INTERIOR WEST FOREST INVENTORY & ANALYSIS

FIELD PROCEDURES

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(V3.01)

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

VOLUME I: FIELD DATA COLLECTION PROCEDURES FOR PHASE 2 PLOTS

Version 3.01

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INTRODUCTION

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

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

The focus of Volume I is on data that are collected in the field on all Phase 2 plots in the FIA sample. The methods in Volume I are also used on Phase 3 plots except when specifically noted otherwise in the methods text. Volume II of the series describes an additional, expanded suite of data collected on the Phase 3 subset of plots. Volume II contains methods for the following indicators: ozone bioindicator plants; lichen communities; soils (physical and chemical characteristics); crown condition; vegetation diversity and structure; and down woody material. Volume III of the series (in preparation) will document the office procedures including data elements measured in the office, data from other sources that are merged into the FIA database, and CORE compilation and analysis algorithms. When complete, the three-volume set will describe the CORE FIA program field data, all of which are measured consistently across the country.

RM Program Purose

The information obtained through the inventory is used to estimate forest land area, wood fiber, tree volume, growth, mortality, understory composition, recreation opportunities, wildlife habitat, and other related resources. This information provides annual and periodic analysis of renewable resource situations, including current conditions, use trends, and the potential production of forest resources of the Rocky Mountain Area States (Arizona, Colorado, Idaho, New Mexico, Montana, Nevada, Utah, and Wyoming). Findings of the inventories are published and available to resource planners, managers, and the public.

RM Field Organization

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

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.

RM Quality Assurance

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

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

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

1. To obtain uniform and consistent interpretation and application of field instructions among all field crews.

2. To hold technique errors to a minimum.

3. To check the performance of each individual crew member.

4. To reveal inadequacies in the instructions and in the training program.

5. To assess and document the quality (accuracy, precision, completeness) of field data.

RM Personal Conduct and Safety

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

It is 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.

RM Everyday Considerations

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

Follow these suggestions:

1. Before 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(s) in the Field Crew Check-in program on the laptop before 8 am every morning. If unable to complete the Field Crew Check-in or if plans change after check-in, notify the Ogden office.

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

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

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

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

8. Bring your first aid kit, keep it supplied, and know how to use it.

RM 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.

Field Guide Layout

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

0 General Description
1 Plot
2 Condition
3 Subplot
4 Boundary
5 Tree Measurements
6 Seedling
7 Site Tree
8 RM Field Location Reference
9 RM Understory Vegetation Description
10 RM Accounting Procedures
11 RM P2 Down Woody Material Procedures

Each section begins with a general overview of the data elements collected at that level and background necessary to prepare field crews for data collection. Data elements labeled with "RM" refer to Rocky Mountain Area (Interior West FIA) regional variables. These are only collected in the RM area. Descriptions of data elements follow in this format:

Data Element Name

Brief Variable Description:

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

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

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

MQO's state the percentage of time that the collected data are required to be within tolerance. Percentage of time within tolerance is generally expressed as "at least X percent of the time," meaning that crews are expected to be within tolerance at least X percent of the time.

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

UNITS OF MEASURE

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

Plot Dimensions:

Macroplot:

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

Subplot:

Radius= 24.0 feet
Area= 1,809.56 square feet or approximately 0.04 acre or
approximately 1/24 acre

Microplot:

Radius= 6.8 feet
Area= 145.27 square feet or approximately 0.003 acre or
approximately 1/300 acre

Annular:

Radius= from 24.0 feet to 58.9 feet
Area= 9088.4 square feet or approximately 0.21 acre or 5/24 acre

The distance between subplot centers is 120.0 feet horizontal.
The minimum area needed to qualify as accessible forest land is 1.0 acre.
The minimum width to qualify as accessible forest land is 120.0 ft

Tree Limiting Dimensions:

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

*DOB refers to Diameter Outside Bark

0.0 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24 acre in size with a radius of 24.0 feet. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 feet horizontal (+/- 7 feet) at azimuths of 360, 120, and 240 degrees, respectively, from the center of subplot 1 (see Figure 1). Throughout this field guide, the use of the word 'plot' refers to the entire set of four subplots. 'Plot center' is defined as the center of subplot 1. As a CORE OPTION, the field plot may also include macroplots that are ¼ acre in size with a radius of 58.9 feet; each macroplot center coincides with the subplot's center. Macroplots are numbered in the same way as subplots.

If the macroplots are not installed, the subplots are used to collect data on trees with a diameter (at breast height, DBH, or at root collar, DRC) of 5.0 inches or greater. If the macroplots are installed, then subplots are used to collect data on trees from a diameter 5.0 inches to the breakpoint diameter and the macroplot is used to collect data on trees with diameter greater than the breakpoint diameter.

Each subplot contains a microplot of approximately 1/300 acre in size with a radius of 6.8 feet. The center of the microplot is offset 90 degrees and 12.0 feet horizontal (+/- 1 foot) from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH/DRC of 1.0 inch through 4.9 inches) and seedlings [DBH/DRC less than 1.0 inch in diameter and greater than 0.5 foot in length (conifers) or greater than 1.0 foot in length (hardwoods)].

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

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

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

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

Data are collected on field plots at the following levels:

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

Tree	Data describing saplings with a diameter 1.0 inch through 4.9 inches, and trees with diameter greater than or equal to 5.0 inches
Seedling	Data describing trees with a diameter less than 1.0 inch and greater than or equal to 0.5 foot in length (conifers) or greater than or equal to 1.0 foot in length (hardwoods).
Site Tree	Data describing site index trees.

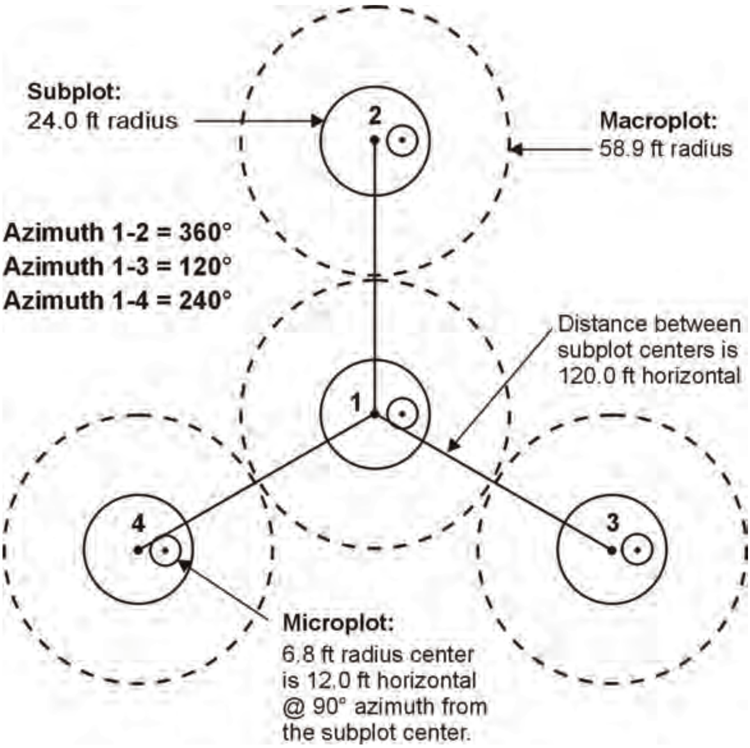


Figure 1. FIA Phase 2 plot diagram. See individual Phase 3 **chapters for Phase 3 plot figures.**

0.1 PLOT SETUP

Plots will be established according to the regional guidelines of each FIA unit. When the crew cannot occupy the plot center because safety hazards exist, or the plot center is inaccessible or out of the sample, the crew should check the other subplots. If any subplot centers can be occupied and are in the sample, the subplots that can be occupied should be established and sampled following normal procedures. When a subplot center or microplot center cannot be occupied, no data will be collected from that subplot or microplot; instead, the entire subplot or microplot should be classified according to the condition preventing occupancy.

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

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

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

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

0.1.0**RM** Finding the Plot Cener

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

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

Prior to the establishment of any plot, the ownership or managing agency of the plot must be verified. Upon arrival in each county, or prior to the field season, the Area Leader 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 plot packet and on the Field Location Description record.

Before visiting each plot, 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”.

0.1.2**RM** Planning Travel to the Vicinity of the Plot Center and Pinprick Verification

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

1. Verify the Placement of the PC Pinprick.

   Before going to any plot , first verify that the PC pinprick on the photo is in the same location as the map grid intersection. If they are not the same, locate the PC 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 plot. As a safety precaution, keep the office informed of any changes to the planned plot and update the Field Crew Check In progam on the computer daily

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

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

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

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

See Appendix E for detailed instructions on the Garmin use.

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

1. Verify GPS Settings

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

2. Select a Suitable RP

Designate a reference point (RP) readily identifiable on both the ground and the photograph/DOQ. The RP should be close to the plot center, but at least 100 feet from the PC, if possible. Select a landmark such as a prominent tree or large boulder, a sharp bend in a road or drainage ditch, a fence corner, etc. When selecting a tree, choose one not likely to die or be removed within the next 10-15 years (Note: do not select an RP next to features that may affect GPS or compass readings such as metal objects like barbed-wire fences or high power transmission lines.)

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

Pinprick the RP on the aerial photograph with the PC pinprick, circle and label the pinpricked RP on the back of the photograph, and provide a detailed desription of it on the Field Location Reference form. Refer to section 8 - Field Location Reference for instructions on tagging the RP.

3. Find the Position of the RP

Tolerance: EHE ≤ 70 feet.
Use the “Averaging” option in the GPS to provide coordinates for the position of the RP on the Universal Transverse Mercator (UTM) grid system. Refer to Appendix E. If the 180 hit averaged estimated error is > 70 feet, check map datum, and GPS settings, then try again. If the EHE is still > 70 feet, refer to 0.1.4RM “Establishing a Baseline and Scale” to locate the PC.

4. Chaining from the RP to the PC

   Record the distance and azimuth from the RP to the PC waypoint obtained from the GPS. Use a chaining tape and compass for chaining from the RP to PC. Refer to **Appendix E.**

5. PC Verification

   Tolerance: ±6 feet per 100 feet chained. ± 30 foot maximum error.
   Upon arrival at the PC, put a stake in the ground and use the **Average** function of the GPS to collect UTM coordinates for the PC.
   For correct placement of the PC, chaining error should be no more than ±6 feet per 100 feet of chaining distance up to ± 30 feet. Check photos and topo map to verify the PC Position. If the PC pinprick and GPS placement disagree by more than 0.1 inches, re-pinprick the photo, and begin referencing the plot. Use the "**Moving the Pinprick"** procedures described in 0.1.4.8RM.

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

0.1.4**RM** Establishing a Baseline and Scale

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

0.1.4.1**RM** 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 appoximate 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 PC 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:

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

0.1.4.2RM Map/Photo Method

1. Select Landmarks

   Select two baseline points that are easily identifiable on both the topographic map labeled with the plot center (PC) and on the aerial photo with the PC 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:

   a. 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.

   b. 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.

   c. 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").

   d. 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 Rocky Mountain Area, 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 counter clockwise from true north, or
- Magnetic declination minus grid declination, if GN is clockwise from true north.

