INTERIOR WEST FOREST INVENTORY & ANALYSIS

FOREST SURVEY FIELD PROCEDURES

Rocky Mountain Research Station

FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE

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Additions/Changes or Deletions made from the 2003 manual

General

- Subplot Data now Chapter 8, Tree Data now Chapter 9, Understory Data now Chapter 10, and Accounting now Chapter 11
- Regional (RMRS) variables and procedures are indicated by shading of the text - In previous years the National Core variables were shaded.
- New Cover
- Added: all Core "item" numbers

Chapter 1 - Introduction

- Updated some "Everyday Considerations" and "Field Organization"

Chapter 2 – Finding the Location Center

None

Chapter 3 – Defining the Condition Class and Condition Class Description

- Combined chapters 3 (Defining the condition class) and chapter 8 (Condition Class Description Items)
- Changed: The Secondary Habitat Type code will now be the same as the Primary code unless a secondary code is needed. Last year 9999999 was used which is now a valid code
- Added: Forest Type 709 Cottonwood/Willow
- Changed: the stocking rules where a plot is stocked (forested) with any combination of 40 seeds /Saps/Trees.
- Changed: CONDITION STATUS was changed to CONDITION CLASS STATUS
- Rearranged: Section 2 CONDITION CLASS. Several of the sub-sections were rearranged for clarity and in some cases renumbered.
- Changed: Step 1: Delineate the plot area by CONDITION CLASS STATUS. Changed "5. Denied access area, 6. Area too hazardous to visit, and 7. Area that is not in the sample, e.g., in Canada or Mexico" **to** "5. Nonsampled". Also, added text addressing an additional attribute, PRESENT NONFOREST Land Use, used at remeasurement.
- Added: Figures 8,9, and 10
- Modified: Figure 14
- Modified: CONDITION CLASS STATUS
- Added: CONDITION NONSAMPLED REASON
- Changed: DENIED ACCESS. Changed "DENIED ACCESS" to code 02 "denied access area" in PLOT NONSAMPLED REASON.
- Moved and Changed: HAZARDOUS. Changed "HAZARDOUS" to code 03 "Hazardous situation" in PLOT NONSAMPLED REASON.
- Moved and Changed: NOT IN THE SAMPLE. Changed "NOT IN THE SAMPLE" to code 01 "Outside U.S. boundary" in PLOT NONSAMPLED REASON.
- Added: Figures 18-23
- Changed: FOREST TYPE. Added additional text to address forest type if STAND SIZE CLASS is nonstocked. Addressed MQO in the same situation.

- Changed: STAND SIZE CLASS. Modified some text and deleted some text from the description under Values.
- Changed: STAND SIZE CLASS. Changed variable description from "Record the code that best describes the predominant size class of all live trees in the condition class that are not overtopped." to "Record the code that best describes the predominant size class of all live trees in the condition class."
- Changed: STAND SIZE CLASS. Clarified (b) of code 0 from "for forest types where stocking standards are not available, less than 5 percent crown cover of trees of any size" to "for several western woodland species where stocking standards are not available, less than 5 percent crown cover of trees of any size".

- Changed: STAND SIZE CLASS. Clarified code 6 from "Cover trees (non-tallied)" to "Cover trees (trees not on species list, used for plots classified as nonforest)"
- Changed: DISTURBANCE 1. Changed code 10 from "Insects" to "Insect damage". Added code "11 insect damage to understory vegetation" and code "12 insect damage to trees, including seedlings and saplings". Changed code 20 from "Disease" to "Disease damage". Added code "21 disease damage to understory vegetation" and code "22 disease damage to trees, including seedlings and saplings". Added code "55 earth movement/avalanches". Clarified code 80.
- Clarified: TREATMENT 1. Clarified Code 30, code 40, and code 50.
- Deleted: PAST NONFOREST / INACCESSIBLE LAND USE
- Changed: PRESENT NONFOREST LAND USE. Listed the codes: 10, 11, 12, 13, 14, 15, 20, 30, 31, 32, 33, and 40. Deleted code 90 series.
- Deleted: NONFOREST YEAR
- Clarified: BOUNDARY CHANGE. Added additional text to code 0.
- Clarified: CORNER DISTANCE. Added text to Values for microplot and annular plot.
- Deleted: Forest Type Code 999

Chapter 4 – Field Procedure Overview

None

Chapter 5 – Field Location Layout and Tree Sampling Procedures

Changed: Wording on qualifying saplings: Only tally live saplings are tallied.

Chapter 6 – Field Location Reference

- Added: clarification to Noxious Weed procedures – chapter 6 **and** 10
- Added: Detail on what exactly is collected on the separate Reference File (Option 0).

Chapter 7 – Field Location Description (Plot Identification Items)

- Changed: Manual version from V 1.7 to V 2.0
- Added: PLOT NONSAMPLED REASON"
- Deleted: RANGE DATA
- Changed: Denied Access/Hazardous" was changed to "NONSAMPLED"
- Changed: PLOT NUMBER. When collected changed from "All plots" to "SAMPLE KIND = 1 or SAMPLE KIND = 2".

- Added: PLOT STATUS
- Changed: SAMPLE KIND. Code definitions clarified.
- Added: PREVIOUS PLOT NUMBER
- Changed: YEAR. Values: changed from "Beginning with 1998, constant for a given year" to "> 2003"
- Deleted: TRAILS OR ROADS
- Deleted: ROAD ACCESS
- Deleted: PUBLIC USE RESTRICTIONS
- Deleted: RECREATION USE 1
- Deleted: RECREATION USE 2
- Deleted: RECREATION USE 3
- Changed: QA STATUS. Clarified code 7 as "Hot check (production plot)".
- Changed: 1.14.3 GPS UNIT. Changed code 3 from" Trimble GeoExplorer or Pathfinder Pro" to "Other brands capable of producing files that can be post-processed". changed code 4 from " Recreational GPS (Garmin, Magellan, etc.)" to "Other brands not capable of field-averaging or post processing".
- Added: Regional (RMRS) SAMPLE KIND

Chapter 8 – Subplot Data

- Changed: 3.2 SUBPLOT/ANNULAR PLOT STATUS. Codes changed from "0 No accessible forest land condition class" and "1 At least one accessible forest land condition class" to "1 Sampled – at least one accessible forest land condition present on subplot" and " 2 Sampled – no accessible forest land condition present on subplot" and "3 Nonsampled".
- Added: SUBPLOT NONSAMPLED REASON
- Clarified: SUBPLOT SLOPE. Changed When collected from "All subplots with an accessible forest land condition class (CONDITION STATUS = 1)" to "All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/ANNULAR PLOT STATUS = 1)".
- Clarified: SUBPLOT ASPECT. Changed When collected from "All subplots with an accessible forest land condition class (CONDITION STATUS = 1)" to "All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/ANNULAR PLOT STATUS = 1)".
- Clarified: SNOW/WATER DEPTH. Changed When collected from "All subplots with an accessible forest land condition class (CONDITION STATUS = 1)" to "All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/ANNULAR PLOT STATUS = 1)".

Chapter 9 – Tree Data

- Deleted: HEIGHT TO CROWN no longer collected
- Clarified: Recording > 20 stems on woodland trees
- Changed: Tally only LIVE Saplings
- Clarified: TREE AND SAPLING DATA. The When collected stated as "All live and dead tally trees > 1.0 in DBH/DRC" was changed to "All live tally trees > 1.0 in DBH/DRC and standing dead tally trees > 5.0 in DBH/DRC".
- Changed: CONDITION CLASS NUMBER. Changed When collected from "All live and standing dead tally trees > 1.0 in DBH/DRC" to "All trees".
- Added: PREVIOUS TREE STATUS

- Changed: PRESENT TREE STATUS. Changed name from "TREE STATUS" to "PRESENT TREE STATUS". And clarified codes 0, 2, and 3. Deleted code 4 "Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc. (remeasurement plots only)." Added text for remeasurement plots.
- Changed: RECONCILE. Changed name from "NEW TREE RECONCILE" to "RECONCILE". Clarified code 2 and added codes 5-8.
- Added: STANDING DEAD. Also added some new figures.
- Deleted: LEAN ANGLE
- Changed: MORTALITY (CORE OPTIONAL). Clarified text.
- Changed: SPECIES. Changed Field width from "3" to "4".
- Modified: DIAMETER. Modified the Tolerance values.
- Clarified: DIAMETER AT BREAST HEIGHT. Added an example of how to measure DBH on a tree with a curved bole (pistol butt tree).
- Clarified: TOTAL LENGTH. Clarified to what point the tree is measured for TOTAL LENGTH.
- Clarified: ACTUAL LENGTH. Clarified how ACTUAL LENGTH is measured and clarified when collected.
- Clarified: UNCOMPACTED LIVE CROWN RATIO. Clarified method text.
- Clarified: COMPACTED CROWN RATIO. Clarified method text.
- Added: Figure 40 (Figure number needs to change after formatting chapter 9).
- Changed: CAUSE OF DEATH. Added text to code 70. Changed text of code 80 from "Human-caused (cultural, logging, accidental, etc.)" to "Silvicultural or landclearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to landclearing activity). Deleted code 90 "Physical (hit by falling tree)". Also, changed When collected from "All TREE STATUS = 1 at time 1 and TREE STATUS = 2 or 3 at time 2" to "CORE: SAMPLE KIND = 2 plots: all PAST 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".
- Clarified: MORTALITY YEAR. Changed When collected from "All TREE STATUS = 1 at time 1 and TREE STATUS = 2 or 3 and time 2" to "Plots where SAMPLE KIND = 2: all PREVIOUSPAST TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3".
- Changed: LENGTH TO DIAMETER MEASUREMENT POINT (CORE OPTIONAL). Change the following text from "If the diameter is not measured at 4.5 ftfeet, record the actual length from the ground, to the nearest 0.1 inch, at which the diameter was measured for each tally tree, 1.0 inch DBH and larger" to "If the diameter is not measured at 4.5 ftfeet, 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.".
- Deleted: UTILIZATION CLASS.
- Clarified: ROUGH CULL (CORE OPTIONAL). Clarified the text about how to collect.
- Changed: TREE NOTES. Changed When collected from " All live and dead tally trees > 1.0 in DBH/DRC" to "All trees".
- Changed: SEEDLING DATA. Changed introductory text from "are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6. are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6.Counts beyond 5 are coded as 6. Species are coded in order from most abundant to least abundant when SEEDLING COUNT is coded as 6." to "Counts beyond five estimated."

- Changed: SPECIES (in Seedling Data) field width from "3 digits" to "4 digits".
- Changed: CONDITION CLASS NUMBER (Seedling Data. Changed name from "CONDITION CLASS" to "CONDITION CLASS NUMBER".
- Changed: SEEDLING COUNT. Text modified, field width changed from "1 digit" to "3 digits", MGO changed from "95" to 90", and values changed from "1 to 5 – exact count. 6 – More than 5 individuals by species by condition class" to "001 through 999".
- Changed: SITE TREE LENGTH. Changed Values from "001 to 999" to "005 to 999".
- Clarified: "center microplot" to "formerly centered microplot" in "When Collected" for many variables
- Clarified: DRC procedures for deciduous woodland oak and bigtooth maple
- Changed: "Height" to "length" in ACTUAL and TOTAL TREE LENGTH sections.

Chapter 10 – Understory Vegetation description

- Added clarification to Noxious Weed procedures - Chapters 6 and 10

Chapter 11 – Accounting Procedures

- Changed: Do not collect information on microplot ingrowth.
  Changed: NEW TREE RECONCILE to RECONCILE
- Added: Code "0" to Reconcile "Tree not measured"
- Delete: STUMP DIAMETER
- Delete: "Hard" or "Soft" dead from CURRENT TREE STATUS
- Deleted: POINT HISTORY
- Added: All Site Tree Data Variables
- Added: MONTH
- Added: DAY
- Added: YEAR
- Added: POINTS ACCOUNTED
- Added: NON ACCOUNTED REASON
- Added: MICROPLOTS ACCOUNTED
- Added: LAND USE
- Added: CO-LOCATED

Appendices

- Deleted: Appendix A.7 Tree-Check Form
- Deleted: Appendix B Map, Photo, and Traversing Tables
- Deleted: Appendix F Variable Name Abbreviations
- Deleted: Appendix C.2 Square foot basal area values for certain diameters
- Deleted: Appendix C.5 Circular Defect Deduction Table
- Combined: Appendix C.6 and C.7 into Defect Chart and Guidelines
- Deleted: Appendix E Item Coding Guides from manual and will provide as handout
- Changed and Updated all appropriate field forms to reflect any changes
- Added: Appendix G – Site Tree Selection Criteria and codes

P3

- Changed: DAMAGE SEVERITY 1 (CORE OPTIONAL). Changed the tolerance from "No errors" to "+ 1 valid class unless otherwise defined by the DAMAGE TYPE".

- Clarified: DAMAGE LOCATION 2. Added “(CORE OPTIONAL)” to name.
- Clarified: DAMAGE TYPE 2. Added “(CORE OPTIONAL)” to name.
- Clarified: DAMAGE SEVERITY 2. Added “(CORE OPTIONAL)” to name.

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CHAPTER 1 - INTRODUCTION

This manual outlines the resource inventory procedures and definitions used by the Forest Survey field crews, Interior West Forest Inventory and Analysis Program (IWFIA), Rocky Mountain Research Station. These instructions cover the establishment and measurement of new and remeasurement field locations for the annual inventory.

This manual is a combination of regional variables that pertain specifically to the interior west and national core variables. National core variables are variables collected by all Forest Inventory and Analysis units (FIA) across the U.S. to ensure a degree of consistency and uniformity in the data collection procedure. Throughout this manual, shading of the text will indicate Interior West regional variables. Some full chapters are Interior West only which are identified in the introductory paragraph of the specific chapter.

A. 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 Interior West States including 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.

B. Field Organization

Field work is administered by field supervisors and section leaders. Each field supervisor is responsible for coordinating the field effort for one or more individual field sections; duties include assigning work areas and transferring field crews between sections to meet work schedules.

A section leader directs the day-to-day work for two or more field crews working in the same area. Some of the duties of a section leader include assigning field plots to crews, collecting completed field packets, and holding camp safety meetings. Other responsibilities include distribution of field equipment and supplies, and assisting the quality control staff and the field supervisor in on-the-job training of field crews.

Two- 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.

C. Quality Control

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

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

Quality control crews conduct periodic on-site inspections of field locations 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.

D. Personal Conduct and Safety

In the course of establishing and measuring field locations, 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 particularly important that field crews obtain permission to enter or pass through private land. Be careful to not cause any property damage. Also, leave all gates as they are found.

The field supervisor will contact local National Forest and BLM District offices immediately upon arrival in an area to inform them of field crew activity.

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 -- NO EXCEPTIONS. Appropriate footwear, such as all-leather boots, and other protective clothing must be worn while on the job.

Immediately report all injuries to the field supervisor and section leader.

E. 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 you leave camp or your motel, plan the travel route to the plot. Always take two or more extra plots each day.

2. If your plot is located far from a road, plan to camp out if necessary.

3. Record your plot destination on the location log in your trailer or attached to the outside of the door for any other housing facility. If you are staying in a motel you must call the office daily with the County and Location of all possible plots planned for that day.

4. Check to make sure you have all your equipment before leaving camp or the motel: field gear, plot packets, data recorder, GPS, metal stakes, nails, lunch, water, rain gear, etc.

5. Check to make sure you have all the equipment needed to conduct the field inventory when you leave your truck.

6. Perform a thorough plot edit before you leave the location. Check for missing data items as well as field gear.

7. Do not travel through the woods after dark. If you are lost, do not panic, but settle down some place and try to make radio/satellite phone contact with the section leader or with another agency. Know how to use the radio/satellite phone!

8. Keep the first aid kits supplied, and know how to use them.

F. Vehicles

A government owned or leased vehicle will be specifically assigned to each crew supervisor. The vehicle's "green book", contains a fuel card and various documents to maintain records of mileage, utilization, fuel and oil consumption, maintenance, and repairs.

The operator must ensure that the assigned vehicle is properly used, serviced, periodically inspected, and always kept reasonably clean and in safe operating condition and that all documentation is completed as scheduled.

The crew leader (or field supervisor/section leader) may authorize other employees to use the vehicle; however, the operator of a vehicle is responsible

for that vehicle and it's equipment while using it. Vehicles must be returned to the assigned driver in good condition.

The field supervisor will monitor compliance with established standards and guidelines.

The fleet manager is responsible for monitoring utilization, the production of yearly use and consumption reports, the monitoring of and arrangement for major repairs and maintenance, upkeep of repair and maintenance records, making vehicle assignments and reassignments. Direct needs and questions regarding trucks, trailers, and field equipment to the fleet manager.

The following schedule of servicing and inspection must be followed:

1. Preventive Maintenance (PM) Check. During the first week of each month, assigned users must complete the monthly PM check card to indicate any needed repairs/maintenance, and then forward the card to the section leader or send them to the office. Attachments such as radios, winches, and tools boxes must be inspected as well. The section leader will make repair arrangements through the fleet manager and will forward PM check forms to the fleet manager when services are complete.

2. Oil Changes/Tire Rotation. Every 4,000 miles (3,000 miles for vehicles with more than 50,000 miles), assigned users must arrange for crankcase oil change, air filter and oil filter replacement, gearbox level checks, fluid level inspections, belt and pulley inspections, front end and suspension inspections, and tire rotation at a professional garage.

3. In-Field Repairs. Repairs to WCF (Green Fleet) and GSA vehicles must be coordinated and authorized through the fleet manager. The fleet manager maintains records for warranty work and trend monitoring. Before any work is completed on the vehicle, Program Support Services personnel must authorize payment based on quotes received. Document repairs on the equipment maintenance/use records, and forward invoices and receipts to the fleet manager. Forward all repair invoices to Program Support Services at the time of completion.

4. Tires. Tire purchases must be authorized and arranged through the fleet manager and Program Support Services personnel. Tire repairs may be charged on the vehicle fuel card. For all tire repairs and replacements, complete a tire failure report and forward the report to the fleet manager.

5. Yearly Mechanical Inspection. Once a year, the fleet manager will coordinate an annual vehicle service and inspection for each vehicle; this will be conducted at a dealership or professional garage. Forward all repair invoices and records to the fleet manager.

6. Radios. Each truck and field supervisor's trailer has a mobile radio. Crews are not permitted to reprogram radios without authorization from the fleet manager. CB's are also included in most vehicles for use on move days and in logging areas.

WEAR SEAT BELTS AT ALL TIMES when a vehicle is in operation.

No Smoking in vehicles/trailers.

Watch for logging trucks -- they always have the rights-of-way and often use the full roadbed.

All accidents involving government vehicles or other property that result in injury/damage to employees, government property, private citizens, and/or private property **must be promptly reported** to the field supervisor regardless of dollar value. Accident packets are located in every vehicle and must be kept complete and up-to-date by the assigned operator.

G. Equipment and Supplies

Each individual will be issued the necessary field equipment and supplies and will sign two copies of an itemized list for that equipment. The individual will keep one copy while the section leader retains the other. Both copies will be kept current. Individuals will be responsible for the use and care of equipment assigned to them.

CHAPTER 2 - FINDING THE FIELD LOCATION CENTER

This chapter provides instructions for finding the field location center (LC). The LC is based on the intersection of map grid lines and is located in the field using past inventory location reference information**,** global positioning system recievers**,** and/or photo baseline techniques. The LC is designated as subplot center 1 of the field sample. This chapter is the Interior West procedures only.

A. Land Owner/Management Agency Verification

Prior to the establishment of any field location, **the ownership or managing agency of the field location must be verified.** Upon arrival in each county, or prior to the field season, the field supervisor will designate a field crew to visit the county courthouse to verify the managing agency and to obtain private land ownership information (name, address, phone number). Land management agencies must be contacted to obtain lessee information. Record corrected land ownerships on the field location packet and on the Field Location Description record.

Before visiting each field location, it is particularly important 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”; notify the supervisor immediately.

B. Planning Travel to the Vicinity of the Field Location and LC Pinprick Verification

As an aid in planning travel and in finding a field location, field crews are supplied with forest and highway maps, a GPS Reciever, and a field location packet. Each packet contains a USGS 7.5 minute (‘) topographic map. On the topographic map, the LC of a field location is indicated by the intersection of designated map grid lines. Each packet also contains current aerial photographs or Digital Orthoquad (DOQ) with the LC pinpricked on one of the photographs. Remeasurement locations also have photos, a copy of the field location data, and road directions used in the previous inventory.

1. Verify the Placement of the LC Pinprick.

Before going to any field location, first verify that the LC pinprick on the photo is in the same location as the map grid intersection.

If they are not the same, locate the LC using the GPS receiver and re-pinprick the correct location.

2. Determine Travel Route

With the packet items, determine the best route of travel to the field location. As a safety precaution, the crew supervisor will maintain a daily record of planned locations to be visited and/or routes to be traveled; keep this log up to date and accessible in the crew supervisor's trailer or other housing facility. If the crew is staying in motels out of a camp setting, the crew supervisor must contact the office on a daily bases giving all possible County and Location numbers for that day.

C. Finding the Field Location Center - New Field Locations

It is the responsibility of the field crew to physically locate the LC on the ground as indicated by the LC pinprick on the aerial photograph. The following procedures describe how to find the LC. **Use the GPS procedure as the primary method for locating the LC and the ground/photo baseline procedure as the secondary method.**

Record all baseline and reference point (RP) traverse information on the Field Location Reference record under "Course to Location Center," and "Baseline Information." Also record the traverse information on the back of the aerial photograph containing the LC pinprick. **Use a ball-point pen for all photo work** (do not use pencil or felt-tip pen), and use a ruler or other straight edge for drawing lines (protractor edges are not necessarily straight)

1. Establishing LC with the Precision Lightweight GPS Receiver

See Appendix E for detailed instructions on PLGR use

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

Important: Each day in the field, set up the PLGR in an open area (e.g., campground) for at least 15 minutes to load the daily almanac. The daily almanac can also be loaded while traveling to plot with the PLGR

connected to the vehicles power source. Also, check map datum in the lower left corner of the topographic map. Refer to Appendix E.

a. **Verify PLGR Settings.** The proper initial PLGR settings are critical for positioning and navigational accuracy. Once the PLGR settings are selected, they become the default value each time the PLGR is turned on. Refer to Appendix E.

b. **Select the LC Waypoint from the Location Waypoint List.** Obtain the LC waypoint number from the Field Location Waypoint List. If for some reason the plot is not listed, UTM coordinates are printed on the location packet label or on the topographic map inside the packet and entered manually into the PLGR.

c. **Select a Suitable RP.** Designate a reference point (RP) readily identifiable on both the ground and the photograph/DOQ. The RP should be close to the field location, but at least 100 feet from the LC, 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., not likely to die or be removed within the next 10-15 years (Note: do not select an RP next to features that may affect GPS or compass readings such as metal objects like barbed-wire fences or high power transmission lines.)

   The **RP selection is critical.** The more unique and obvious the RP on both the photos and the ground, the better the chance crews will be able to relocate the plot in the future should significant change occur over time. If possible, choose an RP with a view of the southern sky to allow for optimum satellite reception. Elevate the GPS receiver off of the ground and remove all obstructions that may block reception.

   Pinprick the RP on the aerial photograph with the LC pinprick. Circle and label the pinpricked RP on the back of the photograph. Refer to the Field Location Reference chapter for instructions on tagging the RP.

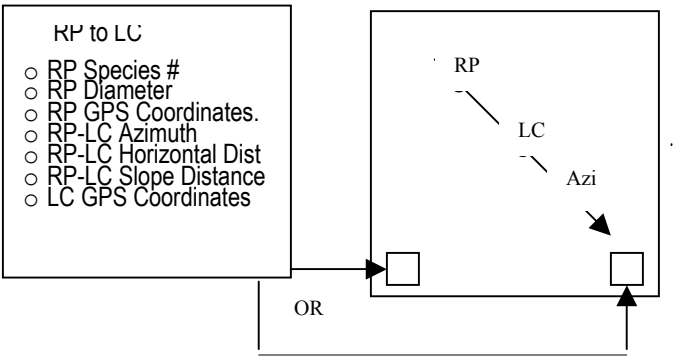
d. **Find the Position of the RP.**
   Tolerance: EHE $\leq$ 70 feet.
   Use the **"Position"** (POS) feature of the PLGR to provide coordinates for the position of the RP on the Universal Transverse Mercator (UTM) grid system. Refer to Appendix E. If the 180 hit averaged EHE is $>$ 70 feet, check satellite strength meter, map datum, and PLGR settings,

then try again. If the EHE is still > 70 feet, refer to Chapter 2 **"Establishing a Baseline and Scale"** to locate the LC.

e. Chaining from the RP to the LC. Employ the PLGR's **"Distance"** function to determine a distance and azimuth from the RP to the LC waypoint. Use a chaining tape and compass for chaining from the RP to LC. Refer to Appendix E.

f. **LC Verification.**
Tolerance: ±6 feet per 100 feet chained. ± 30 foot maximum error. Upon arrival at the LC, put a stake in the ground and use the **Position (POS)** function of the PLGR to collect UTM coordinates for the LC. If a 180 hit averaged EHE of ≤ 70 feet for the LC cannot be obtained, it will be necessary to chain to an opening and use the **RangeCalc** function of the PLGR to calculate the coordinates of the LC (the RP coordinates, distance, and azimuth can be used for the calculation.) For correct placement of the LC, chaining error should be no more than ±6 feet per 100 feet of chaining distance up to ± 30 feet. Check photos and topo map to verify the LC Position. If the LC pinprick and PLGR placement disagree by more than 0.1 inches, re-pinprick the photo, and begin referencing the plot. Use procedures listed on pg. 19, "**Moving the Pinprick**."

Upon verification of the LC, carefully draw a line on the back of the photo, using the RP and LC as guides for your ruler. Do not draw through the pinpricks. Put an arrow at the end of the line indicating the azimuth direction and write the azimuth next to the arrow. Label and circle both the LC and RP. Record all pertinent information in the lower left or right hand corner of the photo.



2. Establishing a Baseline and Scale

Use this technique in the field when an open area for running a baseline is available and GPS receiver not functioning.

a. Ground/Photo Method.

(1) **Select Landmarks.** Select two features easily identifiable on both the ground and on the aerial photo. Trees, road intersections, or other landmarks within sight of each other are adequate. The features should be at least 600 feet apart and at the same relative elevation. Do not use railroad lines, power line poles, etc., as they will influence compass readings.

Pinprick these two landmarks on the photo that has the LC pinprick. On the back of the photo, circle and label one of the landmark pinpricks as "A" and the other as "B".

(2) **Determine baseline azimuth.** With a compass, determine the azimuth (to the nearest degree) between the landmarks. On the back of the photo, draw a thin, straight line through the center of the two landmark pinpricks (A and B).

Place an arrow on the line, indicating the direction the azimuth was taken (i.e., from A to B, or from B to A), and label the azimuth along the line.

(3) **Measure baseline distance.** Measure the distance between A and B on the photograph (using a .001-foot scale) and on the ground (the horizontal distance, to the nearest foot). **Note:** If the ground distance is measured on a slope of 10 percent or greater, convert the slope distance to horizontal distance with the following formula:

$$\text{Horizontal Ground Distance} = \frac{\text{Slope Ground Distance}}{\text{Slope Correction Factor}}$$

Determine the "slope correction factor" (SCF) for the angle of the slope using a clinometer with a SCF option.

(4) **Compute baseline PSR.** Compute a baseline photo scale reciprocal (PSR) using the following formula:

$$PSR = \frac{\text{Horizontal Ground Distance}}{\text{Photo Dist}}$$

b. Map/Photo Method.

(1) **Select Landmarks.** Select two baseline points that are easily identifiable on both the topographic map labeled with the field location center (LC) and on the aerial photo with the LC pinprick. The points must be located stereoscopically on the photo.

Note: Vegetation lines on the topographic maps are often not accurate, so select points such as road and stream intersections. Mountain tops may be used, but it is extremely important that the top is identifiable by stereoscopic viewing.

Label the points as "A" and "B" on the map, and draw a straight line between these points on the map.

(2) **Determine baseline azimuth.** Determine the baseline azimuth (from point A to point B), to the nearest degree, on the topographic map using the following procedures:

i.) Use the UTM grid lines if preprinted on the map, or draw a north-south or east-west line on the topo map by using UTM "tick" marks. Make sure the selected line intersects the A-B baseline.

ii.) Place a photo protractor on the north-south or east-west line. If it is a north-south line, place the protractor so that the line runs through 0 and 180 degrees; use 90 and 270 degrees for an east-west line.

iii.) Slide the protractor along the line until the cross mark in the center of the protractor is over the intersection of the A-B baseline and the north-south or east-west line. Read the baseline azimuth from the protractor (this azimuth is called the "original map azimuth").

iv.) Because compasses are set at 0 degrees declination (magnetic north, not true north), the original or measured map (A to B) baseline azimuth must be adjusted to a magnetic azimuth. Use this **adjusted azimuth** for the A-B baseline azimuth on the photo. In the bottom margin, most 7 1/2' quad maps indicate declination offsets between the

UTM grid north (indicated by "**GN**") and true north (indicated by a **star**), and between magnetic north (indicated by "**MN**") and true north.

Magnetic declination in the western U. S. is always clockwise from true north; The UTM grid declination may be clockwise or counterclockwise, depending on the map's location in the UTM grid zone. For the Interior West, **subtract** the **total declination offset** (between MN and GN) from the original map (A to B) baseline azimuth. **Total** declination between MN and GN is either:

- Magnetic declination **plus** grid declination, if GN is **counterclockwise** from true north, or

- Magnetic declination **minus** grid declination, if GN is **clockwise** from true north.

Adjusted Azimuth = original map azimuth –
(MN declination $\pm$ GN declination)

Examples of computation for both situations:

Example A:
Original map baseline azimuth (A to B) = 130 degrees
GN declination = 2 degrees (clockwise)
MN declination = 17
Adjusted Magnetic Azimuth = 130 - (17 - 2)
= 115 degrees

Use 115 degrees as the baseline azimuth on both photo and compass.

Example B:
Original map baseline azimuth (A to B) = 130 degrees
GN declination = 2 degrees (counter clockwise)
MN declination = 17
Adjusted Magnetic Azimuth = 130 - (17 + 2)
= 111 degrees

Use 111 degrees as the baseline azimuth on both photo and compass.

(3) **Label Photo.** Pinprick points A and B on the photo (with the LC pinprick), and correctly label these points on the **back** of the photo. On the back of the photo, carefully and accurately draw a line from A to B, place an arrow at the end of the line showing proper direction (this is the map baseline), and record the adjusted baseline azimuth on the back of the photo. Use a **ball-point pen** for all marking on the back of photos.

(4) **Measure baseline distance.** Measure the distance between points A and B on the topo map and on the photo. Make all measurements using the same units (e.g., use a .001-foot scale ruler to measure the map and photo distance). The finer the divisions on the ruler being used, the better the results.

(5) **Compute baseline PSR.** Use the formula on the following page to determine the Baseline Photo Scale Reciprocal (PSR):

$$\text{Baseline PSR} = \frac{\text{Baseline Map Distance (ft) X Map Scale Reciprocal}}{\text{Baseline Photo Distance}}$$

Note: If the Map Scale is 1:24,000, then the Map Scale Reciprocal is 24,000.

For example (using a .001-foot scale for map and photo measurements):

Baseline Map Distance (from A to B) = 0.0153 ft
Baseline Photo Distance (from A to B) = 0.0082 ft
Map Scale Reciprocal = 24,000

$$\text{Baseline PSR} = \frac{(0.0153 \text{ ft} \times 24{,}000)}{0.0082 \text{ ft}} = 44{,}780$$

c. Selecting a Reference Point. Once the baseline azimuth and scale have been determined (ground/photo or map/photo method), designate a reference point (RP) readily identifiable on both the ground and the photograph. Refer to page 2-3 for RP selection criteria.

d. Adjusting the Photo Scale Reciprocal. This adjustment to the photo scale is required when the mean elevation of the RP to LC is at least 100 feet different from the mean elevation of the calculated baseline.

- **8.25-inch focal length** (certain NHAP and resource photography - see State Supplement). If the RP to LC mean elevation is **higher** than the baseline, for each 100 feet higher in elevation **reduce** the baseline PSR by 145 units (see below for an example). If the RP to LC mean is **lower** than the baseline, for each 100 feet lower in elevation, **increase** the baseline PSR by 145 units.

- **6.0-inch focal length** (NAPP and certain resource photography - see State Supplement). If the RP to LC mean elevation is **higher** than the baseline, for each 100 feet higher in elevation, **reduce** the baseline PSR by 200 units. If the RP to LC mean is **lower** than the baseline, for each 100 feet lower in elevation, **increase** the baseline PSR by 200 units.

For example:

Baseline PSR = 38,800; baseline photo scale 1:38,8000
Baseline elevation = 6,000 feet; RP elevation = 7,400 feet

7,400 feet
-6,000 feet
1,400 feet difference

Focal length for photography is 8.25 inches. Change baseline 145 units for each 100 feet elevation difference:

1,400 feet / 100 feet = 14
14 X 145 = 2,030

Therefore:
38,800 (baseline PSR)
-2,030 (change in scale)
36,770 adjusted RP PSR.

e. Calculating Azimuth and Distance. Determine the azimuth and horizontal ground distance from the RP to the LC using the following procedure:

(1) **Draw RP-LC line.** On the back of the photo, draw a thin, straight line through the RP and LC pinpricks. Intersect the RP-LC line with the baseline by extending the RP-LC line (figure 1, example 1). If the baseline and RP-LC line do not intersect on the photograph, draw a line (secondary baseline) that intersects the original baseline and the RP-LC line (figure 1, example 2). **Note:** Place arrows on these lines indicating the azimuth direction.

