of organic material overlying the mineral soil, consisting of the litter and the duff (humus).

Litter
Undecomposed or only partially decomposed organic material that can be readily identified (e.g., plant leaves, twigs, etc.)

Loam
The textural class name for a soil having a moderate amount of sand, silt, and clay.

Mineral soil
A soil consisting predominantly of products derived from the weathering of rocks (e.g., sands, silts, and clays).

Organic soil
For the purposes of FIA, an organic soil is defined as any soil in which the organic horizon is greater than 8 inches in thickness. These soils are prevalent in wetland areas such as bogs and marshes and may be frequently encountered in certain regions of the country (e.g., Maine, northern Minnesota, coastal regions)

Restrictive layer
Any soil condition which increases soil density to the extent that it may limit root growth. This limitation may be physical (hard rock) or chemical (acid layer) or both.

Sampling frame
A frame used to collect forest floor samples from a known area. A bicycle tire 12 inches in diameter has been selected as the national standard.

Soil erosion
The wearing away of the land surface by running water, wind, ice or other geological agents.

Texture
The relative proportion of sand, silt, and clay in a soil.

F.3 EQUIPMENT AND SUPPLIES

Minimum required equipment is listed below. Field personnel may add equipment as needed to improve efficiency in some areas.

F.3.1 Field Gear Unique to the Soil Indicator

- Retractable measuring tape (inch intervals) for measuring soil layer depths.
- Frame for sampling known area of surface litter material. A small bicycle

tire (16 x 2.125 inch tire size with an internal diameter of 12 inch) has been chosen as the standard size.

- Impact-driven soil core (2-inch diameter x 8-inch depth) sampler with two 2-inch diameter by 4-in long stainless steel core liners for obtaining mineral soil samples.
- Additional bulk density sampling equipment: crescent wrench and universal slip wrench for disassembling bulk density sampler if stuck.
- Tile probe (42 inch) for measuring depth to a restrictive layer.
- Garden trowel or hand shovel for sampling forest floor and excavating soil sample hole where soil core sampler cannot be used.
- Small knife with sharp blade for sampling the forest floor layers.
- Pruning shears (very useful in cutting through roots and litter).
- Plastic water bottle for use in hand-texturing soil.
- Small plastic tarp (1 yd x 1 yd) to use as a working surface.
- Indelible ink markers (black thin-line) for marking sample bags.
- Cleaning cloths or tissues.
- Soil sample bags (9 x 12 inch or quart size) for mineral soil samples.
- Soil sample bags (10 x 18 inch or gallon size) for forest floor samples.
- Soil sample labels.

F.3.2 Optional Soils Equipment

- Supplemental soil sampling equipment for organic soils: Dutch auger.
- Supplemental soil sampling equipment for saturated or wetland soils: mud auger or piston-type core sampler.
- Garden gloves.
- 1-inch diameter soil tube probe to take soil samples for hand-texturing or where soil core sampler cannot be used.

F.3.3 Required Equipment not Unique to the Soil Indicator:

- Compass for locating sampling points.
- Measuring tape -100 ft loggers tape for measuring distance to sampling locations.
- Flagging for marking soil sample points.
- Back pack for carrying sampling equipment to the field.
- Clear plastic shipping tape to cover labels after they have been filled out.

F.4 LABORATORY ANALYSES

Phase 3 forest floor samples are analyzed in the laboratory for:

- Bulk density.
- Water content.
- Total carbon.
- Total nitrogen.

Phase 3 mineral soil samples are analyzed for:

- Bulk density, water content, and coarse fragment [>0.08-inch (>2-mm)] content.
- pH in water and in 0.01 M $CaCl_{2.}$

- Total carbon.
- Total organic carbon.
- Total inorganic carbon (carbonates) (pH>7.5 soils only).
- Total nitrogen.
- Exchangeable cations (Na, K, Mg, Ca, Al, Mn).
- Extractable sulfur and trace metals.
- Extractable phosphorus (Bray 1 method for pH < 6 soils, Olsen method for pH > 6 soils).

Methods for preparing and analyzing the collected soil samples are available in a separate document.

F.5 QUALITY ASSURANCE (QA)

The QA program for the soils indicator addresses both field and laboratory measurements. For field measurements, QA protocols are the same as those used for all other Phase 3 indicators. Tolerances have been established for each of the measurements. The tolerances are used during training, certification and auditing to assist with the control of data quality. Periodic re-measurements are undertaken to establish data quality attributes such as precision, bias and comparability.

This field guide only addresses aspects of QA related to the field portion of the program. Soil laboratories have another set of guidelines for ensuring data quality and are required to enroll in a national proficiency testing program. Details of the lab QA protocol may be obtained by contacting the regional lab directors.

F.5.1 Training And Certification

Field crews are trained to make field measurements as well as take soil samples. After training, all field crew members are tested and certified for soil indicator measurements. Each trained crew member must demonstrate the ability to conduct soil measurements within established MQOs.

F.5.2 Hot Checks, Cold Checks, and Blind Checks

QA/QC for the field portion of the soil indicator consists of three parts:

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.

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. Data errors are corrected. Discrepancies between the two sets of data may be reconciled. Cold checks are done on production plots only.

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

F.5.3 Reference Plots

Remeasurements of field observations by regional trainer crews occur on routine plots recently visited by a standard field crew (cold checks or hot checks) or on reference plots. All erosion and soil compaction remeasurements can be taken on the subplots as described in the soil measurement methods. Reference plots should be selected with areas of bare and compacted soil to allow for an evaluation of a crew's ability to make these measurements.

F.5.4 Debriefing

Feedback from the field crews is critical to identifying problems with the soil indicator measurements and improving the program for subsequent field seasons. Crew members conducting soil measurements should fill out a debriefing form and submit it to the regional field coordinator prior to the end of the field season. Crew members should consider it part of their responsibility to report any problems, inconsistencies, or errors in the field guide or the method.

F.6 Plot Information

F.6.1 CURRENT DATE

See section 1.13

F.6.1.1 YEAR

See section 1.13.1

F.6.1.2 MONTH

See section 1.13.2

F.6.1.3 DAY

See section 1.13.3

F.6.2 CREW NUMBER

See section 1.18

F.6.3 QA STATUS

See section 1.17

F.6.4 NOTES

Use these fields to record notes pertaining to the soils indicator. 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 soils plots

Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

F.6.1 PERCENT COVER OF BARE SOIL

Record a two-digit code indicating the percentage of the subplot that is covered by bare soil (mineral or organic). Fine gravel [0.08-0.20 inch (2-5 mm)] should be considered part of the bare soil. However, do not include large rocks protruding through the soil (e.g., bedrock outcrops) in this category because these are not erodible surfaces. For the purposes of the soil indicator, cryptobiotic crusts are not considered bare soil.

If the subplot includes non-forested areas, multiply the % COVER OF BARE SOIL in the forested part of the subplot by the % of the subplot that is in forested area. For example, if 50% of the subplot is forested and the % COVER OF BARE SOIL of the forested part is 30%, then the % COVER OF BARE SOIL for the entire subplot is 15 %.