Adjusted Azimuth = original map azimuth –
(MN declination ± 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 PC 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

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

0.1.4.3**RM** 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.

0.1.4.4**RM** Adjusting the Photo Scale Reciprocal.

This adjustment to the photo scale is required when the mean elevation of the RP to PC is at least 100 feet different from the mean elevation of the calculated baseline.

- If the RP to PC 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 PC 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

1,400 feet / 100 feet = 14
14 X 200 = 2,800

Therefore:
38,800 (baseline PSR)
-2,800 (change in scale)
36,000 adjusted RP PSR.

0.1.4.5**RM** Calculating Azimuth and Distance

Determine the azimuth and horizontal ground distance from the RP to the PC using the following procedure:

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

2. Determine RP-PC azimuth. To obtain the RP to PC 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 PC by lining up the correct azimuth over the baseline and reading the azimuth corresponding to the RP-PC line (figure 1). 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-PC line to obtain the RP to PC azimuth.

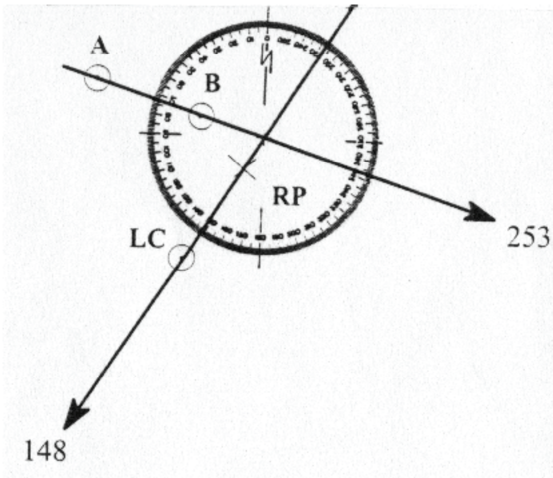
On the back of the photo, record the azimuths along each traverse line. Also record the following information on the back of the aerial photograph containing the PC pinprick in the lower left or right hand corner (depending on photo pinprick location):

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

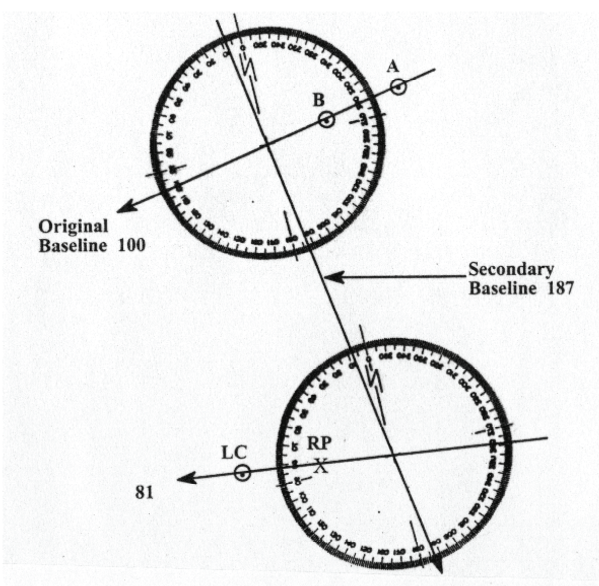
*Optional
**Record only if baseline method is used.

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

Example 1:



Example 2:



3. Determine RP-PC horizontal distance. To determine the horizontal distance from the RP to the PC, use one of the following methods:

   - ".001-foot scale" method (preferred method). Measure the distance on the photo from the RP pinprick to the PC 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-PC horizontal ground distance.

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

     For example:
     Photo scale between RP and PC = .012 feet
     Photo PSR = 36,770 feet
     Horizontal ground distance from RP-PC 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 PC pinpricks (to the nearest 12.5 feet, which is half of an increment on a scale ruler).

0.1.4.6**RM** Traversing to the PC

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

0.1.4.7**RM** PC Verification

Upon arrival at the end of the traverse, determine if the calculated ground point is in agreement with the PC pinpricked on the photograph.

Examine the ground features near the PC 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 PC, 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 Plot Center," and on the Field Location Description record under "Baseline Information."

Tolerance: ±10 feet, 95% of the time.

0.1.4.8**RM** Moving the Pinprick

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

1. Verify that the topographic map is plotted correctly (using UTM coordinates on the plot packet) and also verify photo pinprick matches topographic map.

2. If GPS is used to establish PC and pinprick is off:

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

    b. Move pinprick if you can verify exactly where you are on the photograph and the pinprick is off by ≥ 1/10th inch on the photo.

0.1.5**RM** Finding the Plot Center - Remeasurement Locations

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

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

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

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

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

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

0.1.5.1**RM** RP Not Found

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

1. Follow the procedures described under "Finding the Plot Center - New Plot".

2. 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 PC using one of the following techniques (Note: The new RP must be discernible on the new and old plot photographs):

   The .001-Foot Scale Method

   a. Calculate the azimuth from the new RP to the PC (Figure 2 example 1):

      - Pinprick the new RP on the old photo with the PC pinprick.

      - On the back of the old photo, draw a line connecting the new RP pinprick with the PC pinprick.

      - Orient a photo protractor inverted (wrong-side up) over the PC using the previously calculated azimuth from the old RP to the PC (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 PC. In example 1, the reading is 320 degrees.

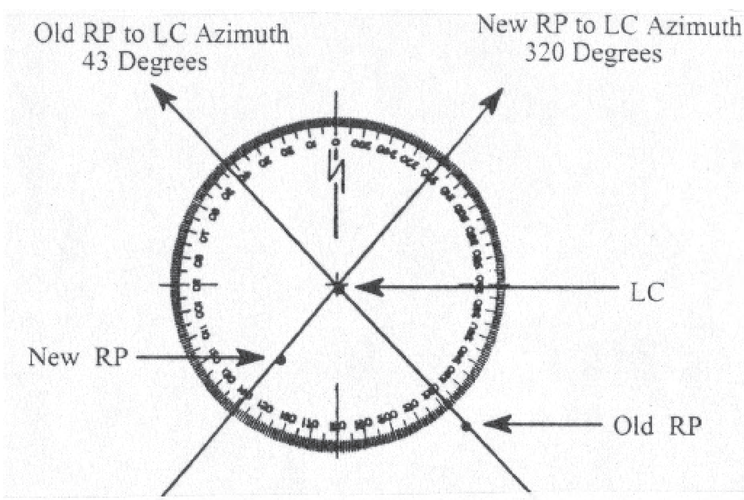
b. Calculate the horizontal ground distance, using a.001-foot scale, from the new RP to the PC (figure 2 example 2):

- Using the old RP to PC line, measure the distance between the RP and PC 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 PC (this item is recorded on the old field forms) by the calculated photo distance (from old RP to PC) 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

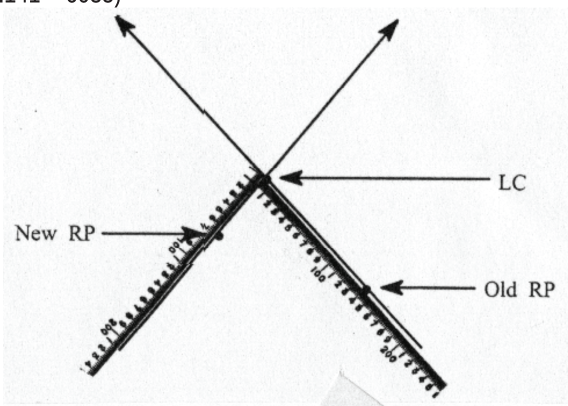


Example 2. The .001- foot method, determining the new horizontal ground distance.

(back of old photo)

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

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



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

- Multiply the PSR by the new RP to PC photo distance to get the new RP to PC 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.

c. On the back of the new photo with the PC 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 PC, and place an arrow on the RP to PC line, indicating the direction that the azimuth was taken.

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

d. Use the new RP to PC azimuth and horizontal distance to find and reference the remeasurement plot center

The Best-Fit Method

1. Calculate the azimuth from the new RP to the PC.
    - Pinprick the new RP on the old photo with the PC pinprick.
    - Draw a line from the new RP to the PC.
    - Orient a photo protractor inverted (wrong-side up) over the PC using the previously calculated azimuth from the old RP to the PC (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 PC. In figure 3, the reading is 320 degrees.

2. Calculate the horizontal ground distance from the new RP to the PC:
   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 PC 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.

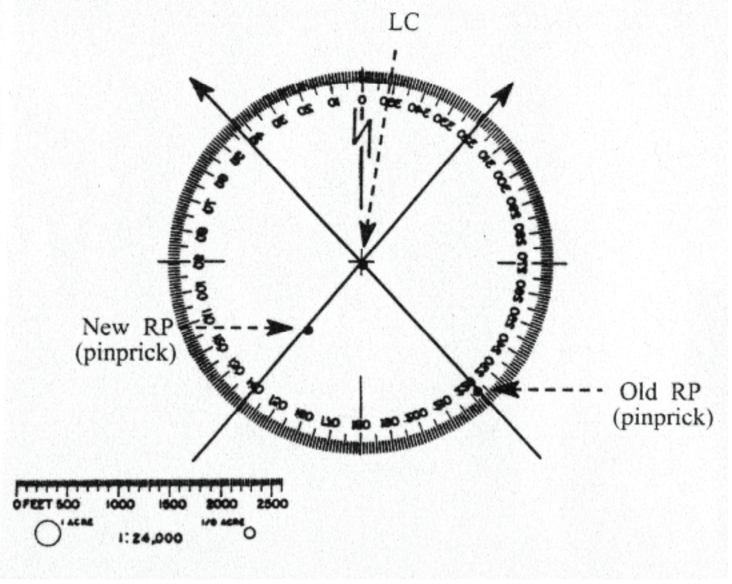
Figure 3. The best fit method.

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 PC 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 PC:	New RP to PC:
Azimuth 43 degrees	Azimuth 320 degrees
Distance 1,675.5 feet	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.)

c. On the back of the new photo with the PC 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 PC, and place an arrow on the RP to PC line, indicating the direction that the azimuth was taken.
Reminder: Use a ball-point pen for all photo work.

d. Use the new RP to PC azimuth and horizontal distance to find and reference the remeasurement plot center.

0.1.5.2**RM** 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 PC course. This can be accomplished by one of the following methods:

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

2. Locate a new RP that is discernible on both the old and new photos. Using the old photo, a new course from the RP to PC can be computed.

0.1.5.3**RM** Plot Center 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-PC 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 plot center cannot be found include the following: azimuth and/or distance incorrectly calculated, compass not set at 0° declination, compass not used properly, or corrections for slope were not made while chaining.