(2) **Determine RP-LC azimuth.** To obtain the RP to LC azimuth, orient a photo-scale protractor **inverted** over the line intersections (in other words, position the protractor "**wrong-side**" up because the photo work is carried out on the back of the photo). Determine the azimuth from the RP to the LC by lining up the correct azimuth over the baseline and reading the azimuth corresponding to the RP-LC line (figure 1, example 1 and example 2).

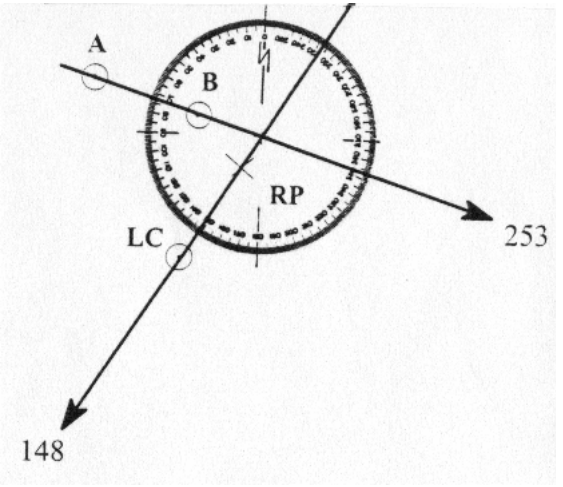
If a secondary baseline is used, first determine the azimuth of the secondary baseline by positioning the protractor (**wrong-side** up) over the intersection of the original and secondary baselines, lining up the correct azimuth for the original baseline, and reading the azimuth corresponding to the secondary baseline. After the azimuth for the secondary baseline is determined, place the protractor over the intersection of the secondary baseline and the RP-LC line to obtain the RP to LC azimuth.
On the back of the photo, record the azimuths along each traverse line. Also record the following information on the back of the aerial photograph containing the LC pinprick in the lower left or right hand corner (depending on photo pinprick location):

RP info:	Course to Plot: RP to LC	*Baseline info: A to B	*Baseline info: RP to LC
Species	Azimuth	Azimuth	Azimuth
Diameter	Distance	Ground Dist.	Photo Dist.
RP Coords.	LC Coords.	Photo Dist.	PSR
		PSR	Ground Dist.
		PSR Adj.	PSR Adj.

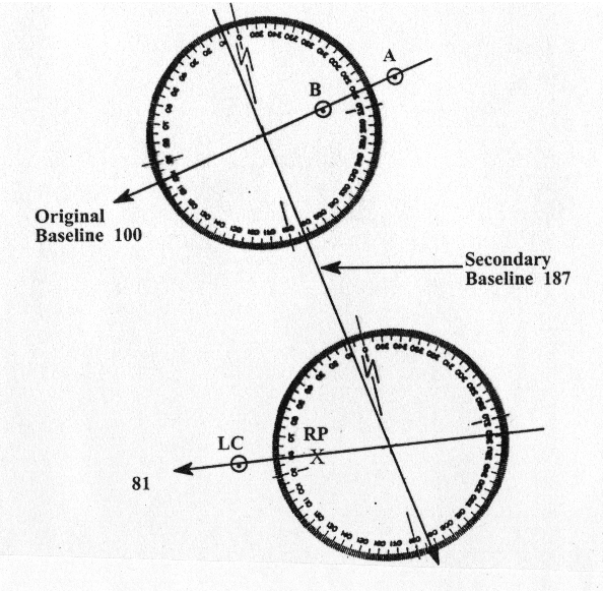
*Record only if baseline method is used.

Figure 1. Examples for two methods of determining azimuth from RP to LC: example 1, the simple baseline; and, example 2, the secondary baseline.

Example 1:



Example 2:



(3) **Determine RP-LC horizontal distance.** To determine the horizontal distance from the RP to the LC, use one of the following methods:

- **".001-foot scale" method** (preferred method)**.** Measure the distance on the photo from the RP pinprick to the LC pinprick to the nearest .001 foot (using a .001-foot scale). Multiply this photo distance by the baseline photo scale reciprocal (PSR as calculated previously) to obtain the RP-LC horizontal ground distance.

  (Photo Distance) X (PSR) = Horizontal Ground Distance

  For example:
  Photo scale between RP and LC = .012 feet
  Photo PSR = 36,770 feet
  Horizontal ground distance from RP-LC is
  (.012) X (36,770) = 441 feet

- **"Photo scale" method.** If a .001-foot scale is not available, determine the horizontal ground distance by selecting the photo scale (on a photo-scale protractor) that is closest to the actual photo scale as determined from the calculated PSR, and measure the distance, on the back of the photo, between the RP and LC pinpricks (to the nearest 12.5 feet, which is half of an increment on a scale ruler).

f. Traversing to the LC. Using a compass and tape, run a traverse from the RP to the LC along the calculated azimuth and horizontal ground distance. Make distance corrections for slope whenever the slope is 10 percent or greater. Use a clinometer to determine the appropriate slope correction for each distance segment traversed. Place a stake at the end of the traverse.

g. LC Verification.
Tolerance: ±10 feet, 95% of the time.
Upon arrival at the end of the traverse, determine if the calculated ground point is in agreement with the LC pinpricked on the photograph. Examine the ground features near the LC area that would be noticeable on the aerial photograph such as individual trees or tree groupings, openings in the crown canopy, rock outcroppings, etc.

If the calculated ground point and the photo point are clearly not in agreement,

(1) **Recheck the azimuth and distance calculations** for possible errors.

(2) **Determine the correct ground location** based on the photos and map, and place a second stake at the correct ground location. If the RP is visible from the corrected LC, remeasure the actual azimuth and distance directly. Otherwise, determine the azimuth and distance from the initial stake (incorrect location) to the second stake (corrected location). Remove the first stake. Record all adjusted measurements on the Field Location Reference record under "Course To Field Location," and on the Field Location Description record under "Baseline Information."

h. Moving the Pinprick.

Tolerance: No errors 100% of the time.
If it is determined that the ground point and the LC pinprick are not in agreement due to the LC pinprick being in the wrong location, use the following rules to move the pinprick to the correct location:

(1) Verify that topographic map is plotted correctly. 5000 meter point labeled in the correct location; verify photo pinprick matches topographic map.

(2) If GPS is used to establish LC and pinprick is off:

i.) Leave pinprick where it is if you cannot verify **EXACTLY** where you are on the photograph due to canopy, topography, etc.

ii.) Move pinprick if you can verify exactly where you are on the photograph and the pinprick is off by $\geq 1/10^{th}$ inch or $\geq 1/100^{th}$ foot on the photo.

(3) If the Baseline method is used to establish LC and pinprick is off:

i.) Leave pinprick where it is if you cannot verify **EXACTLY** where you are on the photograph due to canopy, topography, etc.

ii.) Move pinprick if you can verify exactly where you are on the photograph and the pinprick is off by $\geq 1/10^{th}$ inch or $\geq 1/100^{th}$ foot on the photo.

D. Finding the Field Location Center - Remeasurement Locations

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

Find the previously established RP using directions recorded on the old Field Location Record sheet and the old photos. The RP is a landmark (usually a tree) that is identifiable on both the ground and the field location photo, and should be indicated by a pinprick on the old photos. Trees used as RPs were marked with aluminum tags: one tag nailed below stump height (1 foot) facing in the direction of the field location, and two other tags nailed approximately 6 feet above the ground on opposite sides of the tree.

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

Run the traverse from the RP to the LC using the azimuth and horizontal distance recorded under "Course to Sample Location" on the old Field Location Record sheet and/or old photos. If the slope exceeds 10 percent, horizontal distances must be adjusted for slope (determine the slope correction factor, SCF, using a clinometer with a SCF option. Two witness trees (designated "X" and "Y" trees) were established near the LC. The "X" tree was scribed with an X above DBH/DRC (facing the LC) 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 LC stake on both witness trees. Azimuth and distance from the LC stake to each witness tree, plus species and diameter, were recorded under "Witness Trees" on the old Field Location Record sheet.

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

The following discussion and instructions cover some of the situations that may occur when searching for the field location. In all situations where a new RP or RP-LC course is established, record the appropriate new

information on the new Field Location Reference form, and on both the old and new photographs. Pinprick and label the new RP on the old and new photos.

1. RP Not Found

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

a. Follow the procedures described under "Finding the Field Location Center - New Field Location" (page 8).

b. Locate a new RP on the ground that is discernible on both the old and new photos. Using the old photo, compute a new course from the RP to LC using one of the following techniques (**Note:** The new RP must be discernible on the new and old field location photographs):

The .001-Foot Scale Method:

(1) Calculate the **azimuth** from the new RP to the LC (Figure 2 example 1):

- Pinprick the new RP on the old photo with the LC pinprick.
- On the back of the old photo, draw a line connecting the new RP pinprick with the LC pinprick.
- Orient a photo protractor **inverted** (**wrong-side up**) over the LC using the previously calculated azimuth from the old RP to the LC (this item is recorded on the old field forms). In example 1, the old reading is 43 degrees.
- With the protractor in place, read the azimuth from the new RP to the LC. In example 1, the reading is 320 degrees.

(2) Calculate the **horizontal ground distance**, using a .001-foot scale, from the new RP to the LC (figure 2

example 2):

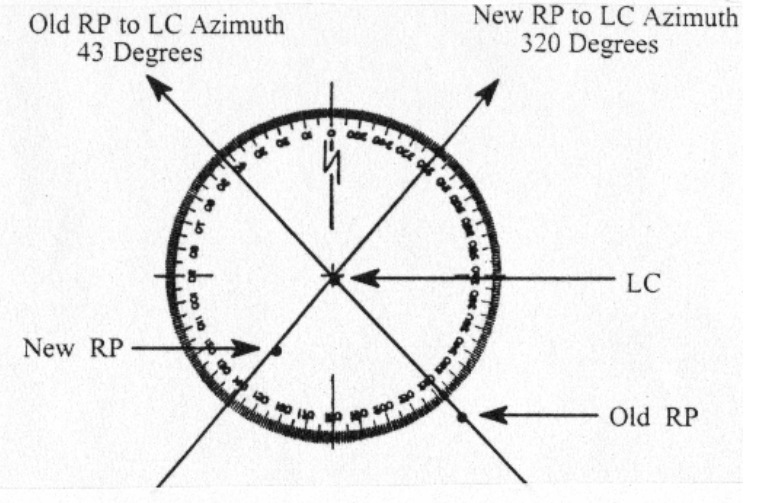
- Using the old RP to LC line, measure the distance between the RP and LC pinpricks (with the .001 foot scale) on the back of the old photo. In example 2, the distance is .141 foot.

- Divide the ground distance from the old RP to the LC (this item is recorded on the old field forms) by the calculated photo distance (from old RP to LC) to obtain the photo scale reciprocal (PSR). In example 2, the ground distance of 851 feet, divided by the photo distance of .141 foot, yields a PSR of 6035. Actual photo scale is 1:6,035.

Figure 2. The .001-foot scale method.

Example 1. The .001-foot method, determining the new azimuth

(back of old photo)

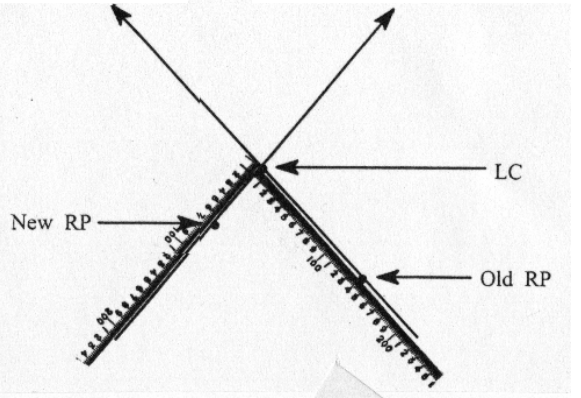


Example 2. The .001- foot method, determining the new horizontal ground distance.

(back of old photo)

Old RP to LC
Ground Distance = 851 ft.
Photo Distance = 0.141 ft.
(PSR = 851 / 0.141 = 6035)

New RP to LC
Photo Distance = 0.069 ft.
Ground Distance = PSR X 0.069 ft = 416 ft.



Measure the distance between the new RP and LC prinpricks, using the .001 foot scale, on the new RP to LC line (on the back of the old photo). In example 2, the distance is .069 foot.

- Multiply the PSR by the new RP to LC photo distance to get the new RP to LC horizontal ground distance. In example 2, the PSR of 6035 multiplied by the photo distance of .069 foot, yields a horizontal ground distance of 416 feet.

(3) On the back of the **new photo** with the LC pinprick, pinprick the new RP, and draw a thin, straight line through the center of the two pinpricks. Record the azimuth and horizontal distance from the new RP to the LC, and place an arrow on the RP to LC line, indicating the direction that the azimuth was taken.

Reminder: Use a ball-point pen for all photo work.

(4) Use the new RP to LC azimuth and horizontal distance to find and reference the remeasurement field location

The Best-Fit Method

(1) Calculate the **azimuth** from the new RP to the LC.
- Pinprick the new RP on the old photo with the LC pinprick.
- Draw a line from the new RP to the LC.
- Orient a photo protractor **inverted** (**wrong-side up**) over the LC using the previously calculated azimuth from the old RP to the LC (this item is recorded on the old forms). In figure 3, the old reading is 43 degrees.
- With the protractor in place, determine the new azimuth from the new RP to the LC. In figure 3, the reading is 320 degrees.

(2) Calculate the **horizontal ground distance** from the new RP to the LC:
Using the photo scale (on a photo-scale protractor) that is closest to the nominal photo scale (a nominal photo scale of 1:24,000 in figure 3), measure the horizontal ground distance on the back of the photo, to the nearest 12.5 feet, between the new RP and the LC pinpricks. **Note:** the nominal photo scale is often printed on the front of the aerial photograph as a two-digit number, e.g., 24, or by the normal scale reference, e.g., 1:24,000).
In figure 3, the measured distance is 850.5 feet.

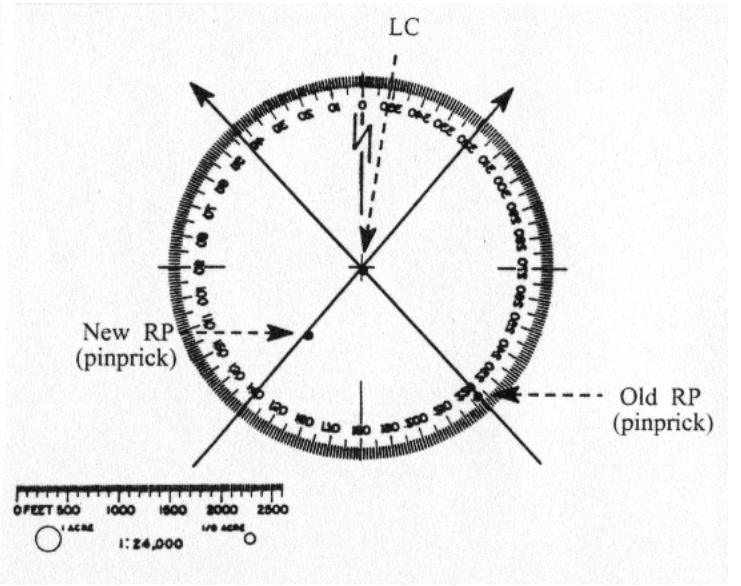
Figure 3. The best fit method.

Aerial Photo Scale Protractor:

In this example, the nominal photo scale on the old photo is 1:24,000. Therefore, the 1:24.000 scale on the aerial photo-scale protractor is used to measure the distance between the new RP and the LC pinpricks (to determine the horizontal ground distance) on the back of the photo.

On the back of the old photo

Previously calculated	New calculation
Old RP to LC: Azimuth 43 degrees Distance 1,675.5 feet	New RP to LC: Azimuth 320 degrees Distance 850.5 feet



(1:24,000 photo scale used to measure distance; this illustration has been enlarged for the example and is therefore not to true scale.)

(3) On the back of the **new photo** with the LC pinprick, pinprick the new RP, and draw a thin, straight line through the center of the two pinpricks. Record the azimuth and horizontal distance from the new RP to the LC, and place an arrow on the RP to LC line, indicating the direction that the azimuth was taken.
Reminder: Use a ball-point pen for all photo work.

(4) Use the new RP to LC azimuth and horizontal distance to find and reference the remeasurement field location.

2. RP Found But Not Usable

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

Select a new RP and compute a new RP to LC course. This can be accomplished by one of the following methods:

a. Choose an RP that can be seen from the location center and is identifiable on the aerial photos. Take the azimuth and distance directly.

b. Locate a new RP that is discernible on both the old and new photos. Using the old photo, a new course from the RP to LC can be computed. Refer to page 17 for examples.

3. Field Location Incorrectly Placed or Not Found

Spend at least 30 minutes (no more than 1 hour) to thoroughly search the area at the end of the RP-LC chain (within approximately 500 feet); circumstances dictate the actual amount of time to spend (e.g., stand density, site disturbance). Factors that might explain why a field location 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.

Re-establish the old field location if any of the following apply:

- the previously established LC (point 1) is more than 500 feet from the correct location center (based on the correct GPS coordinates, photo pinprick and map grid intersection),

- the previously established LC is in a different condition from the correct location center (refer to chapter 3 – Defining the condition class and condition class description), or

- the previously established LC is not located in the correct ownership.

If a field location is incorrectly placed or cannot be found, do the following:

a. Locate the correct location center on the ground and determine if a new field location should be established. Establish a new location using the current procedures.

b. On the outside of the field location packet write "old field location not found" or "old field location incorrectly placed"
and give a brief explanation. Note if a new field location was established.

c. Cross out preprinted data forms and leave the forms in the field location packet.

d. Inform section leader.

CHAPTER 3 - DEFINING THE CONDITION CLASS AND CONDITION CLASS DESCRIPTION

This chapter describes the condition class, providing guidelines for determining condition class on the field location sample, provides definitions necessary for classifying condition class, and guidelines for mapping condition classes. It also presents the Condition Class Description data, the Condition Class Diagram, and Boundary Record .

After the location center (LC) has been established on the ground, determine the condition(s) present on the field location (encompassing the 4 subplots). A **condition** is generally defined as an area of relatively uniform ground cover, such as a homogeneous vegetation cover; a **condition class** is a categorization of the condition based on several variables, called **defining attributes** in this manual. A prospective **contrasting condition class** is any condition that may be different than a previously assigned condition class based on specific defining attributes.

The purpose of recognizing condition classes is to determine and map each area of the plot occupied by distinct conditions, and to define each condition by various attributes.

3.0 CONDITION CLASS (Core 2.0)

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).

3.1 DETERMINATION OF CONDITION CLASS (Core 2.1)

3.1.1 Step 1: Delineate the plot area by CONDITION CLASS STATUS (Core 2.1.1)

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

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

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

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

3.1.2 Step 2: Further subdivide Accessible Forest Land by 6 delineation variables (Core 2.1.2)

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

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

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 3.5.7 to 3.5.26).

3.2 CONDITION CLASS STATUS DEFINITIONS (Core 2.2)

1. Accessible Forest Land

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

(a) the condition is at least 10-percent stocked by trees (in the Interior West a condition is 10 % stocked if it has 5% crown cover of trees, or has any combination of 40 seedlings, saplings or trees per acre) of any size or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities.

(b) In several western woodland species where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.

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

Transition zones and forest/nonforest encroachment – When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10 percent minimum forest land stocking, and where it clearly is less than required stocking; divide the zone

between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 4).

(accessible forest land is either a **or** b above)

Percent Crown Cover Calculation

If a plot is close to 5% crown cover, and the crown cover transect may not represent the true cover, the following method provides another estimate of the total tree crown area within the 1-acre surrounding the LC:

Data:

- **The area of an acre is 43,560 square feet**
- **A 1-acre circle has a radius of 117.8 ft.**
- **5% of 1-acre is 2,178 sqft.**

Assuming the crowns to be circles:

1. Measure the approximate crown diameter for each tree on the acre.
2. Calculate the crown area for each tree as CROWN AREA = (1/2 crown diameter)² X 3.14.
3. Add up the crown areas, then divide by the area of an acre (43,560); multiply by 100.

Assuming the crowns to be rectangles:

1. Measure the approximate length and width of the crown for each tree on the acre.
2. Calculate the crown area for each tree as CROWN AREA = length X width
3. Add up the crown areas, then divide by the area of an acre (43,560); multiply by 100

For example, there are 14 trees on the acre with the following dimensions:

Crowns as Circles:				Crowns as Rectangles:		
Tree #	**Crown Diameter**	**Area (πr^2)**	**or**	**Crown Length**	**Crown Width**	**Area (LxW)**
1	12	113		14	8	112
2	18	254		21	12	252
3	22	380		23	18	414
4	14	154		16	12	192
5	24	452		25	19	475
6	8	50		8	6	48
7	10	79		11	8	88
8	16	201		17	13	221
9	14	154		14	10	140
10	4	13		4	3	12
11	4	13		4	3	12
12	16	201		13	17	221
13	8	50		8	6	48
14	12	113		12	10	120
Total Crown:		**2,227**				**2,355**
Percent of Acre:		**5.1%**				**5.4%**

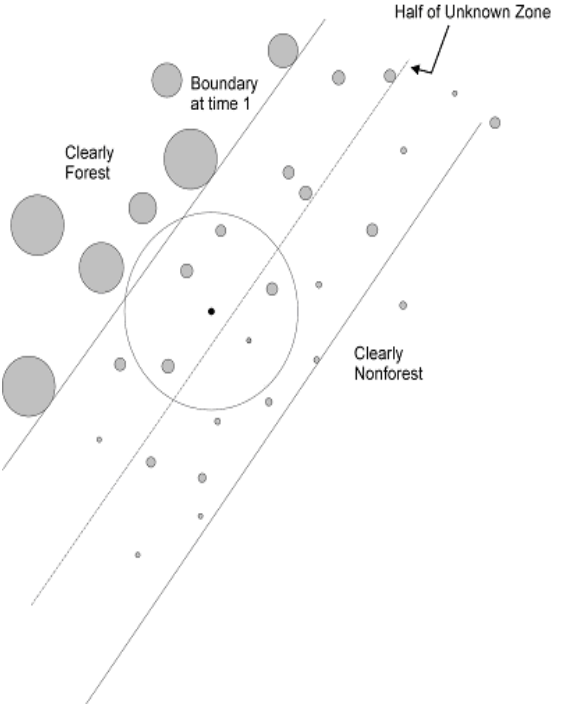


Figure 4. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

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

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

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

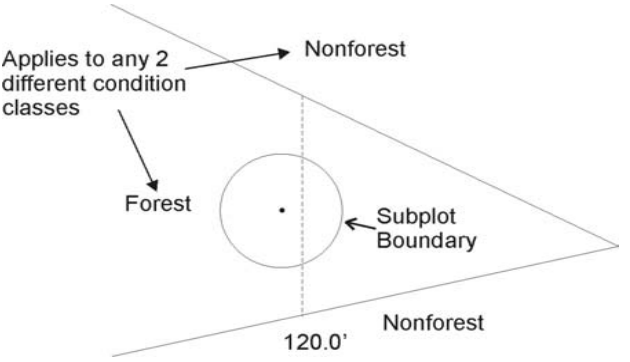


Figure 5. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

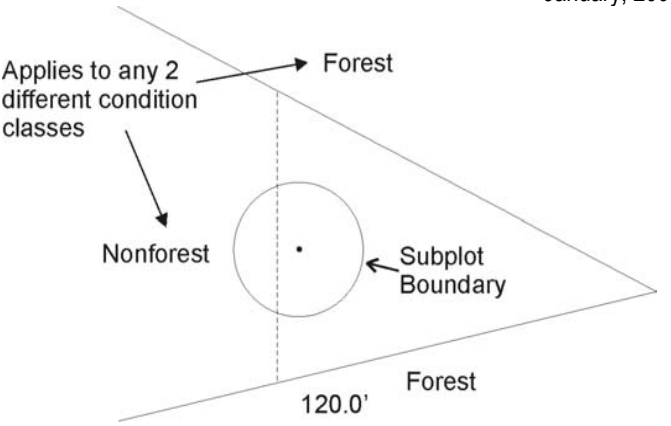


Figure 6. Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

2. Nonforest Land

Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the CONDITION CLASS STATUS values defined in Noncensus Water or Census Water(below). To qualify, the area must be at least 1.0 acre in size and 120.0 feet wide; five exceptions are discussed at the beginning of Section 3.4. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next plot visit to see if it has become forest land.

3. Noncensus Water

Lakes, reservoirs, ponds, and similar bodies of water 1.0 acre to 4.5 acres in size. Rivers, streams, canals, etc., 30.0 feet to 200 feet wide.

4. Census Water

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

3.3 CONDITION CLASS ATTRIBUTES (Core 2.3)

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

3.5.1 RESERVED STATUS
3.5.2 OWNER GROUP
3.5.3 FOREST TYPE
3.5.4 STAND SIZE CLASS
3.5.5 REGENERATION STATUS
3.5.6 TREE DENSITY

Attributes where a change causes a separate condition class

3.5.7 OWNER CLASS
3.5.8 PRIVATE OWNER INDUSTRIAL STATUS
3.5.9 ARTIFICIAL REGENERATION SPECIES
3.5.10 STAND AGE
3.5.14 DISTURBANCE (up to 3 coded)
3.5.15 DISTURBANCE YEAR (1 per disturbance)
3.5.20 TREATMENT (up to 3 coded)
3.5.21 TREATMENT YEAR (1 per treatment)
3.5.26 PHYSIOGRAPHIC CLASS

Ancillary - Do not delineate a new condition class

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

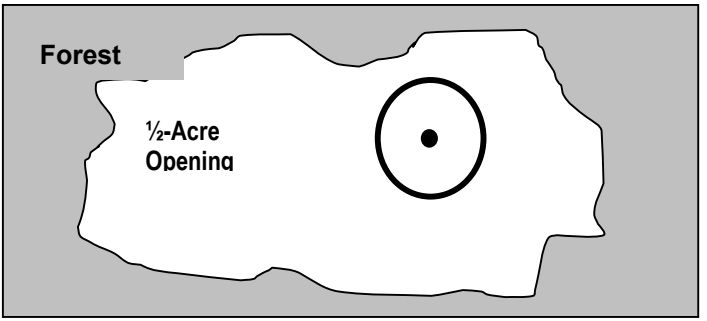
When classifying CONDITION CLASS STATUS, OWNER GROUP, RESERVED STATUS, and PRESENT NONFOREST USE, base the classification on what is present within the area defined by the fixed radius plot (annular, subplot, or microplot). When classifying all other condition class variables, base the classification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

3.4 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION STATUS: (CORE 2.4)

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 condition class. (Figure 7)

Figure 7. Subplot within small opening.



*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.*

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 condition class.

Five exceptions to these size and width requirements apply:

1. Developed nonforest condition: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 acre in size and 120.0 feet in width and are surrounded by forest land. Developed nonforest conditions less than 120 feet wide or an acre in size cannot fragment an otherwise forested condition into nonforest pieces. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements (Figures 8, 9 and 10).

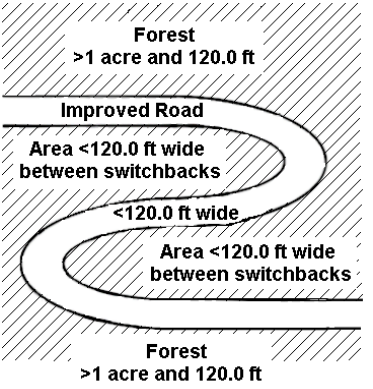


Figure 8. Example of a switchback road where the area between switchbacks is still forest land.

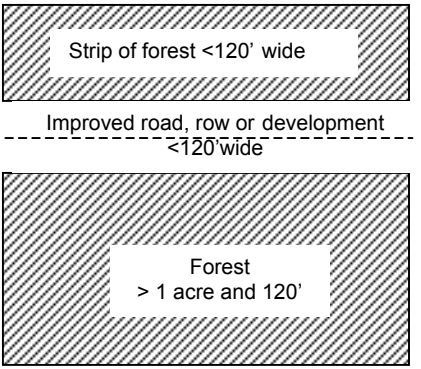


Figure 9. Example of a nonforest strip <120' wide. Area above road, while <120' wide, is still forest.

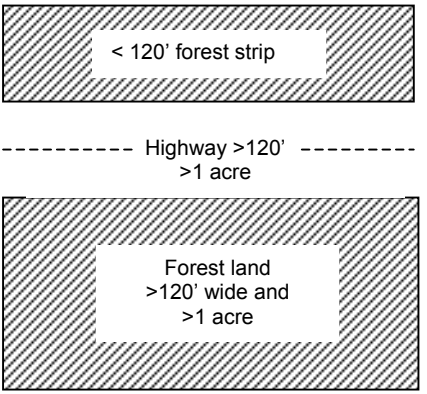
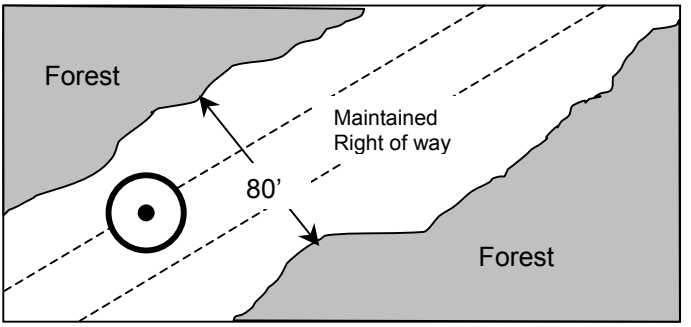


Figure 10. Example of a nonforest strip >120' wide. Area of forest above highway is not forest land.

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 (Figure 11).

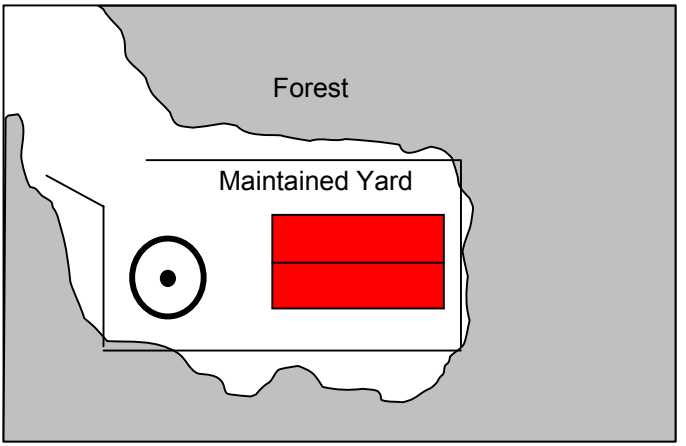
Figure 11. Subplot within a power line right-of-way



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.*

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. (Figure 12)

Figure 12. Subplot within a maintained yard.

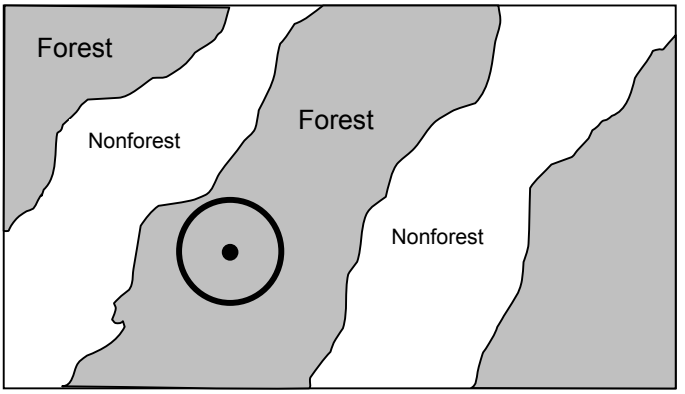


The subplot falls in a maintained yard next to a house; the area of the yard and house is less than 1-acre. However, the yard and house are cultural developments; these are considered nonforest land regardless of size. Therefore, the subplot occurs in ***NONFOREST LAND****.*

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 conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments (Figure 13).

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

Figure 13. Several alternating strips of forest and nonforest.



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.

For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 14. Figure 14 delineates the boundary between the forest and nonforest condition classes for four different examples. The plot center defines the plot condition for all strips covered by the arrow. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.