When Collected: When any portion of the subplot contains at least one accessible forested condition class
Field Width: 2 digits
Tolerance: +/- 10%
MQO: 75% of the time
Values:

00	Absent	35	31-35%	75	71-75%
01	Trace	40	36-40%	80	76-80%
05	1 to 5%	45	41-45%	85	81-85%
10	6-10%	50	46-50%	90	86-90%
15	11-15%	55	51-55%	95	91-95%
20	16-20%	60	56-60%	99	96-100%
25	21-25%	65	61-65%	70	66-70%
30	26-30%				

F.6.2 PERCENT COMPACTED AREA ON THE SUBPLOT

Record a two-digit code indicating the percentage of the subplot that exhibits evidence of compaction. Soil compaction is assessed relative to the conditions of adjacent undisturbed soil. Do not include improved roads in your evaluation.

When Collected: When any portion of the subplot contains at least one accessible forested condition class
Field Width: 2 digits
Tolerance: +/- 15%
MQO: 75% of the time
Values:

00 Absent	35 31-35%	75 71-75%
01 Trace	40 36-40%	80 76-80%
05 1 to 5%	45 41-45%	85 81-85%
10 6-10%	50 46-50%	90 86-90%
15 11-15%	55 51-55%	95 91-95%
20 16-20%	60 56-60%	99 96-100%
25 21-25%	65 61-65%	
30 26-30%	70 66-70%	

F.7 SOIL EROSION AND COMPACTION

Erosion is defined as the wearing away of the land surface by running water, wind, or ice. Erosion is a natural process that occurs on all non-flat areas of the landscape. However, human activity (such as timber removal or road-building) can result in accelerated rates of erosion that degrade the soil and reduce the productivity of land. Extensive areas of soil erosion can have a major effect on the aquatic ecosystems associated with forests, recreational opportunities, potable water supplies and the life span of river infrastructure (e.g., dams, levees).

On average, the U. S. loses about 5 billion tons of soil annually to water and wind erosion. As this soil is removed from the landscape, it carries with it all of the nutrients and organic matter that took decades to centuries (or longer) to build up. On human time scales, fertile topsoil is not a renewable resource.

On FIA plots, soil erosion potential is estimated using published models, such as the Revised Universal Soil Loss Equation (RUSLE) and the Water Erosion Prediction Project (WEPP). These models are based on factors that represent how climate, soil, topography, and land use affect soil erosion and surface runoff. Generally, these models require the following factors for analysis: percent slope, slope length, precipitation factor, vegetation cover, and litter cover. Some of these factors are collected as part of the P2 mensuration data and other P3 indicators (percent slope and vegetation cover), one factor is obtained from outside sources (precipitation factor), and the remaining factors (% cover, which is given by 100 minus % BARE SOIL, and SOIL TEXTURE) are measured on each subplot as part of the soil indicator.

Estimates of bare soil are made on all four subplots. Soil texture is measured at the soil sampling site adjacent to subplot 2 during the collection of mineral and organic soil samples.

Compaction refers to a reduction in soil pore space and can be caused by heavy equipment or by repeated passes of light equipment that compress the soil and break down soil aggregates. This compression increases the bulk density and reduces the ability of air and water to move through the soil. These conditions also make it more difficult for plant roots to penetrate the soil and obtain necessary nutrients, oxygen, and water.

In general, compaction tends to be a greater problem on moist soils and on fine-textured soils (clays). These effects can persist for long periods of time and may result in stunted tree growth.

Information about compaction is collected on all subplots that are in a forested condition. Compaction data collected as part of the soil indicator include an estimate of the percent of each subplot affected by compaction and the type(s) of compaction present.

F.7.3 TYPE OF COMPACTION - RUTTED TRAIL

Type of compaction is a rutted trail. Ruts must be at least 2 inches deep into mineral soil or 6 inches deep from the undisturbed forest litter surface. Record a “1” if this type of compaction is present; record a “0” if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

F.7.4 TYPE OF COMPACTION – COMPACTED TRAIL

Type of compaction is a compacted trail (usually the result of many passes of heavy machinery, vehicles, or large animals). Record a “1” if this type of compaction is present; record a “0” if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

F.7.5 TYPE OF COMPACTION – COMPACTED AREA

Type of compaction is a compacted area. Examples include the junction areas of skid trails, landing areas, work areas, animal bedding areas, heavily grazed areas, etc. Record a “1” if this type of compaction is present; record a “0” if it is not present.

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors

MQO: 75% of the time
Values:

1 Present
0 Not present

F.7.6 TYPE OF COMPACTION – OTHER

Type of compaction is some other form. Record a "1" if this type of compaction is present; record a "0" if it is not present. (An explanation must be entered in the plot notes).

When Collected: When PERCENT COMPACTED AREA ON THE SUBPLOT > 00
Field Width: 1 digit
Tolerance: No errors
MQO: 75% of the time
Values:

1 Present
0 Not present

F.8 SOIL SAMPLE COLLECTION

The chemical and physical properties of the soil are assessed through the collection of soil samples, which are then submitted to a regional laboratory for analysis. Soil samples are collected from the forest floor (subplots 2, 3, and 4) and underlying mineral soil layers (subplot 2). The entire forest floor layer is sampled from a known area after measuring the thickness at the north, south, east, and west edges of a sampling frame of known area. Once the forest floor has been removed, mineral and organic soils are sampled volumetrically by collecting cores from two depths: 0 to 4 inches and 4 to 8 inches. The texture of each layer is estimated in the field and characterized as organic, loamy, clayey, sandy, or coarse sandy. Following soil sampling, the depth to any restrictive horizon within the top 20 inches is estimated using a soil probe. In the case of organic soils, samples are collected from the litter layer and the 0 to 4 inch and 4 to 8 inch organic layers.

Soil samples are collected within the annular plot along soil sampling lines adjacent to subplots 2, 3, and 4 (Figure F-1). During the first visit to a plot for soil sampling, soil samples will be collected at the point denoted as Soil Visit #1. On subsequent visits to a plot, soil sampling sites visit #2 or larger will be sampled. The soil sampling sites are spaced at 10-foot intervals alternating on opposite sides of soil sampling site number 1.

The initial sampling points (Soil Visit #1) are located:

- Subplot 2 soil measurement site: 30 feet due south (180o) from the center of subplot 2.
- Subplot 3 soil measurement site: 30 feet northwest (300°) from the center of subplot 3.
- Subplot 4 soil measurement site: 30 feet northeast (60°) from the center

of subplot 4.

If the soil cannot be sampled at the designated sampling point due to trampling or an obstruction (e.g., boulder, tree, standing water), the sampling point may be relocated to any location within a radius of 5 feet.

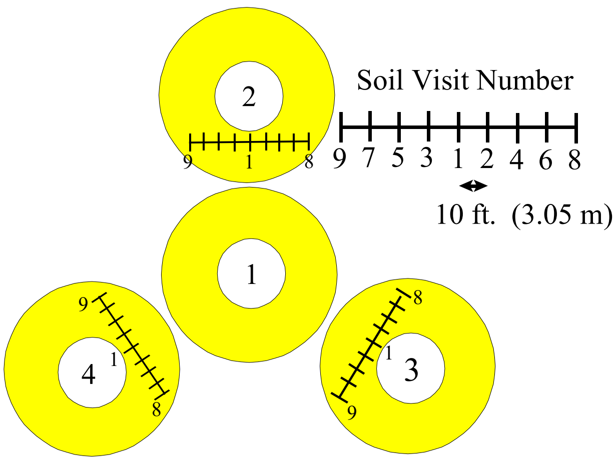


Figure F-1. Location of soil sampling sites

F.8.1 Forest Floor

Forest floor samples are collected from soil sampling sites adjacent to subplots 2, 3, and 4. Samples are collected if, and only if, the soil sampling sites are forested. The forest floor is sampled as a complete unit using a sampling frame (Figure F-2).