Re-establish the new plot center if any of the following apply:

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

- the previously established PC is in a different condition from the correct location center (refer to Section 2 – Condition Class), or

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

If a plot center is incorrectly placed or cannot be found, do the following:

1. Locate the correct PC on the ground using the GPS and determine if it is within 500 feet and in the same condition as the previously established plot. If it is not, or cannot be found at all, a new plot center should be established using the following procedures:

   Close out the template (TALLY Option "L").
   - Code PLOT STATUS as Nonsampled (code 3) and the PLOT NONSAMPLED REASON as Wrong location (code 07) or Lost Plot (code 06).
   - CONDITION CLASS 1 will now have a CONDITION CLASS STATUS as Nonsampled (code 5) and the CONDITION NONSAMPLED REASON as Other (code 10).
   - Assign each subplot CONDITION CLASS 1 and describe the situation in PLOT NOTES.
   - Every tree in this template will have a PRESENT TREE STATUS of No Status (code 0) with a RECONCILE code of "9".

   Open a new file (TALLY Option A, B, or D)
   - Code REGIONAL SAMPLE KIND as Replacement Plot (code 3)
   - Complete the rest of the plot as usual.

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

3. Cross out preprinted data forms, make an appropriote note, and leave the forms in the plot packet.

4. Contact the local Quality Control/Assurance person if unsure of the correct procedures.

0.2 Plot Integrity

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

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

All other potentially damaging procedures that may erode subplot integrity are prohibited.

The following practices are specifically prohibited:

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

0.3.0**RM** Field Procedure Overview

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

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

If the plot 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 Section 2.0).
- The old plot was established within 500 feet of the correct map point based on GPS readings.

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 Section 3.0 (Subplot Description Items).

0.3.1RM Circumstances Precluding Plot Establishment

1. Potential Situations

The following circumstances may preclude the establishment of any plot :

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

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

- **Hazardous.** The crew cannot reach or measure the plot center because of permanent physical conditions (e.g., cliffs) restricting access. Crews are required to establish other subplots if accessible (figure 4).

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

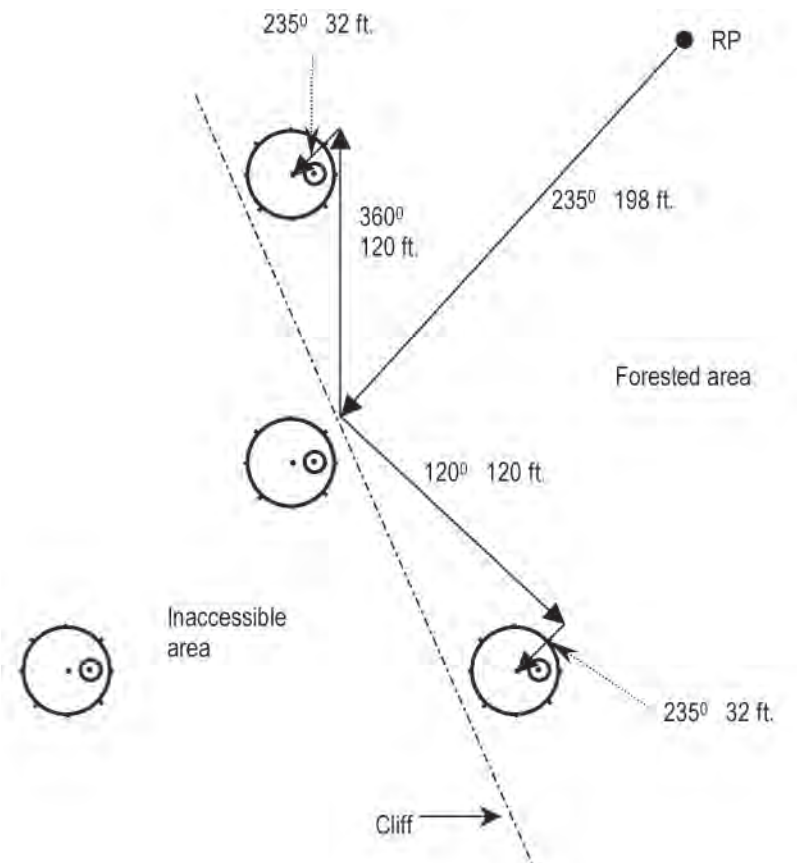


Figure 4. Establishing Subplots When the Location Center is Inaccessible

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 = 5 (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 plot is denied access, entirely too hazardous to visit, or not in the sample area, complete the following inventory sections (it will be provided on the data recorder, or use the appropriate field form). However, **if the location can be seen clearly enough to classify as nonforest, treat it as a nonforest.** Refer to appendix A for data forms and appendix D for specific items to record.

a. The **Field Location Reference** data (Section 8).

b. The **Field Location Description** data (Section 0).

c. On the **outside of the plot packet** record the appropriate Condition Status code.

0.3.2RM Plots with Accessible Forest Land Present

Establish and measure a plot if any portion of one of the four subplots or macroplot (if establishing macroplots) occurs within an accessible forest land condition class. The plot layout consists of 4 subplots where the PC is the center point of subplot 1. Refer to Section 00 for plot layout and tree sampling procedures. Establish these locations using current inventory procedures.

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

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

1. The Field Location Reference data (Section 8).

2. The Field Location Description (Plot Level) data (Section 01).

3. The Condition Class Description data (Section 2) for the condition containing the PC and for any additional conditions occurring on the subplots.

4. The Condition Class Diagram and Boundary Information data (Sections 2 and 4).

5. The Subplot Description data (Section 3) for each of the four subplots.

6. The Tree Data (Section 5); record all tally trees present within accessible forest land conditions. If only a portion of a subplot occurs in accessible forest land, only tally the trees within that portion. Refer to appendix 3 for tally tree selection.

7. The Understory Vegetation Description data (Section 9) for each subplot center that occurs in an accessible forest land condition.

8. If necessary, the Accounting Tree data (Section 10)

9. On the outside of the plot packet, record the following information:
   - Date plot completed
   - Crew Number and first initial and last name
   - Condition Status

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

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

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

1. The Field Location Reference data (Section 8) only the appropriate information is required (including photographing the location).

2. The Field Location Description data (Section 0). Include in the General Comments a brief description of why the plot does not meet the accessible forest land criteria (e.g., this area has been chained and currently has less than 5 percent tree cover and no regeneration).

3. The Condition Class Description data (Section 2).

4. The Subplot Description data (Section 3) for each of the four subplots.

5. On the outside of the plot packet, record the following information:
   - Date plot completed
   - Crew Number and First Initial and last name
   - Condition Status

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

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

Remeasurement plots are resource inventory plots of the same design that were previously established at a location: crews will relocate the field plot, remeasure the trees from the previous inventory, and tally any new trees on the plot. Remeasure plots use the same basic layout as the current inventory (refer to Section 00), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to Section 5.0). The microplot, however, was located at the subplot center for these plots prior to 2001, so crews will need to establish new offset microplots in this inventory. Old reference and witness trees can be reused if appropriate.

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

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

0.3.5**RM** Reserved Lands/Wilderness Areas

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

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

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

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

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

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

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

Sample Plot Monumentation

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

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

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

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

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

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

NOTE:

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

No archeological or vertebrate paleontological materials may be collected. Upon location of any historical or archeological remains field work will cease and the site shall be reported immediately to the local 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 Recreation Heritage and Wilderness Resource (RHWR) Wilderness Manager. All food and garbage will be stored in a sealed containers approved by the local RHWR Wilderness Manager. Field personnel will make all reasonable efforts to prevent wildlife from obtaining food or garbage from humans.

0.4**RM** Tree Sampling Procedures

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

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

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

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

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

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

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

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

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

Previous 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 PC when appropriate.

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

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

In Arizona, most plots on National Forest and reserved land will be considered remeasure or replacement locations (REGIONAL SAMPLE KIND 2 or 3) regardless of past CONDITION STATUS. For example, a plot was all nonforest during the previous inventory (Rocky Mountain 4-point nonforest) but now there is some accessible forest land on the plot (National 4-point offset). Even though this may be the first time trees are being tallied at the location, the REGIONAL SAMPLE KIND = 2. Plots falling outside of National Forest or reserved land that were nonforest during the previous inventory will be considered initial establishments (SAMPLE KIND 1).

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

Accounting Plots: A portion of the plots measured during previous inventories using the 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 Section 10 for accounting plot layout and accounting procedures. For accounting locations that cannot be found, or are mislocated, refer to Section 0 for instructions.

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

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

Plot Type	State	Current Design	Previous Design
Regionall Remeasure	AZ, ID, MT, CO	P2/P3 offset	P2 center P2 offset
Accounting	MT, NV, ID, UT	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

0.4.1**RM** Sampling Procedures

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

0.4.2**RM** Macroplot Tree Tally

1. Procedures. The macroplot is approximately 1/4-acre fixed-radius plot (58.9-foot radius) centered on the subplot stake. The macroplot is made up of subplot (center stake out to a 24.0 foot radius) and an annular plot (24.1 to 58.9 foot radius). At each macroplot, stand directly over the center (stake), and starting at 1° azimuth, rotate clockwise and tally qualifying trees that fall within the macroplot. 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 macroplot 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 58.9 feet or less.

   Trees are tallied and numbered clockwise from the subplot center outward. Numbering may be done on the annular plot after completion of the subplot and microplot.

2. Qualifying trees for the annular plot (subplot trees are described in 0.4.3RM, Subplot Tree Tally)

   a. Live timber species trees (refer to the tally tree species list in appendix 3) ≥ the established breakpoint diameter at breast height. 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.

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

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

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

b. Live woodland trees (refer to the Tally Tree Species List in Appendix 3) with a single stem ≥ the established breakpoint diameter at root collar (DRC) or a cumulative (calculated) DRC of at least 21.0-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.

c. Standing dead timber species ≥ the established breakpoint DBH. 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.

d. Standing dead woodland trees with a single stem ≥ the established breakpoint DRC or a cumulative (calculated) DRC. 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.

e. Down mortality timber species ≥ the established breakpoint DBH. Trees must have died within the past 5 years and are currently down (STANDING DEAD = 0).

f. Down mortality woodland trees with a single stem ≥ the established breakpoint DRC or a cumulative (calculated) DRC. Trees must have died within the past 5 years and are currently down (STANDING DEAD = 0).

0.4.3**RM** Subplot Tree Tally

1. Procedure

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

Trees are tallied and numbered clockwise from the subplot center outward. Numbering is continued in the same fashion on the microplot once the subplot is complete.

2. Qualifying trees.

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

The merchantable bole on a timber species is defined as 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 Appendix 3) with a single stem of at least 5.0-inches diameter at root collar (DRC) or a cumulative (calculated) DRC of at least 5.0-inches. For multistemmed trees, 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.

5. Down mortality timber species 5.0-inches DBH and larger. Trees must have died within the past 5 years and are currently down (STANDING DEAD = 0).