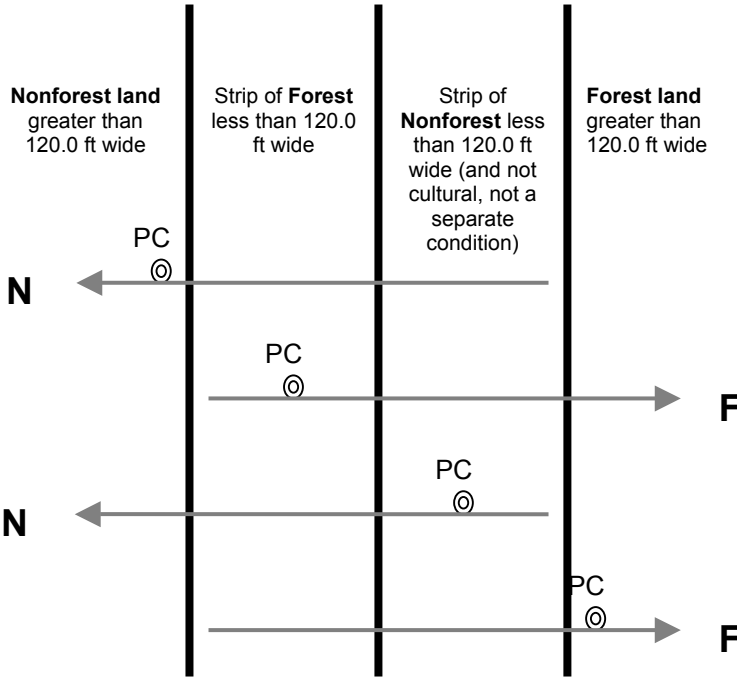


Figure 14. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

3. The 120.0-foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 15).

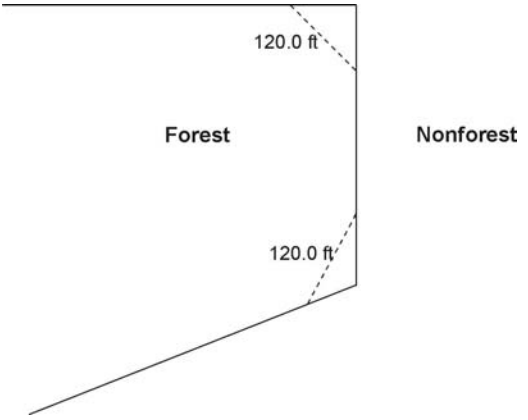
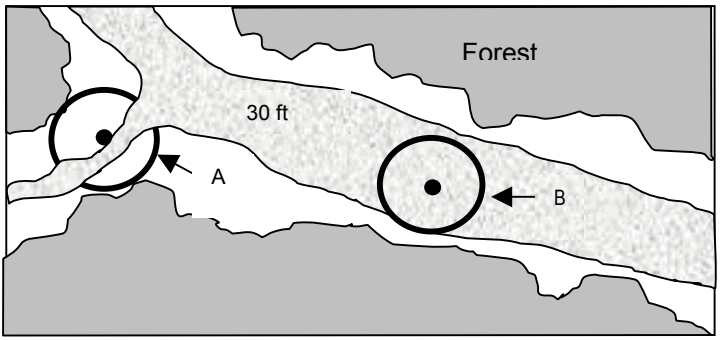


Figure 15. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 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 (Figure 16).

Figure 16. Subplot within a linear water feature.



*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**.*

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

Condition Class Description

The attributes listed below are the critical variables for recognizing and defining a condition class. Each time a distinct change occurs in one or more of the defining attributes, based on the minimum area size criteria and definitions, a new condition class is recognized. If any portion of a subplot is located within a new condition, the new condition class is to be described by the variables below.

As a reminder, the defining attributes are (in order of priority for mapping):

A. Reserved Status
B. Owner group
C. Forest Type (forest land)
D. Stand-size Class (forest land)
E. Regeneration Status (forest land)
F. Tree Density (forest land)

The remaining items (physiographic class, size of condition, etc.) provide additional information about the condition class but do not define the condition class.

Note: For remeasure locations refer to preprinted condition data. If no obvious change has occurred, use previous values for the current inventory.

3.4.1 CONDITION CLASS NUMBER (Core 2.4.1)

On a plot, assign and record a number for each condition class. The condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated.

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

Note: On a remeasure location: If a condition was previously defined, reuse the same number to represent the same condition.

3.4.2 CONDITION CLASS STATUS (Core 2.4.2)

Record the code that describes the sampling status of the condition class. The instructions in Sections 3.3 and 3.4 apply when delineating condition classes that differ by CONDITION CLASS STATUS.

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

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

3.4.3 CONDITION NONSAMPLED REASON (Core 2.4.3)
For portions of plots that cannot be sampled (CONDITION CLASS STATUS = 5), record one of the following reasons.

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

01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.

02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

10 Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.
Note: When a crew cannot complete all 4 subplots in a full day of fieldwork, and the field supervisor

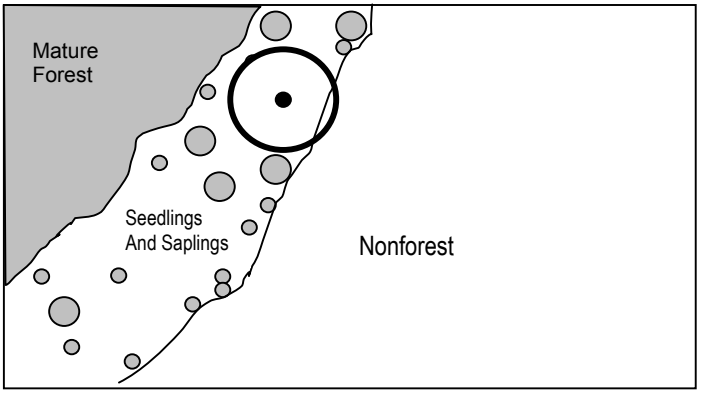
determines that the crew should not return to the location to finish the plot, record code 10. All sampling must be completed for a subplot; partial subplots are not permitted.

3.5 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND: (CORE 2.5)

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 3.1 (Determination of Condition Class) applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in 3.5.1 to 3.5.6. "Stands" are defined by plurality of stocking for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 acre in size and at least 120.0 feet in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained (figure 17).

Figure 17. Combining conditions that do not meet minimum size criteria.



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

No other attribute shall be the basis for recognizing contrasting condition classes within accessible forest land. For each condition class recognized, many "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 3.5.7 to 3.5.27).

General instructions for delineating condition classes within accessible forest lands:

1. Distinct boundary within an annular plot (if applicable), subplot, or microplot – Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 3.7.

2. Indistinct boundary within a subplot – Separate condition classes are NOT recognized if the prospective condition

classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

Example: The four subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large diameter trees. Subplot 2 falls in the middle of a stand size transition zone. In the zone, the large diameter stand phases into a sapling stand.

Subplot 2 must not be divided into two condition classes on the basis of stand size. Instead, it is treated entirely as part of the large diameter condition class or is assigned entirely to a new condition class that is classified as a seedling-sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedlings-saplings than a stand of large diameter trees; then the boundary between the large and small diameter stands is assumed to occur between and not on the subplots.

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

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

4. Riparian forest area – A riparian forest area is defined as a forest area between 30.0 and 120.0 feet wide, and 1.0 acre or more in size, cumulative, and adjacent to but not necessarily present on both sides of a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be

associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated "within forest" and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class. Figures 18-23 provide examples of when to delineate riparian forest area as a separate condition class.

Note: When the width of forest adjacent to a stream is between 120.0 feet and 150.0 feet and the width of the riparian forest is at least 30.0 feet wide, the rules for identifying the non-riparian forest (at least 30.0 feet but less than 120.0 feet) need to be modified. The non-riparian forest can be between 30.0 feet and 120.0 feet and mapped as a separate condition as long as it meets the criteria for delineating a separate condition class, otherwise it will be an inclusion in the riparian forest condition class.

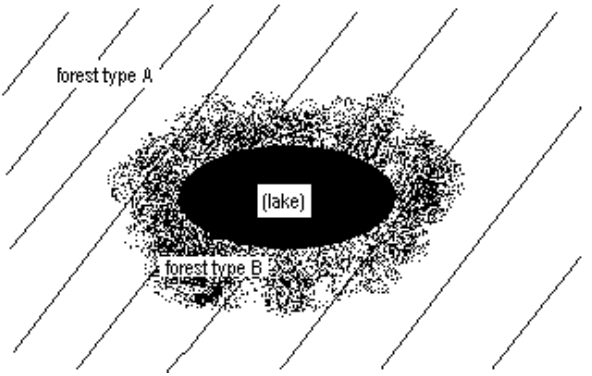


Figure 18. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is $\geq$ 1.0 acre in size.

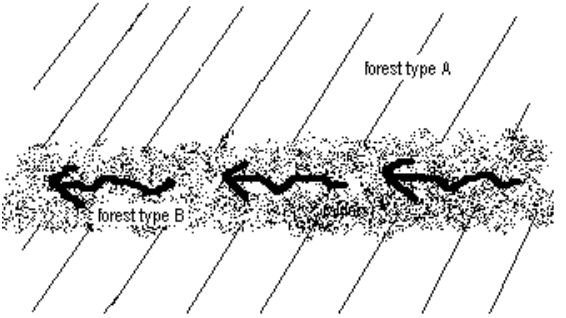


Figure 19. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

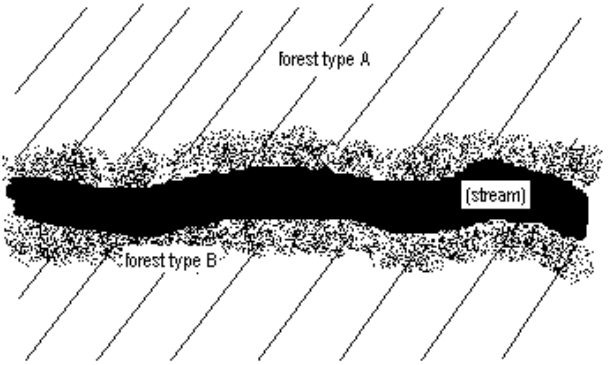


Figure 20. If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands falls between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

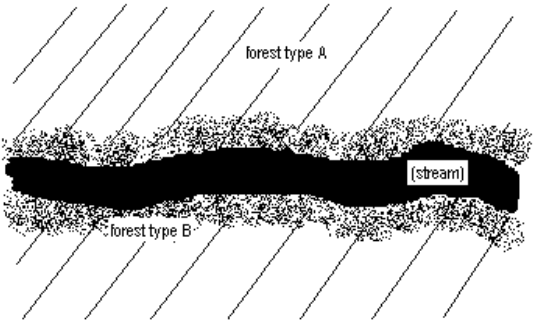


Figure 21. If the stream is > 30.0 feet wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands falls between 30.0 feet and 120.0 feet wide and is ≥ 1.0 acre in size.

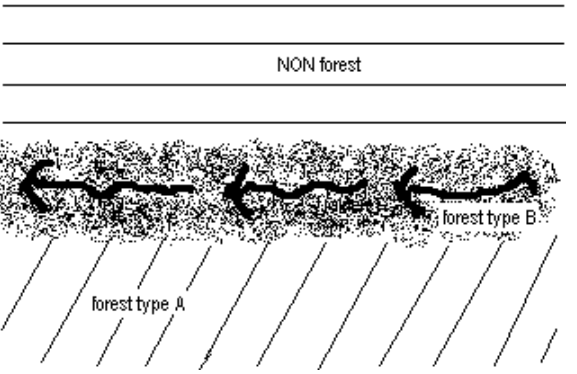


Figure 22. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

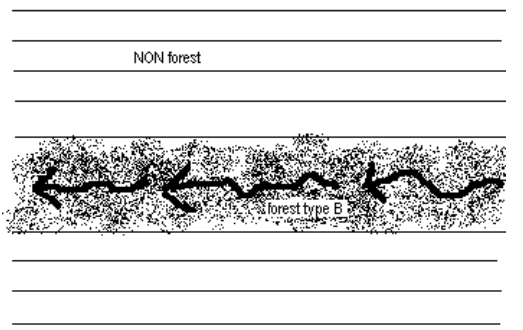


Figure 23. In a non-forested area, a band of forest type B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.

3.5.1 RESERVED STATUS (Core 2.5.1)

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

When collected: All accessible forestland condition classes (CONDITION CLASS STATUS = 1)
RMRS: When CONDITION CLASS STATUS = 1-5
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Not reserved
1	Reserved

3.5.2 OWNER GROUP (Core 2.5.2)

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
RMRS: When CONDITION CLASS STATUS = 1-5
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

3.5.3 FOREST TYPE (Core 2.5.3)

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

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

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 3 digits
Tolerance: No errors in group or type
MQO: At least 99% of the time in group; at least 95% of the time in type. No MQO when STAND SIZE CLASS = 0.

The instructions in Sections 3.1 and 3.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST TYPE.

Values:

Code	Species Type
	Eastern Spruce / Fir Group
122	White spruce
	Pinyon / Juniper Group
181	Eastern redcedar
182	Rocky Mountain juniper
183	Western juniper
184	Juniper woodland
185	Pinyon juniper woodland
	Douglas-fir Group
201	Douglas-fir
	Ponderosa Pine Group
221	Ponderosa pine
222	Incense cedar
223	Jeffrey pine / Coulter pine / bigcone Douglas-fir
224	Sugar pine
	Western White Pine Group
241	Western white pine
	Fir / Spruce / Mountain Hemlock Group
261	White fir
262	California red fir
263	Noble fir
265	Engelmann spruce
266	Engelmann spruce / subalpine fir
267	Grand fir
268	Subalpine fir
269	Blue spruce
270	Mountain hemlock
	Lodgepole Pine Group
281	Lodgepole pine

Code	Species Type
	Hemlock / Sitka Spruce Group
301	Western hemlock
304	Western redcedar
	Western Larch Group
321	Western larch
	Other Western Softwoods Group
362	Southwest white pine
365	Foxtail pine / bristlecone pine
366	Limber pine
367	Whitebark pine
368	Misc. western softwoods
	Exotic Softwoods Group
381	Scotch pine
383	Other exotic softwoods
	Oak / Hickory Group
503	Red oak / White oak / Hickory
509	Bur oak
512	Black walnut
520	Mixed upland hardwoods
	Elm / Ash / Cottonwood Group
703	Cottonwood
705	Sycamore / pecan / American elm
706	Sugarberry / hackberry / elm / green ash
709	Cottonwood/willow
	Maple / Beech / Birch
807	Elm / ash / locust
	Aspen / Birch Group
901	Aspen
902	Paper birch
904	Balsam poplar
	Alder / Maple Group
911	Red alder
	Western Oak Group
925	Deciduous oak woodland
926	Evergreen oak

Code	Species Type
	Other Western Hardwoods Group
951	Pacific madrone
952	Mesquite woodland
953	Cercocarpus woodland
954	Intermountain maple woodland
955	Misc. western hardwood woodlands
	Exotic Hardwoods Group
993	Eucalyptus
995	Other exotic hardwoods

FOREST TYPE Classification is determined by stocking types, which are not necessarily biological associations. Forest tree species are listed under at least one stocking group; some species are listed under several groups.

Determine FOREST TYPE as follows:

a. Sum the basal area of all live hardwoods;
b. Sum the basal area of all live softwoods;
c. Determine which category (hardwood or softwood) contains the most basal area;
d. Look through the Stocking Groups list for the selected Level, and identify which groups within that level contain the species within the condition;
e. If multiple species occur within a Stocking Group, sum their basal areas.
f. After all possible summations are computed, compare the total basal areas for the representative Stocking Groups, and identify the Group with the most basal area.
g. Within the selected Group, determine which FOREST TYPE has the most basal area for the species listed in the type.

For stocked forest land, estimate basal area by using an angle gauge at each subplot within the condition and counting the number of "in" trees by species; each "in" tree would represent a specific number of square feet of basal area (e.g., each tree "in" with a 20-BAF gage represents 20 square feet of basal area). Use same angle gauge for entire plot. Do not change BAF's between conditions or subplots.

Examples:
(1) A 10-BAF gauge is used, and the condition consists of 40 ft^2 of Western hemlock, 30 ft^2 of Western redcedar, and 60 ft^2 of Grand fir. All of these species fall within the Softwood Level. Western hemlock is found in both the Western Hemlocks Stocking Group and the Sitka spruce / hemlock Stocking Group. Western redcedar is found in both the Sitka spruce / hemlock Stocking Group and the Douglas fir / Western larch Stocking Group. Because Western Hemlock and Western redcedar share the Sitka spruce / hemlock Stocking Group, their basal areas are summed to arrive at a total of 70 ft² in the Sitka spruce / hemlock Stocking Group. Grand fir is located in the True firs Stocking Group and does not share a Stocking Group with the previous species so the total basal area for Grand fir is 60 ft². The forest type is then determined from the Sitka spruce / hemlock group; with Western Hemlock having the larger basal area than Western redcedar. The forest type for the condition is 301 – Western hemlock.

(2) A 10-BAF gauge was used and the condition consisted of 40 ft² of Southwestern white pine, 20 ft² of Mexican pinyon pine, and 30 ft² of Alligator juniper. Looking through the stocking group list you would find Southwestern white pine in the Other Western Pines stocking group. The Mexican pinyon pine and alligator juniper are both in the Pinyon Juniper stocking group so their basal area would be summed to arrive at 50 ft². Southwestern white pine is the only species in the Other Western Pine group with a total of 40 ft². Within the Pinyon Juniper stocking group Rocky Mountain juniper, Western juniper, or Eastern redcedar (Juniperus) are summed individually. Other than these junipers, the other junipers are summed with pinyon stocking. Therefore, in this example, the forest type would be 185 – Pinyon Juniper woodland.

(3) After working through the summation process, you determine that the condition is mostly stocked with boxelder. Looking through the stocking groups, boxelder is only located in Elm – Ash – Cottonwood Stocking Group. Within that Group, Boxelder is then located in the forest type 706 – Sugarberry, Hackberry, Elm, Green Ash; this is the FOREST TYPE coded for the condition.

For situations where the trees tallied do not represent the Forest Type evident on the condition, describe the situation in the notes on the Condition Class Description record.

The following list is a breakdown of the forest type stocking groups that

will be used to arrive at a forest type.

SOFTWOODS:

TRUE FIRS AND SPRUCE -
White fir, grand fir, corkbark fir, subalpine fir, California red fir, Shasta red fir, noble fir, Engelmann spruce, blue spruce, Western white pine, Western hemlock, mountain hemlock.

Spruce – subalpine fir

265 Engelmann spruce
Geographic area – Entire Interior West.

266 Engelmann spruce / subalpine fir
Subalpine fir, corkbark fir, Engelmann spruce
Geographic area – Entire Interior West.

268 Subalpine fir
corkbark fir
Geographic area – Entire Interior West.

269 Blue spruce
Geographic area – all Interior West States except MT

Western Hemlocks

270 Mountain hemlock
Geographic area – Northern Idaho and Montana

301 Western hemlock
Geographic area - Northern Idaho and Montana

True Firs

261 White fir
Geographic area – Primarily found in Interior West States South of SE Idaho.

262 Red fir
Geographic area – Extreme W. Nevada

263 Noble fir
Geographic area – Extreme W. Nevada

267 Grand fir
Geographic area – Northern and Central Idaho, Western Montana, Eastern Washington.

268 Subalpine fir
corkbark fir
Geographic area – Entire Interior West.

Western White Pine

241 Western White pine
Geographic area – Primarily E. Washington, North-Central Idaho, W. Montana, may be present in extreme W. Nevada.

EASTERN SPRUCE-FIR -
White spruce

122 White spruce
Geographic area – North Idaho, local in northwest Montana, Wyoming, South Dakota

DOUG-FIR – LARCH – WESTERN PINES
Incense cedar, Western redcedar, Western larch, lodgepole pine, ponderosa pine, Arizona pine, sugar pine, Douglas-fir, Jeffrey pine

Douglas-fir – Western larch

201 Douglas-fir
Geographic area – Entire Interior West.

321 Western larch
Geographic area – Primarily Central Idaho North to W. Montana and Washington (Idaho Panhandle NF).

304 Western redcedar
Geographic area – – Primarily Central Idaho North to W. Montana and Washington (Idaho Panhandle NF).

Douglas-fir – Western pines

201 Douglas-fir
Geographic area – Entire Interior West.

221 Ponderosa pine

Arizona pine, Jeffrey pine
Geographic area – Entire Interior West.

281 Lodgepole pine
Geographic area – Entire Interior West.

224 Sugar pine
Geographic area – Primarily Western Nevada

222 Incense cedar
Geographic area – Primarily Western Nevada

223 Jeffrey pine/Coulter pine/bigcone Douglas-fir
Geographic area – Primarily Western Nevada

Western larch - pine

321 Western larch
Geographic area – Primarily Central Idaho North to W. Montana and Washington (Idaho Panhandle NF).

221 Ponderosa pine
Arizona pine, Jeffrey pine
Geographic area – Entire Interior West.

281 Lodgepole pine
Geographic area – Entire Interior West.

SITKA SPRUCE - HEMLOCK
Western hemlock, Western redcedar

301 Western hemlock
Geographic area - Northern Idaho and Montana

304 Western redcedar
Geographic area – – Primarily Central Idaho North to W. Montana and Washington (Idaho Panhandle NF).

OTHER WESTERN PINES
Arizona cypress, Whitebark pine, Rocky mountain bristlecone pine, Great Basin bristlecone pine, foxtail pine, Apache pine, Southwestern white pine, Chihuahua pine, Washoe pine, limber pine, subalpine larch, Pacific yew.

362 Southwestern white pine
Apache pine, Chihuahua pine, Washoe pine

Geographic area - Primarily south of Interstate 40 in Arizona and New Mexico

365 Foxtail – bristlecone pine
Rocky Mountain bristlecone pine, foxtail pine, Great Basin bristlecone pine.
Geographic area - Foxtail pine located in W. Nevada, bristlecone pines found in Colorado West to Nevada.

366 Limber pine
Geographic area - Primarily North of Interstate 40 to Canada.

367 Whitebark pine
Geographic area – North Idaho – W. Montana South to Central Idaho - Northwest Wyoming, spotty in N. Nevada

368 Misc. Western softwoods
Arizona cypress, subalpine larch, Pacific yew
Geographic area - Arizona cypress in S. Arizona; subalpine larch and Pacific yew in N. Idaho – W. Montana.

PINYON – JUNIPER
Western juniper, Rocky mountain juniper, Eastern redcedar, Pinchot juniper, redberry juniper, California juniper, alligator juniper, Utah juniper, oneseed juniper, common pinyon, singleleaf pinyon, border pinyon, Mexican pinyon pine, Arizona pinyon pine.

181 Eastern redcedar
Geographic area – possible in extreme E. Colorado.

182 Rocky Mountain Juniper
Geographic area – Entire Interior West.

183 Western juniper
Geographic area – W. Idaho to North and West Nevada.

184 Juniper woodland
Pinchot juniper, redberry juniper, California juniper, alligator juniper, Utah juniper, oneseed juniper
Geographic area – Primarily in Southern Interior West states, except Utah juniper which is also present in ID, WY, CO, NV, UT.

185 Pinyon juniper woodland

Pinchot juniper, redberry juniper, oneseed juniper, California juniper, alligator juniper, Utah juniper, common pinyon, singleleaf pinyon, border pinyon, Mexican pinyon pine, Arizona pinyon pine
Geographic area – Entire Interior West.

EXOTIC SOFTWOODS
Austrian pine, Scotch pine

381 Scotch pine
Geographic area – Cultivated in West for shelterbelts and Christmas trees.

383 Other Exotic softwoods
Austrian pine
Geographic area – Planted across U.S., used in shelterbelts.

HARDWOODS:

OAK - HICKORY
Bur oak, honey locust, black walnut, chinkapin oak, American elm, apple spp, mulberry spp.

503 Red oak / white oak / hickory
Chinkapin oak
Geographic area – rare in SE New Mexico.

509 Bur oak
Geographic area – Extreme NE Wyoming.

512 Black walnut
Geographic area - possible in extreme E. Colorado and E. Wyoming.

520 Mixed upland hardwoods
Bur oak, American elm, honey locust, black walnut, apple spp, mulberry spp,
Geographic area - possible in extreme E. Colorado and E. Wyoming.

ELM – ASH - COTTONWOOD
Pecan, Eastern cottonwood, plains cottonwood, Rio Grande cottonwood, narrowleaf cottonwood, black cottonwood, boxelder

703 Cottonwood
Eastern cottonwood, plains cottonwood, Rio Grande cottonwood, narrowleaf cottonwood.
Geographic area – Entire Interior West.

705 Sycamore / pecan / American elm
Pecan, American elm
Geographic area – Planted throughout entire Interior West.

706 Sugarberry / hackberry / elm / green ash
American elm, green ash, boxelder
Geographic area – Entire Interior West.

709 Cottonwood/willow
Cottonwood (Eastern, plains, black, Rio Grande, Fremont, and narrowleaf), aspen, oak, boxelder – mixes where cottonwood is less than ½ the stocking but has plurality.

MAPLE – BEECH - BIRCH
American elm, green ash

807 Elm / ash / locust
Geographic area – rare; E. MT, E. WY and E. CO

ASPEN - BIRCH
Paper birch, balsam poplar, quaking aspen

901 Aspen
Geographic area – Entire Interior West.

902 Paper birch
Geographic area – N. Idaho, W. Montana, spotty in CO.

904 Balsam poplar
Geographic area – spotty and rare in ID, MT, and CO.

ALDER - MAPLE
Bigleaf maple, red alder

911 Red alder
Geographic area – N. Idaho

WESTERN OAKS

Gambel oak, Arizona white oak- gray oak, Emory oak, Mexican blue oak, silverleaf oak, oak - evergreen

925 Deciduous oak woodland
Gambel oak
Geographic area – N. Utah to extreme S. Wyoming; Colorado, Arizona, New Mexico and extreme SE Nevada

926 Evergreen oak
Associates – Arizona white oak, gray oak, Emory oak, Mexican blue oak, silverleaf oak, oak – evergreen.
Geographic area – Primarily southern Interior West.

OTHER WESTERN HARDWOODS

Pacific madrone, Arizona madrone, curlleaf mountain mahogany, bigtooth maple, Western honey mesquite, velvet mesquite, screwbean mesquite, velvet ash, Arizona alder, Arizona walnut, white alder, Pacific dogwood, Arizona sycamore.

951 Pacific madrone
Pacific madrone, Arizona madrone
Geographic area – rare; Arizona madrone in SE Arizona – SW New Mexico; Pacific madrone in extreme W. Nevada.

952 Mesquite woodland
Western honey mesquite, velvet mesquite, screwbean mesquite
Geographic area – southern Interior West.

953 Cercocarpus woodland
Curlleaf mountain mahogany
Geographic area – Entire Interior West.

954 Intermountain maple woodland
Bigtooth maple
Geographic area – Entire Interior West.

955 Misc. western hardwood woodlands
Velvet ash, Arizona alder, Arizona walnut, white alder, Pacific dogwood, Arizona sycamore
Geographic area – Individual species ranges vary.

EXOTIC HARDWOODS
Eucalyptus, Siberian elm

993 Eucalyptus
Geographic area – Planted primarily in CA, becoming naturalized.

995 Other Exotic hardwoods
Siberian elm
Geographic area – Naturalized in entire Interior West

3.5.4 STAND SIZE CLASS (Core 2.5.4)
Record the code that best describes the predominant size class of all live trees in the condition class.

For each **forest land** condition class, estimate and record the appropriate STAND-SIZE CLASS. The STAND-SIZE CLASS is a classification of forest land based on the predominant diameter size of the live tally trees presently forming the majority of live tree stocking (represented by basal area or crown cover) on the condition.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

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

(a) less than 10 percent stocked by trees of any size, and not classified as cover trees (see code 6), or

(b) for several western woodland species where stocking standards are not available, less than 5 percent **crown cover** of trees of any size.

1 ≤ 4.9 inches (seedlings / saplings)
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 inches DBH/DRC.

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

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

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

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

6 Cover trees (trees not on species list, used for plots classified as nonforest)
Less than 10 percent stocking by trees of any size, and greater than 5 percent **crown cover** of species that comprise cover trees.

For situations where the trees tallied do not represent the Stand-size Class evident on the condition, include a note on the Condition Class Description record to verify the class recorded.

Note: Stand-size codes 2 and higher take priority over code 1 when both qualify.

The instructions in Sections 3.1 and 3.4 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

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

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 5 percent of the crown cover in STAND SIZE CLASSES of 1, 2, 3, 4, or 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is 0. If 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 1. If less than 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 2, 3, 4, or 5, based on which of these STAND SIZE CLASSES has the most crown cover.

3.5.5 REGENERATION STATUS (Core 2.5.5)

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

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

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

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

The instructions in section 3.1 and 3.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

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

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

3.5.6 TREE DENSITY (Core 2.5.6)

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

Use code 1 for the first forest condition encountered.

The instructions in Sections 3.1 and 3.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate condition classes are homogenous, i.e., when a change in density is the ONLY difference within what would otherwise

be treated as only one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy, but not total tree mortality due to a ground fire. Delineation by density should only be done when the less-dense condition is 50 percent or less as dense as the more dense condition.

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

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

Examples of valid contrasting conditions defined by differences in tree density are:

- the eastern half of an otherwise homogeneous, 20-acre stand has many trees killed by a bark beetle outbreak,
- one portion of a stand is partially cut over (with 40 square feet basal area per acre) while the other portion is undisturbed (with 100 square feet basal area per acre).

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

ANCILLARY (NON-DELINEATING) VARIABLES

3.5.7 OWNER CLASS (2.5.7)

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

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
RMRS: When CONDITION CLASS STATUS = 1-5
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Owner Classes within Forest Service Lands (Owner Group 10)

11	National Forest
12	National Grassland
13	Other Forest Service

Owner Classes within Other Federal Lands (Owner Group 20)

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

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

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

Owner Classes within Private lands (Owner Group 40)

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

44 Native American (Indian) – within reservation boundaries
45 Individual

3.5.8 PRIVATE OWNER INDUSTRIAL STATUS (Core 2.5.8)
Record the code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, "mom & pop" home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner's industrial status due to name, commercial plant size, type plant, etc., choose code 0.

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) when the owner group is private (OWNER GROUP 40)
RMRS: When CONDITION CLASS STATUS = 1-5
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

3.5.9 ARTIFICIAL REGENERATION SPECIES (Core 2.5.9)
Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand. This attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)

Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Tree Species Codes (Chapter 9)

3.5.10 STAND AGE (Core 2.5.10)

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

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

Years to add to DBH (RMRS States):		
5	10	20
Western white pine	Ponderosa pine	Subapline larch
Western larch	Washoe pine	Whitebark pine

Cottonwood	Douglas-fir	Limber pine
Aspen	Lodgepole pine	
	Hemlock	

Add 15 years to all other species measured at DBH.

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 % of stand that type of core represents so that STAND AGE can be calculated later.

When collected: All accessible forest land condition classes
(CONDITION CLASS STATUS = 1)
RMRS: only record if no trees representing the stand size class are aged.

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

3.5.11 CONDITION HABITAT TYPE (RMRS)

When collected: All accessible forest land condition classes.
Field width: 7 digits.
Tolerance: Series - no errors.
Type - no errors.
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 code 9999999.

3.5.12 CROWN COVER (RMRS)

When collected: All accessible forest land condition classes.
Field width: 3 digits.
Tolerance: ±10%.

Record the percentage of crown cover, to the nearest 1 percent, of **all tally tree species** greater than 1.0" DBH/DRC (refer to the tally tree species list in Chapter 9). Crown cover is the percentage of ground surface area covered by a vertical projection of the live crowns. **Do not** include seedlings.

Use the following **line transect method** to determine the percentage of crown cover. Establish four 25-foot transects at each subplot, in the cardinal directions from subplot center (figure 17). 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.

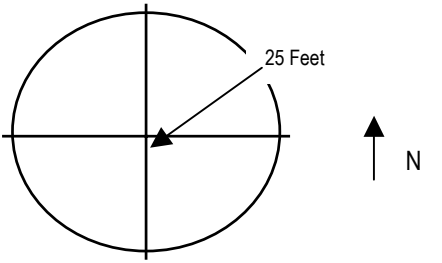
For example, the following crown length was intercepted for the 4 subplots:

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 Item 233 and record an estimate of cover in the condition class comments along with an explanation.

Figure 17. Crown cover transects.



3.5.13 PERCENT BARE GROUND (RMRS)

When collected: All accessible forest land condition classes.
Field width: 3 digits.
Tolerance: ±10%.

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 non-forested areas, estimate the percent bare

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

For estimating purposes:
1% is an area 4.25ft X 4.25ft
The microplot is approximately 8% of the area of the subplot

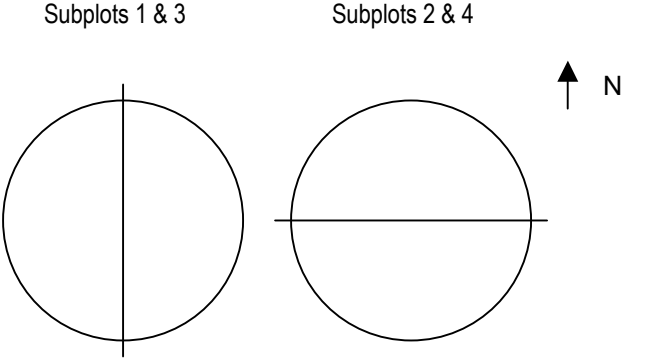
Method 1
Visually estimate the percent bare ground on each subplot by forested condition and record on the Crown/Ground Cover Supplemental Data Form (appendix A.8). Add the percent bare ground estimates and divide by the number of subplots sampled. Where more than one forested condition class occurs 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.



3.5.14 DISTURBANCE 1 (Core 2.5.11)

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 as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

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

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

When collected: All accessible forest land condition classes
(CONDITION CLASS STATUS = 1)
Field width: 2 digits
Tolerance: No errors

MQO: At least 99% of the time
Values:

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
55	earth movement/avalanches
60	Vegetation (suppression, competition, vines):
70	Unknown/not sure/other (include in NOTES)
80	Human-caused damage – any significant threshold of human-caused damage not described in the DISTURBANCE codes listed or in the TREATMENT codes listed. Must include a plot-level note to describe further.

3.5.15 DISTURBANCE YEAR 1 (Core 2.5.12)
Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: When DISTURBANCE 1 > 00
Field width: 4 digits
Tolerance: +/- 1 year for measurement cycles of 5 years
+/- 2 years for measurement cycles of > 5 years

MQO: At least 99% of the time
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

3.5.16 DISTURBANCE 2 (Core 2.5.13)
If a stand has experienced more than one disturbance, record the second disturbance here. See DISTURBANCE 1 for coding instructions.