1. Place the sampling frame over the sampling point taking care not to compact the litter layer.
   Locate the points due north, due east, due south and due west on the inside of the soil sampling frame and mark these with small vinyl stake flags. Carefully remove the sampling frame.

2. Measure the thickness of the entire forest floor to the nearest 0.1 inch at the four flagged locations. At each sampling point, also measure the thickness of the litter layer.

3. Replace the soil sampling frame. Using a pair of clippers, carefully remove all live vegetation from the sample area. Living mosses should be clipped at the base of the green, photosynthetic material.

4. Using a sharp knife or a pair of clippers, carefully cut through the forest floor along the inner surface of the frame to separate it from the

surrounding soil.

5. Using inward scooping motions, carefully remove the entire volume of the forest floor from within the confines of the sampling frame. Discard all woody debris (including pine cones, large pieces of bark, and decomposed wood) above 0.25 inches in diameter (approximately the diameter of a pencil). Discard any rocks or pebbles collected with the forest floor material.

6. Working over the tarp, place the entire forest floor layer sample into a pre-labeled gallon sample bag. In some areas more than one bag might be required to hold the sample. If so, label the bags with identical information, then add “1 of 2” and “2 of 2” respectively.

22.8.2 Assembly and Operation of Impact Driven Soil Corer (Bulk Density Sampler)

The impact driven core sampler (Figure F-3) is used to collect a known volume of soil with a minimum of compaction and disturbance. The weight of this core is then used to determine bulk density (the mass of soil per unit volume), an important physical property of the soil. Although we usually think about the soil in terms of the mineral fraction, soils are actually a matrix of solids (mineral and organic), water, and air. The ratio between these fractions (pore space) determines the capacity of the soil to provide nutrients, air, and water to plant roots. In addition, bulk density is used to convert the chemical concentrations obtained in the lab to a volumetric basis, which is more meaningful in terms of plant nutrition.

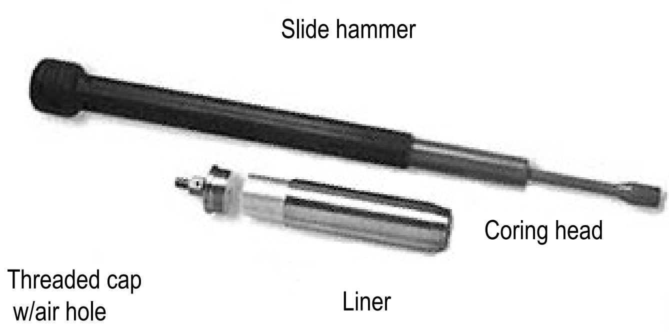


Diagram of Impact Driven Soil Corer

Figure F-3. Diagram of Impact Driven Soil Corer

<u>Assembly</u>

- Thread the top cap of the soil coring head onto the slide hammer attachment and tighten. This connection must be tight; if not, this connection may be sheared off during use.

- Insert two 2-inch diameter x 4-inch long stainless steel soil core liners into the soil coring head. It may be helpful to number the core liners with an indelible marker in order to tell them apart after the sample has been collected.

- Thread the soil coring head onto the top cap and slide hammer attachment until the top rim of the coring head just contacts the top cap. Make sure that the vent hole in the top cap is kept open, so that air displaced while the coring head is driven into the soil can escape from inside the coring head.

Maintenance

- Take care to clean and dry the inside and outside of the soil coring head after each sample. Moisture can cause rust build-up on the inside of the core head and make it difficult to insert and remove the liners.

- Use a brush and rag to clean both the inside and outside of the core liners as well. Grit on the outside of the liner can cause damage to the inside of the coring head and make it difficult to collect samples.

- Never twist, pull, or put pressure on the core sampler while the hammer attachment is extended. This can cause the attachment to break or bend.

F.8.3 Mineral Soil

Two mineral soil samples 0-4 inch and 4-8 inch are collected from the soil sampling site adjacent to **subplot 2 only**, and are collected if, and only if, the soil sampling site is forested (Figure F-2).

1. Mineral soil samples are collected from within the area of the sampling frame after the forest floor has been removed.

2. Place the core sampler in a vertical position and drive the sampler into the soil until the top of the coring head is about 1 inch above the mineral soil surface. At this point, the soil should be even with the top of the liner.

3. With the handle of the slide hammer down, rotate the sampler in a circular motion. This motion breaks the soil loose at the bottom of the sampler and makes it easier to remove the core. Do not extend the sliding part of the slide hammer upwards to gain additional leverage as this may bend the attachment. Remove the core sampler from the ground by pulling the slide hammer upwards in a smooth vertical motion.

4. If a complete and intact core has been collected, unscrew the coring head from the top cap and carefully slide the core liners onto the tarp (see sections F.8.5 and F.8.6 for techniques used in handling problem soils). If necessary, use the crescent and slip wrenches to separate the parts.

Trim the top and bottom of the core even with the liner rims. Take care to avoid any loss of soil from the cores; if any material spills, you must resample.

5. Using a knife, slice through the soil core at the interface between the two liners (the 4-inch depth). Remove the soil from the 0-4 inch stainless steel liner and place it into a pre-labeled soil sample bag. Repeat for the 4-8 inch core. Be sure to place all of the material in the liner (including coarse fragments, roots, soil, etc.) into the sample bags.

6. For each plot, you should have a maximum of five samples:

    - Three labeled gallon bags containing the forest floor samples from the sampling sites adjacent to subplots 2, 3, and 4. Additional bags may be needed for deep soils.
    - One labeled quart bag containing the 0 - 4 inch mineral soil sample from the soil sampling site adjacent to subplot 2.
    - One labeled quart bag containing the 4 - 8 inch mineral soil sample from the soil sampling site adjacent to subplot 2.

7. Clean all soil sampling equipment thoroughly before sampling soil at the next plot.

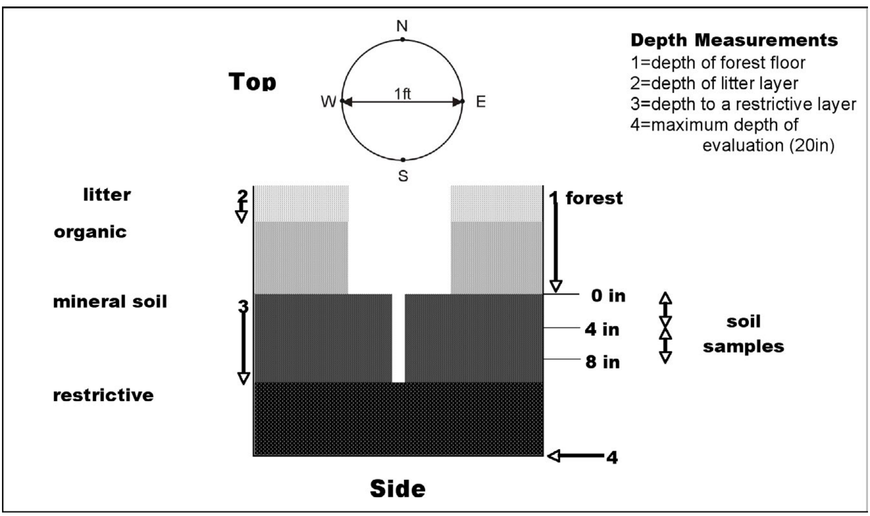


Figure F-2. Cross-sectional views of sampling sites (top view and side view).