6. Down mortality woodland trees with a single stem of at least 5.0-inches DRC or a cumulative (calculated) DRC of at least 5.0-inches. Trees must have died within the past 5 years and are currently down (STANDING DEAD = 0).

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

Standing dead trees are classified as either hard or soft:

(a) A hard dead tree has a minimum of 33 percent of the original merchantable 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).

0.4.4**RM** Microplot Sapling Tally.

1. Procedure

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

2. Qualifying trees

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

      1. A sound live timber species sapling is one that is expected to become a sound tree 5.0-inches DBH or larger by rotation age.

      2. A rough live timber species sapling is one that is precluded from becoming a sound tree, 5.0-inches DBH or larger by rotation age due to suppression or damage.

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

0.4.5**RM** Seedling Counts.

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

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

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

For 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. Once a stem within a fir layer meets sapling tree qualifications, then tally the stem as a sapling.

1.0 PLOT LEVEL DATA

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

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

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

1.1 STATE

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

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

1.2 COUNTY

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

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

1.3 PLOT NUMBER

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

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

1.2.1**RM** USGS MAP NUMBER

Record the map number assigned to the topographic map for the plot . The map number is indicated on the plot packet. The plot center (PC) is indicated on the topographic map by the intersection of designated map grid lines.

When collected: All plots.
Field width: 8 digits
Tolerance: No errors.

1.2.2**RM** CONSECUTIVE POINT NUMBER (CPN)

Record the CPN assigned to the plot . This item is indicated on the plot packet.

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

1.4 PLOT STATUS

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

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

1 Sampled – at least one accessible forest land condition present on plot
2 Sampled – no accessible forest land condition present on plot
3 Nonsampled

1.5 PLOT NONSAMPLED REASON

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

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

01 Outside U.S. boundary – Entire plot is outside of the U.S. border.

02 Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot. Because a denied-access plot can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.

03 Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc. Although most hazards will not change over time, a hazardous plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.

05 Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only.

06 Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required. The plot that

is lost is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 6. The replacement plot is assigned SAMPLE KIND = 3.

07 Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required. The plot being relocated is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 7. Its replacement plot is assigned SAMPLE KIND = 3.

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

09 Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.

10 Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

1.5.1**RM** CONDITION CLASS CHANGE

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

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

0 There have been no condition class changes from the previous inventory. Copy condition class defining (mapping) variables from computer-generated printouts included in the plot packet.

1 True change has taken place since the last inventory. At least one condition class defining (mapping) variable has changed on any condition. Include changes in CONDITION STATUS such as: previous CONDITION STATUS was accessible forest land, now some portion or all of the condition is not accessible forest land (condition is now nonforest land, noncensus water, census water, denied access, area too hazardous to visit, area that is not in the sample, or not

sampled/out of time), or vice versa.

2 There are no true condition changes. The previous crew mapped a condition(s) in obvious error. Explain error in notes.

3 There are no true condition changes. Change is due to procedural or definition changes.

1.5.2**RM** RANGE DATA

Record whether range data will be collected for the location.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
Values: 0 or 1

Values	Definition
0	Range data not collected
1	Range data collected

1.6 SUBPLOTS EXAMINED

Record the number of subplots examined.

When collected: When PLOT STATUS = 2 or 3
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

1 Only subplot 1 center condition examined and all other subplots assumed (inferred) to be the same

4 All four subplots fully described (no assumptions/inferences)

1.7 SAMPLE KIND

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

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

Values:

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

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

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

1.7.1**RM** REGIONAL SAMPLE KIND

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

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

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

2 Remeasurement – remeasurement of a national design annual plot that was sampled at the previous inventory or remeasurement of a previously established "Rocky Mtn 4-

point center micro" or "National 4-point offset micro" (see Section 00 for definitions). If the previously established plot is a design other than those mentioned above, the SAMPLE KIND will equal 1.

3 Replacement plot - a replacement plot for a previously established national design annual plot. Assign SAMPLE KIND = 3 if a plot is installed at a location other than the previous location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the previous plot. Replaced plots are assigned PLOT STATUS = 3, SAMPLE KIND = 2, and the appropriate NONSAMPLED REASON code. The plot number for the replacement plot is assigned by NIMS or replacement of a previously established "Rocky Mtn 4-point center micro" or "National 4-point offset micro" (see Section 00 for definitions). Includes a plot that was replaced with a new plot because the original plot was established in the wrong location (see Section00, field procedure overview).

1.8 PREVIOUS PLOT NUMBER

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

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

1.9 FIELD GUIDE VERSION

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

When collected: All plots
Field width: 2 digits (x.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: 3.0

1.9.1**RM** REGIONAL FIELD GUIDE VERSION

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

When collected: All plots
Field width: 3 digits (x.yy)
Tolerance: No errors
MQO: At least 99% of the time
Values: 3.01

1.10 CURRENT DATE

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

1.10.1 YEAR

Record the year that the plot was completed.

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

1.10.2 MONTH

Record the month that the plot was completed.
When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

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

1.10.3 DAY

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

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

1.10.4**RM** CREW NUMBER(S)

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).

1.11 DECLINATION (CORE OPTIONAL)

(Not used by RM)

1.12 HORIZONTAL DISTANCE TO IMPROVED ROAD

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

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

Values:

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

1.13 WATER ON PLOT

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

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1)
Field width: 1 digit
Tolerance: No errors

MQO: At least 90% of the time
Values:

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

1.14 QA STATUS

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

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

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

1.15 CREW TYPE

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

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

Values:

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

1.16 GPS Coordinates

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

1.16.1 GPS Unit Settings, Datum, and COORDINATE SYSTEM

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

Each FIA unit will determine the Datum to be used in that region. Most will use the NAD 27 Datum (also known as NAS-C or NA 27 CONUS/CLK66), but coordinates collected using any appropriate datum can be converted back to a national standard (NAD 83) for reporting purposes.

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

1.16.2 Collecting Readings

Collect at least 180 GPS readings at the plot center. These may be collected in a file for post-processing or may be averaged by the GPS unit. Each individual position should have an error of less than 70 feet if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error less than or equal to 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 1.15.12 and 1.15.13.

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 1.16.12 and 1.16.13.

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

1.16.3 GPS UNIT

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

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

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

1.16.4 GPS SERIAL NUMBER

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

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

1.16.5 GPS DATUM

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

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

Values:

NAD27	North American Datum of 1927
NAD83	North American Datum of 1983
WGS84	World Geodetic System of 1984

1.16.6 COORDINATE SYSTEM

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

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

1	Geographic coordinate system
2	UTM coordinate system

1.16.7 LATITUDE

(Not used by RM)

1.16.7.1 LATITUDE DEGREES

(Not used by RM)

1.16.7.2 LATITUDE MINUTES

(Not used by RM)

1.16.7.3 LATITUDE SECONDS

(Not used by RM)

1.16.8 LONGITUDE

(Not used by RM)

1.16.8.1 LONGITUDE DEGREES

(Not used by RM)

1.16.8.2 LONGITUDE MINUTES

(Not used by RM)

1.16.8.3 LONGITUDE SECONDS

(Not used by RM)

1.16.9 UTM ZONE

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

1.16.10 EASTING (X) UTM

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:

1.16.11 NORTHING (Y) UTM

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:

1.16.12 Correction For “Offset” Location

As described in Section 1.16.2, coordinates may be collected at a location other than the plot center (an “offset” location). If a PLGR unit is used all offset coordinates will be “corrected” back using the Rng/Calc function. If a GPS unit other than a PLGR is used, then record items 1.16.13 and 1.16.14.

1.16.13 AZIMUTH TO PLOT CENTER

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

When collected: When GPS UNIT = 2, 3 or 4
Field width: 3 digits

Tolerance: +/- 3 degrees
MQO: At least 99% of the time
Values: 000 when coordinates **are** collected at plot center
001 to 360 when coordinates **are not** collected at plot center

1.16.14 DISTANCE TO PLOT CENTER

Record the horizontal distance in feet from the location where coordinates were collected to the actual plot center. If coordinates are collected at plot center, record 000. As described in Section 1.16.2, if a laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 feet from the plot center. If a range finder is not used, the offset location must be within 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

1.16.15 GPS ELEVATION

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

When collected: When GPS UNIT = 1, 2 or 4
Field width: 6 digits (1st digit is + or -, last 5 digits are numeric)
Tolerance:
MQO: At least 99% of the time
Values: -00100 to +20000

1.16.16 GPS ERROR

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

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

MQO: At least 99% of the time
Values: 000 to 070 if possible
071 to 999 if an error of less than 70 cannot be obtained

1.16.17 NUMBER OF READINGS

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

When collected: When GPS UNIT = 1 or 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001 to 999

1.16.18 GPS FILENAME (CORE OPTIONAL)

(Not used by RM)

1.17 MACROPLOT BREAKPOINT DIAMETER (CORE OPTIONAL)

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

When collected: All plots
Field width: 2 digits (xx)
Tolerance: No errors
MQO: At least 99% of the time
Values: 21, 24, and 30

1.17.1**RM** MACROPLOT RADIUS

When collected: All plots
Field width: 3 digits
Tolerance: No errors
Values: 000 or 589

Values

000	Macroplot was not measured
589	589 = 58.9 foot radius (1/4 acre fixed-radius subplot)

1.17.2**RM** MICROPLOT RADIUS

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)

1.17.3**RM** SUBPLOT RADIUS

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)

1.17.4**RM** MICROPLOT LOCATION

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.

1.17.5**RM** FUTURE FOREST POTENTIAL

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

When collected: When no accessible forest land condition class is present on the location.
Field width: 1 digit.
Tolerance: No errors.

Values

0 No, there is no chance this plot will meet the forest definition at the next cycle. It meets one or more of the following criteria:

- Located more than ½ mile from the nearest forest land, and there are no trees present on or near the location. No disturbance evident (e.g. large fires, clearcut, etc.)
- Located in a large reservoir.
- Located in a developed urban area (on a house, building, parking lot), but the plot does not fall in a park, undeveloped yard, etc. that may revert to natural forest.
- Located on barren rock, sand dunes, etc.

1 Yes, there is some chance that this plot could become forested in the next cycle; there are trees present, or forest land is present within ½ mile.

2 There are no forest tree species (Appendix 3 - Tree Species Codes) on the site, but other woody species not currently defined as forest species occupy the site (such as palo verde, ironwood, big sage). Where code 2 is selected, note the dominant tree or shrub species on the site in the Condition Notes.

1.18 PLOT-LEVEL NOTES

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

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

2.0 CONDITION CLASS

The Forest Inventory and Analysis (FIA) plot is cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1).

2.0.1**RM** CONDITION CLASS INTRODUCTION

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

2.1 DETERMINATION OF CONDITION CLASS

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

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

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

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

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

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

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

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

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 2.5.7 to 2.5.23).

2.2 CONDITION CLASS STATUS DEFINITIONS

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

   (a) the condition is at least 10-percent stocked by trees (Appendix 3) of any size or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities; or RM a condition is 10% stocked if it has 5% crown cover or 40 established seedlings per acre of any tally tree species (Appendix 3).