3.5.17 DISTURBANCE YEAR 2 (Core 2.5.14)
Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

3.5.18 DISTURBANCE 3 (Core 2.5.15)
If a stand has experienced more than two disturbances, record the third disturbance here. See DISTURBANCE 1 for coding instructions.

3.5.19 DISTURBANCE YEAR 3 (Core 2.5.16)
Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

3.5.20 TREATMENT 1 (Core 2.5.17)
Forestry treatments are a form of disturbance. These human disturbances are recorded separately here for ease of coding and analysis. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood, Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 1.0 acre in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

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

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

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
00	None - No observable treatment.
10	Cutting - The removal of one or more trees from a stand.
20	Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	Artificial regeneration - 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 western woodlands to encourage wildlife forage.

3.5.21 TREATMENT YEAR 1 (Core 2.5.18)
Record the year in which TREATMENT 1 occurred.

When collected: When TREATMENT 1 > 00
Field width: 4 digits
Tolerance: +/- 1 year for measurement cycles of 5 years
+/- 2 years for measurement cycles of > 5 years
MQO: At least 99% of the time
Values: Since the previous plot visit, or the past 5 years for plots visited for the first time

3.5.22 TREATMENT 2 (Core 2.5.19)
If a stand has experienced more than one treatment, record the second treatment here. See TREATMENT 1 for coding instructions; code 00 if none.

3.5.23 TREATMENT YEAR 2 (Core 2.5.20)
Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.

3.5.24 TREATMENT 3 (Core 2.5.21)
If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions; code 00 if none.

3.5.25 TREATMENT YEAR 3 (Core 2.5.22)
Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.

3.5.26 PHYSIOGRAPHIC CLASS (Core 2.5.23)
Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition within the plot area; land form, topographic position, and soil generally determine physiographic class.

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

Xeric	Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.
11	Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.
12	Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes

most steep slopes with a southern or western exposure.

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

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

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

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

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

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

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

25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes

associated levees, benches, and terraces. Excludes swamps, sloughs, and bogs with year-round water problems.

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

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

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

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

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

34 Beaver ponds

35 Cypress ponds

39 Other hydric - All other hydric physiographic sites.

3.5.27 PRESENT NONFOREST LAND USE (Core 2.5.24)

Record this attribute when area sampled and classified at last inventory as accessible forest land is now nonforest land. The area that has changed is a new, separate condition class. It should not be considered part of any nonforest land condition class(es) sampled during the previous inventory that may still be present. Instructions in Sections 3.1 and 3.4 apply. When classifying these cases, select the classification that, within sampled area, indicates what the majority of

this changed area is now if more than one nonforest classes are present.

(CORE OPTIONAL) - Record the PRESENT NONFOREST LAND USE for all nonforest conditions (CONDITION CLASS STATUS = 2), regardless of past condition.

When collected: CORE: SAMPLE KIND = 2, previous CONDITION CLASS STATUS = 1, current CONDITION CLASS STATUS = 2
CORE OPTIONAL: current CONDITION CLASS STATUS = 2

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide. 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

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, 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

40 Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, that do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), noncensus water, marshes, bogs, ice, and snow.

3.6 CONDITION STATUS CHANGE (RMRS)

When collected: SAMPLE KIND 2; Condition Class Change =1.
Field width: 1 digit.
Tolerance: No errors.

Code	Present	Past
1	Accessible forest land (CONDITION STATUS = 1)	Previously all accessible forest land (1)
2	Not accessible forest land (2, 3, 4, 5, 6, 7, 8)	Previously all not accessible forest land (2, 3, 4, 5, 6, 7, 8)
3	Accessible forest land (1)	Some portion of this condition was not accessible forestland (2, 3, 4, 5, 6, 7, 8)
4	Not accessible forest land (2, 3, 4, 5, 6, 7, 8)	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.

B. Condition Class Diagram and Boundary Information

On the Condition Class Diagram illustrating the location area, sketch all condition class boundaries. In addition, on the individual subplot diagrams, carefully draw all condition class boundaries; be sure the boundary lines intersect the subplots at the same azimuth recorded for the boundary (below). Conditions must be labeled by Ground Cover Class, Land Use, Forest Type, or any other item used to differentiate condition classes. **This map is required even when data are entered on the data recorders.**

See figure 26 for a condition boundary examples.

3.7 BOUNDARY REFERENCES (Core 4.0)

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 annular plots). 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.

3.7.1 REFERENCE PROCEDURE (Core 4.1)

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

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points and/or from microplot center to the reference points (Figures 15 and 16). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference or microplot circumference, and one "corner" point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

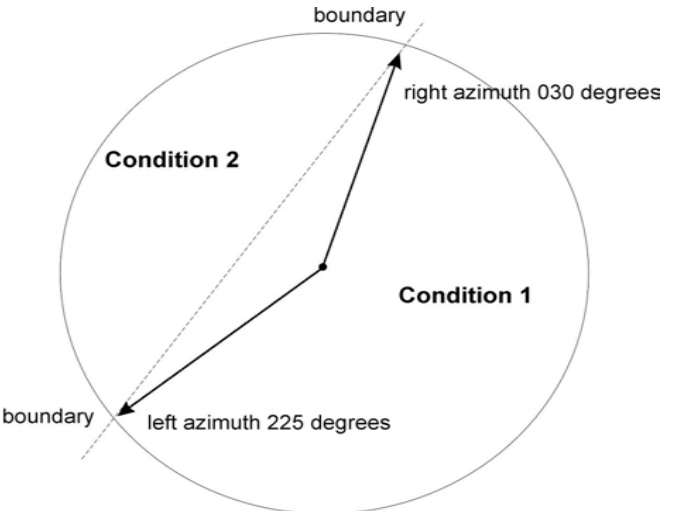


Figure 24. How to measure a straight boundary on a microplot, subplot, or annular plot.

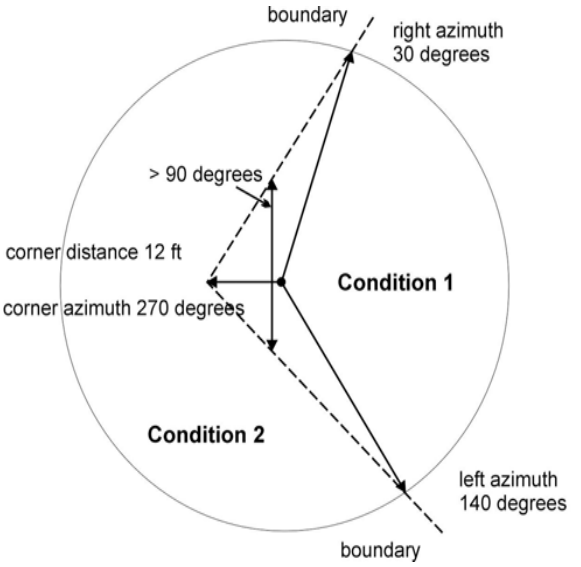


Figure 25. How to measure a boundary with a corner on a subplot or annular plot.

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

Refer to Sections 3.1 and 3.4 for general condition class delineation guidelines. The following additional rules apply when referencing a boundary within a subplot, microplot, or annular plot:

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

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

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

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

5. Although individual MQO's 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.

3.8 BOUNDARY DATA (Core 4.2)

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

3.8.1 SUBPLOT NUMBER (Core 4.2.1)

Record the code corresponding to the number of the subplot.

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

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

3.8.2 PLOT TYPE (Core 4.2.2)

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

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

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

3.8.3 BOUNDARY CHANGE (Core 4.2.3)

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

When collected: SAMPLE KIND = 2, All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

0 No change - boundary is the same as indicated on plot map and/or data collected by a previous crew.
1 New boundary, or boundary data has been changed to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded.
2 Boundary has been changed to correct an error from previous crew.
3 Boundary has been changed to reflect a change in variable definition.

3.8.4 CONTRASTING CONDITION (Core 4.2.4)

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot or annular plot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line. See Chapter 8 for subplot data.

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

3.8.5 LEFT AZIMUTH (Core 4.2.5)

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

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

3.8.6 CORNER AZIMUTH (Core 4.2.6)

Record the azimuth from the subplot, microplot, or annular plot center to a corner or curve in a boundary. If a boundary is best described by

a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 000 to 360

3.8.7 CORNER DISTANCE (Core 4.2.7)

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

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

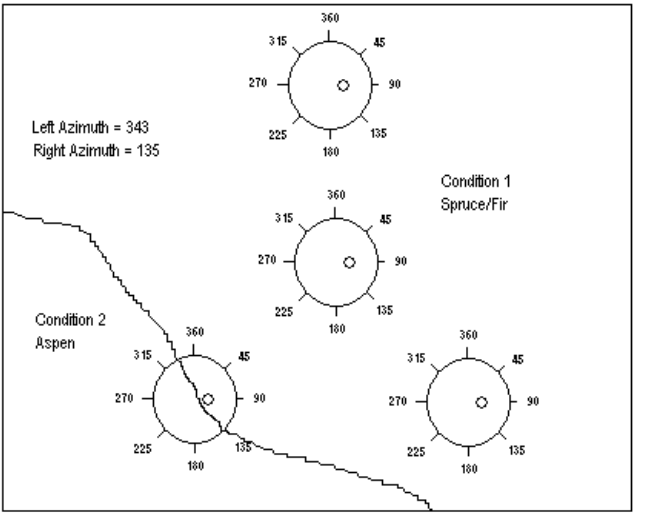
microplot	01 to 07 ft (actual limiting distance is 6.8 ft)
subplot	01 to 24 ft
annular plot	01 to 59 ft (actual limiting distance is 58.9 ft)

3.8.8 RIGHT AZIMUTH (Core 4.2.8)

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

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 36

Condition Boundary Map example:
Figure 26



CHAPTER 4 - FIELD PROCEDURE OVERVIEW

This chapter provides a general overview of the field procedures required to conduct the inventory, depending on the field location situation and condition classes present on the location. The first part of this chapter discusses several situations where the crew may not be able to conduct the inventory; the next portion of the chapter describes the basic parts (data forms) of the inventory to be completed. The final section discusses remeasurement and P3 field plots, and reserved lands.

For this inventory, a portion of the field locations 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 location center (LC) will be the same point for both samples.

If the field location was not established at the correct map point during the previous inventory, determine whether the location placement meets the following criteria:

- The old plot was established in the correct condition class (refer to chapter 3).
- The old plot was established within 500 feet of the correct map point.

If the old location meets both criteria; remeasure the trees and saplings from the previous inventory and tally any new trees on the location using current procedures, including the establishment of the new offset microplot (SAMPLE KIND 2).

If the old location does not meet both the criteria, establish the current plot layout in the correct location (SAMPLE KIND 3). Remove the old tags and nails from the trees, and note this re-location in the notes/comments for the current inventory.

If a previously established subplot was not established in the correct location see Chapter 8 (Subplot Description Items).

A. Circumstances Precluding Field Location Establishment

1. Potential Situations.

The following circumstances may preclude the establishment of any field location:

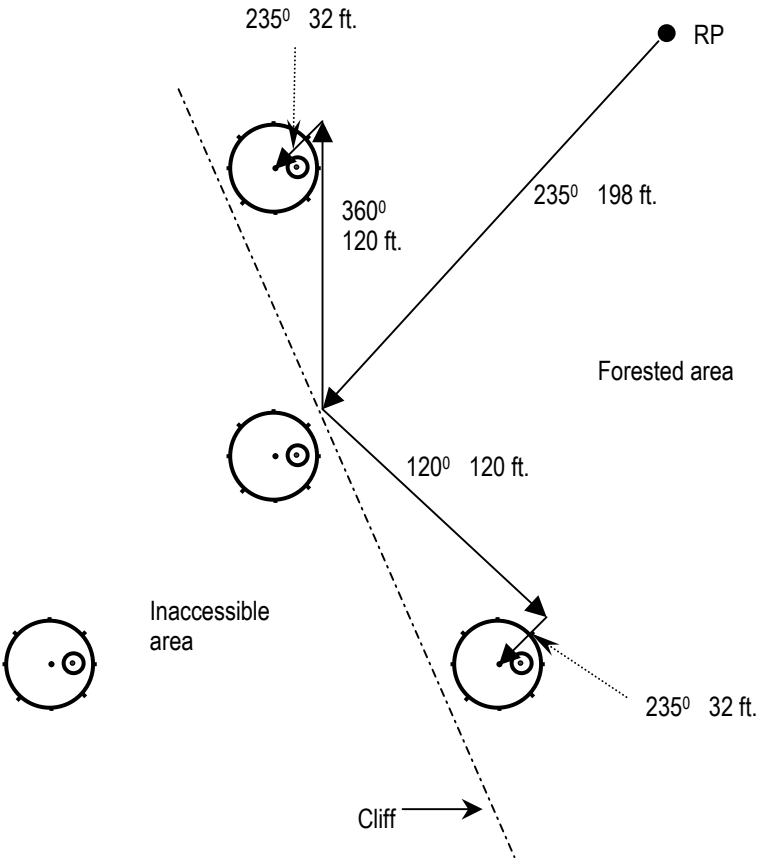
- **Field location currently being logged**. If the field location is currently being logged, determine when the logging will be completed (ask the foreman), and establish and measure the location only after logging is complete.

- **Denied access.** The landowner denies access to the field location on private property, or obtaining permission from the owner is not possible. **Promptly leave the property!**

- **Hazardous.** The crew cannot reach or measure the field location center (LC) because of permanent physical conditions (e.g., cliffs) restricting access. Crews are required to establish other subplots if accessible (figure 27).

- **Not in Sample Area.** The LC falls outside the State currently being inventoried.

Figure 27. Establishing Subplots When the Location Center is Inaccessible



This example depicts a situation where the location 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 = 6 (Area too hazardous to visit). Subplots 2 and 3 must be established since they are in accessible forest land.

Procedure: The course from RP to the location center is 235^0 for 230 ft. The cliff is encountered at 198 ft, 32 feet short of the location center. To establish subplot 2, proceed 360^0 for 120 ft., then proceed on the original azimuth (235^0) for the remaining 32 ft. (230 ft - 198 ft) to the center of subplot 2. To establish subplot 3, start where the original course from RP to the location center ended, go 120^0 for 120 ft., then go 235^0 for 32 ft. to the center of subplot 3.

2. Procedures.

When a field location 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.** Refer to appendix A for data forms and appendix D for specific items to record.

1. The **Field Location Reference** data (chapter 6).

2. The **Field Location Description** data (chapter 7).

3. On the **outside of the field location packet** record the appropriate Condition Status code.

Return the plot packet to the section leader and provide the section leader with the details of the situation.

B. Field Locations with Accessible Forest Land Present

Establish and measure a field location if any portion of one of the four subplots occurs within an **accessible forest land** condition class. The field location layout consists of 4 subplots where the LC is the center point of subplot 1. Refer to chapter 5 for field location layout and tree sampling procedures. Establish these locations using current inventory procedures.

For previously established locations using another sample design, re-establish the LC where it was placed before, and sample the location using current inventory procedures. In addition, account for the tally tree species **(TIMBER PLOTS ONLY, DO NOT ACCOUNT FOR TREES ON PREVIOUSLY ESTABLISHED WOODLAND PLOTS)** using the layout and sampling rules from the previous inventory as described in chapter 11.

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

1. The **Field Location Reference** data (chapter 6).

2. The **Field Location Description** data (chapter 7).

3. The **Condition Class Description** data (chapter 3) for the condition containing the LC and for any additional conditions occurring on the subplots.

4. The **Condition Class Diagram** and **Boundary Information** data (chapter 3).

5. The **Subplot Description** data (chapter 8) for each of the four subplots.

6. The **Tree Data** (chapter 9); 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 chapter 5 for tally tree selection.

7. The **Understory Vegetation Description** data (chapter 10) for each subplot that occurs in an accessible forest land condition.

8. If necessary, the **Accounting Tree** data (chapter 11).

C. Field Locations with No Accessible Forest Land Present (Nonforest Land and/or Water Only)

Do not establish and measure a field location if no portion of the four subplots occurs within accessible forest land and the subplot layout is located completely within conditions classified as nonforest land, census water, and/or noncensus water.

For these locations, place a plot stake in the ground at the LC, and do the following. Refer to appendix A for data forms and appendix D for specific items to record:

1. The **Field Location Reference** data (chapter 6); only the appropriate information is required (including photographing the location).

2. The **Field Location Description** data (chapter 7). Include in the General Comments a brief description of why the field location does not meet the accessible forest land criteria (e.g., this area has been chained and currently has less than 5 percent tree cover and no regeneration).

3. The **Condition Class Description** data (chapter 3).

4. The **Subplot Description** data (chapter 8) for each of the four subplots.

5. On the outside of the field location packet, record the following information:

    - Current Date
    - Crew Number
    - Condition Status

D. Remeasurement, P3, and Accounting Plots

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

Remeasurement plots indicate a resource inventory plot of the same design was 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 chapter 5), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 9). The microplot, however, was located at the subplot center for these plots prior to 2001, so crews will need to establish new offset microplots in this inventory. Old reference and witness trees can be reused if appropriate.

P3 plots are remeasured every five years; some P3 plots will be revisited this year, and others in future years. **In Utah, CO, NV, and ID** these plots use the same layout as the current inventory (refer to chapter 5), so the subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 9). **In Arizona**, some P3 plots will be established for the first time, while others will be co-located with previously established Rocky Mountain 4-point center micro plots. The current P3 plot will use the same basic plot layout as the previously established plot (refer to chapter 5), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 9). The microplot of the previously established Rocky Mountain 4-point center micro plot, however, is located at the subplot center, so crews will need to establish new offset microplots in this inventory**. In MT, most P3 plots will be established for the first time.**

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

E. 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 "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, avoid blazing trees near roads and trails, and others.

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 or Monument may require adjustments to these guidelines, but crews should follow the procedures in this manual unless specific instructions are included with the plot packet information. Refer to the special provisions section and the index for various reserved land/wilderness area topics.

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

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

1. *Identifying tags/nails* – Paint tags/nails an approved color, and face away from obvious trails and roads. Tags/nails may only be used at the base of the tree. Use marking tags/nails minimally.

2. *Flagging* – Remove any flagging used to facilitate entry and exit from the plot area upon completion of the plot measurements.

3. *Painting/Scribing* – Do not paint or scribe any trees. This includes trees used to monument the plot and witness trees. Do not paint or scribe to mark breast height.

Sample Plot Monumentation:

1. *Reference point trees* – Do not paint or scribe Reference Point trees. Nail a tag marked with "RP" to the base of the tree facing the direction of field location. Describe the reference point on the plot sheet notes and include reference landmarks.

2. *Subplot center* – Witness subplot centers with a metal wire/rod in the ground as a marker (not to protrude from the ground more than 1 inch). Do not attach flagging to the marker.

3. *Subplot witness trees* – Do not paint or scribe witness trees. Nail a tag to the base of the tree facing subplot center with the appropriate letter (X or Y) and the plot location number inscribed on it.

4. *Sample trees* – Do not paint or scribe sample trees. Mark each sample tree 5.0" DBH and larger with a tag/nail at ground level either facing subplot center or on the uphill side of the tree if there is a slope. If the sample tree is in view of a known path or trail, place the tag/nail away from the path or trail and note in the field tally. If only saplings are on the subplot mark a couple of them with nails at ground level and note which are so marked. Measure DBH at exactly 4.5 feet above the nail. If diameter needs to be taken at a location other than breast height, measure the distance (to the nearest inch) from the nail to the place of diameter measurement, and note it in the Tree Data Record.

Boring trees: Boring or drilling will be done on representative non-tally site trees and only when absolutely necessary to estimate site, age, or growth. (This will generally be the case during initial establishment of permanent plots.)

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 RHWR 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 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.

CHAPTER 5 - FIELD LOCATION LAYOUT AND TREE SAMPLING PROCEDURES

This chapter explains the field location layout and tree sampling procedures to use on all locations where accessible forest land is sampled on any of the 4 subplots as described below. **This chapter is in supplement to the National Core Manual**.

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 28).

National 4-point offset micro (P3): Current National 4-subplot plot design with an "offset" microplot located 12 feet horizontal at 90 degrees from subplot center (phase 3, formerly known as FHM - see figure 28). This is the same plot design as National 4-point offset. However, additional forest health data are collected on these locations.

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

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

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

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

Old variable-radius plot: Previous "timberland" 5-point plot design in Utah. The five variable-radius points are arranged in a "bowtie" pattern, each having a fixed radius microplot at the center. 5-point, 7-point and 10-point variable-radius plots were previously established in other states as well.

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

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

Remeasurement Plots: Current National 4-point offset co-located with a previously established Rocky Mountain 4-point center or a Rock Mountain 4-point offset. A portion of the field locations measured during previous inventories will be revisited during the current inventory. For remeasurement locations that cannot be found, or are mislocated, refer to chapter 2 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. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused.

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

In Arizona, most plots on National Forest and reserved land will be considered remeasure or replacement locations (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 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).

Accounting Plots: A portion of the field locations measured during previous inventories using the Old variable-radius plot (timberland plot) design will be revisited during the current inventory. On these locations past tree data will be accounted for using the previous location layout and sampling procedures and the location will be sampled using the current location layout sampling procedures. Accounting locations will have previous tree data downloaded to the Data Recorder, and will have a separate set of preprinted field forms included with the field packet; refer to chapter 11 for accounting field location layout and accounting procedures. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused. . For accounting locations that cannot be found, or are mislocated, refer to chapter 2 for instructions.

New plots: A portion of the field locations 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. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused.

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

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

Possible current design vs. previous design for future inventories - next 1-4 yrs.

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

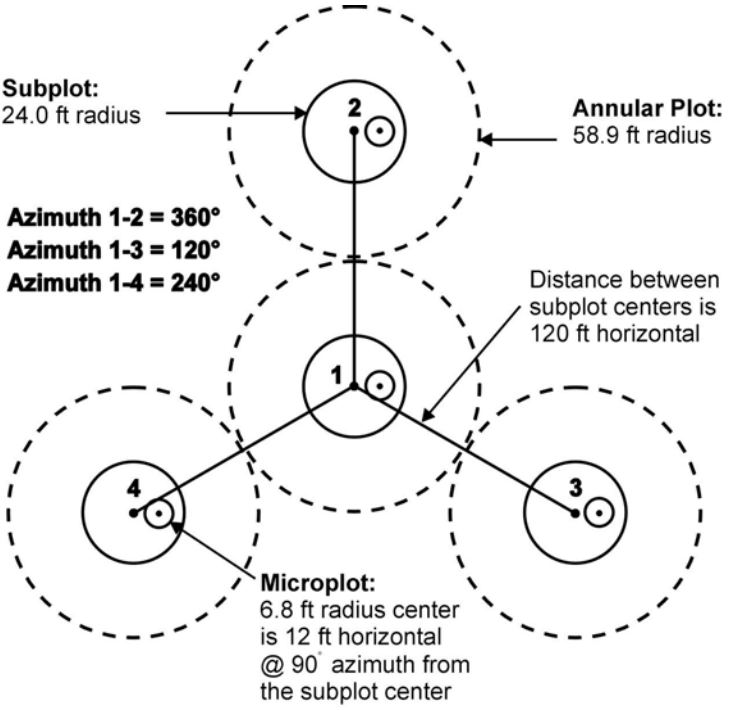
A. Field Location Layout

The field location layout (figure 28) consists of 4 fixed-radius subplots for tree and understory measurements and condition class mapping, 4 fixed-radius microplots for seedling and sapling tally and mapping, and 4 fixed-radius annular plots for sample intensification or sampling relatively rare events.

Once the LC has been established, it is designated as the center of subplot 1. Subplots 2-4 are established in a triangle pattern surrounding the LC as follows:

From LC (1) to	Subplot Center	Azimuth (Deg)	Distance (feet)
	2	360	120
	3	120	120
	4	240	120

Figure 28. Field location layout.



In addition, subplots 2-4 can be located from subplots centers other than the LC if necessary:

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

Note: Distance correction for slope is necessary when the slope exceeds 10 percent. Use a clinometer to determine the appropriate slope correction, or see slope correction table in appendix B.1.

Mark the location center (LC) and subplot centers 2-4 on the ground with a metal stake. If a metal stake cannot be placed in the ground because of bedrock, etc., build a rock cairn (rock pile) around the stake. If the 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 reference the azimuth and distance to the subplot center. Take all measurements from subplot center, not from the offset stake.

B. Sampling Procedures

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

1. Subplot Tree Tally

a. Procedures. 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. 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.

b. Qualifying trees.

(1) **Live timber species trees** (refer to the tally tree species list in chapter 9) 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 the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter.

(a) A **sound** live timber species has at least 1/3 of the merchantable volume in live and solid wood, and contains at least one solid 8-foot section now or prospectively, reasonably free of form defect.

(b) A **rough** live timber species has less than 1/3 of the merchantable volume live and solid, with more than half of the unsound wood due to solid dead wood volume or severe form defect; or, a live tree that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the bole.

(c) A **rotten** live timber species has less than 1/3 of the volume live and solid, with more than half of the unsound wood due to rotten and/or missing volume.

(2) **Live woodland trees** (refer to the Tally Tree Species List in chapter 9) 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, at least one measured stem must be 1.0-inch DRC or larger.

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

(3) **Standing dead timber species** 5.0-inches DBH and larger. To qualify as a standing timber species, the main tree stem/bole

must be at least 4.5 feet tall (i.e., a standing timber species cannot be broken below 4.5 feet) and must be standing (Standing Dead = 1). Trees supported by other trees or by their own branches are considered standing.

(4) **Standing dead woodland trees** with a single stem of at least 5.0-inches DRC or a cumulative (calculated) DRC of at least 5.0-inches. For a single stem to qualify as standing dead, the stem must be at least 4.5 feet tall, and standing (Standing Dead = 1). For multistemmed trees at least one stem must be 1.0-inch DRC or larger, and at least 1/3 of the volume must be attached and upright; do not consider cut and removed volume. Trees supported by other trees or by their own branches are considered standing.

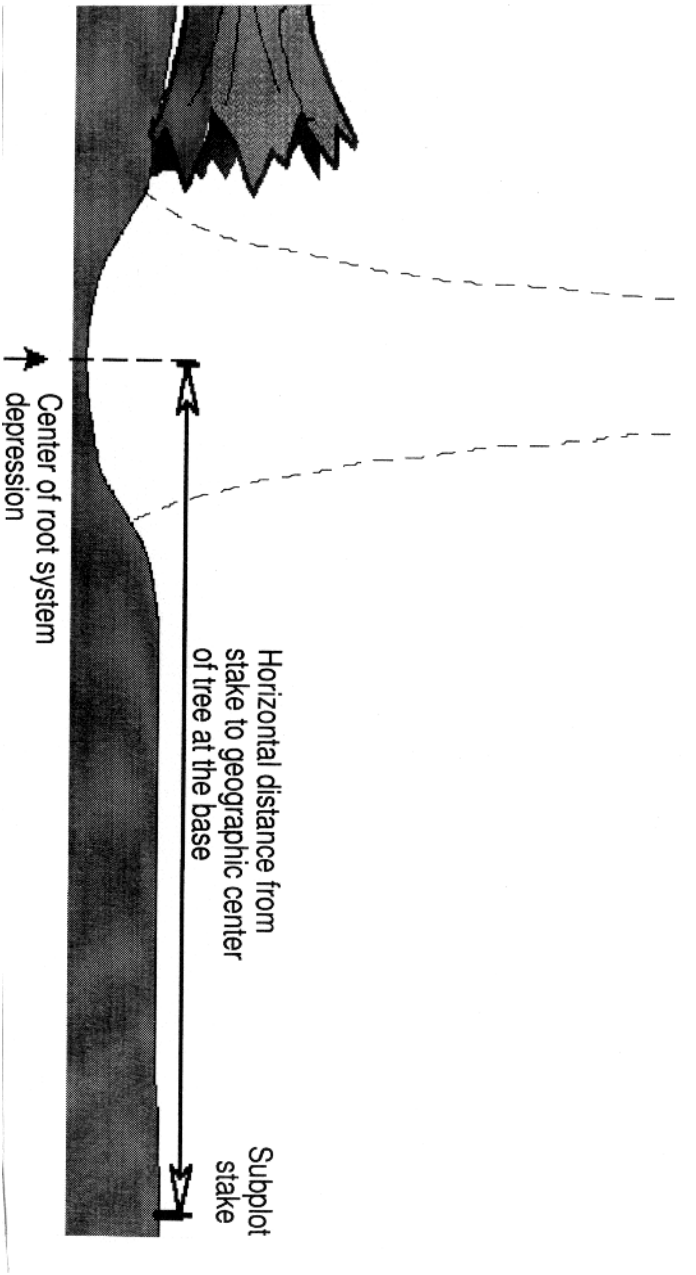
To determine if a downed tree is within the subplot, visually upright the tree at its origin (e.g., base of broken tree stem or bole, root system depression) and determine if the center of the tree at its base would fall within the maximum subplot distance for tally (refer to figure 29 for an example). 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 trees are classified as either hard or soft:

(a) A **hard** dead tree has a minimum of 1/3 of the original merchantable 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 volume in solid wood (more than 67 percent rotten and/or missing).

Figure 29. Down tree limiting distance.



2. Microplot Sapling Tally.

a. 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 (see Figure 28 Location layout). 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. 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.

b. Qualifying trees.

(1) **Live timber species** 1.0- to 4.9-inches DBH. Live timber species saplings are classified as either sound or rough; examine these trees from a 1-foot stump to a 1.0-inch top diameter.

(a) 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.

(b) 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.

(2) **Live woodland species**, with a single stem between 1.0 and 4.9-inches DRC or a cumulative DRC of 1.0- to 4.9-inches. For multistemmed trees, at least one stem must be 1.0-inch DRC or larger.

3. Seedling Counts.

Using the same microplot as in 2. above, 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 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 in order to qualify for counting . For western woodland species, each stem on a single tree must be less than 1.0 inch at DRC.

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

Do not tally or count fir “layers” (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Tally as saplings once they become established.

CHAPTER 6
FIELD LOCATION REFERENCE ITEMS

This chapter describes items for referencing and relocating the field location center (LC), and provides procedures for monumenting the location and completing the Field Location Reference Record and the Reference file required for each plot on the Portable Data Recorder (PDR) - Option 10 on the TALLY Main Menu. **All variables in this chapter pertain to the Interior West only.**

Procedures for monumenting locations on **reserved lands** (wilderness, parks, etc.) and **P3 plots** are also included. Because the information documented on the Field Location Reference record (appendix A.1) will be used to find the field location in subsequent inventories, the information must be legibly recorded in understandable terms. Procedures for photographing field locations are provided at the end of this chapter.

The PDR reference file contains 5 menus that must be completed for each forested plot.

A. Plot Reference Data
B. Truck Coordinates
C. Reference Point
D. LC Witness Trees
E. Noxious Weeds
F. Travel Notes

(PDR Reference Menus)

G. Editing (Field Location Reference Record and Print-outs only)
H. Truck to LC and Boundary Maps (Field Location Reference Record only)
I. Photographing the Field Location

For access denied, nonforest, or dangerous/inaccessible plots, complete the Plot Reference Data, Truck Coordinates if obtained, and a short explanation in the travel notes section.

A. Identification Items

Record the following Identification items on the Field Location Reference record and electronically in the associated Reference file in the PDR.

When completing the Reference file on the PDR (Option 0), refer to chapter 7 for a description of State, County, P2 #, Map, CPN, Crew Type, QA Status, and Plot Status. Other variables in the Option 0 file are described

below. On the Field Location Reference Record, record the first initial and the full last names of the cruiser(s) and the recorder.

6.1.0 INVENTORY PHASE

When collected: All plots
Field width: 1 digit
Tolerance: No errors
For each Reference file (PDR option 0) record the whether the plot is either a P2 or P3 plot.

Values	Definition
2	P2 Plot
3	P2/P3 Plot

6.1.1 HEXAGON NUMBER

When collected: All P3 plots
Field width: 7 digits
Tolerance: No errors

Record the Hex# assigned to the P3 field location indicated on the plot packet label.

6.1.2 P3 PLOT NUMBER

When collected: All P3 plots
Field width: 1 digit
Tolerance: No errors

Record the Phase 3 plot number indicated on the plot packet label (values 1-9).

6.1.3 OWNER CONTACT

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record if it was necessary to contact the landowner to access the location. Record “Y” for yes and “N” for no

6.1.4 4 X 4

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record if it was necessary to use 4 wheel drive to access the location.
Record "Y" for yes and "N" for no

6.1.5 ATV

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record if ATV use **would be helpful** (not necessarily used**)** to access the location.
Record "Y" for yes and "N" for no

6.1.6 LOCKED GATE

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record if it was necessary to go through a locked gate to access the location.
Record "Y" for yes and "N" for no

6.1.7 PHOTO PROJECT

When collected: All plots
Field width: Up to 10 characters
Tolerance: No errors
Record the Project of the aerial photography as shown along the top edge of the photos. Examples include NAPP (most commonly 1:40,000 black and white) or 613030, 612040, etc. (most commonly 1:16.000 or 1:24,000 color National Forest photos).

6.1.8 PHOTO ROLL

When collected: All plots
Field width: Up to 8 characters
Tolerance: No errors
Record the roll number of the aerial photography as shown along the edge of the photos.