F.8.4 Regulations Governing Sample Collection (National Historic Preservation Act)

The National Historic Preservation Act of 1966 (as amended) provides for the protection of historical and cultural artifacts. Due to the random placement of the Phase 3 monitoring design, a possibility exists that a Phase 3 plot may be located on a site of prehistoric or historical significance.

If cultural artifacts are encountered on a Phase 3 plot, do **not** take soil samples. Code the site as not sampled on the PDR and record a plot note explaining why soil samples were not taken.

If needed, archeologists or cultural resource specialists in these land management agencies will assist in obtaining permission to sample. Assistance is also available from State Historic Preservation Programs for state and private lands.

F.8.5 Alternate Sampling Methods for "Problem" Soils

In some cases, the soil coring procedure outlined above will not work. For example, in saturated organic soils, use of the core sampler may cause significant compaction of the sample. Very sandy soils or dry soils may tend to fall out of the liners, while in soils with a high rock content or a shallow depth to bedrock, it may not be possible to drive the core sampler into the ground. Approaches to handling these specific problems are addressed in section F.8.6.

In general, make at least three attempts to collect a sample using the core sampler. If these attempts are unsuccessful, then use one of the following techniques to collect a sample.

1. Excavation method (hand shovel) – Dig a shallow hole whose width is at least 1.5 times the length of your knife. Starting at the top of the mineral soil, measure down 8 inches. Make a mark on the side of the hole at 4 and 8 inches. Use your hand shovel to collect material from the 0-4 and 4-8 inch depth increments. Collect a sufficient volume of soil from the sides of the hole at each depth increment to approximately equal the volume of a soil core liner and place each depth increment sample in separate soil sample bags. Be sure to collect material from throughout the entire depth increment to avoid biasing the sample.

2. Tube probe – Remove the forest floor from an area and use the tube probe to collect samples from the 0-4 inch depth at a number of locations. Composite these samples until you have a sample volume approximately equal to that of the soil core liner. Repeat the sub-sampling and compositing for the 4-8 inch layer by returning to the points sampled previously and pushing the tube probe into the soil an additional 4 inches.

3. Dutch auger – Dutch augers can be very useful in wetland or saturated soils. In an area where the forest floor has been removed, drill into the soil with the auger and use a tape measure to help you collect material from the 0-4 and 4-8 inch depth increments.

For all of these methods, make sure to collect approximately the same amount of soil material [< 0.08 inch (< 2 mm)] that would have been needed to fill the core liner. Completion of the laboratory analyses requires at least 5 ounces (150 g) of mineral soil.

In soils with a large number of small rocks and pebbles, this means that you will need to collect a larger amount of sample so that the lab will have enough material to analyze once the rocks have been removed. In these soils, collect enough material to fill two core liners.

Be certain to circle "Other" on the label under sampler type.

F.8.6 Commonly Encountered Problems

It may not always be possible to obtain soil core samples using the soil core sampler. The following section provides some suggestions on how to overcome these problems.

1. Rocky soils
   In soils containing a high percentage of rocks, it may not be possible to drive the core sampler in to the required depth of 8 inches. If this occurs, remove any soil within the sampler, test for the presence of an obstruction using a plot stake pin or the tile probe, and make a second attempt either within the area where the forest floor has been removed or within the available soil sampling area (within a 5-foot radius of the original soil sampling location). Make a maximum of five attempts. If a complete sample from the 0-4 inch depth can be obtained, collect that sample. Otherwise, use the excavation or soil tube probe approaches outlined above (Section F.8.5).

2. Very sandy soils (or very dry soils) – sample falls out of the core
   If the soil will not stay in the core liner, use the shovel to dig around the soil coring head while it is still in place. Tilt the soil corer to one side and insert the blade of the shovel underneath the base of the core. Use the base of the shovel to hold the sample in place as you remove the corer from the soil. Depending on the soil type, this technique may require some practice and/or the use of a partner.

3. *Saturated or wetland soils.*
   Attempt to collect a sample using the soil corer. If this is not possible, or if compaction occurs,
   use one of the three alternate methods outlined in Section F.8.5.

4. *Buried Soils*
   In areas located adjacent to rivers or other bodies of water, sediment transport and periodic flooding may result in the formation of buried soils. Buried soils may be identified by alternating layers of mineral soil and forest floor material. To confirm the presence of a buried soil, excavate a small hole near the soil sampling site with a shovel and look for the presence of forest floor and litter materials buried between layers of mineral soil.

   Collect only the litter and organic matter currently on the soil surface as a forest floor sample following the standard protocol. Attempt to collect 0-4 and 4-8 inch samples using the bulk density corer. If this is not possible, or if the cores do not fill completely, collect a sample using a shovel following the excavation method outlined in F.8.5. Place a star on the upper right corner of the sampling label, circle “Other” for sampler type, and make a clear note on the shipping form to indicate that this sample represents a buried soil.

5. *Other situations in which a complete 8 inch core cannot be collected*

If a complete core cannot be obtained in one sample, but is cohesive enough to collect a second sample from the same hole, try the following. Collect a partial sample and measure the length of the collected core. Reinsert the sampler and drive it into the soil to an additional depth close to the length of the collected core. Remove the new core from the sampler. When placed together, the two cores should exceed 8 inches in length. With a knife, cut the cores at the 4-inch and 8-inch lengths. Replace the additional soil into the soil hole.

In some soil types, the 0-4 inch core may not fill completely, although the 4-8 inch core appears to be full. In this instance, attempt to collect a second core by driving the core deeper into the soil. In terms of the soil chemistry, it is better to *slightly* overcompact the sample than to under fill the core. Make three attempts to completely fill the core, driving the corer deeper each time. If you are still unable to obtain a complete 0-4 inch core, collect the 0-4 inch sample and mark “Other” under sampler type. An under filled core cannot be used a bulk density sample. If the 4-8 inch sample is full, it should be collected as a bulk density sample (mark “Bulk Density” under sampler type)

F.7.7 Organic soils

These soils are prevalent in certain regions of the country (e.g., Maine, northern Minnesota, coastal regions) and proper sampling requires modification of the above procedures.

- Due to the large thickness of the underlying organic soil, sampling is restricted to the litter layer. Measure the entire thickness of the forest floor to a maximum depth of 20 inches. However, only collect a sample of the litter layer (see section F.8.1).

- Attempt to collect a soil sample using the impact driven corer. In many cases, this will not be possible without severe compaction of the sample. If compaction occurs, or if you have difficulty in obtaining a complete core, samples may be collected at the 0 - 4 inch and 4 - 8 inch depth increments using a Dutch auger or shovel (see section F.8.5).

F.8.8 SUBPLOT NUMBER

Record the number of the subplot adjacent to the soil sampling site.