   (b) in several western woodland species (Appendix 3) where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the

condition is not subject to nonforest use that prevents normal regeneration and succession such as regular mowing, chaining, or recreation activities.
To qualify as forest land, the prospective condition must be at least 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.

2.2.1**RM** PERCENT CROWN COVER CALCULATION

Percent Crown Cover Calculation
If a plot is close to 5% crown cover, and the crown cover transect (see 2.5.10.2) may not represent the true cover, the following method provides another estimate of the total tree crown area within the 1-acre surrounding the plot center:
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 dimension

Crowns as Circles:			or	Crowns as Rectangles:		
Tree #	Crown Diameter	Area (πr^2)		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			Total Crown =	2,355
	Percent of Area =	5.1%			Percent of Area =	5.4%

Transition zones and forest/nonforest encroachment – When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. This may cause difficulties determining exactly where the forested area meets the minimum stocking criteria. For these cases, determine where the land clearly meets the 10 percent minimum forest land stocking, and where it clearly is less than required stocking; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (Figure 2).

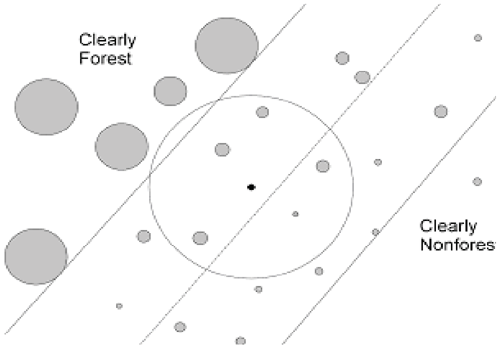


Figure 2. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

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

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

Indistinct boundary due to the condition minimum-width definition – Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 feet) definition. Although the point where the definition changes from forest to nonforest creates an invisible "line" between conditions, **this definitional boundary is not distinct and obvious**. See Figures 3 and 4. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.

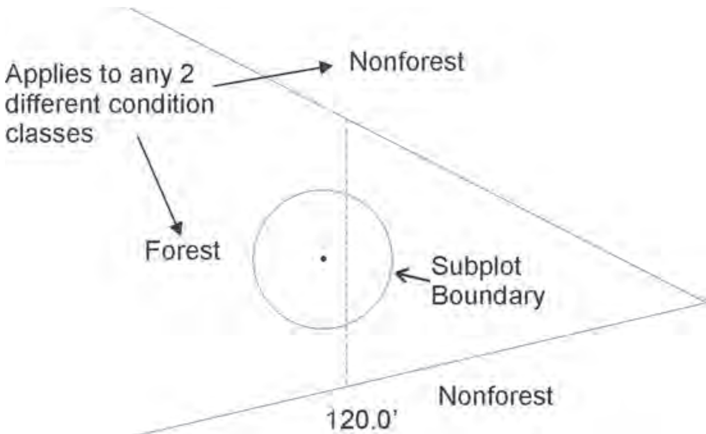


Figure 3. Forest condition narrows within a nonforest condition. Examine the location of the subplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

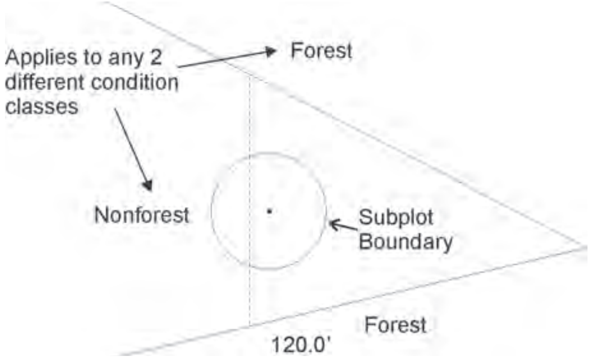


Figure 4. Nonforest condition narrows within a forest condition. Examine the location of the subplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

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 #'s 3 and 4 in Section 2.2. To qualify, the area must be at least 1.0 acre in size and 120.0 feet wide; five exceptions are discussed at the beginning of Section 2.4. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next plot visit to see if it has become forest land.

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

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

5. Nonsampled
   See section 2.4.3 CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled.

2.3 CONDITION CLASS ATTRIBUTES

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

2.5.1	RESERVED STATUS
2.5.2	OWNER GROUP
2.5.3	FOREST TYPE
2.5.4	STAND SIZE CLASS
2.5.5	REGENERATION STATUS
2.5.6	TREE DENSITY

Attributes where a change causes a seperate condition class

2.5.7	OWNER CLASS
2.5.8	PRIVATE OWNER INDUSTRIAL STATUS
2.5.9	ARTIFICIAL REGENERATION SPECIES
2.5.10	STAND AGE
2.5.10.1RM	HABITAT TYPE
2.5.10.2RM	CROWN COVER
2.5.10.3RM	PERCENT BARE GROUND
2.5.11	DISTURBANCE (up to 3 coded)
2.5.12	DISTURBANCE YEAR (1 per disturbance)
2.5.17	TREATMENT (up to 3 coded)
2.5.18	TREATMENT YEAR (1 per treatment)
2.5.23	PHYSIOGRAPHIC CLASS

Ancillary - changes do not delineate a new condition class

2.5.24 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 LAND USE, base the classification on what is present within the area defined by the fixed radius plot (macroplot, subplot, or microplot). When classifying all other condition class variables, base the classification on the macroplot.

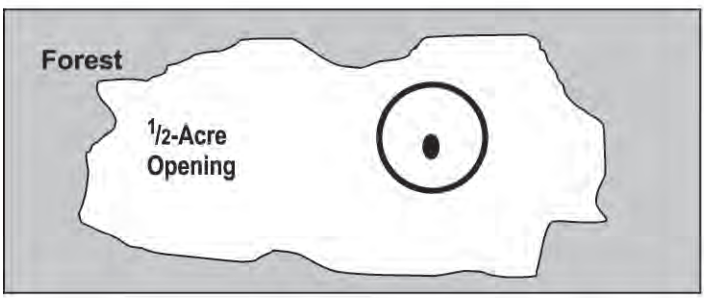
2.4 DELINEATING CONDITION CLASSES DIFFERING IN CONDITION CLASS STATUS:

The first step in delineating condition classes is to recognize differences in CONDITION CLASS STATUS. The most common difference is adjacent accessible forest land and nonforest land.

Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 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.

RM FIGURE 4.1



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

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. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements (Figures 5, 5.1, and 5.2).

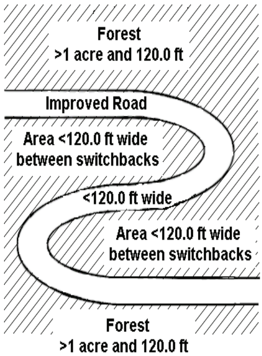
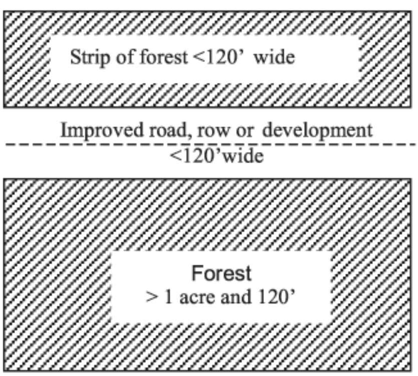
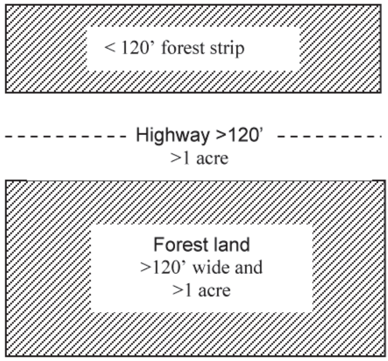


Figure 5. Example of a switchback road.



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



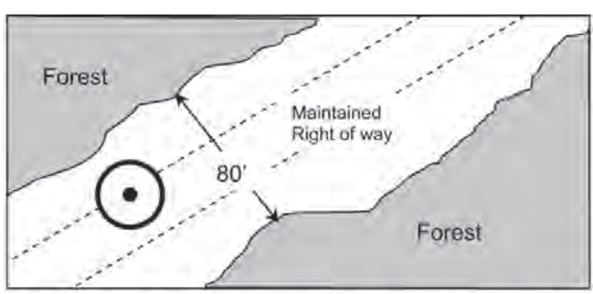
RM Figure 5.2. Example of a nonforest strip >120' wide. Area of forest above highway is not forest land

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

b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs. (RM Figure 5.3)

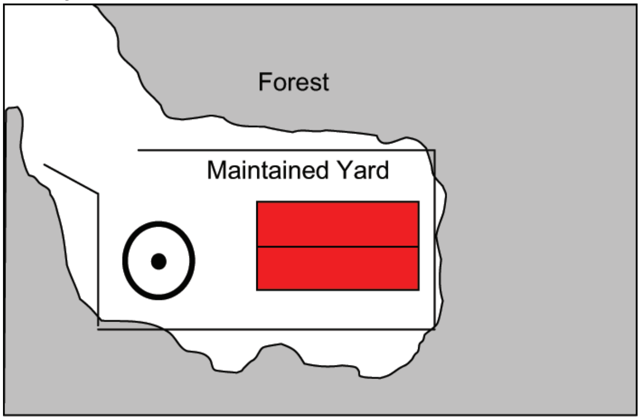
c) Developments: structures and the maintained area next to a structure, all less than 1.0 acre in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds. (RM Figure 5.4)

RM Figure 5.3



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

RM Figure 5.4



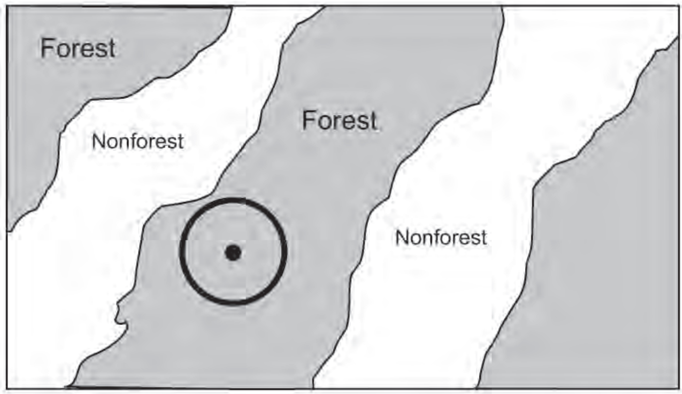
The subplot falls in a maintained yard next to a house; the area of the yard and house is less than 1-acre. However, the yard and house are cultural developments; these are considered nonforest land regardless of size. Therefore, the subplot occurs in **NONFOREST LAND**.

2. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is less than 1.0 acre in size and less than 120.0 feet in width. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement. This exception applies only to nonforest conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments. (RM Figure 5.5)

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

   For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see Figure 7. Figure 7 delineates the boundary between the forest and nonforest condition classes for four different examples. The plot center defines the plot condition for all strips covered by the arrow. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type

RM Figure 5.5



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

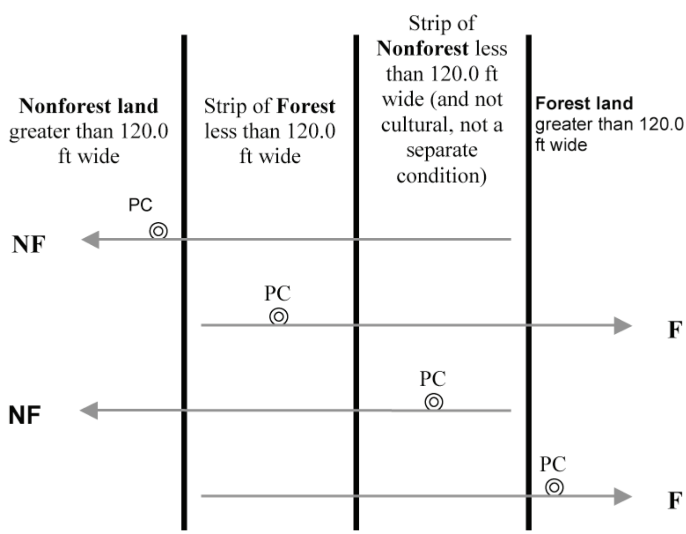


Figure 7. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

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

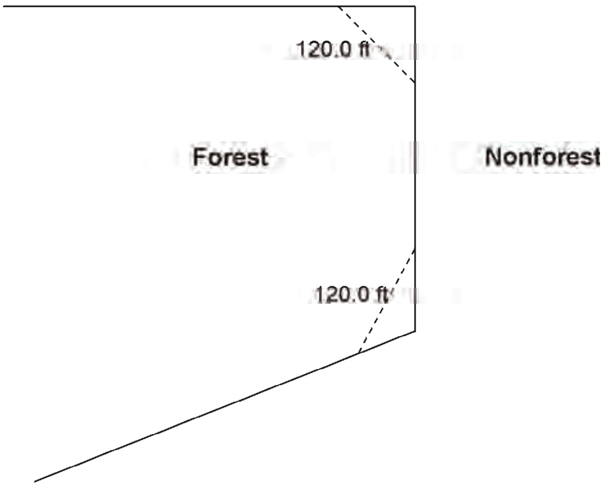
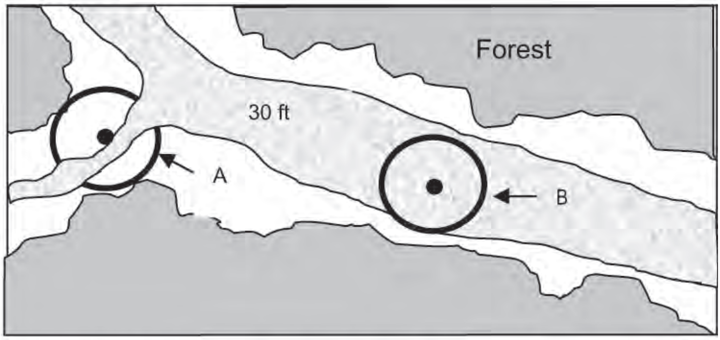


Figure 8. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 feet wide and cover at least 1.0 acre. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features that do not meet the definition for Census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 acre requirement; use professional judgment and common sense on any linear water feature. (RM Figure 8.1)

RM Figure 8.1. 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.

2.4.1 CONDITION CLASS NUMBER

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

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

2.4.2 CONDITION CLASS STATUS

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

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

Values:

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

2.4.3 CONDITION NONSAMPLED REASON

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

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

Values:

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.

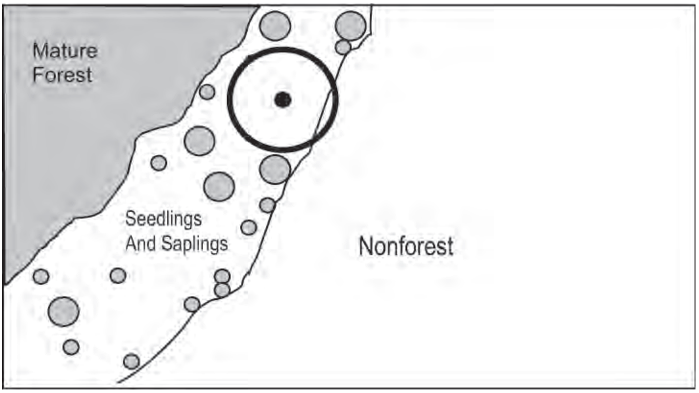
03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains 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.

2.5 DELINEATING CONDITION CLASSES WITHIN ACCESSIBLE FOREST LAND:

Accessible forest land is subdivided into condition classes that are based on differences in RESERVED STATUS, OWNER GROUP, FOREST TYPE, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY. Section 2.1 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in 2.5.1 to 2.5.6. "Stands" are defined by plurality of stocking for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 acre in size and at least 120.0 feet in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained. (RM Figure 8.2)



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

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

No other attribute shall be the basis for recognizing contrasting condition classes within accessible forest land. For each condition class recognized, many "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see Sections 2.5.7 to 2.5.23).

General instructions for delineating condition classes within accessible forest lands:

1. <u>Distinct boundary within an macroplot (if applicable), subplot, or microplot</u> – Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see Section 4.0.

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

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

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

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

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

4. Riparian forest area – A riparian forest area is defined as a forest area between 30.0 and 120.0 feet wide, and 1.0 acre or more in size, cumulative, and adjacent to but not necessarily present on both sides of a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, bogs, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated "within forest" and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class. Figures 9-14 provide examples of when to delineate riparian forest area as a separate condition class.

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

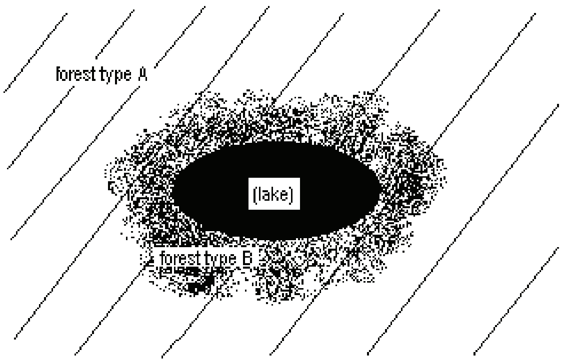


Figure 9. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

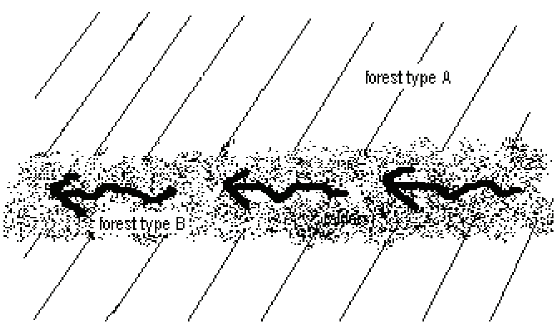


Figure 10. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

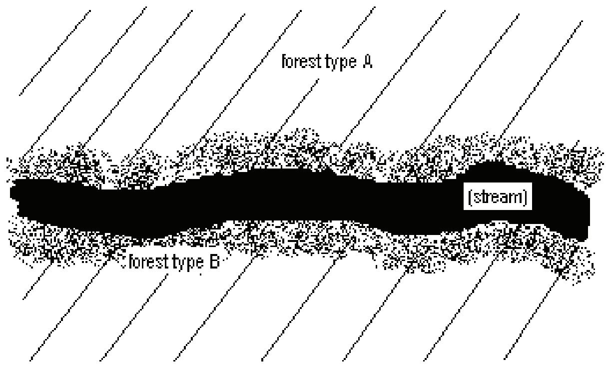


Figure 11. If the stream is < 30.0 feet wide, forest type B is a separate condition class (riparian) if the sum of the two widths of the bands falls between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

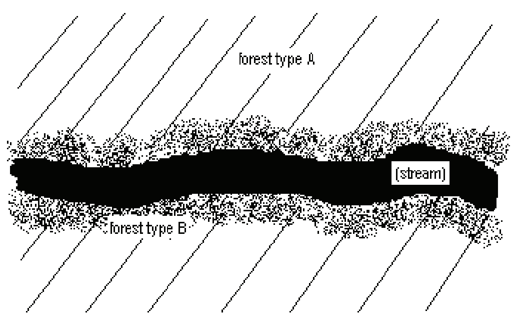


Figure 12. If the stream is > 30.0 feet wide, forest type B is a separate condition class (riparian) if either of the two widths of the bands falls between 30.0 feet and 120.0 feet wide and is ≥ 1.0 acre in size.

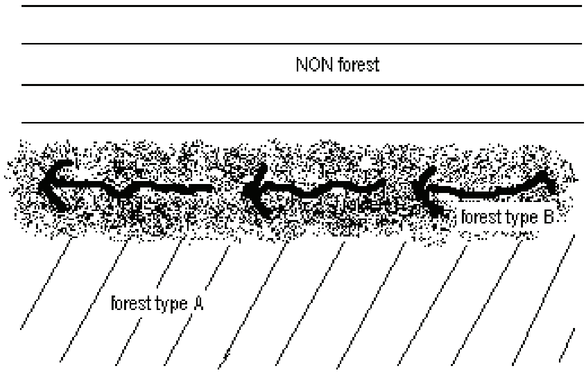


Figure 13. Forest type B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

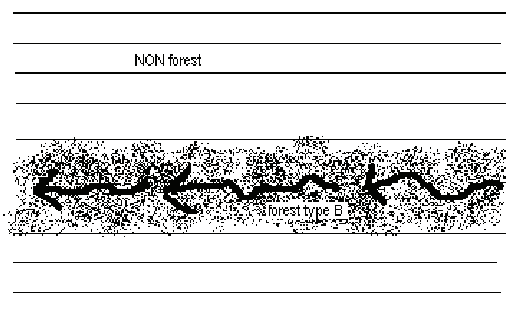


Figure 14. In a non-forested area, a band of forest type B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.

2.5.1 RESERVED STATUS

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

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

0 Not reserved
1 Reserved

2.5.2 OWNER GROUP

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

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

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

2.5.3 FOREST TYPE

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

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

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 3 digits
Tolerance: No errors in group or type
MQO: At least 99% of the time in group; at least 95% of the time in type. No MQO when STAND SIZE CLASS = 0.
Values: See Appendix 2

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

2.5.4 STAND SIZE CLASS

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

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

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

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

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

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

2 5.0 – 8.9 inches (softwoods) / 5.0 – 10.9 inches (hardwoods)
At least 10 percent stocking (or 5 percent crown cover if stocking standards are not available) in trees of any size; and at least 1/3 of the crown cover is in trees 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 $\geq$ 40.0 inches DBH.