6.1.9 PHOTO NUMBERS

When collected: All plots
Field width: Up to 15 characters
Tolerance: No errors
Record the numbers of the aerial photographs as shown along the top edge of the photos, separated by a slash (/). Place an asterisk (*) immediately after the photo number with the LC pinprick. Examples include 142/143* or 56*/57.

6.1.10 PHOTO SCALE

When collected: All plots
Field width: 5 digits
Tolerance: No errors
Record the nominal scale of the aerial photography as shown along the top edge of the photos without using commas. Examples include 16,000 and 24,000 (usually Forest Service color), 40,000 (NAPP black and white) or 60,000 (less common).

6.1.11 PHOTO YEAR

When collected: All plots
Field width: 4 digits
Tolerance: No errors
Record the year of the aerial photography used for the location shown along the top edge of the photos.

Note: For remeasurement locations, use the current photos if provided; however, if the old photos are a better scale, and no significant changes have occurred (new roads, etc), use the old photos.

6.1.12 TOWNSHIP

When collected: All plots
Field width: 3 digits
Tolerance: No errors
Record the township where the field location is located. The Township can be found on the plot packet label or on the Forest/BLM/Topographic maps. Be careful when examining maps; abrupt changes in the township numbering often occur along State, baseline, or other boundaries.

Note: If the Township number includes a fraction (such as "19 ½") then use the Township Fraction field to record "50" to represent the ½.

6.1.13 NORTH/SOUTH

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record "N" for a north township or "S" for a south township

6.1.14 RANGE

When collected: All plots
Field width: 3 digits
Tolerance: No errors
Record the Range where the field location is located. The Range can be found on the plot packet label or on the Forest/BLM/Topographic maps. Be careful when examining maps; abrupt changes in the township numbering often occur along State, baseline, or other boundaries.

Note: If the Township number includes a fraction (such as "19 ½") then use the Township Fraction field to record "50" to represent the ½.

6.1.15 EAST/WEST

When collected: All plots
Field width: 1 letter
Tolerance: No errors
Record "E" for a east township or "W" for a west township

6.1.16 SECTION

When collected: All plots
Field width: 2 digits
Tolerance: No errors
Record the Section where the field location is located. The Section can be found on the plot packet label or on the Forest/BLM/Topographic maps. Be careful when examining maps; abrupt changes in the township numbering often occur along State, baseline, or other boundaries.

Note: If the Section number includes a fraction (such as "19 ½") then use the Township Fraction field to record "50" to represent the ½.

6.1.17 OWNER

When collected: All plots
Record "private landowner" or the name of the managing agency into the PDR. If a private landowner is listed record the address and telephone number, if known, on the plot packet (this information is used for quality control crew access and remains confidential). **Do not enter the owner's name or any other confidential information such as addresses or phone numbers into the PDR.**

Below "Owner Information," record information about landowner contact, recommendations for 4-wheel drive and ATV use, and information about locked gates.

B. Truck Coordinates

Record the following data for the Truck Coordinates on the Field Location Reference Record and electronically in the associated Reference file in the PDR.

Collect and record the UTM coordinates at the site where the vehicle is parked to begin hiking. This point will provide information to future crews for access and may also help the crew relocate the vehicle in an emergency.
Refer to the Precision Lightweight GPS Receiver (PLGR) instruction manual (Appendix G) for detailed information on using the PLGR.

Important: Each day in the field, set up the PLGR in an open area for at least 15 minutes to load the satellite data. Always carry a spare set of 8 AA batteries.

Warning: Do not depress the CLR/MARK and the NUM LOCK keys simultaneously as this will zeroize the PLGR unit causing it to malfunction. If the unit is zeroized, return it to the office for re-keying. Also, never remove the PLGR internal battery without having fully charged batteries in place, or without the unit being plugged in to an external power source; otherwise, removing the internal battery will zeroize the PLGR unit. The internal battery should only be removed during its replacement.

Collect GPS data at the following sites. See **Appendix E** for instructions.

Truck Coordinates:

6.2.0 GPS TYPE: Refer to Chapter 7

6.2.1 TRUCK UTM ZONE: Refer to Chapter 7

6.2.2 TRUCK UTM EASTING: Refer to Chapter 7

6.2.3 TRUCK UTM NORTHING: Refer to Chapter 7

C. Reference Point

Record the following data for the Reference Point on the Field Location Reference record and electronically in the associated Reference file in the PDR.

RP selection is critical to the relocation of any field plot. Extreme care is required to select an RP that is easy to locate, is readily identifiable on the ground and the aerial photos, and will likely be identifiable in 10 years. Refer to "Selecting a Suitable RP" (chapter 2).

Remeasurement locations and P3 plots: use the reference point from the previous measurement if it meets the site tree requirements.

Tagging the RP -- Attach to the RP, when appropriate, aluminum tags labeled "RP 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. Nail a third tag at ground level facing towards the field location. 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, and avoid tagging aspen trees.

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 field location; do not tag RP trees at 6 feet above the ground. Remove all flagging before you leave the vicinity. For plots near trails or roads, metal tags must be spray painted gray or brown on both sides. The RP must be carefully selected and adequately described to provide adequate means for future relocation.

6.3.0 PHOTO SCALE RECIPROCAL (PSR)

When collected: All plots
Field width: 5 digits

If a baseline is used to calculate azimuth and distance from the RP to LC, record the PSR used (See Chapter 2 Establishing a Baseline and Scale). If the GPS is used to obtain the azimuth and distance from the RP to LC, record 00000.

PSR = Horizontal Ground Distance/Photo Distance

6.3.1 RP SPECIES

When collected: When a tree is used as an RP
Field width: 7 characters
Tolerance: No errors (if a tree is used)

When a tree is used as an RP, record the species code. This field will not fill zeros, so remember to enter “0XX” instead of “XX” for species codes starting in zero. If other landmarks are used for an RP, such as a sharp bend in a road, a corner of a building, the intersection of two fence lines, etc., then record a short word to describe the landmark, such as ROCK, FORK, or CORNER, and describe the RP in the Remarks fields. Example remarks could be "large ponderosa pine located on the southwest corner of the meadow" or "six-stemmed juniper with a dead top on ridgeline.”

6.3.2 RP DIAMETER

When collected: When a tree is used as an RP
Field width: 3 digits
Tolerance: +/- 0.2 in per 20.0 in increment of measured diameter

When a tree is used as an RP, record the diameter**.** If a multistemmed woodland tree is selected, measure only one stem, preferably the largest or main stem. If other landmarks are used for an RP, such as a sharp bend in a road, a corner of a building, the intersection of two fence lines, etc., then record 000 for the diameter and describe the RP in the Remarks fields.

6.3.3 RP AZIMUTH

When collected: All plots with an established RP
Field width: 3 digits
Tolerance: ± 2 degrees.

Record the azimuth (to the nearest degree.

6.3.4 RP HORIZONTAL DISTANCE

When collected: All plots with an established RP
Field width: 4 digits
Tolerance: Distance ±6 feet per 100 feet of transect, maximum tolerance of 30 feet.

Record the horizontal distance, **to the nearest foot,** from the RP to the LC.

Note distinct landmarks and obstructions encountered on the course to location center such as fences, streams, cliffs, etc., and the associated distances from RP on the Field Location Reference Record.

6.3.5 RP SLOPE DISTANCE

When collected: All plots with an established RP
Field width: 4 digits
Tolerance: Distance ±6 feet per 100 feet of transect, maximum tolerance of 30 feet.

Record the slope distance, **to the nearest foot,** from the RP to the LC.

6.3.6 REMARKS 1-8

Record a description of the RP and it's location, for example, "large ponderosa pine in the southwest corner of the meadow" or "six-stemmed juniper standing alone on ridgeline". If the RP is not a tree, record a description such as "northwest corner of old building at the south end of clearing" (Use CNTRL-POPUP to activate the Editor function in the PDR)

6.3.7 GPS TYPE: See Chapter 7

6.3.8 GPS ERROR: See Chapter 7

6.3.9 NUMBER OF READINGS: See Chapter 7

6.3.10 RP UTM ZONE: See Chapter 7

6.3.11 RP UTM EASTING: See Chapter 7

6.3.12 RP UTM NORTHING: See Chapter 7

D. LC Witness Trees

Record the following data for "X" and "Y" trees under the "Witness Trees" section of the Field Location Reference record and electronically in the associated Reference file in the PDR.

1. Selection

Reference the LC 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 LC azimuth.
- Ideally, a distance of 25-30' from LC.
- If there are no suitable trees at 25-30', use a tree within the subplot radius (24.0' or less). Tag only, no blaze.

"Y" Tree

- As close to LC as possible.
- At a right angle to the RP to LC 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 aspen, if possible; if aspen is used, be sure it is off the subplot and tag only. Do not blaze.
- At least 5.0-inches DBH for timber species and 3.0-inches DRC for woodland trees if possible.

  If no live trees are within the vicinity of the LC (e.g., clearcut, burn area) select alternative witness landmarks that are likely to be present in 10 years (e.g., a sound snag, large stump, prominent rock). Describe the alternative landmarks selected on the Field Location Reference record.

2. Marking

For witness trees outside the subplot radius, scribe an "X" above DBH/DRC on the side of the "X" tree facing the stake (LC); scribe the bark, but be careful not to penetrate the cambium.

For trees not scribed (tree within subplot radius), nail a witness tag (2.5" x 2.5" black, heavy aluminum, diamond shaped tag) approximately 6 feet above the ground facing the LC if appropriate. If a small tree is used, or if the location is in close proximity to private residence, do not blaze or tag but record a note under the "Witness Trees" section of the Field Location Reference record. If a multistemmed woodland tree is used as an "X" Tree, scribe an "X" on the stem measured for DRC.

For all witness trees, scribe two aluminum tags, one labeled "X LOC #" (with the actual location number) and the other labeled "Y LOC #". Nail each tag to the appropriate witness tree, at ground level, with the tags facing the LC stake. 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.

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 LC in future remeasurement inventories.

Reserved locations: Nail a tag (spray painted gray or brown on both sides) with the appropriate letter (X or Y) and location number inscribed on it to the base of the tree facing subplot center.

6.4.0 X SPECIES
6.4.1 Y SPECIES

When collected: All forested plots
Field width: 7 characters
Tolerance: No errors

Record the species code for the X/Y tree. It should be a species easily located on the site. Avoid using aspens if possible.
If no trees are near the LC and an alternative landmark was used as the X/Y tree, record a short word to describe the landmark, such as "ROCK" or "POST" and the describe the X/Y tree in the notes fields.
When a tallied tree species is used, use the species code number. As with the RP species field, these fields will not fill zeros in the species codes.
When a nontallied tree species is used, use the appropriate vegetation species code.

6.4.2 X DIAMETER
6.4.3 Y DIAMETER

When collected: All forested plots
Field width: 3 digits
Tolerance: ±0.2 inch per 20 inches diameter

Record the diameter of the X/Y tree to the last whole 0.1 inch. It should be at least 5.0 inches for timber species or 3.0 inches for woodland species. If a multistemmed woodland tree is used as a witness tree, record the DRC of one stem (the largest or main stem). If a landmark is used instead of a tree, record "000" and describe the X/Y tree in the notes fields.

6.4.4 X DISTANCE
6.4.5 Y DISTANCE

When collected: All forested plots
Field width: 4 digits
Tolerance: ±0.2 feet.

Record the **Slope Distance** (to the nearest 0.1 foot) from the top of the LC stake to the nailed tag (see below). If an alternative landmark is used as a witness, distance is from the top of LC stake to the face of the landmark.

6.4.6 X AZIMUTH
6.4.7 Y AZIMUTH

When collected: All forested plots
Field width: 4 digits
Tolerance: ± 2 degrees

Record the azimuth (to nearest degree) from the LC stake to the center of tree/landmark at its base.

6.4.8 NOTES

When collected: When witness tree descriptions or notes are helpful
Values:
0 No description is needed
1 Description is needed

E. Noxious Weeds

At each subplot, examine the vegetation within the subplot fixed-radius area for the presence of any designated noxious weeds. Record the species code for any identified weeds, and indicate the subplot number(s) where the plant was found. The list of designated noxious weeds for each State is located in the State supplement.

When collected: **All subplots will be evaluated if there is at least 1 forested condition**. If completely nonforest, do not collect noxious weed information.
Field width: 7 characters

Tolerance: No errors 90% of the time

F. Travel Description

Record road directions on the Field Location Reference record and in the Reference file in the PDR. Start the directions from the nearest post office, Forest Service office, major highway intersection, or other prominent landmark to the vicinity of the RP. This space can also be used to record other travel information that will assist in relocating the field location (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.
- Drain/creek/stream/ridge etc., name if applicable.
- Major landmarks.
- Approximate distances between trails, creeks, landmarks etc.

G. Editing- Field Location Reference record only

1. Field Crew Edit

After measuring the field location, 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 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.

H. Truck to LC and Boundary Map

On the top of the backside of the Field Location Reference record draw, including any helpful landmarks (old jeep roads, hiking/game trails, the RP, slope, cliffs, or openings), a map of the hike from the truck to the LC. The map aids future crews in locating the LC.

If boundaries occur within any of the 4 subplots draw a map indicating approximate boundary lines, labeling each condition class, on the backside of the Field Location Reference record.

I. Photographing the Field Location

As an additional aid in describing the field location, and as a record of plot conditions at the time of the field inventory, take photographs of the field location using digital field cameras.

Procedure: At each field location, stand over the LC stake and take four photographs in the cardinal directions (i.e., take pictures facing north, east, south, and west). Include a placard in each picture, placed in the lower right-hand corner of the view, indicating the State, county, location number, 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. **Note:** Field compass declination is set to 0°.

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 LC on the ground, Subplot 1 will be photographed in the 4 cardinal directions. If the crew does not identify the LC but determines the approximate location or conditions of the LC, the crew will photograph the LC area (e.g., crew determines LC 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 LC should be representative of the sample area.

CHAPTER 7 -
FIELD LOCATION DESCRIPTION ITEMS
(PLOT IDENTIFICATION DATA)

This chapter presents the field location description items. Refer to appendix A.2 for the Field Location Description record.

Carefully read all instructions for each item. Record leading zeros for each item, where appropriate. When instructed to examine the location area, refer to the area encompassing the subplots, about 2.5 acres (approx. 185-foot radius) centered on the LC.

This section also describes field procedures for attempted, field-visited nonforest/nonsampled plots. These plots are of interest from the standpoint that they may once have been forest, or that they may revert to forest or become accessible in the future. Thus, they are monitored to account for lands that move into and out of the forest land base. Only basic plot identification data are recorded on these plots.

A plot is considered nonforest if no part of it is currently located in forest land (CONDITION CLASS STATUS = 1). A plot is nonsampled if the entire plot is not sampled for one of the reasons listed in PLOT NONSAMPLED REASON.

If a forest plot has been converted to nonforest or becomes a nonsampled plot, the previous data are reconciled and an attempt is made to visit the plot during the next inventory. If a nonforest plot becomes forest or access is gained to a previously nonsampled plot, a new forest ground plot is installed. All nonforest and nonsampled plots are visited if there is any reasonable chance that they might include some forest land condition class.

PROCEDURE
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. The procedures in this section do not apply to clearcuts unless and until the land is converted to a nonforest use. Additional information concerning land use classifications is contained in Section 2.3.

In cases where a plot is inaccessible, but obviously contains no forest land, 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.
Refer to the Item Coding Guide (Separate handout) for the items to record

7.0 PLOT LEVEL DATA (Core 1.0)

All variables listed in Section 1.0 are collected on plots with at least one accessible forested condition (PLOT STATUS = 1). For all NONFOREST/NONSAMPLED plots (PLOT STATUS = 2 or PLOT STATUS = 3), see Chapter 4. In general, plot level data apply to the entire plot and they are recorded from the center of subplot 1.

7.1 FIELD GUIDE VERSION (Core 1.7)
Record the version number of the National Core Field Guide that was used to collect the data on this plot. FIELD GUIDE VERSION will be used to match collected data to the proper version of the field guide.

When collected: All plots
Field width: 2 digits (x.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: 2.0

7.2 STATE (Core 1.1)
Record the unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.

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

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

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

7.4 P2 LOCATION NUMBER (RMRS)

When collected: All plots.
Field width: 4 digits.
Tolerance: No errors.

Record the number assigned to the field location.
This item is indicated on the field location packet.

7.5 USGS MAP NUMBER (RMRS)

When collected: All plots.
Field width: 8 digits
Tolerance: No errors.
Record the map number assigned to the topographic map for the field location. The map number is indicated on the field location packet. The field location center (LC) is indicated on the topographic map by the intersection of designated map grid lines.

7.6 CONSECUTIVE POINT NUMBER (CPN) (RMRS)

When collected: All plots.
Field width: 4 digits.
Tolerance: No errors.
Record the CPN assigned to the field location. This item is indicated on the field location packet.

7.7 P3 HEXAGON NUMBER (Core 1.16)
Record the unique code assigned to each Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 7 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

7.8 P3 PLOT NUMBER (Core 1.17)
Record the P3 PLOT NUMBER that is used to identify individual plots within the same Phase 3 (former FHM) hexagon.

When collected: All Phase 3 plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

7.9 INVENTORY PHASE
When collected: All plots
Field width: 1 digit
Tolerance: No errors

For each Reference file (PDR option 0) record the whether the plot is either a P2 or P3 plot.

Values:

2	P2 Plot
3	P2/P3 Plot

7.10 PLOT NUMBER (Core 1.3)
Record the identification number, unique within a county, parish, or borough (survey unit in AK), for each plot. If SAMPLE KIND = 3, the plot number will be assigned by the National Information Management System (NIMS).

When collected: SAMPLE KIND = 1 or SAMPLE KIND = 2
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 0001 to 9999

7.11 CURRENT DATE (Core 1.8)
Record the year, month, and day that the current plot visit was completed as follows:

7.11.1 MONTH (Core 1.8.2)
Record the month that the plot was completed.

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

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

7.11.2 DAY (Core 1.8.3)
Record the day of the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors

MQO: At least 99% of the time
Values: 01 to 31

7.11.3 YEAR (Core 1.8.1)
Record the year that the plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: ≥ 2003

7.12 CREW NUMBER(S) (RMRS)

When collected: All plots.
Field width: 3 digits.
Tolerance: No errors.
Record up to 5 crew numbers as assigned to the field crew; always record the crew supervisor first (e.g., for crew supervisor 02 working with crew members 12 and 31, record 002,012,031,000,000).

7.13 CREW TYPE (Core 1.13)
Record the code to specify what type of crew is measuring the plot.

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

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

7.14 QA STATUS (Core 1.12)
Record the code to indicate the type of plot data collected, using the following codes:

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

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

7.15 SAMPLE KIND (Core 1.5)
Record the code that describes the kind of plot being installed.

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

1 Initial plot establishment - the initial establishment and sampling of a national design plot (FIA Field Guide versions 1.1 and higher). SAMPLE KIND 1 is assigned under the following circumstances:
- Initial activation of a panel or subpanel
- Reactivation of a panel or subpanel that was previously dropped
- Resampling of established plots that were not sampled at the previous visit

2 Remeasurement – remeasurement of a national design annual plot that was sampled at the previous inventory.

3 Replacement plot - a replacement plot for a previously established plot. Assign SAMPLE KIND = 3 if a plot is installed at a location other than the previous location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the previous plot. Replaced plots are assigned PLOT STATUS = 3, SAMPLE KIND = 2, and the appropriate NONSAMPLED REASON code. The plot number for the replacement plot is assigned by NIMS.

7.16 REGIONAL SAMPLE KIND (RMRS)

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

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

Values:

1	Initial plot establishment - the initial establishment and sampling of a national design plot (FIA Field Guide versions 1.1 and higher). SAMPLE KIND 1 is assigned under the following circumstances: • Initial activation of a panel or subpanel • Reactivation of a panel or subpanel that was previously dropped • Resampling of established plots that were not sampled at the previous visit
2	Remeasurement – remeasurement of a national design annual plot that was sampled at the previous inventory or remeasurement of a previously established "Rocky Mtn 4-point center micro" or "National 4-point offset micro" (see chapter 5 for definitions). If the previously established plot is a design other than those mentioned above, the SAMPLE KIND will equal 1.
3	Replacement plot - a replacement plot for a previously established national design annual plot. Assign SAMPLE KIND = 3 if a plot is installed at a location other than the previous location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the previous plot. Replaced plots are assigned PLOT STATUS = 3, SAMPLE KIND = 2, and the appropriate NONSAMPLED REASON code. The plot number for the replacement plot is assigned by NIMS or replacement of a previously established "Rocky Mtn 4-point center micro" or "National 4-point offset micro" (see chapter 5 for definitions). Includes a plot that was replaced with a new plot because the original plot was established in the wrong location (see chapter 4, field procedure overview).

7.17 PLOT STATUS (Core 1.5)
Record the code that describes the sampling status of the plot.

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

1 Sampled – at least one accessible forest land condition present on plot or previously had at least one accessible forest land condition on plot
2 Sampled –no accessible forest land condition present on plot and no previously accessible forest land condition on plot.
3 Nonsampled

7.18 PLOT NONSAMPLED REASON (Core 8.3.5)
For entire plots that cannot be sampled, record one of the following reasons.

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

01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border. Entire plots would only be assigned this code if it is determined that a previously measured plot is currently beyond the U.S. border.

02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available. In some regions denied access plots may be replaced; check with the field supervisor regarding regional

protocols for plot replacement.

03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

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 – This code applies to whole plots that cannot be relocated. This situation requires notification of the field supervisor. 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 Plot in wrong location – This code applies to whole plots that can be relocated, but their placement is beyond the tolerance limits for plot location. This situation requires verification by the regional office. Whenever this code is assigned, a replacement plot is required. The plot that is lost is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 7. The replacement plot is assigned SAMPLE KIND = 3.

08 Skipped visit – This code applies to whole plots that are skipped (i.e., the entire plot should be assigned to this condition class). It is used for plots that are not completed prior to the time a panel is finished and submitted for processing. Note: This code is for office use only.

09 Dropped intensified plot - This code applies only to regions engaged in intensification. It is used for intensified plots that have been dropped due to a change in grid density.
Note:

- This code is for office use only.
- This code is primarily intended for regions engaged in sub-paneling for intensification purposes.
- Plot records for dropped subpanels may be generated with the information management system.

10 Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

7.19 CONDITION CLASS CHANGE (RMRS)

When collected: All SAMPLE KIND 2 plots.
Field width: 1 digit.
Tolerance: No errors.

Code	Type
0	There have been no condition class changes from the previous inventory. Copy condition class defining (mapping) variables from computer-generated plot map.
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 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.

7.20 PREVIOUS PLOT NUMBER (Core 1.6)
Record the identification number for the plot that is being replaced.

When collected: When SAMPLE KIND = 3
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 0001 to 9999

7.21 SUBPLOT RADIUS (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 3 digits.
Tolerance: No errors.
Record the following code for the subplot radius:

Code	Subplot Radius
240	**24.0-foot radius (1/24-acre subplot)**

7.22 MICROPLOT RADIUS (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 3 digits.
Tolerance: No errors.
Record the following code for the seedling/sapling microplot radius:

Code	Microplot Radius
068	**6.8-foot radius (1/300-acre)**

7.23 MICROPLOT LOCATION (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record the location of the microplot.

Code	Location
1	12 feet horizontal at 90 degrees east of subplot center.

7.24 HORIZONTAL DISTANCE TO IMPROVED ROAD (Core 1.10)
Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements.

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

1	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

7.25 WATER ON PLOT (Core 1.11)
Record the water source that has the greatest impact on the area within the accessible forestland portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water. This variable can be used for recreation, wildlife, hydrology, and timber availability studies.

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

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

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

7.26 GPS Coordinates (Core 1.14)
Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field-visited plot locations.

7.26.1 GPS Unit Settings, Datum, and COORDINATE SYSTEM (Core 1.14.1)
Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured.

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

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

7.26.2 Collecting Readings (Core 1.14.2)
Collect at least 180 GPS readings at the plot center. These may be collected in a file for post-processing or may be averaged by the GPS

unit. Each individual position should have an error of less than 70 feet if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error less than or equal to 70 feet) cannot be obtained, try again before leaving the plot center.

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 feet of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. If a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance as described in Sections 7.26.13 and 7.26.14.

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. Again, if a PLGR unit is used, use the Rng-Calc function in the PLGR to compute the coordinates of the plot center. If another type of GPS unit is used, record the azimuth and horizontal distance as described in Sections 7.26.13 and 7.26.14.

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

7.26.3 GPS UNIT (Core 1.14.3)

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

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

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

7.26.4 GPS SERIAL NUMBER (Core 1.14.4)
Record the last six digits of the serial number on the GPS unit used.

When collected: When GPS UNIT > 0
Field width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000001 to 999999

7.26.5 COORDINATE SYSTEM (Core 1.14.5)
Record a code indicating the type of coordinate system used to obtain readings. **For RMRS, code 2 (UTM Coordinate System) is only valid code.**

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

1 Geographic coordinate system
2 UTM coordinate system

7.26.6 GPS ERROR (Core 1.14.15)
Record the error as shown on the GPS unit to the nearest foot. As described in Section 7.26.2, make every effort to collect readings only when the error less than or equal to 70 feet. However, if after trying several different times during the day, at several different locations, this is not possible, record readings with an error of up to 999 feet.

When collected: When GPS UNIT =1 or 2
Field width: 3 digits
Tolerance: +/- 100'
MQO: At least 99% of the time
Values: 000 to 070 if possible
071 to 999 if an error of less than 70 cannot be obtained

7.26.7 NUMBER OF READINGS (Core 1.14.16)
Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

When collected: When GPS UNIT = 1 or 2
Field width: 3 digits
Tolerance: No errors

MQO: At least 99% of the time
Values: 001 to 999

7.26.8 GPS ELEVATION (Core 1.14.14)
Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

When collected: When GPS UNIT = 1, 2 or 4
Field width: 6 digits
Tolerance:
MQO: At least 99% of the time
Values: -00100 to 20000

7.26.9 UTM ZONE (Core 1.14.8)
Record a 2-digit and 1 character field UTM ZONE as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 3 digits: (##C)
Tolerance: No errors
MQO: At least 99% of the time
Values: 03-19Q and 03-19W

7.26.10 EASTING (X) UTM (Core 1.14.9)
Record the Easting coordinate of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values:

7.26.11 NORTHING (Y) UTM (Core 1.14.10)
Record the Northing coordinate of the plot center as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values:

7.26.12 Correction for "Offset" Location (Core 1.14.11)
As described in Section 7.27.2, coordinates may be collected at a location other than the plot center (an "offset" location). If a PLGR unit

is used all offset coordinates will be "corrected" back using the Rng/Calc function. If a GPS unit other than a PLGR is used, then record items 7.26.13 and 7.26.14.

7.26.13 AZIMUTH TO PLOT CENTER (Core 1.14.12)

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

When collected: When GPS UNIT = 2, 3 or 4
Field width: 3 digits
Tolerance +/- 3 degrees
MQO: At least 99% of the time
Values: 000 when coordinates **are** collected at plot center
001 to 360 when coordinates **are not** collected at plot center

7.26.14 DISTANCE TO PLOT CENTER (Core 1.14.13)

Record the horizontal distance in feet from the location where coordinates were collected to the actual plot center. If coordinates are collected at plot center, record 000. As described in Section 7.26.2, if a laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 feet from the plot center. If a range finder is not used, the offset location must be within 200 feet.

When collected: When GPS UNIT = 2, 3 or 4
Field width: 3 digits
Tolerance: +/- 6 ft
MQO: At least 99% of the time

Values: 000 when coordinates **are** collected at plot center
001 to 200 when a Laser range finder **is not** used to determine distance
001 to 999 when a Laser range finder **is** used to determine distance

7.27 PLOT-LEVEL NOTES (Core 1.15)

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

When collected: All plots
Field width: Unlimited alphanumeric character field
Tolerance: N/A
MQO: N/A

7.28 FUTURE FOREST POTENTIAL (RMRS)

When collected: When no accessible forest land condition class is present on the location.
Field width: 1 digit.
Tolerance: No errors.
Indicate if the location requires a prefield examination at the time of the next inventory (10-20 years).

Code	Definition
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 (tally tree species as defined in Item 416 pg 10-11 to 10-14) on the site, but other woody species not currently defined as forest species occupy the site (such as palo verde, ironwood, big sage). Where code 2 is selected, note the dominant tree or shrub species on the site in the Condition Notes.

CHAPTER 8
SUBPLOT DESCRIPTION ITEMS

This chapter describes the data items that will be collected on each of the 4 subplots on a field location (Subplot Description record, appendix A.2). Complete the following items at each subplot:

If a previously established subplot was not established in the correct location, determine whether the subplot placement meets the following criteria:

- The old subplot was established in the correct condition class (refer to chapter 3).
- The old subplot was established within $\leq$ 24 feet of the correct location.
- Subplot 1 is within 500' of correct location.

If the old subplot meets both criteria; remeasure the trees and saplings from the previous inventory and tally any new trees on the subplot using current procedures, including the establishment of the new offset microplot.

If the old subplot does not meet both the criteria, establish a new subplot in the correct location using the current procedures. Remove the old tags and nails from the trees, and note this re-location in the notes/comments for the current inventory.

Subplot Establishment. (RMRS)

Tolerance: $\pm$ 8 feet.

8.0 SUBPLOT INFORMATION (Core 3.0)

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.

8.1 SUBPLOT NUMBER (Core 3.1)

Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

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

8.2 SUBPLOT/ANNULAR PLOT STATUS (Core 3.2)

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

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

1 Sampled – at least one accessible forest land condition present on subplot
2 Sampled – no accessible forest land condition present on subplot
3 Nonsampled

8.3 SUBPLOT CONDITION LIST (RMRS)

When collected: All subplots.
Field width: 4 digits.
Tolerance: No errors.
This is a listing of all condition classes located within the 24.0-ft radius around the subplot center. A maximum of four conditions is permitted at any individual subplot. If a condition class has already been defined at a previously completed subplot, 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 1,0,0.

8.4 SUBPLOT NONSAMPLED REASON (Core 3.3)
For entire subplots that cannot be sampled, record one of the following reasons.

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

01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.

02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available. In some regions denied access plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition. In some regions hazardous plots may be replaced; check with the field supervisor regarding regional protocols for plot replacement.

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 8.3.5).

05 Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.

10 Other – This code is used whenever a plot or 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.

8.5 SUBPLOT CENTER CONDITION (Core 3.4)
Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

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

Microplot Establishment (RMRS)

Tolerance: ±1 foot

8.6 MICROPLOT CENTER CONDITION (Core 3.5)
Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

When collected: All microplots where subplot center is CONDITION CLASS STATUS = 1, 2, 3
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

8.7 SUBPLOT SLOPE (Core 3.6)

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

- If slope changes gradually across the subplot, record an average slope.
- If slope changes across the subplot but the slope is predominantly of one direction, code the predominant slope percentage rather than the average.
- If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill where most of the area lies.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/ANNULAR PLOT STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

8.8 SUBPLOT ASPECT (Core 3.7)

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/ANNULAR PLOT STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values:

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

8.9 SNOW/WATER DEPTH (Core 3.8)

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

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/ANNUALR PLOT STATUS = 1)
Field width: 2 digits (x.y)
Tolerance: +/- 0.5 ft
MQO: At the time of measurement (no MQO after initial date of visit)
Values: 0.0 to 9.9

8.10 ROOT DISEASE SEVERITY RATING (RMRS – only in ID and MT)

When collected: All subplots with an accessible forest land condition class.
Field width: 1 digit.
Tolerance: ±1 class.

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.

Code	Criteria
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.**

CHAPTER 9
TREE, SAPLING, AND SEEDLING DATA (Core 5.0)

This chapter describes the tree data to be recorded on individual trees, saplings, and seedling counts, and covers instructions for measuring various tree attributes. These instructions apply to trees in accessible forest land condition classes. Refer to appendix A.5 for the Tree Data record. For specific items to record, refer to appendix D.

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.

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

For multi-stemmed western woodland species, a cumulative diameter at root collar (DRC) is used to compute diameter as described in Section 9.13.4.

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 defoliated may still be alive.

Once tallied, dead trees over 5.0 inches in diameter are tracked until they no longer qualify as standing dead. **Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be estimated.**

To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical.

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

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Debris (DWD) if they otherwise meet DWD tally criteria.

For western woodland species (tally tree species section 9.12) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For western woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter at root collar (DRC), be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

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

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement.

The following apply at remeasurement:

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

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

9.1 SUBPLOT NUMBER (Core 5.1)
Record the subplot number where the tree occurs.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
When Collected: (RMRS): Record for every line of data.

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Verify for previously tallied trees. Correct if an obvious error exists.
Values:

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

9.2 TREE RECORD NUMBER (Core 5.2)
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 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. Repeat the numbering procedure, described below, for each subplot.

If TREE RECORD NUMBERs are not assigned in the field, record 000.

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

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

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.

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.

Assign nontallied site trees to the nearest subplot and give the tree the next available tree number following the tally tree numbers.

When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the formerly centered microplot.

Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000 or 001 to 999

9.3 AZIMUTH (Core 5.4)

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 western woodland species. The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

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

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

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

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 inch DBH/DRC on the formerly centered microplot.

Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

9.4 HORIZONTAL DISTANCE (Core 5.5)

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 western woodland trees (woodland species indicated in Tree Species section 9.12), 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.