When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values: 2 to 4

F.8.9 VISIT NUMBER

Record the number of the location where the soil sample is being attempted (Figure F-1)

When Collected: All soil sample locations
Field Width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

F.8.10 SOIL SAMPLE STATUS

Record whether or not a forest floor or mineral soil sample is being collected at the soil sampling location. For both forest floor and mineral samples, it is the condition of the soil sampling sites in the annular plot that determines whether soil samples are collected. Samples are collected if, and only if, the soil sampling site is in a forested condition. In rare instances, the soil sampling site may occur in a forested condition that has not been sampled on any of the 4 subplots. If this is the case, then use SOIL SAMPLE STATUS code 11 to indicate that a sample has been collected for a forest condition that is not otherwise represented on the plot.

When Collected: All soil sample locations (mineral soil on subplot 2 and forest floor on subplots 2, 3, and 4
Field Width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01 Sampled: forest that has been identified as a condition on the plot
02 Not sampled: non forest

The following are for forest conditions:
03 Not sampled: too rocky to sample
04 Not sampled: water or boggy
05 Not sampled: access denied
06 Not sampled: too dangerous to sample
07 Not sampled: obstruction in sampling area
08 Not sampled: broken or lost equipment
09 Not sampled: other enter reason in plot notes
11 Sampled: forest that has NOT been identified as a condition on the plot

F.8.11 CONDITION CLASS NUMBER

Record the forested CONDITION CLASS NUMBER that best represents the condition from which the soil sample is being taken. If the condition class for the soil sample is different from any recorded on the 4 subplots, (or macroplots, if used), enter the CONDITION CLASS NUMBER for the most similar forest condition sampled on the plot.

When Collected: Soil sample locations that are being sampled (SOIL SAMPLE STATUS = 1 or 11)
Field Width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values: 1 to 9

F.8.12 FOREST FLOOR THICKNESS – NORTH

Record the thickness (to the nearest 0.1inch) of the forest floor measured from the top of the litter layer to the boundary between the forest floor and mineral soil

Measure to a maximum depth of 20.0 inches. If the thickness of the forest floor is greater than 20.0 inches, then code "20.0". For locations where bare soil or bedrock material is exposed, enter "00.0" inches depth. On organic soils, measure the entire thickness of the forest floor (to 20.0 inches) even though you will only sample the litter layer.

When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.13 FOREST FLOOR THICKNESS – EAST

Record the thickness (to the nearest 0.1 inch) of the forest floor measured from the top of the litter layer to the boundary between the forest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the forest floor is greater than 20.0 inches, then code "20.0". For locations where bare soil or bedrock material is exposed, enter "00.0" inches depth. On organic soils, measure the entire thickness of the forest floor (to 20 inches) even though you will only sample the litter layer.

When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.14 FOREST FLOOR THICKNESS – SOUTH

Record the thickness (to the nearest 0.1 inch) of the forest floor measured from the top of the litter layer to the boundary between the forest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the forest floor is greater than 20.0 inches, then code "20.0". For locations where bare soil or bedrock material is exposed, enter "00.0" inches depth. On organic soils, measure the entire thickness of the forest floor (to 20.0 inches) even though you will only sample the litter layer.

When Collected: When SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.15 FOREST FLOOR THICKNESS – WEST

Record the thickness (to the nearest 0.1 inch) of the forest floor measured from the top of the litter layer to the boundary between the forest floor and mineral soil.

Measure to a maximum depth of 20.0 inches. If the thickness of the forest floor is greater than 20.0 inches, then code "20.0". For locations where bare soil or bedrock material is exposed, enter "00.0" inches depth. On organic soils, measure the entire thickness of the forest floor (to 20.0 inches) even though you will only sample the litter layer.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.16 THICKNESS OF THE LITTER LAYER - NORTH

Record the thickness of the litter layer (to the nearest 0.1 inch) at the north location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the forest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter "00.0" inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.17 THICKNESS OF THE LITTER LAYER - EAST

Record the thickness of the litter layer (to the nearest 0.1 inch) at the east location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the forest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.18 THICKNESS OF THE LITTER LAYER - SOUTH

Record the thickness of the litter layer (to the nearest 0.1 inch) at the south location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the forest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.19 THICKNESS OF THE LITTER LAYER - WEST

Record the thickness of the litter layer (to the nearest 0.1 inch) at the west location within the sampling frame. The bottom of the litter layer can be distinguished as the boundary where plant parts (such as leaves or needles) are no longer recognizable as such because of decomposition. Another criterion is that the organic layer may contain plant roots, but the litter layer will probably not. At some locations, the depth of the forest floor and the litter layer may be the same. For locations where bare soil or bedrock material is exposed, enter “00.0” inches depth.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 2 inches
MQO: 90% of the time
Values: 00.0 to 20.0

F.8.20 DEPTH TO RESTRICTIVE HORIZON

Insert the tile probe into five locations within the soil sampling area (center, north, east, south and west edges) to identify if a restrictive horizon exists. Record the median depth to a restrictive layer (to the nearest 0.1 inch). The maximum depth for testing for a restrictive horizon is 20.0 inches. If a restrictive layer is encountered within the 20.0 inches, record the median depth (to the nearest 0.1 inch) to the restrictive horizon of the five locations probed.

Record:
20.0 if a restrictive horizon is not encountered.
00.0 if superficial bedrock is present.
99.9 if too many rock fragments or cobbles prevent inserting soil probe.

When Collected: SOIL SAMPLE STATUS = 1
Field Width: 3 digits
Tolerance: +/- 6 inches
MQO: 90% of the time
Values: 00.0 to 20.0, 99.9

F.8.21 SOIL TEXTURE IN THE 0-4 INCH LAYER

Record the code for the soil texture of the 0-4 inch layer. To estimate texture in the field, collect a sample of the soil from the appropriate horizon and moisten it with water to the consistency of modeling clay/wet newspaper; the sample should be wet enough that all of the particles are saturated but excess water does not freely flow from the sample when squeezed. Attempt to roll the sample into a ball. If the soil will not stay in a ball and has a grainy texture, the texture is either sandy or coarse sandy. If the soil does form a ball, squeeze the sample between your fingers and attempt to form a self-supporting ribbon. Samples which form both a ball and a ribbon should be coded as clayey; samples which form a ball but not a ribbon should be coded as loamy.

In some soils, telling the difference between the bottom of the forest floor and the top of an organic-rich mineral horizon can be difficult. If uncertain:

- Look for evidence of plant parts (e.g., leaves, needles). If you can see them decomposing in place, you're still in the forest floor.

- Rub the soil between your finger. Does it crumble (organic forest floor) or feel more like modeling clay (try pinching into a ribbon).

- Look for shiny flecks of mica or quartz (won't help in all soils).

- Look for a subtle change in color. Organic horizons tend to be black; a mineral horizon will tend to be more brownish.

- Wet a sample of the material and press it between your fingers. Note the color of the liquid that runs out. The blacker the color, the higher the organic content.

- Check for a change in density (mineral soils are denser).

When Collected: SOIL SAMPLE STATUS = 1 and SUBPLOT NUMBER = 2
Field Width: 1 digit
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

0 Organic
1 Loamy
2 Clayey
3 Sandy
4 Coarse Sand
9 Not measured – make plot note

F.8.22 SOIL TEXTURE IN THE 4-8 INCH LAYER

Record the code for the soil texture of the 4-8 inch layer (see the directions for SOIL TEXTURE IN THE 0-4 INCH LAYER).