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

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

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

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

2.5.5 REGENERATION STATUS

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

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

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

The instructions in section 2.1 and 2.4 apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

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

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

2.5.6 TREE DENSITY

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

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

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

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

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

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

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

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

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

- the eastern half of an otherwise homogeneous, 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

2.5.7 OWNER CLASS

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

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

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

11	National Forest
12	National Grassland
13	Other Forest Service

Owner Classes within Other Federal Lands (Owner Group 20)

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

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

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

Owner Classes within Private lands (Owner Group 40)

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

2.5.8 PRIVATE OWNER INDUSTRIAL STATUS

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

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

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

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

2.5.9 ARTIFICIAL REGENERATION SPECIES

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

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 3

2.5.10 STAND AGE

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

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

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

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

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

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

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

2.5.10.1**RM** CONDITION HABITAT TYPE

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

For conditions that have had a severe or recent disturbance (e.g., burn or cut), estimate the type from a nearby similar site or use a series level type code and explain in the general comments or notes. Refer to the local Habitat Type key and manual(s).
For condition classes that do not have a defined type or series in the Habitat Type manuals, record 9999999.

When collected: Condition Class Status = 1
Field width: 7 digits.
Tolerance: Series - no errors
MQO: - no errors.

2.5.10.2**RM** CROWN COVER

When collected: Condition Class Status = 1
Field width: 3 digits.
Tolerance: ±10%.
Record the percentage of crown cover, to the nearest 1 percent, of all tally established seedlings, saplings, and trees (refer to the tally tree species list in Appendix 3). Crown cover is the percentage of ground surface area covered by a vertical projection of the live crowns.

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. Each transect begins 1 foot from the subplot stake; measure the length of live tally tree species crown intercepted (above or below) by the 4 transects at each subplot.

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

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

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

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

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

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

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

2.5.10.3 **RM** PERCENT BARE GROUND

When collected: Condition Class Status = 1
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.9). Add the percent bare ground estimates and divide by the number of subplots sampled. Where more than one forested condition class occurs on the location, separate and record (PDR) the estimate by condition class.
Record the percent using a three-digit code (e.g. record 5 percent as "005", 21 percent as "021").

Method 2 (optional)
As the amount of bare ground increases on a subplot it may become difficult to estimate the Percent Bare Ground. If a crew is having difficulty or is "calibrating" their eyes, to reduce subjectivity, Ground Cover Transects can be used to obtain the same information as Method 1. Follow the procedures below:

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

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

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

2.5.10.4**RM** LIVE CROWN COVER

Record the percentage of live crown cover of the condition. Include tally trees saplings, and seedlings (see Appendix 3). For conditions with low live crown cover (<15%) it may be necessary to measure every crown width on the condition sample acre (see 2.2.1RM PERCENT CROWN COVER CALCULATION) to determine an accurate live crown cover. For conditions that are certain to have more than 10% live crown cover, record an estimate. Base your estimate on field observations, aerial photos, and cover transects.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 3 digits
Tolerance: 0-10% - No errors
11 – 100% - 10%
MQO: At least 99% of the time
Values: 000 - 100

Code	Definition
00	None – no live crown cover
01	1% live crown cover
….	
10	10% live crown cover
…	
99	99% live crown cover
100	100% live crown cover

2.5.10.5**RM** LIVE PLUS MISSING CROWN COVER

Record the percentage of live plus missing crown cover on the condition. Sum the LIVE CROWN COVER (from 2.5.10.4RM) and the estimated crown cover that occurred prior to disturbance (harvesting, fire, chaining, etc). Include tally trees, saplings, and seedlings (see Appendix 3). Base your estimate on field observations, aerial photos, and similar undisturbed conditions. The total of the two crown covers cannot exceed 100%.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 3 digits
Tolerance: 0-10% - No errors
11 – 100% - 10%
MQO: At least 99% of the time
Values: 000 - 100

Code	Definition
02	None – no live crown cover
03	1% live crown cover
….	
11	10% live crown cover
…	
99	99% live crown cover
100	100% live crown cover

2.5.10.6**RM** TOTAL SEEDLINGS

Record the number of live seedlings per acre of the condition. Take the number of live seedlings tallied on the subplot and expand (4 microplots in the condition – multiply each seedling by 75; 3 microplots in the condition – multiply each seedling by 100; 2 microplots in the condition – multiply each seedling by 150; 1 microplot in the condition – multiply each seedling by 300). If the microplot seedling tally does not accurately represent what's on the condition, record an estimate. Base your estimate on actual counts or field observations.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 4 digits
Tolerance: 10%
MQO: At least 90% of the time
Values: 0000 - 9999

2.5.10.7**RM** LAND USE

Variable description not available at the time of printing.

2.5.10.8**RM** TREE FORM

Variable description not available at the time of printing.

2.5.11 DISTURBANCE 1

Record the code corresponding to the presence of the following disturbances. Disturbance can connote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 acre in size. Record up to three different disturbances per condition class from most important to least important 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.

2.5.12 DISTURBANCE YEAR 1

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

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

2.5.13 DISTURBANCE 2

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

2.5.14 DISTURBANCE YEAR 2

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

2.5.15 DISTURBANCE 3

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

2.5.16 DISTURBANCE YEAR 3

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

2.5.17 TREATMENT 1

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

For initial 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.

2.5.18 TREATMENT YEAR 1

Record the year in which TREATMENT 1 occurred.

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

2.5.19 TREATMENT 2

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

2.5.20 TREATMENT YEAR 2

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

2.5.21 TREATMENT 3

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

2.5.22 TREATMENT YEAR 3

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

2.5.23 PHYSIOGRAPHIC CLASS

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

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

2.5.24 PRESENT NONFOREST LAND USE

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 2.1 and 2.4 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.

RM (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.

2.6**RM** CONDITION STATUS CHANGE

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

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

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

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

3.0 SUBPLOT INFORMATION

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

3.0.1**RM** SUBPLOT DESCRIPTION INTRODUCTION

This chapter describes the data items that will be collected on each of the 4 subplots on a plot (Subplot Description record, appendix A.2). Complete the following variables in this section for 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 Section 2).
- The old subplot was established ≤ 24 feet of the 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.

Tolerance on newly established plots:
Subplot: ± 8 feet
Microplot: ±1 foot

3.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

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

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

3.2 SUBPLOT/MACROPLOT STATUS

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

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

1 Sampled – at least one accessible forest land condition present on subplot
2 Sampled – no accessible forest land condition present on subplot
3 Nonsampled

3.3 SUBPLOT NONSAMPLED REASON

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

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

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

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

protocols for plot replacement.

03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, 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 1.5).

05 Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.

10 Other – This code is used whenever a 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.

3.4 SUBPLOT CENTER CONDITION

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

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

3.5 MICROPLOT CENTER CONDITION

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

When collected: All microplots 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

3.6 SUBPLOT SLOPE

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

- If slope changes gradually across the subplot, record an average slope.
- If slope changes across the subplot but the slope is predominantly of one direction, code the predominant slope percentage rather than the average.
- If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill where most of the area lies.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/MACROPLOT STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

3.7 SUBPLOT ASPECT

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction.

SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope.

- If aspect changes gradually across the subplot, record an average aspect.
- If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.
- If the subplot falls on or straddles a canyon bottom or narrow ridge top, code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT/MACROPLOT STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values:

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

3.8 SNOW/WATER DEPTH

Record to the nearest 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/MACROPLOT STATUS = 1)
Field width: 2 digits (x.y)
Tolerance: +/- 0.5 ft
MQO: At the time of measurement (no MQO after initial date of visit)
Values: 0.0 to 9.9

3.9 SUBPLOT/MACROPLOT CONDITION LIST (CORE OPTIONAL)

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

When collected: All forested Phase 3 plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1000 to 9876

3.9.1**RM** ROOT DISEASE SEVERITY RATING (Collected only in ID and MT)

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

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

When collected: Subplot/Macroplot Status = 1
Field width: 1 digit.
Tolerance: ±1 class.

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.

4.0 BOUNDARY REFERENCES

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

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

4.1 REFERENCE PROCEDURE

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

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

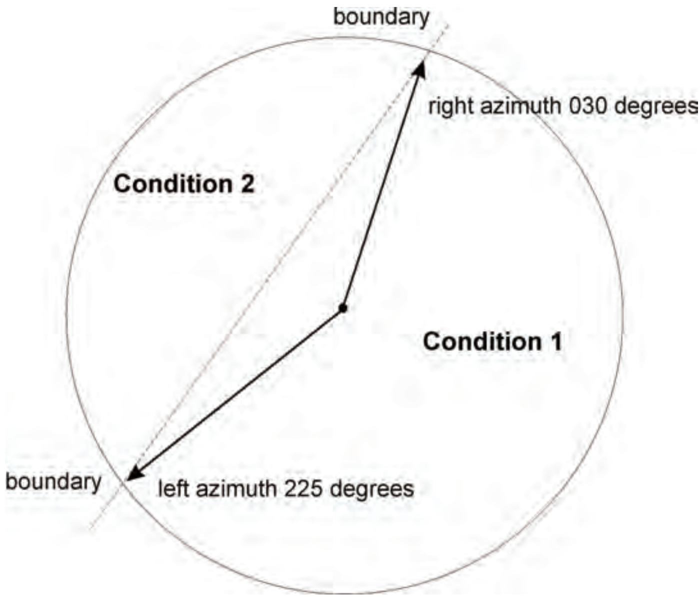


Figure 15. How to measure a straight boundary on a microplot, subplot, or macroplot.

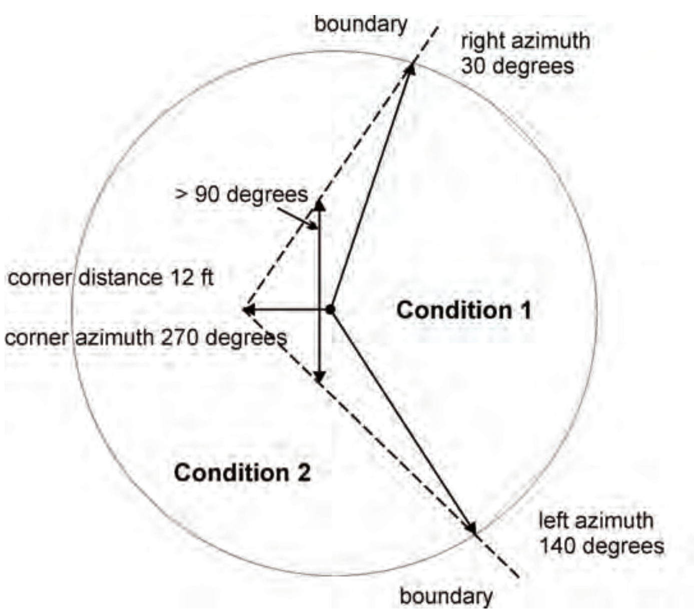


Figure 16. How to measure a boundary with a corner on a subplot or macroplot.