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

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

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

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
Field width: 3 digits
Tolerance: Microplot: +/- 0.2 ft
Subplot: +/- 1.0 ft from 0-22.9 feet; +/- .1 foot for > 23 fee
Annular plot: +/- 3.0 ft
MQO: At least 90% of the time
Values: Microplot: 00.1 to 06.8
Subplot: 00.1 to 24.0
Annular plot: 00.1 to 58.9

9.5 CONDITION CLASS NUMBER (Core 5.3)

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a boundary is not clearly defined by a distinct feature such as a fence row or road edge. Tally trees that lie on the edge of the defined boundary should be assigned to the actual condition in which they are most closely identified, regardless of the recorded approximate boundary (Figure 30).

When Collected: All trees

When collected (RMRS): All tally trees, nontallied site trees, tree counts, and new tally trees ≥ 1.0 in DBH/DRC on the microplot.

Field width: 1 digit

Tolerance: No errors

MQO: At least 99% of the time

Values: 1 to 9

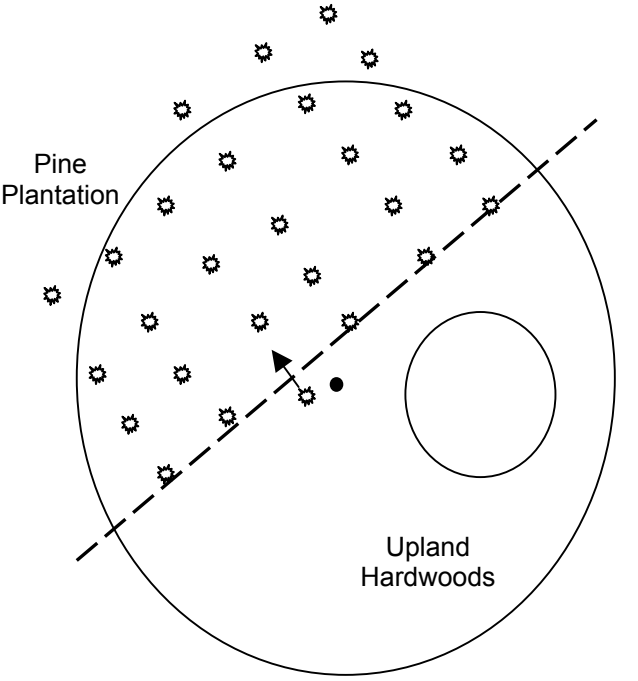


Figure 30. Ragged CONDITION CLASS boundary and tree condition class designation.

9.6 PREVIOUS TREE STATUS (Core 5.6)

If not downloaded from the previous inventory, record PREVIOUS TREE STATUS for each remeasured tally tree. This code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change. If the old TREE STATUS appears to be incorrect (e.g., PREVIOUS TREE STATUS preprinted as "2", but tree is alive), record an estimated PREVIOUS TREE STATUS.

When collected: On remeasurement plots (SAMPLE KIND = 2), all previously tallied trees ≥ 1.0 in DBH/DRC
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Live Tree – alive at the previous inventory

2 Dead tree – standing dead tree at the previous inventory

9.7 PRESENT TREE STATUS (Core 5.7)

Record a PRESENT TREE STATUS for each tallied tree. This information is needed to correctly assign volume information to the proper component of volume change.

When Collected: All new live tally trees ≥ 1.0 in DBH/DRC
All new dead tally trees ≥ 5.0 in
On remeasurement plots, all previously tallied trees
When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the formerly centered microplot.

Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

0 No status –- tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes. Requires RECONCILE code =

5-8.
Nontallied site tree – site tree selected from off the subplots.

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

2 Dead tree -- any dead tree (new, remeasured, or ingrowth), regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural or land clearing activity, and are assumed not to have been utilized.

3 Removed - a tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree is assumed to have been utilized.

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

9.8 RECONCILE (Core 5.7.1)

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

When Collected: On SAMPLE KIND = 2; all new live tally trees $\geq$ 1.0 in DBH/DRC (PRESENT TREE STATUS = 1 and no PREVIOUS TREE STATUS), all new dead tally trees $\geq$ 5.0 in (PRESENT TREE STATUS = 2 and no PREVIOUS TREE STATUS), all no status trees (PRESENT TREE STATUS = 0)

Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

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

1 Ingrowth – new tally tree not qualifying as through growth (includes reversions).

2 Through growth – new tally tree 5.0 inches DBH/DRC and larger, within the microplot, which was not missed at the previous inventory.

3 Missed live – a live tree missed at previous inventory and that is live or dead now.
Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

4 Missed dead – a dead tree missed at previous inventory that is dead now.
Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

Codes 5-8 are valid for remeasured trees that no longer qualify as tally:

5 Shrank – live tree that shrank below threshold diameter on microplot/subplot/ annular plot

6 Missing – tree was tallied in previous inventory, but is now missing due to natural causes such as landslide, fire, etc.

7 Cruiser error – erroneously tallied at previous inventory

8 Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot/subplot/annular plot. 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.

9.9 STANDING DEAD (Core 5.7.2)

Record the code that describes whether the tree qualifies as standing dead or not. To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical. See Figures 31-33 for examples.

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

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Debris (DWD) if they otherwise meet DWD tally criteria.

For western woodland species (tree species list section 9.12) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For western woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

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

When collected: SAMPLE KIND = 2 only: All dead tally trees (PRESENT TREE STATUS = 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

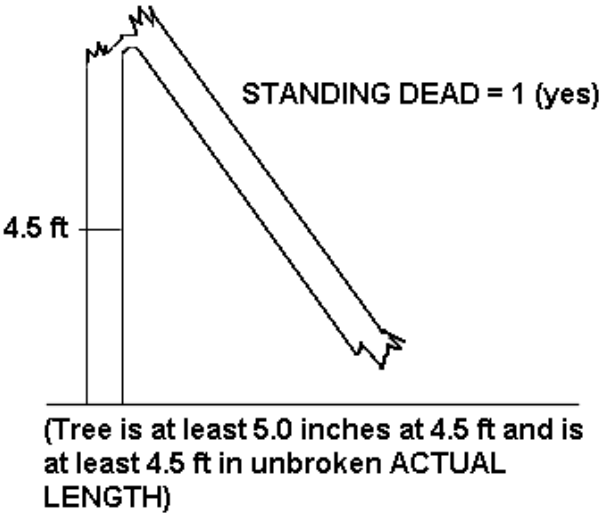


Figure 31. Example of an unbroken bole to 4.5 feet.

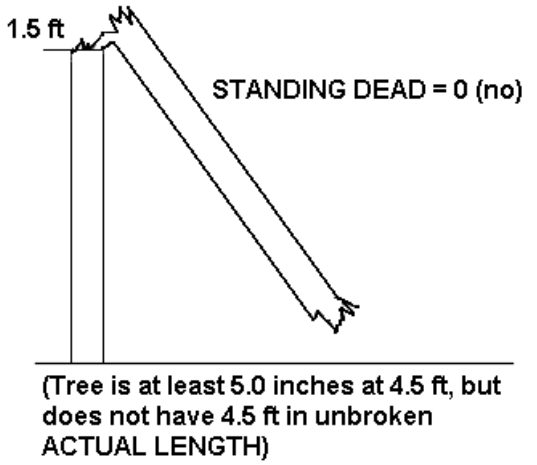


Figure 32. Example of an unbroken length of < 1.5 feet.

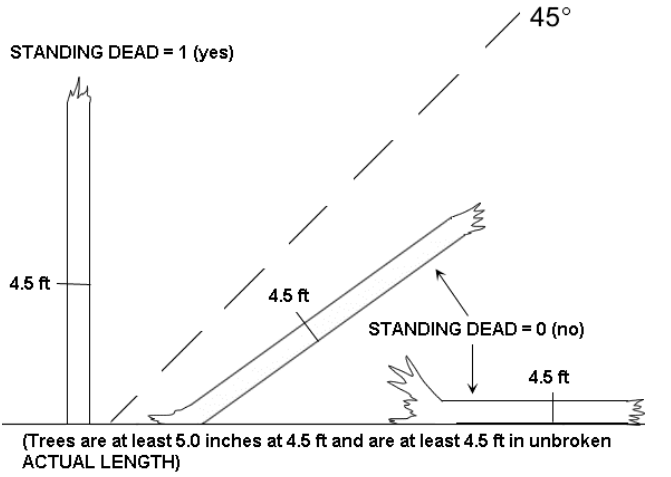


Figure 33. Other examples of dead trees.

9.10 MORTALITY (CORE OPTIONAL) (Core5.7.3)

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.

When Collected: All standing dead trees 5.0 in 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).

When collected (RMRS): All dead tally trees ≥ 5.0 in DBH/DRC that were live at the previous inventory or within the past 5 years if no previous inventory.

Record one of the following one-digit codes for each dead tree. If code 1 is recorded, also record a CAUSE OF DEATH code and a PAST TREE CLASS code.

Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:

0	No - tree does not qualify as mortality.
1	Yes – tree does qualify as mortality

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.

9.11 MORTALITY YEAR (Core 5.20)

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

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

When collected (RMRS): All dead tally trees ≥ 1.0 in DBH/DRC that were live at the previous inventory or within the past 5 years if no previous inventory.

Field width: 4 digits

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

MQO: At least 70% of the time

Values: 1995 or higher

9.12 SPECIES (Core 5.8)

Record the appropriate SPECIES code from the following list. If you encounter a species not listed and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use code 0299 for unknown dead conifer and 0998 for unknown dead hardwood when the genus or species codes cannot be used. The generic code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. This is often the case with standing dead trees on newly established plots. In this case use the sample collections procedures described earlier in this paragraph.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC

Field width: 4 digits

Tolerance: No errors

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

This following list is a subset of the FIA National Tree Species List. This list includes all tree species tallied in the Interior West States, and excludes those species found primarily in shrub form within the Interior West. "W" designates woodland species where DRC is measured instead of DBH. This list is based on the V1.5 National Manual list with RMRS additions (*) as recommended by the AB 11/2000.

Values:

Code	Common Name	Genus	Species	Woodland
15	white fir	Abies	concolor	
17	grand fir	Abies	grandis	
18	corkbark fir	Abies	lasiocarpa var. arizonica	
19	subalpine fir	Abies	lasiocarpa	
20	California red fir	Abies	magnifica	
21	Shasta red fir	Abies	shastensis	
22	noble fir	Abies	procera	
51	Arizona cypress	Cupressus	arizonica	
58	Pinchot juniper	Juniperus	pinchotii	w
59	redberry juniper	Juniperus	coahuilensis	w
62	California juniper	Juniperus	californica	w
63	alligator juniper	Juniperus	deppeana	w
64	western juniper	Juniperus	occidentalis	
65	Utah juniper	Juniperus	osteosperma	w
66	Rocky Mountain juniper	Juniperus	scopulorum	w
68	eastern redcedar	Juniperus	virginiana	
69	oneseed juniper	Juniperus	monosperma	w
72	subalpine larch	Larix	lyallii	
73	western larch	Larix	occidentalis	
81	incense-cedar	Calocedrus	decurrens	
93	Engelmann spruce	Picea	engelmannii	
94	white spruce	Picea	glauca	
96	blue spruce	Picea	pungens	
101	whitebark pine	Pinus	albicaulis	
102	Rocky Mountain bristlecone pine	Pinus	aristata	
104	foxtail pine	Pinus	balfouriana	
106	common or twoneedle pinyon	Pinus	edulis	w
108	lodgepole pine	Pinus	contorta	
112	Apache pine	Pinus	engelmannii	

Code	Common Name	Genus	Species	Woodland
113	limber pine	Pinus	flexilis	
114	southwestern white pine	Pinus	strobiformus	
116	Jeffrey pine	Pinus	jeffreyi	
117	sugar pine	Pinus	lambertiana	
118	Chihuahua pine	Pinus	leiophylla var. chihuahuana	
119	western white pine	Pinus	monticola	
122	ponderosa pine	Pinus	ponderosa	
130	Scotch pine	Pinus	sylvestris	
133	singleleaf pinyon	Pinus	monophylla	w
134	border pinyon	Pinus	discolor	w
135	Arizona pine	Pinus	arizonica	
136	Austrian pine	Pinus	nigra	
137	Washoe pine	Pinus	washoensis	
140	Mexican pinyon pine	Pinus	cembroides	w
142	Great Basin bristlecone pine	Pinus	longaeva	
143	Arizona pinyon pine	Pinus	monophylla var. fallax	w
202	Douglas-fir	Pseudotsuga	menziesii	
231	Pacific yew	Taxus	brevifolia	
242	western redcedar	Thuja	plicata	
263	western hemlock	Tsuga	heterophylla	
264	mountain hemlock	Tsuga	mertensiana	
313	boxelder	Acer	negundo	
322	bigtooth maple	Acer	grandidentatum	w
351	red alder	Alnus	rubra	
352	white alder	Alnus	rhombifolia	
*354	Arizona alder	Alnus	oblongifolia	
361	Pacific madrone	Arbutus	menziesii	
*362	Arizona madrone	Arbutus	arizonica	
375	paper birch	Betula	papyrifera	
404	pecan	Carya	illinoensis	
475	curlleaf mountain-mahogany	Cercocarpus	ledifolius	w
492	Pacific dogwood	Cornus	nuttallii	
510	eucalyptus	Eucalyptus	spp.	
544	green ash	Fraxinus	pennsylvanica	
547	velvet ash	Fraxinus	velutina	

Code	Common Name	Genus	Species	Woodland
552	honeylocust	Gleditsia	triacanthos	
602	Black walnut	Juglans	nigra	
*606	Arizona walnut	Juglans	major	
660	apple spp.	Malus	spp.	
680	mulberry spp.	Morus	spp.	
*732	Arizona sycamore	Platanus	wrightii	
741	balsam poplar	Populus	balsamifera	
742	eastern cottonwood	Populus	deltoides	
745	plains cottonwood	Populus	deltoides ssp. monilifera	
746	quaking aspen	Populus	tremuloides	
747	black cottonwood	Populus	balsamifera spp. trichocarpa	
748	Rio Grande cottonwd, Fremont's Poplar	Populus	deltoides ssp. wislizeni	
749	narrowleaf cottonwood	Populus	angustifolia	
756	western honey mesquite	Prosopis	glandulosa var. torreyana	w
757	velvet mesquite	Prosopis	velutina	w
758	screwbean mesquite	Prosopis	pubescens	w
803	Arizona white oak, gray oak	Quercus	arizonica, grisea	w
810	Emory oak	Quercus	emoryi	w
814	Gambel oak	Quercus	gambelii	w
823	bur oak	Quercus	macrocarpa	
826	chinkapin oak	Quercus	muehlenbergii	
829	Mexican blue oak	Quercus	oblongifolia	w
843	silverleaf oak	Quercus	hypoleucoides	w
850	Oak – evergreen (for RMRS only netleaf oak)	Quercus	spp. (rugosa)	w
972	American elm	Ulmus	americana	
974	Siberian elm	Ulmus	pumila	

9.13 DIAMETER (Core 5.9)

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 the species code list. Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-foot radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-foot radius subplots.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC

When collected (RMRS): All live and dead tally trees and nontallied site trees ≥ 1.0 in DBH/DRC, including new trees ≥ 1.0 in DBH/DRC on the formerly centered microplot.

Field width: 4 digits

Tolerance: +/- 0.1 in per 20.0 in increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2
+/- 1.0 in per 20.0 in increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5
Woodland species +/- 0.2 inch per stem.
Down dead trees +/- 4.0 inches.

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

Values: 0001 to 9999

Measuring DBH. Tree diameter for timber 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.

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.

Marking timber species.

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

(1) **Standing tally trees.** Mark trees 3.0-inches DBH and larger with an aluminum nail at 4.5 feet above the ground on the uphill side of the tree, except aspen or trees with a bole irregularity at breast height (BH). **Place the nail first, then measure DBH directly above** the nail. Place the nail perpendicular to the tree bole, and etch the tree number in pencil on the nail head. Leave at least 1 inch of the nail exposed to allow for tree growth.

Mark 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. Do not nail.

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.

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

the nail to the place of diameter measurement, and note it in the Tree Data Record.

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.

Remeasurement trees:

When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), there is an abnormality at the previous DIAMETER measurement point, or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

Change the PAST DBH/DRC if it is obviously incorrect (see PAST DBH/DRC).

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. Trees cannot shrink off the plot. If the tree has shrunk below the above-mentioned thresholds, record the previous diameter for the current diameter.

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.

9.13.1 PREVIOUS DIAMETER AT BREAST HEIGHT (Core 5.9.1)
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.

Change past DBH/DRC if it is obviously wrong. For example, previous crew recorded 31.0 instead of 13.0, or it appears that the crew read the tape wrong (a nice growing tree shrunk with no evidence of bark damage etc.).

9.13.2 DIAMETER AT BREAST HEIGHT (DBH) (Core 5.9.2)

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.

Special DBH situations:

1. Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates below 1.0 foot, between 1.0 and 4.5 feet, or above 4.5 feet.

   - Trees forked below 1.0 foot. Trees forked in this region are treated as distinctly separate trees (Figure 34). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 37 A-C). DBH is measured for each stem at 4.5 feet above the ground. When stems originate from pith intersections below 1 foot, it is possible for some stems to be within the limiting distance of the microplot or subplot, and others to be beyond the limiting distance. If stems originating from forks that occur below 1.0 foot fork again between 1.0 and 4.5 feet (Figure 37-E), the rules in the next paragraph apply.

   - Trees forked between 1.0 foot and 4.5 feet. Trees forked in this region are also counted as separate trees (Figure 35), but only one distance and azimuth (to the central stump) is used for all (Figure 37 D-F).

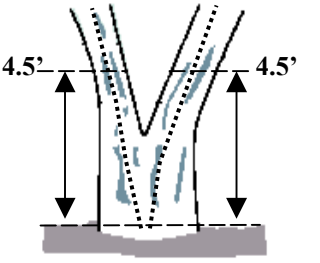


Figure 34. Forked below 1.0 ft.

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.

Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 feet above the common pith intersection (Figure 37-F).

Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 feet, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems just below the base of stem separation as shown in Figure 37-E (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).

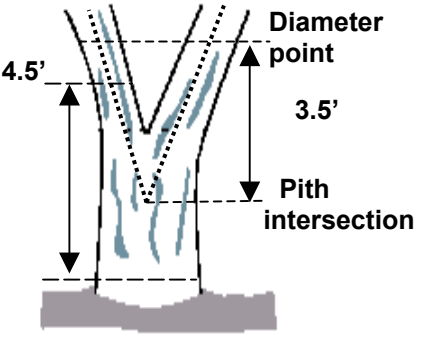
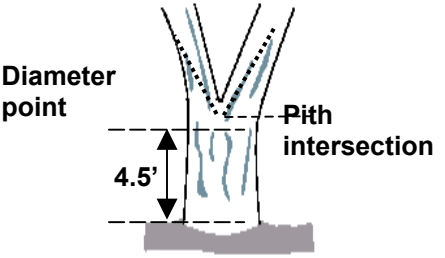


Figure 35. Forked between 1.0-4.5 ft.

- Trees forked at or above 4.5 feet. Trees forked in this region count as one single tree (Figure 36). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH.



1 **Figure 36. One tree.**

2. Stump Sprouts. Stump sprouts originate between ground level and 4.5 feet on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 foot are measured at 4.5 feet from ground line. Stump sprouts originating between 1.0 foot and 4.5 feet are measured at 3.5 feet above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 1.0 foot. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

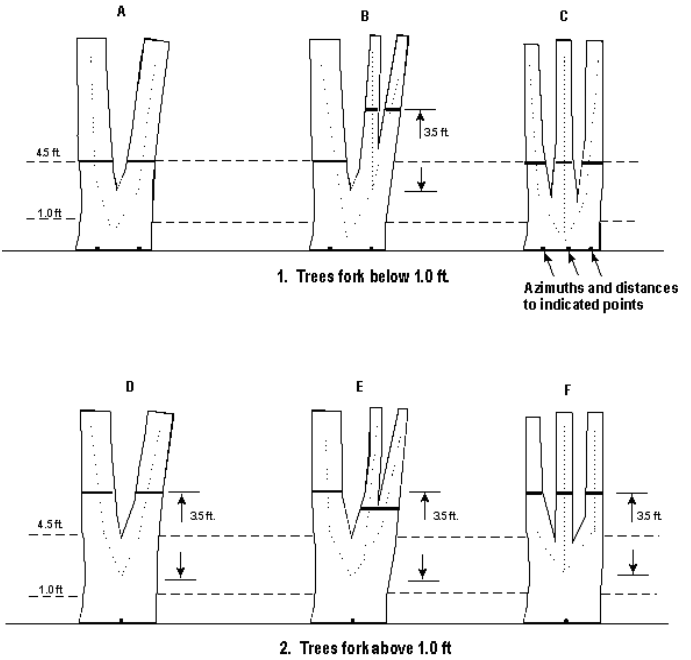


Figure 37. Summary of where to measure DBH, distance, and azimuth on forked trees.

3. Tree with butt-swell or bottleneck: Measure these trees 1.5 feet above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 feet or more above the ground (Figure 38).

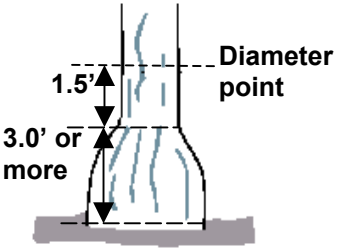


Figure 38. Bottleneck tree.

4. Tree with irregularities at DBH: On trees with swellings (Figure 39), bumps, depressions, and branches (Figure 40) at DBH,

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

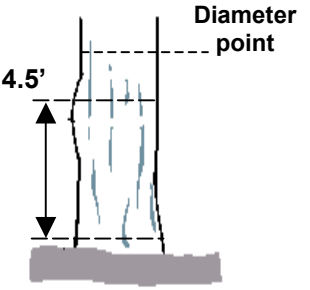


Figure 39. Tree with swelling.

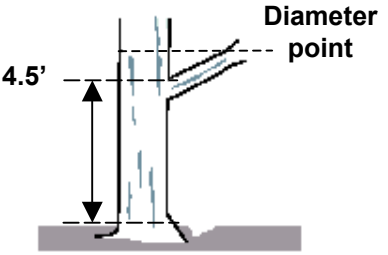


Figure 40. Tree with branch.

5. Tree on slope: Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 41).

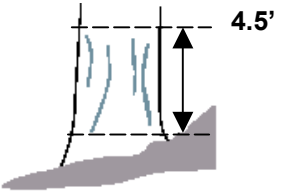


Figure 41. Tree on a slope.

6. Leaning tree: Measure diameter at 4.5 feet from the ground along the bole. The 4.5-foot distance is measured along the underside face of the bole (Figure 42).

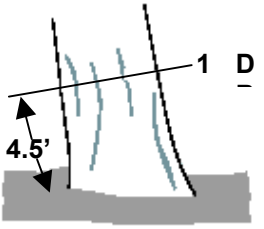


Figure 42. Leaning tree.

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 (South East only).

8. Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, set the "DIAMETER CHECK" code to 1, and explain the situation in the notes.

9. Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark or at the point of measurement. Record the diameter, to the nearest 0.1 inch, of the wood and bark that is still attached to the tree (Figure 43). 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 (Figure 39 and 40).

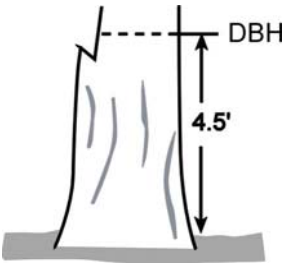


Figure 43. Tree with part of stem missing.

10. Live wind thrown tree: Measure from the top of the root collar along the length to 4.5 feet (Figure 44).

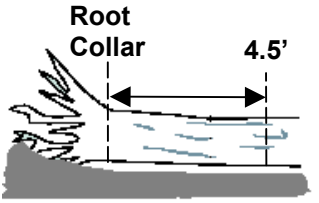


Figure 44. Tree on the ground.

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

    - If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 45).

    - 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.

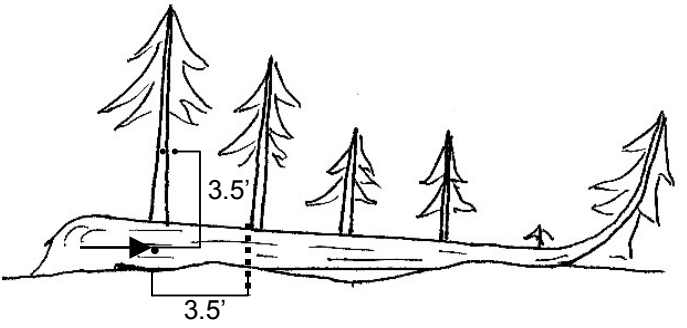


Figure 45. Down tree above duff.

- If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet point from the stump along the main bole, treat that branch as part of the main down bole.

- If the pith of main tree bole is below the duff layer, ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 46). 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.

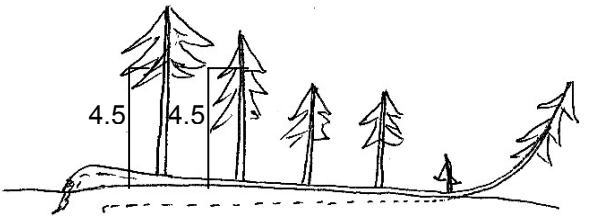


Figure 46. Down tree below duff.

12. Tree with curved bole (pistol butt tree): Measure along the bole on the uphill side (upper surface) of the tree (Figure 47).

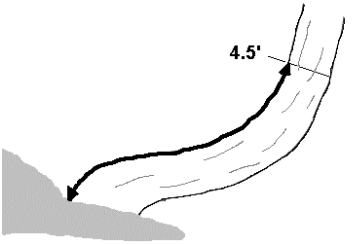


Figure 47. Tree with curved bole (pistol butt tree).

9.13.3 PREVIOUS DIAMETER AT ROOT COLLAR (Core 5.9.3)
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 set to 2 and an explanation is required in the notes if previous DRC is changed.
Woodland species +/- 0.2 inch per stem.

9.13.4 DIAMETER AT ROOT COLLAR (DRC) (Core 5.9.4)
For species requiring diameter at the root collar (refer to Species Code List), 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 rootstock as a single tree; examples include evergreen oaks, mesquite, juniper, and mountain mahogany. Treat stems of deciduous oak/maple woodland species (gamble oak and bigtooth maple) as individual trees if they originate below the ground. For multi-stemmed trees, compute and record a cumulative DRC; record individual stem diameters and a stem status (live or dead) on a separate form or menu as required.

1 Measuring DRC: 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 reflective of the volume above the stems (especially when trees are extremely deformed at the base).

Stems must be at least 1.0 foot in length and 1.0 inch in diameter to qualify for measurement; stems that are missing due to cutting or damage must have previously been at least 1.0 foot in length and 1.0" in diameter.

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

Woodland species diameter groupings.

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

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

Marking woodland species. For woodland species 1.0-inch DRC and larger, mark the exact location of stem diameter measurement with a lumber crayon or paint pen. Draw a small line (at least 1.0-inch long and parallel to the diameter tape placement on the stem) on each stem measured for DRC.

In addition, for all standing woodland trees, 5.0-inches DRC and larger, place a nail at the base of one stem, preferably the largest or main stem, facing subplot center. Etch the tree number in pencil on the nail head. For down woodland trees, place the nail on top of the largest or main stem. **Note:** The purpose of the nail is to aid in tree relocation and not to mark the exact location of a stem diameter measurement.

Whenever DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, pack rat's nest), stems may be estimated and recorded to the nearest 1.0-inch class.

Additional instructions for DRC measurements are illustrated in Figure 48a and 48b.

2 Computing and Recording DRC: For all tally trees requiring DRC, with at least one stem 1.0 inch in diameter or larger at the root collar, 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:

$$\begin{aligned} DRC &= SQRT\ (12.2^2 + 13.2^2 + 3.8^2 + 22.1^2) \\ &= SQRT\ (825.93) \\ &= 28.74 \\ &= 28.7 \end{aligned}$$

The field data recorders calculate DRC (up to 20 stems) using the individual stem diameters entered in the "Pop Up" menu.

The Pop Up menu in the field data recorder only calculates DRC for 20 stems. If a multistemmed woodland tree has greater than 20 stems, enter the first 20 stems into the Pop Up menu on the data recorder and obtain a DRC. In the tree or plot notes field, record the other stem diameters and recalculate DRC using the first DRC obtained and the diameters of the rest of the stems. Change the "#Stems" field to reflect the actual number of stems.

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

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

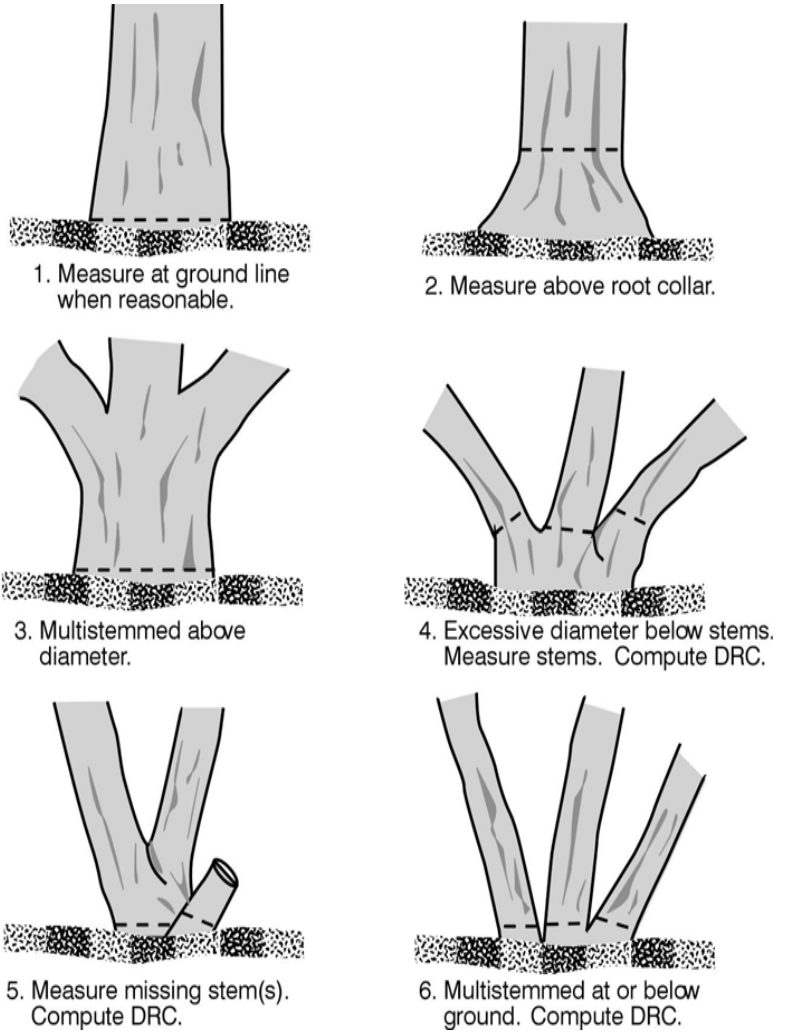
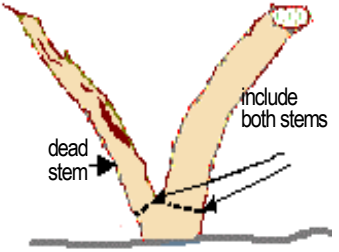
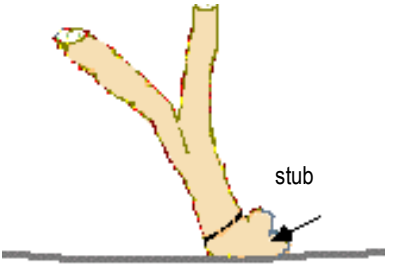


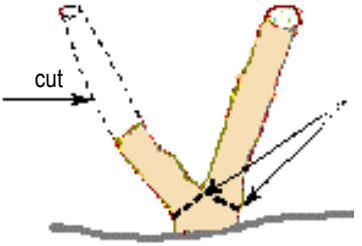
Figure 48a. How to measure DRC in a variety of situations.



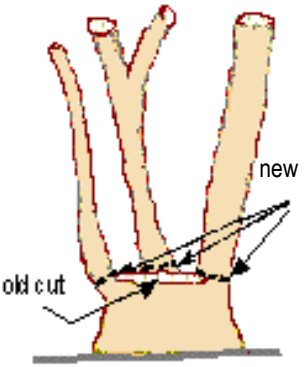
1. Measure the diameter of a dead stem if it is essentially intact, the volume is sound, and the stem represents a portion of the main tree form. Include the stem diameter in the DRC computation and record the appropriate percent of dead volume.



2. Ignore stem stubs that are deteriorated. Do not deduct missing volume for stems not measured for DRC computation.



3. Measure diameter on recently cut stems 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.

Figure 48b. How to measure DRC in a variety of situations.

9.13.5 PAST NUMBER OF STEMS

When collected: Value is preprinted for SAMPLE KIND 2 locations.
Field width: 2 digits.
Tolerance: No errors.
If the PAST NUMBER OF STEMS does not equal THE CURRENT NUMBER OF STEMS, **do not** change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

9.13.6 CURRENT NUMBER OF STEMS

When collected: For tallied **woodland** species with at least one stem 1.0 inches in diameter or larger; includes woodland species tallied on the microplot.
Field width: 2 digits.
Tolerance: No errors.
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.

9.13.7 DIAMETER CHECK (Core 5.10)

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

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

When collected (RMRS)**:** All tally trees and nontallied site trees, including new trees $\geq$ 1.0 in DBH/DRC on the formerly centered microplot, and seedling counts.

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

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

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

9.15 PAST TOTAL TREE LENGTH

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

9.16 TOTAL LENGTH (Core 5.12)

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.