When Collected: SOIL SAMPLE STATUS = 1 and SUBPLOT NUMBER = 2
Field Width: 1 digit
Tolerance: +/- 1 class
MQO: 80% of the time
Values:

0 Organic
1 Loamy
2 Clayey
3 Sandy
4 Coarse Sand
9 Not measured – make plot note

F.9 SAMPLE LABELS

Pre-printed labels will be provided to each field crew. Completion of all items on the soil label is essential for proper processing of the sample by the laboratories. In past years, numerous samples have had to be discarded due to mistakes or inconsistencies on the labels. If you encounter a situation where you need to make additional notes on the sample (e.g., a sample which was particularly unusual or required significant deviation from the standard methods), place a star on the upper right corner of the label and make a note on the sample shipping form. An example label is presented in Figure F-4.

Soil Sample Collected by Regular Field Crew

State: «State» County: «county»

P2 Plot: «FIAHex» P3 Hex: «FHMHex»

P3 Plot #: _ Soil Visit #: _ Crew **#:** ____________

Date: ____/____/____ Subplot#: 2 3 4

Layer: Forest Floor 0–4 in 4–8 in

Figure F-4. Example soil label

STATE
The 2-digit FIPS (Federal Information Processing Standard) code for the State (see Appendix 1 in the P2 field guide). This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

COUNTY
The 3-digit FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK). See Appendix 1 in the P2 field guide. This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

PLOT NUMBER
The P2 plot number (should be pre-printed on label)

P3 HEXAGON NUMBER
The seven digit P3 hexagon number for the plot. This must be the same as that entered on the PDR (should be pre-printed on label).

P3 PLOT NUMBER:
This number will usually be “1.” However, if more than one Phase 3 plot is located within a hexagon, then enter the number of the plot. Since most labels are preprinted, the number “1” may already be printed on the label. If incorrect, cross through this value and write the correct plot number above. If uncertain, check with your field supervisor.

SOIL VISIT NUMBER:
Record the soil visit number as described in Figure F-1. For the first soil sample collected along a soil sampling line, this number will be “1”. All subsequent visits to a plot will have higher numbers.

DATE SAMPLED:
Enter the date that soils were sampled on this plot.

CREW NUMBER
Enter your field crew identification number. If you have not been assigned a number, enter your last name.

LAYER TYPE:
Circle the type of sample collected and the depth increment of the sample.

SUBPLOT NUMBER:
Circle the subplot adjacent to the soil sampling site.

Subplot 2	Soil sample is from a soil sampling site adjacent to subplot 2
Subplot 3	Soil sample is from a soil sampling site adjacent to subplot 3
Subplot 4	Soil sample is from a soil sampling site adjacent to subplot 4

SAMPLER:
For mineral or organic soils, circle the method used to collect the sample

Bulk density - Impact-driven soil core sampler
Other - Soil tube probe, excavation method, mud auger, or Dutch auger

F.10 SAMPLE SHIPPING

After samples have been collected, changes in the oxygen and moisture content within the bag can cause significant alteration of sample chemistry. To prevent this from occurring, samples are to be shipped on a weekly basis to the regional soil lab designated for your state. Do not keep soil samples longer than a week unless they can be stored in a refrigerated area. Ship samples using the most economical rate. There is no need to ship soil samples using expensive overnight delivery rates.

F.9.1 Shipping Forms

All crews will be provided with shipping forms for forwarding soil samples to a regional laboratory that has been approved to receive soil samples from regulated areas. The addresses for the regional labs are listed at the bottom of the shipping form. An example shipping form is provided in Figure F-5.

Forms may be submitted either in hard copy or electronically. Electronic versions are preferred by the lab since this greatly increases the efficiency of sample inventory.

The hard copy version of the shipping form consists of a triplicate copy. Prior to shipping samples, crews should completely fill out the shipping form and:

- Send the original with the soil samples to the laboratory.
- Mail one copy immediately to the laboratory in a separate envelope along with a copy of the shipping (tracking) information from the shipping service. The separate mailing of shipping forms will serve to notify the laboratory if a shipment of samples has been misplaced during transport.
- Send the third copy to the regional field supervisor for their records.

Electronic versions may be filled out on a computer and electronic copies sent to the lab and your regional field supervisor. Lab email addresses are provided at the bottom of the shipping form. Print out a hard copy of the form and enclose this in the box prior to shipping. The hard copy is required as a QA check on sample inventory.

A separate line must be completed for each sample collected. Information on the sample shipping form is used by the laboratory to create an inventory of samples, to assign lab numbers, and to help resolve inconsistencies on the sample label. A complete and accurate inventory of samples is critical to efficient and cost-effective processing of samples.

FIA Phase 3 Soil Samples Shipping Form

Name: ________________________ Shipped Via: ________________________
Signature: _____________________ Tracking Number: ____________________
Date: __________________________
Crew #: ________________________ QA Status: □ Standard □ Audit

State	County	P2 Plot Number	P3 Hexagon Number	Date Sampled	Layer Type (Forest Floor, 0-4 in, or 4-8 in)	Subplot Number (2, 3, or 4)	Bags/Sample (note if more than 1 such as for large forest floor samples)

Total Number of Bags Sent __________

Figure F-5 FIA Phase 3 soil samples shipping form.

Please provide all information and ship samples WEEKLY to the appropriate lab for the region in which the samples were collected.
Western states:
Carolyn Sieg
SW Forest Science Complex
2500 S. Pine Knoll Drive
Flagstaff, AZ 86001-6381
928-556-2151

Instructions:
1. Fill out form completely. Make certain all soil sample bag labels are correct and complete.
2. Send white copy with soil samples.
3. Mail yellow copy in separate envelope to lab.
4. Keep pink copy.
5. Regular field crews: Please check "Standard" box at top of form.
6. QA crews: Please use a separate form for QA audit samples and check "Audit" box above.

SHIPPED VIA:
Enter the method used to ship the sample (e.g., UPS, Priority mail, regular mail).

SIGNATURE:

Sign your name here.

TRACKING NUMBER:
Enter the tracking number assigned to the shipment. This information is used by regional supervisors and the laboratories to locate lost or missing shipments.

STATE CODE:
Enter the two-digit FIPS code for the state in which the samples were collected.

DATE:
Enter the date on which samples were shipped.

CREW NUMBER:
If you have been assigned a crew number, enter it here.

QA STATUS:
Indicate whether this sample was collected as part of a standard plot or as part of an audit/QA plot. Unless you are conducting a hot, cold, or blind check, the option for "standard" should be checked.

P3 HEXAGON NUMBER:
Enter the seven digit P3 hexagon number for the plot. This must be the same as that entered on the PDR (should be pre-printed on sample label).

STATE
The 2-digit FIPS (Federal Information Processing Standard) code for the State (see Appendix 1 in the P2 field guide). This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

COUNTY
The 3-digit FIPS (Federal Information Processing Standard) code identifying the county, parish, or borough (or unit in AK). See Appendix 1 in the P2 field guide. This will be used by the soil analysis laboratory for batching of samples (should be pre-printed on labels).

PLOT NUMBER
The P2 plot number (should be pre-printed on label).

DATE SAMPLED:
Enter the date that the soil sample was collected.