On multistemmed woodland trees, measure length along the main or largest stem.

When Collected: Phase 2 CORE - All live tally trees ≥ 5.0 in DBH/DRC
Phase 2 CORE OPTIONAL - All live tally trees ≥ 1.0 in DBH/DRC and all standing dead tally trees ≥ 5.0 in DBH/DRC
Phase 3 CORE - All live tally trees ≥ 1.0 in DBH/DRC

When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the formerly centered micro.
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 005 to 400

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.

For all standing trees that **lean**, go out perpendicular to the lean to determine tree length. For standing trees with **excessive lean** (more than 15° from vertical, or 27 percent), go out perpendicular to the

lean, and visually "up-right" the tree to a vertical position before determining length with a clinometer; also, in the comments column, note that tree length was estimated due to lean.

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

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.

9.17 PAST ACTUAL TREE LENGTH

When collected (RMRS): Verify for remeasure trees ≥ 1.0 inch DBH/DRC.
Field width: 3 digits.
Tolerance: ±10% of true 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.

9.18 ACTUAL LENGTH (Core 5.13)

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.
If the top is intact, repeat total length.
For multistemmed woodland trees, use the longest remaining stem to obtain actual length – only use the top of the broken stem if it is longer than the other remaining stems.

When Collected: Phase 2 CORE - All live and standing dead tally trees (with broken or missing tops) ≥ 5.0 in DBH/DRC
Phase 2 CORE OPTIONAL - All live tally trees (with broken or missing tops) 1.0 – 4.9 in DBH/DRC
Phase 3 CORE - All live tally trees (with broken or missing tops) ≥1.0 in DBH/DRC

When collected (RMRS): All tally trees ≥ 1.0 in DBH/DRC.
Field width: 3 digits
Tolerance: +/- 10 % of true length
MQO: At least 90% of the time
Values: 005 to 400

9.19 LENGTH METHOD (Core 5.14)

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

When Collected: Phase 2 CORE - All live tally trees ≥ 5.0 in DBH/DRC
Phase 2 CORE OPTIONAL - All live tally trees ≥ 1.0 in DBH/DRC and all standing dead tally trees ≥ 5.0 in DBH/DRC
Phase 3 CORE - All live tally trees ≥ 1.0 in DBH/DRC

When collected (RMRS): All tally trees ≥ 1.0 in DBH/DRC.
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relaskop, tape)
2 Total length is visually estimated, actual length is measured with an instrument
3 Total and actual lengths are visually estimated

9.20 COMPACTED CROWN RATIO (Core 5.17)

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 inch and larger, to the nearest one percent. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in the case of extreme defoliation should be supporting live foliage) and is expressed as a percentage of the actual tree length. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2 feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 49). Figure 51 shows an example of COMPACTED CROWN RATIO on a leaning tree.

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

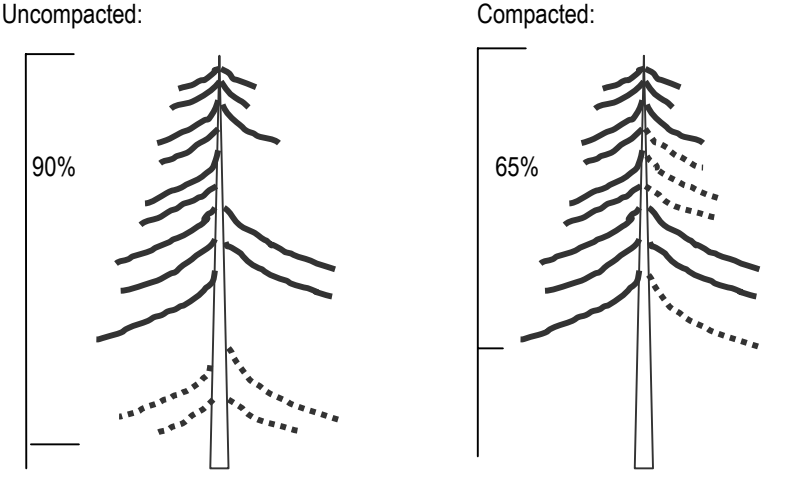


Figure 49. Sapling ratio determination examples.

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

Uncompacted (P3 ONLY): Compacted:

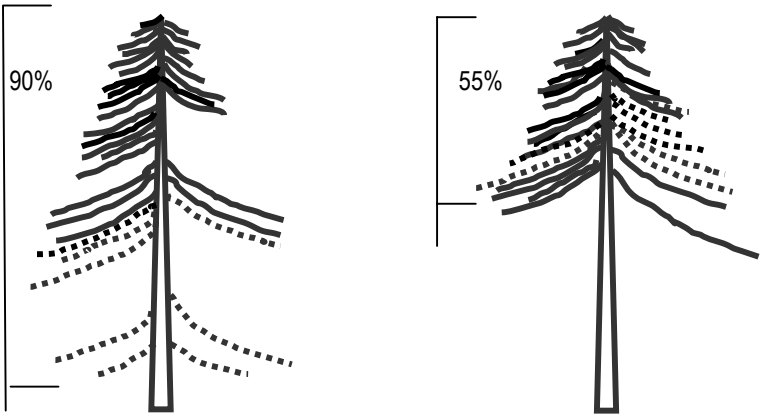


Figure 50. Examples of and comparison between COMPACTED LIVE CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of conifers.

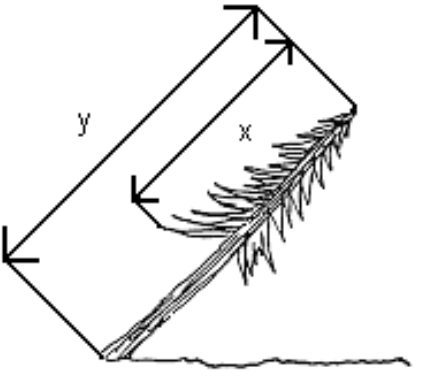


Figure 51. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO = (x/y)100.

For multi-stemmed western woodland species, ocularly transfer lower live foliage to fill large holes on all stems and form an even crown across the tree (Figure 52).

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

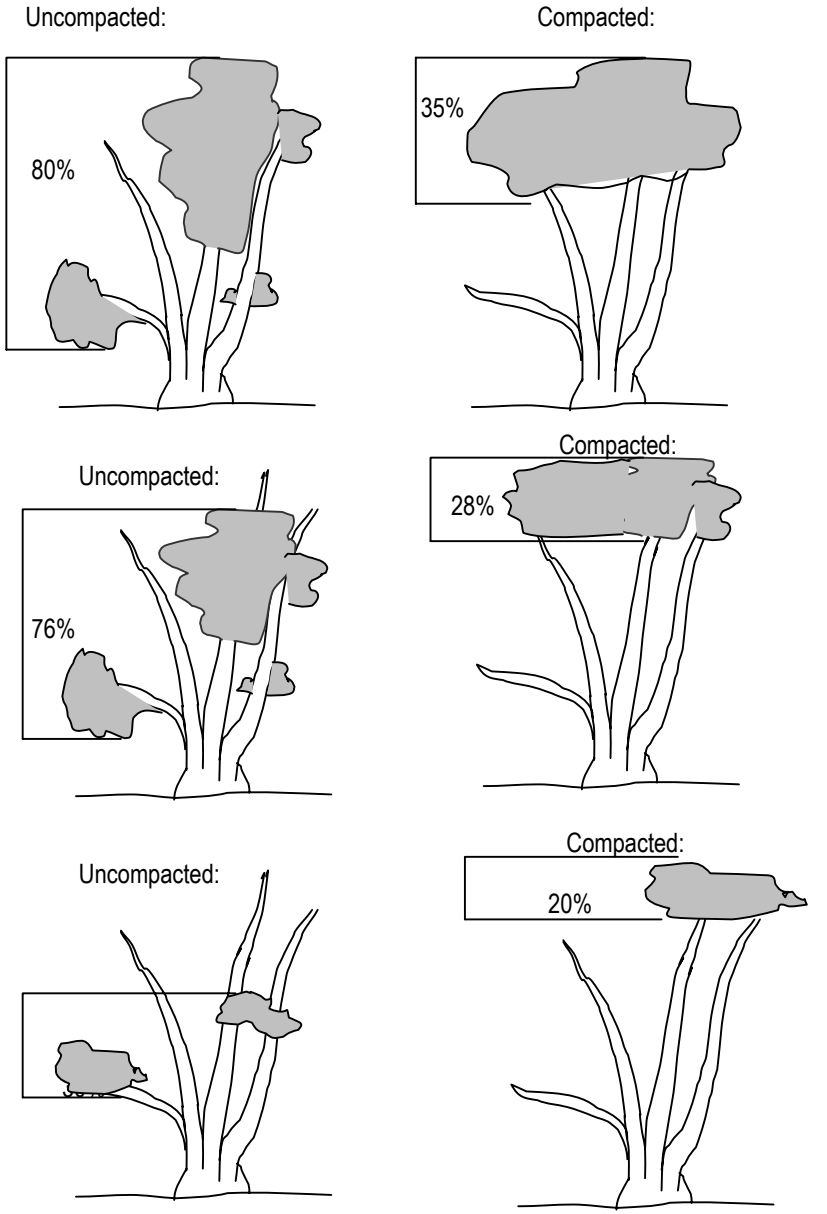


Figure 52. Examples of and comparison between COMPACTED LIVE CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of western woodland species.

9.21 CROWN CLASS (Core 5.15)

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 53). Base the assessment on the position of the crown at the time of observation. Example: a formerly overtopped tree which is now dominant due to tree removal is classified as dominant.

Crown Class is a categorization of a tree based on dominance in relation to adjacent trees in the stand. This dominance is indicated by crown development and amount of light received from above and the sides.

Each tree must be judged in the context of its immediate environment (that is, those trees affecting it or being affected by it in terms of crown competition).

When Collected: All live tally trees ≥ 1.0 in DBH/DRC
When collected (RMRS): All live tally trees ≥ 1.0-in DBH/DRC, and nontallied timber-species site trees.
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:

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

2 Dominant – trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.

3 Co-dominant – trees with crowns at the general level of the crown canopy. Crowns receive full light from

above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.

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

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

CROWN CLASS definitions are most appropriate when considering a single-storied or clumpy/patchy canopy structure. However, in any type of canopy structure, classify each tree, as stated, in the context of its immediate environment. Therefore, a medium- or small-sized tree in a multistoried canopy structure that receives full light from above and partial light on the sides can be classified as a dominant tree.

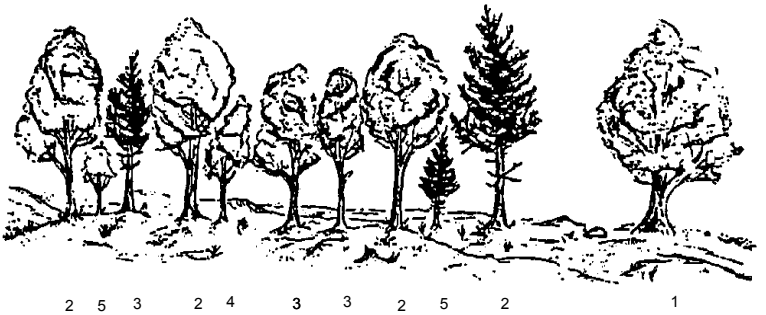


Figure 53. Examples of CROWN CLASS code definitions (numbers are the CROWN CLASS codes).

9.22 MISTLETOE CLASS (CORE OPTIONAL) (Core 5.24)

Rate all live conifer species, except juniper species, greater than or equal to 1.0 inch diameter for dwarf mistletoe (*Arceuthobium* spp.) infection. Use the Hawksworth six-class rating system: divide the live crown into thirds, and rate each third using the following scale (Figure 54):

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

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

When Collected: CORE OPTIONAL: All live conifer (except juniper) tally trees $\geq$ 1.0 in DBH/DRC

Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 0 to 6

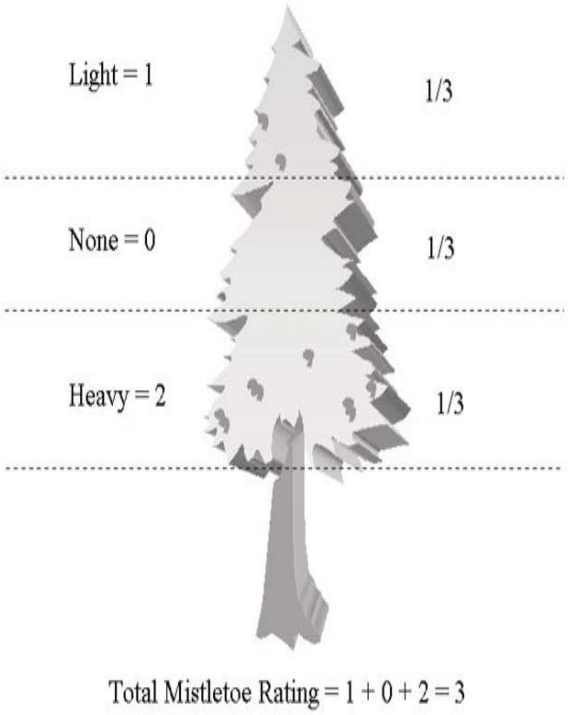


Figure 54. Example of the Hawksworth six-class rating system.

9.23 DAMAGE AGENT 1,2,3.

MQO: No errors 2 of 3, 80% of the time.
Record a primary, secondary, and tertiary damage code for all live tally trees, 1.0-inch DBH/DRC and larger, and nontallied site trees. Only trees with serious damage, insect, or pathogen activity are to be given damage codes other than 00.

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

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

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

Examine trees carefully. Sometimes serious internal tree damage can only be determined based on external indicators (e.g., small conks on the main bole can indicate serious volume loss that may affect the tree's chance of survival). On the other hand, a minor defect, such as a small fire scar that results in some cull, would not be serious enough to qualify as damage.
It is not necessary to code as damage any form defect items common to a particular species (such as forking on a cottonwood or juniper tree).

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

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

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

Definitions for Damage codes are described as follows:

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

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

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

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

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

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

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

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

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

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

Cankers (code 23): A canker -- a sunken lesion on the stem caused by the death of cambium -- may cause tree breakage or kill the portion of the tree above the canker. If cankers occur on the lower 1/2 of the tree bole, the tree will likely be killed. Examples include Atropellis canker in lodgepole pine and ponderosa pine (characterized by a blue-black stain in the wood), Cytospora canker in spruce, fir, and aspen, Ceratocystis canker in aspen (forming highly irregular and blackened callous ridges around the canker), and sooty bark canker in aspen (which kills trees rapidly and causes the underside of dead bark to be blackened and "sooty"). **Note:** Record code 21 for cankers resulting from a stem rust.

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

Dwarf mistletoe (code 26): This is a parasitic plant (Arceuthobium spp.) that grows on tree branches or stems of host trees and can substantially reduce tree growth, deform the tree, and increase the tree's susceptibility to other damaging agents. Dwarf mistletoe occurs on larch, Douglas-fir, and pines (rarely on true fir and spruce). A mistletoe class rating of 4 to 6 is considered damaging. Signs and symptoms include witches brooms (a massed dense clump of branches, typically with live foliage), the visual presence of the mistletoe plant (simple or branched shoots, approximately 1 to 4 inches in length), and swellings on the tree stem or branches.
Note: If any dwarf mistletoe occurs on the tree, whether it is coded as a damage or not, enter an appropriate code for Mistletoe Class
(pg 205).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Excessive Crook, Sweep, or Taper (code 79): Record for timber species trees 5.0-inches DBH and larger that have abnormal diameter to height ratios, or severe sweeps and crooks that will significantly reduce the tree's quality or affect its marketable products.

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

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

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

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

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

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

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

9.23.1 DAMAGE AGENT 2

Follow the same procedures as for DAMAGE AGENT 1.

9.23.2 DAMAGE AGENT 3

Follow the same procedures as for DAMAGE AGENT 1.

9.24 DECAY CLASS (Core 5.21)

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

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

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

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

9.25 PERCENT VOLUME MISSING TOP (RMRS)

When Collected: All tally trees ≥ 5.0 inches in diameter, missing a portion of the merchantable top (i.e. missing a portion of the top with a DOB ≥ 4.0 inches).
Field width: 2 digits.

Tolerance: ±5% for total deductions ≤20%, 90% of the time, and ±10% for total deductions >20%, 90% of the time.

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

For multistemmed woodland trees, record 0.

9.26.1 ROTTEN/MISSING CULL (Core 5.11)
9.26.2 SOUND DEAD
9.26.3 FORM DEFECT

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 (CORE OPTIONAL).

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. Do not include any cull estimate above ACTUAL LENGTH. For western woodland species, the merchantable portion is between the point of DRC measurement to a 1.5-inch DOB top.

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

When Collected (RMRS): All tally trees ≥ 5.0 inches diameter (FORM DEFECT to be recorded on live timber species ≥ 5.0 inches diameter only, FORM DEFECT not to be recorded for woodland species).
Field width: 2 digits.

Tolerance: ±5% for total deductions ≤20%, and
±10% for total deductions >20% for standing trees.
± 20% for down dead trees.

Tally trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 90% of the time
Values: 00 to 99

Using the general Seen Defect Guidelines provided (supplement), along with any other evidence, record the percentage of rotten and missing volume (less the PERCENT VOLUME MISSING TOP), sound dead volume, and form defect (live timber species only), to the nearest 1 percent, for all tally trees **5.0-inch** DBH/DRC and larger. When estimating volume loss (tree cull) only consider the cull on the merchantable bole/portion of the tree. **Do not include any cull estimate above ACTUAL LENGTH.**

The **merchantable bole on a timber species** is defined as the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter.

The **merchantable portion of a woodland species** is defined as the portion of a tree, with at least 1 stem 3.0-inches DRC or larger, up to a minimum top diameter of 1.5-inches, and includes all qualifying segments above the place(s) of diameter measurement; do not include sections below the place(s) of diameter measurement. Qualifying 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:

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

(1) **Rotten and missing volume** loss is often difficult to estimate. 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 when struck with an ax.
- Large dead limbs, esp. those with frayed ends.
- Sawdust around the base of the tree.

Regard with suspicion all trees exhibiting any of the characteristics 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.

Refer to supplemental disease and insect pests field guides as an aid in identifying damaging agents and their impact on volume loss.

(2) **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.

(3) **Form defect volume**. 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.

b. **Woodland species tally trees ≥ 5.0-inches DRC and at least 1 stem 3.0-inches DRC and larger.**

(1) **Rotten volume** may be identified by visual evidence of cubical rot, or indirectly detected by a dull hollow sound when the segment is struck by the flat side of a hatchet. Also, if a tree segment is suspected of containing rot, bore into the segment (but only far enough to detect rot), and check the core for punky wood.

(2) **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.

(3) **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.

9.27 PAST TREE CLASS (RMRS)

When collected: Verify for remeasure trees ≥ 1.0 inch DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
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.

9.28 CURRENT TREE CLASS (RMRS)

When collected: All tally trees ≥ 1.0 inch and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the formerly centered microplot.
Field width: 1 digit.
Tolerance: No errors 90% of the time.
Base the Tree Class code on the information collected in 9.26.1, 9.26.2, and 9.26.3

Code	Tree Class
1	**Sound (live) - timber species** • a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor.

- a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.

2 **All live woodland species**

3 **Rough (live) - timber species**

- a live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a sound tree of good form, 5.0-inches DBH or larger.

- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
- a live tree, 5.0-inches DBH or larger, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

Code	Tree Class

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 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 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).

9.29 RADIAL GROWTH and
9.30 TREE AGE (RMRS)

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.

Reserved plots: Boring or drilling will be done on representative non-tally trees and only when absolutely necessary to estimate site, age, or growth. (This will generally be the case during initial establishment of permanent plots.)

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

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

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

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

Stand Size Class	Softwoods Class Range (DBH, inches)	Hardwoods Class Range
1	0 - .9" (count whorls/scars): age only 1 – 2.9" (age at base): age only 3 – 4.9" (age at BH): age and radial	0 - .9" 1 – 2.9" 3 – 4.9"
2	5 – 8.9"	5 – 8.9" 9 – 10.9"
3	9 – 12.9" 13 – 16.9" 17 – 20.0" etc.	11 – 12.9" 13 – 16.9" 17 – 20.9" etc.

(a) 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.

(b) 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.

For example (subplot 1 measured first, and subplot 2 measured second):

Subplot 1:	DBH	Species	Diameter Class	Bore for: Age	Bore for: Radial
		Doug fir	Seedling	X	
	3.2	Doug fir	4”	X	X
	4.1	Doug fir	4”		
SOFTWOODS	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
		Aspen	Seedling	X	
	3.9	Aspen	4”	X	X
	2.1	Aspen	2”	X	
HARDWOODS	5.5	Aspen	8”	X	X
	8.7	Aspen	8”		
	9.3	Aspen	10”	X	X
	11.3	Aspen	12”	X	X
NOTE:		Softwoods do not have a 10” size class.			

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

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

The "Control, Pop-Up" function on the Portable Data Recorder will show, by line number, the correct trees to age and obtain radial information for.

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.

(2) **Woodland species.** For each woodland genus group tallied across the subplots, select one representative live tally tree within each size class tallied (refer to STAND-SIZE CLASS). If the age cannot be determined in the field, leave age/growth blank (record 000 for age and 00 for radial growth on paper forms).

For each of the selected trees, bore one total age core. Count whorls or estimate age if seedlings represent the seedling/sapling size class. **Important:** Do not bore dead trees, and do not bore cercocarpus species.
If the total age and growth cannot be determined in the field, send the cores to the office for measurement. Glue cores into a core holder; for pinyon cores, glue with the resin ducts up. On the side of the core holder, place arrows indicating the outside end (bark end) of the cores, and record the appropriate codes for items listed below.

(a) **Species groups.** Woodland genus groups for boring are as follows:

- oak (codes 800-850)
- maple (code 322)
- juniper (codes 058-069)
- pinyon (codes 106, 133, 134, 140, 143)
- mesquite (codes 755-758)

(2) **Woodland species**

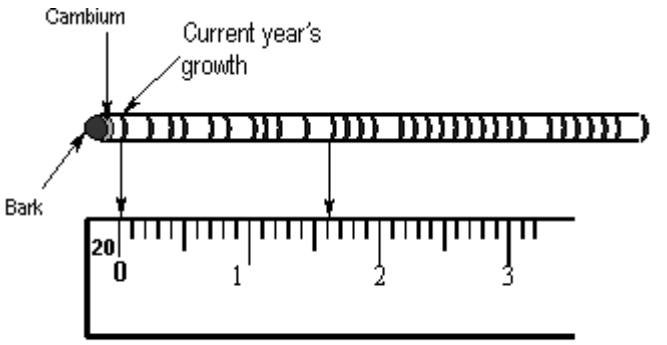
(b) **Saving cores.** Glue the cores into a core holder and label the core holder with the following:

- State
- County
- Location Number
- Subplot Number
- Tree Number
- Species
- Total DBH/DRC of tree
- DRC of stem

Note: Do not place age cores from more than one State or county on a single core holder. After the cores are glued, wrap the core holder in flagging to protect the cores, and record the State, County number, Location number(s) on the flagging.

b. **Radial-growth measurement** (timber species, 4-inch diameter class and larger). Measure the last 10 years of RADIAL GROWTH from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. To reduce bias, bore on the side of the tree facing the subplot center, where reasonable. Using a ruler with a 1/20-inch scale, measure the length of the core from the inner edge of the last (most recent) complete summer wood ring to the inner edge of the summer wood ring 10 years previous (figure 55).

Figure 55. Radial growth measurement.



Use the 20ths scale on the 6" ruler. Each graduation = 1/20th"
In this example, the radial = 16.

c. **Age tree measurement** (timber species).

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

- **2-inch diameter class (1.0- to 2.9-inches DBH) age trees:** Measure and record **total tree age**. Use the following methods:

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

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

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

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

- **4-inch diameter class and larger age trees:** 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.

d. <u>Radial-growth and age tree coding</u>.

(1) 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.

(2) Age tree coding. Record Tree Age as a three-digit number. For example, record 29 years as 029, and record 195 years as 195.

9.31 RADIAL GROWTH AND TREE AGE CHECK (RMRS)

When collected (RMRS)**:** All tally trees where RADIAL GROWTH and/or TREE AGE is collected.
Field width: 1 digit.
Tolerance: No errors.

Code	Description
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 spp. and diam. class). • Age/radial growth was based on a similar tree off the subplot.
	If 1 is coded, explain in the notes.

9.32 SITE TREE INFORMATION (Core 7.0)

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.

SITE TREE SELECTION (Core 7.1)

Select at least 2 site trees for each accessible forest land condition class; select site tree based on the criteria listed in Appendix G. 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. 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.

When collected (RMRS): All timber species site trees.
Field width: 1 digit.
Tolerance: Selected as required by the condition class tally.

9.32.1 SITE TREE (RMRS)

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.

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 or in the tree notes on the field form.

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

Code	Site Tree
0	**Not selected as a site tree**
1	**Suitable site tree**
2	**Unsuitable site tree**

a. Site tree requirements.

(1) Suitable site trees:

- live sound tree;
- 5.0-inches DBH or larger;
- open grown, dominant, or codominant throughout most of its life;
- minimum of 35 years (DBH age) for softwoods or minimum of 45 years (DBH age) for hardwoods;
- under rotation age (80 years for aspen and paper birch, 120 years for all other timber species);
- undamaged top (not dead or broken);

- vigorous, having an uncompacted crown ratio of at least 50 percent, if possible, and have the best height/age ratio of all the trees on the site.

(2) Unsuitable site trees:

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

b. **Site tree selection.** Select a minimum of **two** site trees that represent the species of the condition class Forest Type.

Note: If only dead trees of a particular species are tallied, and no seedlings of that species were counted, and that species does not represent the Forest Type, it is not necessary to obtain site trees for that species.

If not enough suitable trees can be selected from the subplot tally, then select nontallied suitable site trees (Tree History 00) off the subplots from a nearby site of similar slope, aspect, elevation, and soils. Assign each nontallied site tree selected to the nearest subplot. Obtain only suitable site trees where possible; however, if no suitable site trees are present within 60 feet of the subplots, select an unsuitable site tree. 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.

SITE TREE DATA VARIABLES

9.32.2 SUBPLOT NUMBER (CORE OPTIONAL) (Core 7.2.7)
Record the subplot number to which the site tree is referenced.

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

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

9.32.3 TREE RECORD NUMBER
See procedures on page 161

9.32.4 HORIZONTAL DISTANCE (CORE OPTIONAL) (Core7.2.9)
Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center to the pith of the tree at the base.

When Collected: All site trees
Field width: 4 digits (xxx.y)
Tolerance: +/- 5 ft
MQO: At least 90% of the time
Values: 0001 to 2000

9.32.5 AZIMUTH (CORE OPTIONAL) (Core 7.2.8)
Record the AZIMUTH from the subplot center; sight the center of the base of each tree with a compass. Record AZIMUTH to the nearest degree. Use 360 for north.

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

9.32.6 CONDITION CLASS LIST (Core 7.2.1)
List all CONDITION CLASSES that the site index data from this tree represent.

When Collected: All site trees
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9 or 10000 to 98765

9.32.7 SPECIES (Core 7.2.2)
Use the same procedures described in Section 9.12

When Collected: All site trees

9.32.8 DIAMETER (Core 7.2.3)
Use the same procedures described in Section 9.13.

When Collected: All site trees

9.32.9 SITE TREE LENGTH (Core 7.2.4)
With a clinometer or other approved instrument, measure the total length of the site tree from the ground to the top of the tree. Record to the nearest 1.0 foot. SITE TREE LENGTH must be measured; no estimates are permitted on site trees.

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

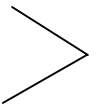
9.32.10 RADIAL GROWTH AND RADIAL AGE CHECK
See procedures starting on page 224

9.32.11 TREE AGE AT DIAMETER (Core 7.2.5)
Record the tree age as determined by an increment sample. Bore the tree at the point of diameter measurement (DBH/DRC) with an increment borer. Count the rings between the outside edge of the core and the pith. Do not add years to get total age.

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

9.32.12 CROWN CLASS
See procedures on page 203

9.32.13 DAMAGE AGENT 1
9.32.14 DAMAGE AGENT 2
9.32.15 DAMAGE AGENT 3



See procedures starting on page 207

9.32.6 TREE CLASS
See procedures on page 222

9.32.7 SITE TREE NOTES (Core 7.2.6)
Record notes pertaining to an individual site tree.

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

9.33 CAUSE OF DEATH

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

When Collected: CORE: SAMPLE KIND = 2 plots: all PAST 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

Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

Code	Definition
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)

9.34 TREE NOTES (Core 5.25)

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

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

9.35 SEEDLING DATA (Core 6.0)

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

9.35.1 SUBPLOT NUMBER (Core 6.1)

Use the procedures outlined in Chapter 8.

When Collected: All counts of seedlings

9.35.2 SPECIES (Core 6.2)

Use the procedures outlined in Chapter 9.

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

9.35.3 CONDITION CLASS NUMBER (Core6.3)

Use the procedures outlined in Chapter 3.

When Collected: All counts of seedlings

9.35.4 SEEDLING COUNT (Core 6.4)

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

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

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

When collected (RMRS): Each accessible forest land condition class on each microplot, **not required** for formerly centered microplot.

Field width: 3 digits

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

MQO: At least 90% of the time

Values: 001 through 999

9.35.5 COUNT CHECK

When collected: Any time seedlings recorded

Field width: 1 digit.

Tolerance: No errors.

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

Values:

Code	Definition
0	seedlings counted accurately.
1	seedling count estimated.

CHAPTER 10
UNDERSTORY VEGETATION DESCRIPTION

This chapter gives instructions for the Understory Vegetation Description sample and for recording the presence of noxious weeds. The description sample provides information about the horizontal and vertical distribution, cover, diversity, and composition of the understory vegetation. Cover of the life forms is routinely summarized and tabled for standard reporting. Some other uses for the understory data include estimation of habitat, biomass, and forage availability. Refer to appendix A.7 for the Understory Vegetation Description record. This chapter refers to data collected for RMRS only.

No understory vegetation data will be collected if the subplot center is located in nonforest land, non-census water, or census water.

When all or part of the vegetation sample cannot be determined due to snow cover, write "snow" in the General Comments and in the notes area on the vegetation description record. For any cover in Part II (below) that cannot be determined due to deep snow, record 999; do not record 0, which means "no cover".

Tolerance: Plant identification - genus no errors.
- species no errors.

Layer - no errors.
Cover ±10%.

A. Sample Subplot Size

For each of the subplots, estimate and record understory vegetation data for the 1/24-acre subplot (24.0-foot radius). If a portion of one of the 1/24-acre subplots is not in the condition class of the subplot center (i.e., in a contrasting condition class), determine understory cover percentages based only on the portion of the subplot within the subplot center condition class.

B. Sample Identification

On the Understory Vegetation Description, record the appropriate codes for the header items listed below:

1. State
2. Map Number
3. Consecutive Point Number (CPN)
4. County
5. Field Location Number
6. Subplot Number
7. Subplot Center Condition Class Number

C. Vegetation Description

Part I is an assessment of the major species that have at least 5 percent cover. List the predominant species (a maximum of four per plant group) within each plant group heading (e.g., tree, shrub) by the appropriate plant alphanumeric code and record a percent cover and a code for vegetation layer (as described below).

Part II is an assessment of the plant groups by layer: 0-1.5 feet, 1.6-6.0 feet, and ≥ 6.1 feet. Assign a percent cover to each plant group that occurs within each layer.

1. General Definitions.

a. Plant groups. The vegetation is divided into four growth forms or plant groups; these groups are trees, shrubs, forbs, and graminoids, and are defined as follows (classify each species into one category):

- **Trees:** This category includes

  (1) seedlings and saplings of both timber and woodland tally species (refer to tally tree species list , chapter 9),
  (2) tree species defined as “other tree species” (those defined by Little, 1979, as trees but not listed as tally species in chapter 9, such as ash, willow, etc.); refer to appendix C for the tree species list.

- **Shrubs:** Woody, multiple-stemmed plants, of any size, except species designated as trees above. Most cacti are included in this category.

- **Forbs:** Herbaceous, broad-leaved plants; includes vines, ferns (does not include mosses and cryptobiotic crusts).
- **Graminoids:** Grasses and grass-like plants (includes rushes and sedges).

b. Percent cover. Crown canopy cover is defined as the area of ground surface covered by a vertical projection of the canopy of a plant. Estimate cover to the nearest 1 percent of crown canopy by species in Part I and for entire plant groups in Part II.

To record an individual species in Part I, it must have at least 5 percent cover; a circle 5.4 feet in radius or a square 9.5 feet on a side would represent 5 percent (≈ 90 square ft.) of the total 1/24-acre subplot (24.0-foot radius).

Note regarding dead vegetation: Do not include cover by a dead shrub, or portion of a dead shrub (that will not recover) in cover estimates. However, cover should be estimated for the current season's annual forbs and grass species that have already died. Perennial forbs and grasses may also appear dead, but are actually in an inactive or dormant stage -- these plants should also be included in the cover estimates.

c. Layer codes. One of the following Layer codes will be assigned to individual plant species in Part I and to plant groups in Part II.

Layer Code	Item
1	**Layer 1** (0-1.5 feet)
2	**Layer 2** (1.6-6.0 feet)
3	**Layer 3** (≥ 6.1 feet)

The 1.5- and 6.0-foot boundaries should be considered approximate. For example, visualize layer 1 as graminoids, forbs, and low shrubs that occur (general height) below your knee. Layer 2 includes plants that occur between knee and eye level, possibly grasses or forbs, but usually medium shrubs. Layer 3 includes plants occurring above eye level and would usually consist of seedlings, saplings, and tall shrubs only.

Note: For unusual circumstances that may occur (e.g., an entry for a forb or graminoid in Layer 3), include a note at the bottom of the vegetation form to verify the entry.

2. Entries to be Recorded.

a. Understory Vegetation Description record -- Part I (Species List by Cover and Layer). For recording purposes on the Understory Vegetation Description record, start with the first space (or block) under each plant group heading. Do not leave blank spaces above or between individual species listed.

(1) **Species.** In the appropriate plant group column, record up to four plant species (the most dominant) that have 5 percent cover or greater, occurring on the 1/24-acre subplot. Record the alphanumeric code for the plant, as listed in the PLANTS[a] data base. Record all alphanumeric codes in **capital letters** to avoid possible misinterpretation of a small letter. Also, record the entire alphanumeric code listed in the PLANTS handbook.

For field use, many of the plants and associated codes for a particular State or region are summarized on a "common plant" code list(s). These codes have been taken directly from the PLANTS handbook. If a plant is not listed on the "common plant" code list, first check to see if it is listed in the PLANTS handbook. If the alphanumeric code for a certain plant species is not listed in the PLANTS handbook, record an abbreviation for that plant species using the first two letters of both the genus and species followed by an asterisk (*), and write out the abbreviation and the scientific name at the bottom of the vegetation form. For example, the hypothetical plant "Plantus exampleis" would be coded as "PLEX*".

Use the "?" symbol for species that can be identified in the field, but the scientific name or code must be identified at camp; for example "?RedBrome."

[a] USDA, Natural Resources Conservation Service. 1994. The PLANTS data base. Ecological Sciences Division, Washington D.C.

Some plants require identification only to the genus level. When multiple species in one genus occur together on a subplot, but the actual species name is not known, and the genus is either a graminoid or other genus where species identification is not required, the multiple species can be lumped in one genus record.

For example, a crew encounters multiple species of the genus Poa but cannot confidently identify the different species. All of the species' crown canopy cover would be combined and listed under the genus Poa. There will be no way to determine how many individual species made up the genus during data processing.

However, field crew supervisors are responsible for identifying **indicator plants**, used for habitat typing, to the species level (even if some of the indicators are in one of the genera listed below).

Plants coded to the genus level are as follows:

Trees

Salix spp. (Salix) – willow (based on observed growth form on plot)

Grasses

All Grasses – except habitat type indicators (these must be identified to the species level).

Forbs

Allium spp. (ALLIU) -- onion
Aster spp. (ASTER) -- aster
Astragalus spp. (ASTRA) -- locoweed, milkvetch, poisonweed
Castilleja spp. (CASTI2) -- paintbrush
Cirsium spp. (CIRSI) -- thistle
Erigeron spp. (ERIGE2) -- fleabane, daisy
Lupinus spp. (LUPIN) -- lupine
Trifolium spp. (TRIFO) -- clover
Viola spp. (VIOLA) -- violet

Shrubs

Rosa spp. (ROSA5) -- wild rose
Salix spp. (Salix) – willow (based on observed growth form on plot)

In the event a qualifying plant species cannot be identified to the species level:

- Record "UNKN1" in the species column for the first unknown, "UNKN2" for the second unknown, and so forth. Each unknown on a field location will have a different unknown number, even if unknowns are from various species groups.

- Collect a sample of the unknown to be sent to the office (refer to page 249).

Note: When the vegetation cannot be determined due to snow cover, describe the situation in notes/comments, but **do not record snow as a species in Part I**.

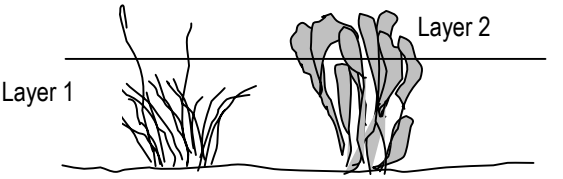
(2) **Species canopy cover.** For each individual plant species that makes up at least 5 percent cover, estimate and record crown canopy coverage to the nearest 1 percent. Crown canopy cover is identified as the area of ground surface covered by, in this case, the canopy of each plant species. Do not count overlap of crowns within a species for Part 1.

(3) **Species vegetation layer.** For each individual plant species recorded, assign one of the vegetation layers (page 242). These layers illustrate the vertical diversity of the 1/24-acre subplot.

In this part (Part I), a plant species can be assigned only one vegetation layer; if a plant species is found in more than one layer, assign the layer that best represents where most of the cover tops out in (based on ground cover, not bio-mass). If a plant species occurs equally in more than one layer, record the highest layer where it occurs. (See the **"Agave Rule"**)

Agave Rule:

If a plant has a seed head that grows much taller than the rest of the plant, put the layer that the main part of the plant is in, not the top of the seed head.



b. Understory Vegetation Description record -- Part II (Plant Group Cover by Layer). In this part (Part II), determine a total crown canopy coverage by layer for each plant group, and record to the nearest 1 percent.

Crown canopy cover is identified as the area of ground surface area covered by, in this case, the canopy of each plant group occurring in each of the three layers. Plant groups recorded in each layer will include plants whose heights end in that layer. If a plant group does not end (top out) within a layer, record 0 for the Cover code. Record 1 for plant groups occupying a trace to 1 percent cover.

One plant species may be represented on the 1/24-acre subplot by plants growing in two layers. In Part I, because each plant species could be assigned only one layer, the layer where most of the cover tops out in is recorded. However, in Part II, species detail is not a consideration; **different plants of the same species that occur in more than one layer can be assigned to the different layers**. For example, sagebrush plants may occur with heights ranging from 1.0 foot to 5.0 feet. Individual plants, with heights between 0 and 1.5 feet, would be assigned to layer 1; individual plants, with heights between 1.6 and 6.0 feet, would be assigned to layer 2.

Note: Although different plants of the same species can be divided into more than one layer, parts of an individual plant (e.g., upper half, lower half) cannot be assigned to different layers unless they fall under the "Agave Rule". If so, put a trace amount in the layer the seed head tops out in and put

the rest in the layer where most of the cover occurs.

For the total cover, examine the total canopy cover of each lifeform as if the other lifeforms do not exist. Do not double count overlapping layers within a lifeform. The total cover for a specific lifeform must be equal to or greater than the highest cover recorded for an individual layer in that lifeform, and it must be equal to or less than the sum of the covers recorded for all the layers in that lifeform.

This portion (Part II) of the vegetation sampling procedure documents lifeform cover for plants that were too insignificant to record by species (in Part I) but contribute to vegetation cover when grouped together.

Where snow cover obscures the sample, record 999 for cover in the appropriate group layers. If 999 is recorded in any individual layer, the total cover of that group must be 999.

Refer to figure 56 for an example of a completed Understory Vegetation Description record.

D. Noxious Weeds

At each subplot, examine the vegetation within the subplot fixed-radius area for the presence of any designated noxious weeds. Record the species code for any identified weeds, and indicate the subplot number(s) where the plant was found. The list of designated noxious weeds for each State is located in the State supplement.

Only collect noxious weed information if there is at least one forested condition present on the plot; if a forested condition is present, record noxious weed information for all subplots regardless of forest/nonforest status.

Figure 56. Example of a completed understory vegetation description record.

UNDERSTORY VEGETATION DESCRIPTION

Feb-00

STATE 04 MAP 811 CPN 147

COUNTY 15 LOC# 21

SUBPT	COND#	PART I TREES SPECIES	COVER	LAYER	SHRUBS SPECIES	COVER	LAYER	FORBS SPECIES	COVER	LAYER	GRASS SPECIES	COVER	LAYER
		xxxxx	xxx	x	xxxxx	xxx	x	xxxxx	xxx	x	xxxxx	xxx	x
1	1	PIFL2	45	3	MARE11	12	1	DESC	25	1			
		JUSC2	10	2	ROSA5	6	2	UNKN1	8	1			
2	2	JUSC2	6	2	MARE11	6	1	DESC	7	1	UNKN2	20	1
					AMUT	5	2				MUEM	15	1
3	1	PIFL2	11	3							BOGR2	11	1
											MUEM	8	1
4	1	PIFL2	5	3	ROSA5	8	1	UNKN3	5	1			

PART II GROUP	COVER LAYER 1 (0-1.5 feet)	COVER LAYER 2 (1.5-6 feet)	COVER LAYER 3 (>6 feet)	TOTAL COVER (AERIAL VIEW)
	xxx	xxx	xxx	xxx
TREES	2	12	40	48
SHRUBS	15	7	0	18
FORBS	35	1	0	36
GRASS	2	0	0	2
TREES	0	5	3	7
SHRUBS	8	6	0	12
FORBS	5	3	0	7
GRASS	42	1	0	42
TREES	1	1	12	12
SHRUBS	6	1	0	7
FORBS	5	3	0	8
GRASS	21	0	0	21
TREES	0	1	5	6
SHRUBS	9	2	0	11
FORBS	3	2	0	5
GRASS	4	0	0	4

PART I - Do not include species with < 5% cover

5% of a 1/24-acre subplot entails a circle with radius 5.4 ft.

Part II - code 999 for snow

NOTES:

UNKN1 GOLDENROD?

UNKN2 POSSIBLY BOER4

UNKN3 LARGE HEART-SHAPED LEAVES, BASAL

NOXIOUS WEEDS

SPECIES (xxxxxxx)	PRESENT ON SUBPLOT? (Y OR N) 1	2	3	4
EXTC	N	Y	N	N

E. Instructions for Collecting Plant Sample "Unknowns"

If a qualifying plant species cannot be identified in the field, do the following:

1. **Collect Sample.** Collect as good a sample as possible -- include roots, leaves, flowers, more than one leaf blade and inflorescence for graminoids, etc. Also, collect more than one specimen of the plant to be identified. Place the unknown in a plastic cover, with a piece of paper for absorbency, and place the cover in a tatum or book so that the sample remains pressed. Do not place the sample in a field vest pocket or lunch bag for it is likely to be crumpled or ruined and may no longer be suitable for identification.

2. **Fill Out an Unknown Identification Document** (ID slip)**.** These forms are located in the notebook included with the plant press. Fill out a form with the following information:

   - State code.
   - County code.
   - Field location number.
   - The subplot number(s) where the unknown was found.
   - The unknown number (e.g., UNKN1, UNKN2); each unknown on a field location must have a unique unknown number.

3. **Place Sample in Camp Plant Press.** It is important that the unknown samples be dried and pressed. After arriving back at camp, carefully take the unknown sample out of the plastic cover (do not leave the unknown samples in the plastic cover overnight). Place the unknown sample in a standard size sheet of newspaper, attach the unknown identification slip, and place the newspaper in the camp plant press.

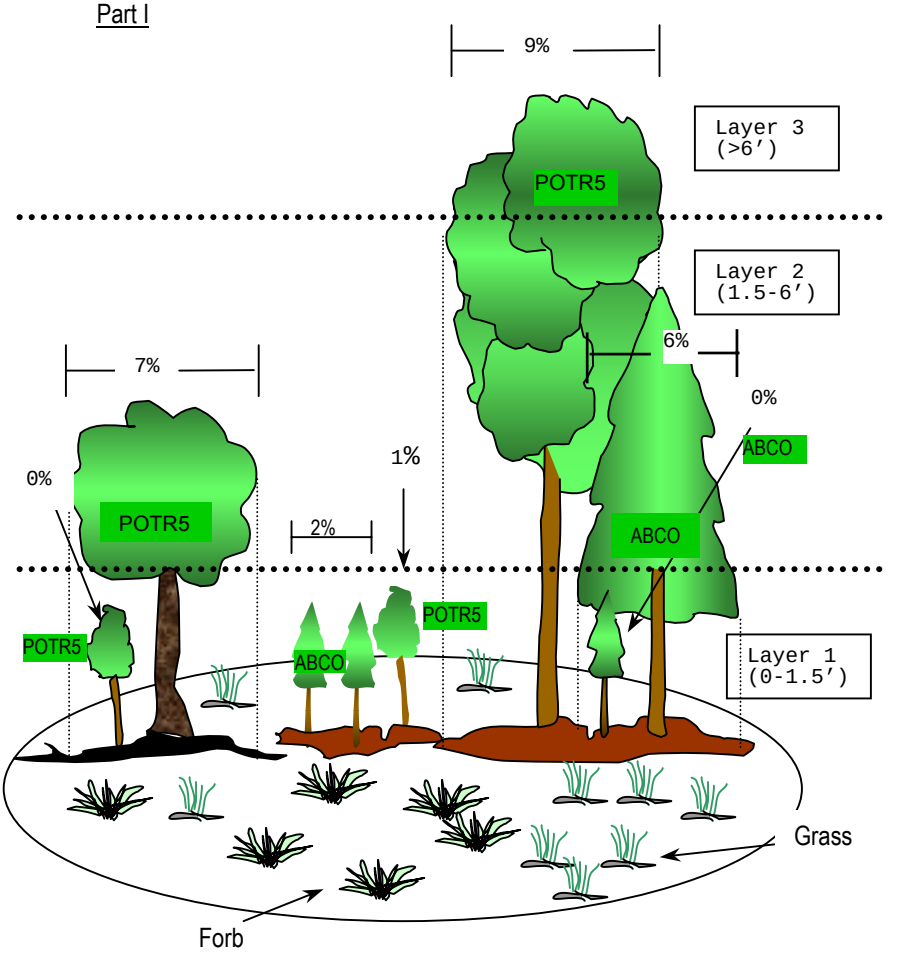
   Note: Do not put tape directly on plant samples, and do not store plant presses outdoors or in an unprotected location.

After the camp plant press is full, the field supervisor will collect the samples and return them to the office.

Reserved locations: 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 RHWR Wilderness Manager. No archeological or vertebrate paleontological materials may be collected.

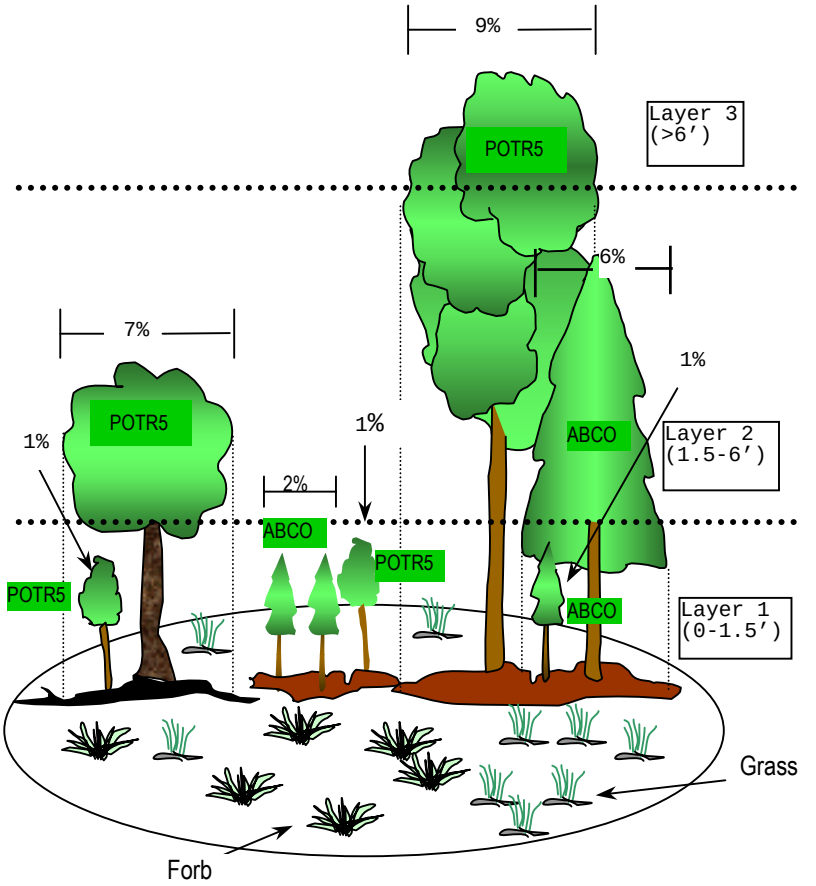
UNDERSTORY VEG EXAMPLES

Part I



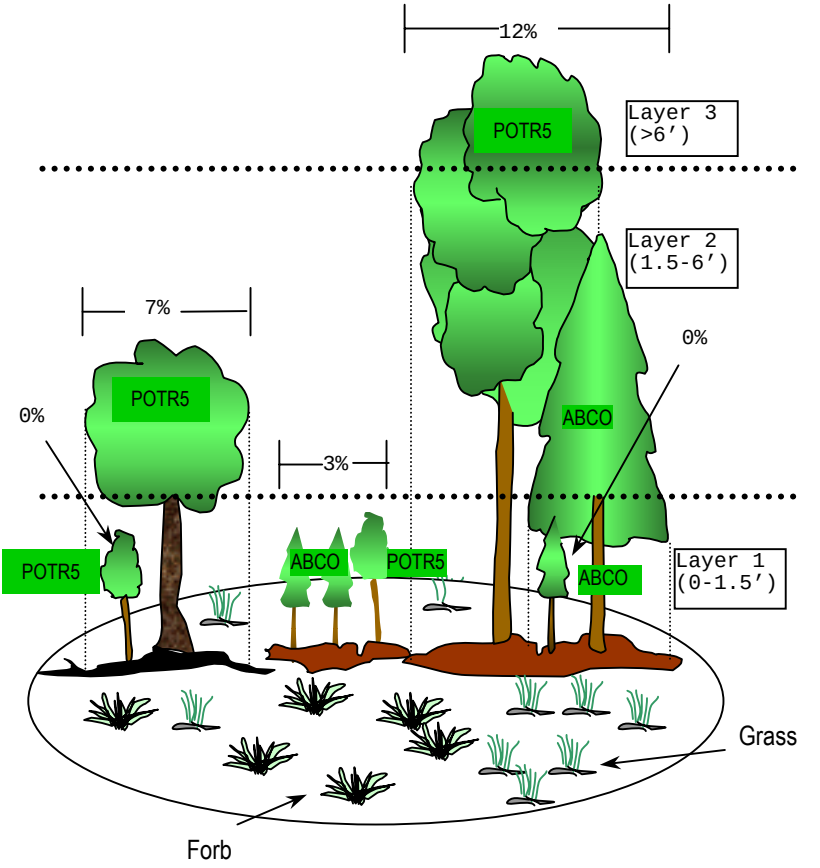
TREES			SHRUBS			FORBS			GRASS		
SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER
POTR5	17	3				ARCO9	5	1	POPR	5	1
ABCO	8	2									

Part II



Group	Layer 1 (0-1.5')	Layer 2 (1.5 – 6')	Layer 3 (>6')
Trees	5	13	9
Shrubs	0	0	0
Forbs	5	0	0
Grass	5	0	0

Part II (Total Cover / Aerial View)



Group	Total Cover (Aerial View)
Trees	22
Shrubs	0
Forbs	5
Grass	5

CHAPTER 11- ACCOUNTING PROCEDURES

For this inventory, a portion of the field locations measured during previous inventories may be revisited. In addition to the current location layout and sampling procedures for sampling trees, previously tallied trees on these locations will be accounted for using the original location layout and sampling procedures. The location center (LC) will be the same point for both samples. This chapter refers to data collected for RMRS only.
If the field location was not established at the correct map point during the previous inventory, determine whether the location placement meets the following criteria:

- The old plot was established in the correct condition class (refer to chapter 3).
- The old plot was established within 500 feet of the correct map point.
- The plot was not a "shifted" woodland plot.

If the old location meets all of the criteria; **account** for the trees and saplings on the old location, remove the tags and nails from old plot design trees not re-tallied in the current inventory, and establish the new plot layout at the old location center.

If the old location does not meet all of the criteria, **account** for the trees and saplings on the old plot as instructed in this chapter, but establish the current plot layout in the correct location. Remove the old tags and nails in the trees, but note this re-location in the notes/comments for the current inventory. **Note:** In the first inventory, some fixed-radius plots were "shifted" away from nonforest land, moving the entire sample plot into accessible forest land. For these locations establish the current design in the correct (grid) location.

A. Plot Layout

In the previous inventory, the Sampling Factor designated the plot layout and sampling system used. For field locations with the Sampling Factor coded as a 20 or 40, a 5-point, 7-point, or 10-point variable radius timberland plot was established. On locations with the Sampling Factor coded as 01, 02, 05, 91, 92, or 95, a fixed-radius woodland plot was established. For these fixed-radius woodland plots **DO NOT ACCOUNT FOR TREES OR SAPLINGS**. However, the new plot layout will be established at the old location center (provided the old location was established in the correct condition class, was established within 500 feet of the correct map point, and was not a "shifted" woodland plot).

1. Variable-Radius Plots.

The LC was designated as point 1 of 5, 7, or 10 points on the field location. Points 2 through 5, 7, or 10 were distributed around the LC, and within the condition of the LC, using a triangular grid pattern with 100-foot or 70-foot intervals (figure 37). The spacing and orientation of the primary point positions was as follows:

5/7-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from LC (1) to	2	60		70/100
	3	120		70/100
	4	300		70/100
	5	240		70/100
	6	180		70/100
	7	360		70/100

10-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from LC (1) to	2	360		70
2 to	3	360		70
3 to	4	120		70
4 to	5	180		70
5 to	6	180		70
6 to	7	240		70
7 to	8	300		70
8 to	9	360		70
9 to	10	360		70

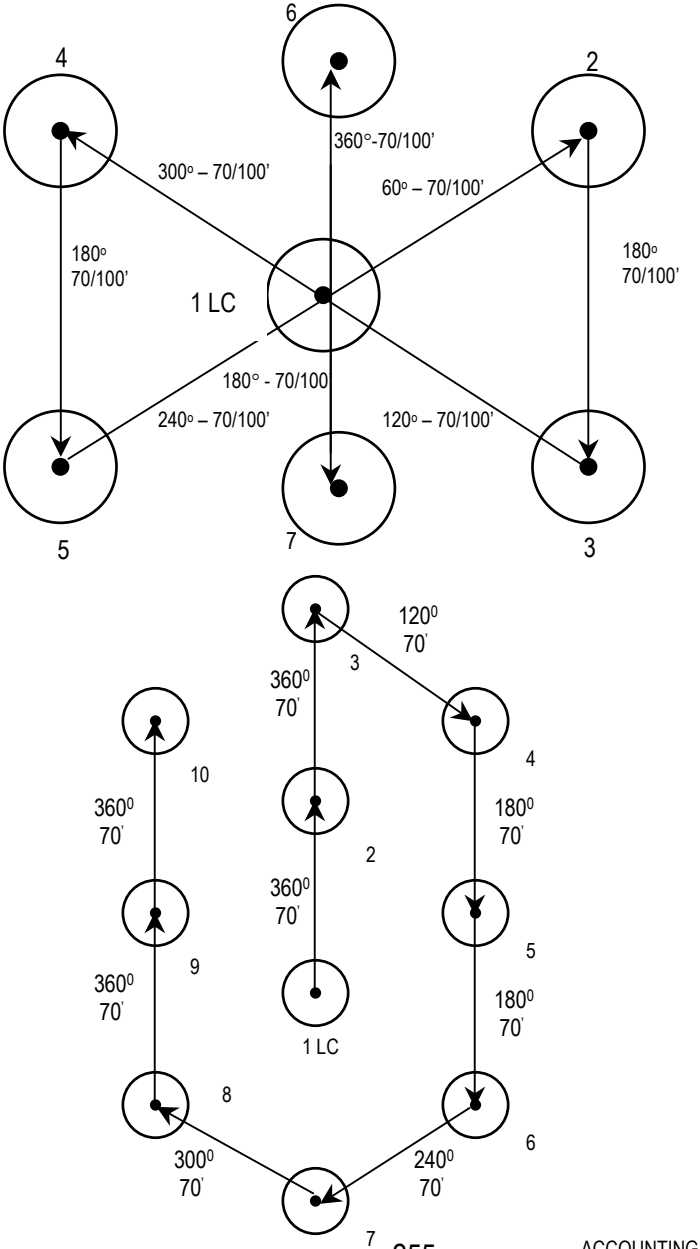
In the previous inventory, when points 2 through 5, 7, or 10 fell into vegetation conditions different than the condition at the LC, those points were redistributed back into the LC condition. Refer to the previous field location map to determine the actual point placement established.

At each of the points, timber species 5.0-inches DBH and larger, and woodland species 3.0-inches DRC and larger, were tallied on a variable-radius main plot; a 20 or 40 basal area factor (BAF) angle gauge, depending on forest type, was used to select tally trees:

Sampling Factor	Basal Area Factor	Forest Types	Limiting Distance to Geographic Center
20	20	Ponderosa pine	DBH/DRC X 1.945
40	40	All other conifer	DBH/DRC X 1.375

In addition, saplings were tallied or counted, and seedlings were counted, on a 1/300 acre fixed-radius microplot centered on the point stake.

Figure 57. Previous variable-radius plot layouts.



2. Fixed-radius plots.

Woodland fixed-radius plots will be relocated, but no tree accounting information will be collected.

B. Sampling Methods

Locate and account for all trees preprinted on the Accounting Tree Data record (appendix A.10) using the preprinted Sampling Factor code and the plot diagram on the old field form as a reference for the plot layout. **Only points 1-5 will be accounted for**. If a preprinted tree cannot be relocated and the reason cannot be determined, code CURRENT TREE STATUS = 0 and make a note in comments.

On the microplot: Locate and account for all trees preprinted on the Accounting Tree Data record and measure and record all new live trees ≥ 5" in diameter that were not previously recorded as saplings.

With variable-radius sampling (Sampling Factors 20 and 40), the limiting distance values are related to an individual tree's diameter (DBH or DRC) and its **horizontal** distance from the sample point stake.

For the microplot, the center of the tree (single-stemmed trees) or the geographic center of the trees stems (multistemmed woodland trees) must be at or within the fixed horizontal distance of 6.8 feet.

Locate individual trees by referencing the preprinted azimuth and distance, or by locating the numbered tree tag.

The following trees were sampled in the previous inventory:

1. Main Plot.

a. Live timber species 5.0-inches DBH and larger.

b. Live woodland trees 3.0-inches DRC and larger. For multistemmed trees, at least one stem was 3.0-inches DRC or larger.

c. Standing dead timber species 5.0-inches DBH and larger.

d. Standing dead woodland trees that had at least one standing qualifying stem (3.0-inches DRC or larger, 8.0 feet in length to a 1.5-inches branch diameter).

2. Seedling/Sapling Microplot.

After trees were tallied on the main plot, the following microplot trees were tallied:

a. Timber species saplings (1.0 - 4.9 inches DBH).

b. Woodland species saplings (1.0 - 2.9 inches DRC).

c. Established seedlings (less than 1.0-inches DRC/DBH) to bring the total tally of main plot and microplot live trees to 4.

C. Plot and Tree Data

11.1 MONTH

Record the month that the accounting plot was completed.

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

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

11.2 DAY

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

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

11.3 YEAR

Record the year that the accounting plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: ≥ 2004

11.4 POINTS ACCOUNTED

Record the number of points accounted for.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 0-5

11.5 NON ACCOUNTED REASON

Record the reason accounting data was not collected.

When collected: All plots accounting data not obtained (when POINTS ACCOUNTED = 0)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
1	Accounting plot not found
2	Access denied
3	Hazardous
4	Ran out of time

11.6 MICROPLOTS ACCOUNTED

Record the number of Microplots accounted for.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 0-5

11.7 LAND USE

Record the present Land Use code **for Point 1**.

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

Value	Definition
1	Timberland
2	Woodland
3	Nonforest

11.8 CO-LOCATED

Record whether or not the Accounting plot is co-located with the current plot design.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 0 - 1

Value	Definition
0	No
1	Yes

11.9 POINT NUMBER

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists. For new trees, record the point number where the tree occurs.
Valid codes = 1 to 5

11.10 TREE RECORD NUMBER

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists.
Record next available tree number for new tally trees.

11.11 AZIMUTH

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: ± 10 degrees.
Record azimuth to the nearest degree for new tally trees. Record 360^0 for due north.

11.12 DISTANCE

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 2 digits.
Tolerance: ± 1 foot

This value is the **slope** distance from the center stake or microplot stake to the center of single-stemmed trees or to the geographic center of multistemmed trees.

11.13 PREVIOUS TREE STATUS

When collected: Value is preprinted.
Field width: 1 digit.
Tolerance: No errors.
Only live trees are pre-printed. If a tree is not on the pre-printed form (other than through growth) ignore.
Values:
1 Live Tree – alive at the previous inventory

11.14 CURRENT TREE STATUS (Current Tree History)

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record a present TREE STATUS for each preprinted tree and new microplot tree. This code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change.

Code	Tree Status
0	No status –- tree is not presently in the sample (preprinted trees only). Reasons to use this code are as follows: Tree was incorrectly tallied during previous survey; tree is not tallied due to definitional or procedural change; tree is not tallied due to hazardous situation; tree is not tallied due to denied access; tree is not tallied due to crew running out of time.
1	Live tree - any live tree (remeasure or through growth).
2	Dead tree -- any dead tree (remeasure or through growth), regardless of cause of death, which does not qualify as a removal.
3	Removed - tree was tallied in previous inventory but has been cut or killed by direct human activity related to harvesting, silviculture or land clearing. The tree may, or may not, have been utilized. Only code trees killed by fire as removals if it was a prescribed burn.

11.15 RECONCILE

When Collected: When CURRENT TREE STATUS = 0 and when New tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record a NEW TREE RECONCILE for any new tally tree on the microplot that was not tallied in the previous inventory; this code is used to identify the reason a new tree appeared in the inventory. This information is needed to correctly assign volume information to the proper component of volume change. **Codes 1,3, and 4 will not be used for accounting purposes.**

0 Tree not measured – For Example: Use when hazardous, ran out of time, access denied, or could not find plot.

2 Through growth - new tally tree 5 inches DBH/DRC and larger, within the microplot.

Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

5 Shrank – live tree that shrank below threshold diameter on microplot/subplot/annular plot

6 Missing – tree was tallied in previous inventory, but is now missing due to natural causes such as landslide, fire, etc.

7 Cruiser error – erroneously

8 Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change.

11.16 SPECIES

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 4 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists. Record for new tally trees. Refer to section 9.12 for species list; for preprinted species no longer valid. Assign CURRENT TREE STATUS = 0 and RECONCILE code 8. If preprinted species is incorrect, code delete the preprinted code and record the correct species code.

11.17 PAST DBH/DRC

When collected: Value is preprinted.
Field width: 4 digits (xxx.y).
Tolerance: No errors.
If the preprinted past diameter appears to be incorrect (e.g., past DBH larger than current DBH, and the tree is still alive and growing) delete the preprinted value and record a past DBH/DRC estimate.

11.18 CURRENT DBH/DRC

When collected: Record only for live previously tallied trees; record for new live tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 4 digits (xxx.y).
Tolerance: Standing trees ±0.1 inch per 20 inches of diameter, down trees ±1 inch per 20 inches of diameter. Multi-stemmed Woodland species ± 0.2 inch per stem.
Record as directed in Tree Data starting on page 177, for each preprinted and new tally tree. If individual stems are nailed, measure the stems at (above) the nail. Trees cannot shrink off the plot. If the tree has shrunk below the above-mentioned thresholds, record the previous diameter for the current diameter.

11.19 DBH/DRC CHECK

When collected: All tally trees ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

Code	Definition
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.

11.20 PAST NUMBER OF STEMS

When collected: Value is preprinted.
Field width: 2 digits.
Tolerance: No errors.
If the past number of stems does not equal the current number of stems, do not change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

11.21 CURRENT NUMBER OF STEMS

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0" DRC.
Field width: 2 digits.
Tolerance: No errors.
Record for each preprinted and new tally **woodland** species with at least one stem 1.0 inch in diameter or larger.

11.22 PAST TOTAL TREE LENGTH

When collected: Value is preprinted.
Field width: 3 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists.

11.23 CURRENT TOTAL TREE LENGTH

When collected: New tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: ± 10% of true length.
Determine Total Tree Length for new tally trees as directed in 9.16 page 196.

11.24 CAUSE OF DEATH

When collected: Record for previously tallied trees that have died since the previous inventory and new tally trees ≥ 5.0 in DBH/DRC that grew onto a microplot and died since the previous inventory.
Field width: 2 digits.
Tolerance: No errors.
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.

Code	Cause of Death
10	Insect
20	Disease
30	Fire
40	Animal
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other – includes death from human activity not related to silvicultural or land clearing activity (accidental, random, etc.). TREE NOTES required
80	Silvicultural or land clearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc, or land clearing activity).

Note: If multiple possibilities for cause of death exist, record the lowest numbered code.

11.25 PAST TREE CLASS

When collected: Preprinted for previously tallied trees.

Field width: 1 digit.
Tolerance: No errors.
Refer to CURRENT TREE CLASS for codes. For preprinted tees, if the PAST TREE CLASS appears to be incorrect (e.g., tree was coded as rotten in first inventory, but is sound), delete the preprinted code and record an estimate of the correct PAST TREE CLASS.

11.26 CURRENT TREE CLASS

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record the CURRENT TREE CLASS for each previously tallied and new tree.

Code	Tree Class
1	**Sound (live) - timber species** • a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor. • a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.
2	**All live woodland species**
3	**Rough (live) - timber species**

- a live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a sound tree of good form, 5.0-inches DBH or larger.
- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
- a live tree, 5.0-inches DBH or larger, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

4 Rotten (live) - timber species

- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.