LAYER TYPE:
Indicate the soil layer from which this sample was collected. Choices are: forest floor, 0-4 inches, and 4-8 inches.

SUBPLOT NUMBER:
Enter the subplot adjacent to the soil sampling line from which this sample was collected.

BAGS/SAMPLE
Enter the number of bags associated with a sample. For some forest floor samples, more than 1 bag may be needed to collect all of the material. The lab uses this information to make certain that samples consisting of multiple bags are processed together.

TOTAL NUMBER OF BAGS SENT:
Enter the total number of bags contained in the shipment. The laboratory staff will compare the number on this shipping form to the number of bags that they receive in order to make sure that no samples are missing.

F.10.2 Government Regulations For Pest-Regulated States (Southern Region, NY, AZ, NM, CA, and HI)

In order to limit the movement of agricultural pests (e.g., fire ant, corn cyst nematode, golden nematode, witchweed, and Mexican fruit fly), the shipment of soil samples across state boundaries is strictly regulated by the USDA. States with these pests are primarily located in the southern United States and include AL, AR, FL, GA, LA, MD, MS, NC, OK, SC, TN, and TX); soil shipments are also regulated in AZ, NM, CA, HI, and NY. In order to receive a permit to accept soil samples from these areas, the soil labs have had to sign a compliance agreement with the Plant Protection and Quarantine program of the USDA Animal and Plant Health Inspection Service (APHIS) and pass an inspection.

The burden for meeting APHIS shipping regulations falls on the field crews. Crews must:

- Double bag or enclose all samples from a shipment within a larger plastic bag (i.e., trash bag).
- Attach a shipping label to the outside of the box .
- Attach a regulated soils label showing the regional lab's APHIS permit number to the box.

After analysis, all soil samples must be stored or disposed of in the prescribed manner.

F.11 TASKS THAT CAN BE PERFORMED BY OTHER CREW MEMBERS

In order to maximize efficiency on the plot, crew members not trained in the soil indicator may be asked to assist with certain tasks related to sample collection. These tasks include:

- Locating the sampling site (with instruction from trained crew member).
- Assembling the impact driven corer.
- Filling in bag labels and sample shipping forms (Note: these should be checked by trained crew member prior to leaving the plot to ensure completeness and accuracy).

- Cleaning the core liners and the coring head.
- Disassembling the impact driven corer.

F.12 REFERENCES

RM Not included due to space limitations.

F.13 EXAMPLE DATA SHEETS

Soil Data Sheet 1

FIA Phase 3 Soil Sampling Site Measurements

State: ___ ___ County: ___ ___ ___ P2 Plot #: ___ ___ ___ ___

P3 Hexagon #: ___ ___ ___ ___ ___ ___ ___ Plot #: ___Soil Visit #: ___

Date: ___/___/_____ Crew Member(s): ______________________________

____

Soil Sampling Site Information

Soil Sampling Site Adjacent To:	Condition Class Code	Sampling Min 1	Sampling Min 2	Sampler
Subplot 2:	_______	_______	_____	_____
Subplot 3:	_______	_______	_____	_____
Subplot 4:	_______	_______	_____	_____

Sampling Codes
1 = Sampled
2 = Not sampled: non-forest
3 = Not sampled: too rocky
4 = Not sampled: water
5 = Not sampled: access denied
6 = Not sampled: too dangerous
7 = Not sampled: obstruction in sample area
8 = Not sampled: broken or lost equipment
9 = Not sampled: other (enter reason in plot notes)

Sampler
1 = Bulk density
2 = Other

Forest Floor Thickness (inches)

	N	E	S	W
Subplot 2 Soil Sampling Site:	_____	_____	_____	_____
Subplot 3 Soil Sampling Site:	_____	_____	_____	_____
Subplot 4 Soil Sampling Site:	_____	_____	_____	_____

Litter Layer Thickness (inches)

	N	E	S	W
Subplot 2 Soil Sampling Site:	_____	_____	_____	_____
Subplot 3 Soil Sampling Site:	_____	_____	_____	_____
Subplot 4 Soil Sampling Site:	_____	_____	_____	_____

Depth to Subsoil Restrictive Layer (inches)

Subplot 2 Soil Sampling Site:	_____
Subplot 3 Soil Sampling Site:	_____
Subplot 4 Soil Sampling Site:	_____

Field Texture Determination

Soil Texture Codes

Subplot 2 Soil Sampling Site	Mineral 1 (0-4)	_____
	Mineral 2 (4-8 in)	_____
Subplot 3 Soil Sampling Site:	Mineral 1 (0-4 in)	_____
	Mineral 2 (4-8 in)	_____
Subplot 4 Soil Sampling Site:	Mineral 1 (0-4 in)	_____
	Mineral 2 (4-8 in)	_____

0 = Organic
1 = Loamy
2 = Clayey
3 = Sandy
4 = Coarse sandy

Note to regular field crews: Collect mineral 1 and mineral 2 samples from forested sampling sites adjacent to subplot 2 only

Soil Data Sheet 2
FIA Phase 3 Soil Erosion and Compaction Measurements

State: ___ ___ County: ___ ___ ___P2 Plot #: ___ ___ ___ ___
P3 Hexagon #: ___ ___ ___ ___ ___ ___ ___Plot #: ___Soil Visit #: ___

Date: ___/___/_____ Crew Member(s): ____
____

Soil Erosion Measurements:

Subplot	Bare Soil[a] (%)
1	
2	
3	
4	

[a] Percent area estimate for forested portion of subplot

Soil Compaction Measurements:

Measurement	Subplot 1	Subplot 2	Subplot 3	Subplot 4
% Forested Area Compacted				
Type - Rutted Trail				
Type - Compacted Trail				
Type - Compacted Area				
Type - Other (Explain)*				

*Explanations: ____
____
____
____
____

RM Appendix G. RMRS Habitat Type Guides

Valid Habitat Type Publications by State

State	HT Pub Code	Habitat Type Publication
AZ	301	Plant Associations of Arizona and New Mexico, edition 3, July 1997. Volume 1: Forests, and Volume 2: woodlands (replaced the 3 volume little yellow, green, and tan books.) July 1997.
AZ	303	Forest and Woodland Habitat Types (Plant Associations) AZ South of Mogollon Rim and Southwest NM, Edition 2, reprinted March 1995 (little yellow book).
AZ	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.
CO	201	Plant Associations of Region Two: Potential Plant Communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas; Edition 4
CO	491	Office-generated codes for Ogden FIA for habitat type series and undefined types. (code 9999999)
ID	110	Forest Habitat Types of Northern Idaho: A Second Approximation Stephen V. Cooper, Kenneth E. Neiman, Robert Steele, and David W. Roberts 1987
ID	113	Plant Community Classification for Alpine Vegetation on the Beaverhead National Forest, Montana. INT-GTR-362. 1997. 61 p. Stephen V. Cooper, Peter Lesica, and Deborah Page-Dumroese
ID	401	Forest Habitat Types of Central Idaho R. Steele, R.D. Pfister, R.A. Ryker, and J.A. Kittams 1981
ID	402	Forest Habitat Types of Eastern Idaho-Western Wyoming R. Steele, S.V. Cooper, D.M. Ondov, D.W. Roberts, and R.D. Pfister 1983
ID	405	Aspen Community Types of the Intermountain Region W.F. Mueggler 1988
ID	406	Riparian Community Type Classification of Eastern Idaho-Western Wyoming A.P. Youngblood, and A.H. Winward 1989
ID	407	Riparian Community Type Classification of Utah and Southeastern Idaho Padgett, A.P. Youngblood, and A.H. Winward 1989
ID	408	Sagebrush-Grass Habitat Types of Southern Idaho M Hironaka, M.A. Fosberg, and A.H. Winward 1983
ID	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.
ID	494	Curlleaf Mountain-Mahogany Habitat Types for Interior West Inventories; from Ecology of Curlleaf Mountain-Mohogany in Oregon and Adjacent Areas Dealy, J. Edward 1975
ID	602	Vegetation-Soil Units in the central Oregon juniper zone. Res. Pap. PNW-19. Portland, OR: USDA, Forest Service, Pac.N.W. For. And Range Exp. Stat. 60 pp.
ID	615	Plant Associations of the Wallowa-Snake Province, Wallowa-Whitman National Forest. R6 Ecol 255-1986. Johnson, C.G. and S.A. Simon. 1987
MT	101	Forest Habitat Types of Montana; Gen.Tech.Rep. INT-34 R.D. Pfister, B.L. Kovalchik, S.F. Arno, and R.C. Presby (1977)
MT	102	Key to Montana Forest/Woodland Habitat Types East of the Continental Divide, developed for RMRS FIA Steve Cooper and Bob Pfister, 1988.
MT	103	Grassland and Shrubland Habitat Types of Western Montana; USDA/FS Gen.Tech. Rep. INT-66 W.F. Mueggler and W.L. Stewart (1980)

MT	112	Classification and Management of Montana's Riparian and Wetland Sites. Paul L. Hansen, Robert D. Pfister, et. al. Miscellaneous Publication NO. 54. May 1995.
MT	113	Plant Community Classification for Alpine Vegetation on the Beaverhead National Forest, Montana. INT-GTR-362. 1997. 61 p. Stephen V. Cooper, Peter Lesica, and Deborah Page-Dumroese
MT	114	The Vegetation of the Grand River /Cedar River, Sioux, and Ashland Districts of the Custer National Forest: A habitat Type Classification Hansen and Hoffman
MT	402	Forest Habitat Types of Eastern Idaho-Western Wyoming; USDA/FS Gen.Tech.Rep. INT-144 YELLOWSTONE NP ONLY
MT	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.
NV	401	Forest Habitat Types of Central Idaho; USDA/FS Gen.Tech.Rep INT-144
NV	403	Coniferous Forest Types of Northern Utah; USDA/FS Gen.Tech.Rep. INT-170
NV	404	Coniferous Forest Types of Central and Southern Utah; USDA/FS Gen.Tech.Rep. INT-187
NV	405	Aspen Community Types of the Intermountain Region; USDA/FS Gen.Tech.Rep. INT-250
NV	407	Riparian Community Type Classification of Utah and Southeastern Idaho; USDA/FS Report R4-ECOL-89-01
NV	408	Sagebrush-Grass Habitat Types of Southern Idaho M Hironaka, M.A. Fosberg, and A.H. Winward 1983
NV	414	Plant Community Classification of the Spring Mountains National Recreation Area. The Nature Conservancy and USDA Forest Service. 1996 Unpublished.
NV	415	NatureServe Explorer: An online encyclopedia of life [web application]. Version 1.8. NatureServe, Arlington, Virginia. Http://www.natureserve.org/explorer. 2003
NV	416	A Management-Oriented Classification of Pinyon-Juniper Woodlands of the Great Basin. RMRS-GTR-12. USDA-FS, Rocky Mountain Research Station. Ogden, UT. 1988
NV	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.
NV	494	Curlleaf Mountain-Mahogany Habitat Types for Interior West Inventories; from Ecology of Curlleaf Mountain-Mohogany in Oregon and Adjacent Areas Dealy, J. Edward 1975
NV	501	Riparian Community Type Classification for Humboldt and Toiyabe National Forests, Nevada and Eastern California; R4-Ecol-95-01. 1995.
NV	504	Ecological Guide to Eastside Pine Plant Associations; Northeastern California: Modoc, Lassen, Klamath, Shasta-Trinity, Plumas, and Tahoe National Forests. 1988.
NV	506	A Classification of Upper Montane Forests in the Central and Southern Sierras of California, Zone 5. Gen Tech Report R5-ECOL-TP-003.
NV	602	Vegetation-Soil Units in the central Oregon juniper zone. Res. Pap. PNW-19. Portland, OR: USDA, Forest Service, Pac.N.W. For. And Range Exp. Stat. 60 pp.
NM	301	Plant Associations of Arizona and New Mexico, edition 3, July 1997. Volume 1: Forests, and Volume 2: woodlands (replaced the 3 volume little yellow, green, and tan books.) July 1997.
NM	303	Forest and Woodland Habitat Types (Plant Associations) AZ South of Mogollon Rim and Southwest NM, Edition 2, reprinted March 1995 (little yellow book).
NM	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.

UT	403	Coniferous Forest Habitat Types of Northern Utah
UT	404	Coniferous Forest Habitat Types of Central and Southern Utah
UT	405	Aspen Community Types of the Intermountain Region
UT	407	Riparian Community Type Classification of Utah and Southeastern Idaho
UT	408	Sagebrush-Grass Habitat Types of Southern Idaho M Hironaka, M.A. Fosberg, and A.H. Winward 1983
UT	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.
WY	103	Grassland and Shrubland Habitat Types of Western Montana; USDA/FS Gen.Tech. Rep. INT-66 W.F. Mueggler and W.L. Stewart (1980)
WY	201	Plant Associations of Region Two: Potential Plant Communities of Wyoming, South Dakota, Nebraska, Colorado, and Kansas; Edition 4
WY	202	The Black Hills Community Inventory prepared by The Nature Conservancy authors, Midwest Regional Office, Minneapolis, Minnesota
WY	203	Riparian and Wetland Plant Communities of the Black Hills. The Nature Conservancy. 12/2000
WY	205	Forest Vegetaion on National Forests in the Rocky Mountain and Intermountain Regions: Habitat Types and Community Types; USDA/FS Gen.Tech.Rep. RM-162
WY	207	Forest Vegetation of the Medicine Bow National Forest in Southeast Wyoming: A Habitat Type Classification. RM-271. USDA Forest Service
WY	208	Forest Vegetation of the Bighorn Mountains, Wyoming: A Habitat Type Classification. RM-170. USDA Forest Service
WY	402	Forest Habitat Types of Eastern Idaho-Western Wyoming; USDA/FS Gen.Tech.Rep. INT-144
WY	405	Aspen Community Types of the Intermountain Region; USDA/FS Gen.Tech.Rep. INT-250
WY	406	Riparian Community Type Classification of Eastern Idaho-Western Wyoming; USDA/FS Report R4-ECOL-85-01
WY	408	Sagebrush-Grass Habitat Types of Southern Idaho M Hironaka, M.A. Fosberg, and A.H. Winward 1983
WY	491	Office-generated codes for Ogden FIA for habitat type series and undefined types.

RM Index

Symbols

A

B

C

D

E

F

G

H

I

L

M

N

O

P

S

T

U

V

W

X

Y