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

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

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

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

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

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

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

4.2 BOUNDARY DATA

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

4.2.1 SUBPLOT NUMBER

Record the code corresponding to the number of the subplot.

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

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

4.2.2 PLOT TYPE

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

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

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

4.2.3 BOUNDARY CHANGE

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

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

Values:

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

4.2.4 CONTRASTING CONDITION

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot or macroplot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line. See section 3.0 for subplot data.

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

4.2.5 LEFT AZIMUTH

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

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

4.2.6 CORNER AZIMUTH

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

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

4.2.7 CORNER DISTANCE

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

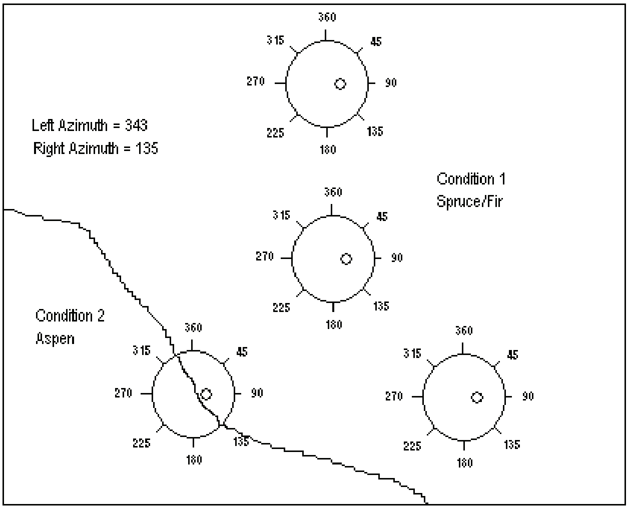
When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 2 digits
Tolerance: +/- 1 ft
MQO: At least 90% of the time
Values:

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

4.2.8 RIGHT AZIMUTH

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

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



RM Figure 16.1. Condition Boundary Map Example:

5.0 TREE AND SAPLING DATA

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

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

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

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

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

Once tallied, dead trees over 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 as measured from the base of the tree to 4.5 feet.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

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

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 degrees from subplot center and continue clockwise around the subplot. Repeat this sequence for trees on the microplot and again on the annular plot.

5.1 SUBPLOT NUMBER

Record the subplot number where the tree occurs.

When Collected: All live tally trees $\geq$ 1.0 in DBH/DRC and standing dead tally trees $\geq$ 5.0 in DBH/DRC
RM When Collected: Record for every line of data.
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot

2 North subplot
3 Southeast subplot
4 Southwest subplot

5.2 TREE RECORD NUMBER

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

If TREE RECORD NUMBERs are not assigned in the field, record 000.

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.

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

RM Subplot tally
Standing over the subplot center stake, start at 001° azimuth and rotate clockwise numbering sequentially all tally trees 5.0-inches and greater, beginning with TREE RECORD NUMBER 001. For example, the first tally tree is coded 001, the second tree is 002, and so on. If a tree tallied on the microplot during the previous inventory has grown to 5.0 inches DBH/DRC, it will be tallied on subplot this inventory.

RM Microplot tally
Next, standing over the microplot center stake, begin at 001° azimuth and rotate clockwise to number the live tallied saplings; begin

numbering where the subplot tally tree numbers left off.

Assign nontallied site trees to the nearest subplot and give the tree the next available tree number following the tally tree numbers.

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
RM When collected: All tally trees and nontallied site trees, including through growth (new trees ≥ 5.0 in DBH/DRC) on the formerly centered microplot, and dead tally trees ≥ 5.0 in DBH/DRC
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000 or 001 to 999

5.3 CONDITION CLASS NUMBER

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 17).

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

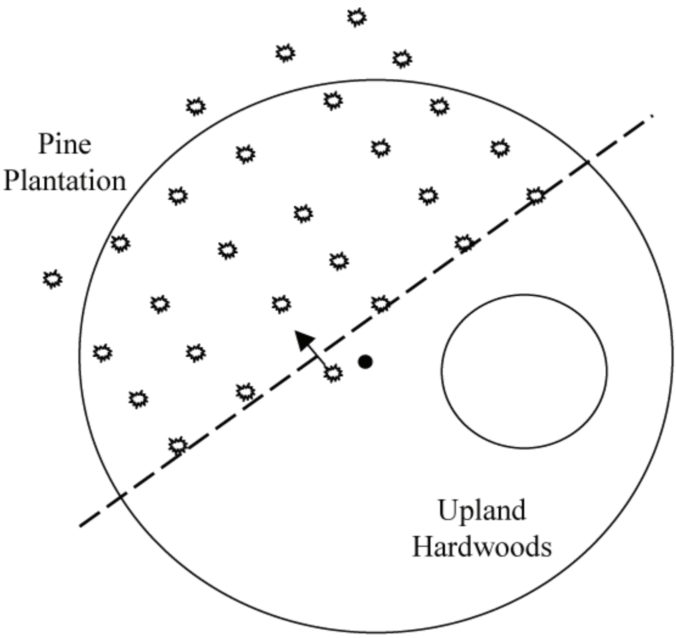


Figure 17. Ragged CONDITION CLASS boundary and tree condition class designation.

5.4 AZIMUTH

Record the AZIMUTH from the subplot center (for trees greater than or equal to 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 (Appendix 3). The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

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

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

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

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
RM When collected: All tally trees and nontallied site trees, including through growth (new trees ≥ 5.0 in DBH/DRC) on the formerly centered microplot, and dead tally trees ≥ 5.0 in DBH/DRC
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

5.5 HORIZONTAL DISTANCE

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

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

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

RM Remeasure and P3 plots: use the same distances as previously recorded. If the previous crew made an obvious error (recorded 1.0' instead of 10.0'), record the 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
RM When collected: All tally trees and nontallied site trees, including through growth (new trees ≥ 5.0 in DBH/DRC) on the formerly centered microplot, and dead tally trees ≥ 5.0 in DBH/DRC
Field width: 3 digits (xx.y)
Tolerance: Microplot: +/- 0.2 ft
Microplot woodland species: +/- 0.4 ft
Subplot: +/- 1.0 ft; RM +/- .1 foot for > 23 ft
Subplot woodland species: +/- 2.0 ft

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

5.6 PREVIOUS TREE STATUS

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

When collected: On remeasurement plots (SAMPLE KIND = 2), all previously tallied trees ≥ 1.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

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

5.7 PRESENT TREE STATUS

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

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

0 No status –- tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous inventory,

currently is not tallied due to definition or procedural change, or is not tallied due to natural causes. Requires RECONCILE code = 5-9.

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

2 Dead tree -- any dead tree (new, remeasured, or ingrowth), regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural or land clearing activity, and are assumed not to have been utilized.
RM This also includes down mortality trees.

3 Removed - a tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree is assumed to have been utilized.

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

5.7.1 RECONCILE

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

When Collected: On SAMPLE KIND = 2; all new live tally trees ≥ 1.0 in DBH/DRC (PRESENT TREE STATUS = 1 and no PREVIOUS TREE STATUS), all new dead tally trees ≥ 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 or reversions – either a new tally tree not qualifying as through growth or a new tree on land that was formerly nonforest and now qualifies as forest land (reversion or encroachment).
2 Through growth – new tally tree 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.
4 Missed dead – a dead tree missed at previous inventory that is dead now.

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

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

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot/subplot/macroplot. For example, if a live remeasurement tree shrinks below the 5.0 inch DBH/DRC, then record the following combination of codes: PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 0, RECONCILE = 5. If a live measured tree shrinks below the 5.0 inch threshold on the subplot and is currently greater than or equal to 1.0 inch on the microplot, then record PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 1. Record all required items for a tally sapling. Use the tree coding guide in Appendix 8 to determine the national coding method for remeasurement trees.

5.7.2 STANDING DEAD

Record the code that describes whether 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 as measured from the base of the tree to 4.5 feet. See Figures 18-20 for examples.

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

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

For western woodland species (Appendix 3) with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For western woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 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)
RM When collected: All dead tally trees.
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

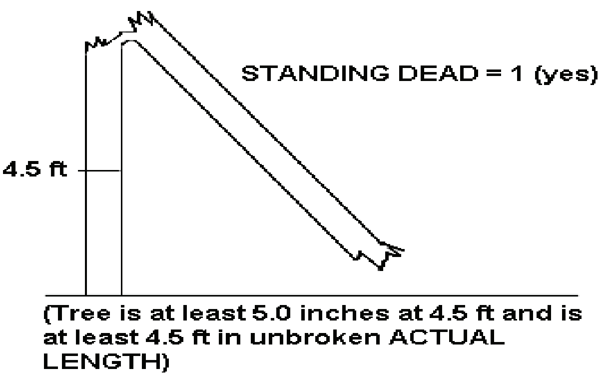


Figure 18. Example of an unbroken bole to 4.5 feet.

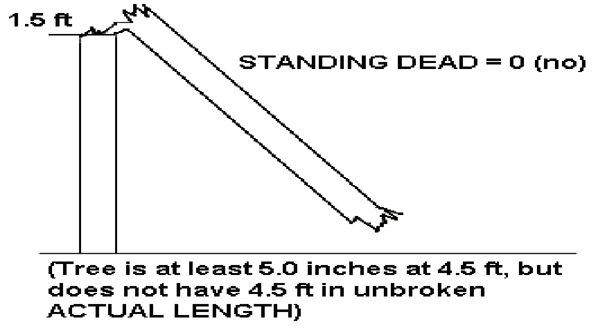


Figure 19. Example of an unbroken length of < 1.5 feet.

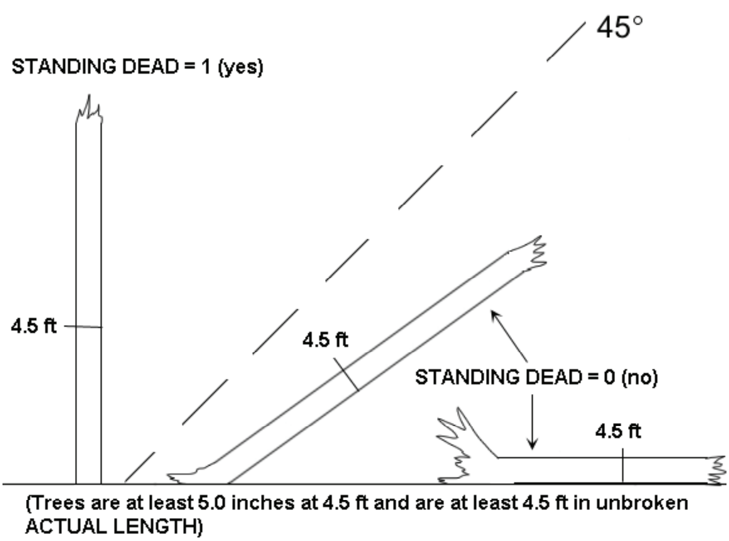


Figure 20. Other examples of dead trees.

5.7.3 MORTALITY (CORE OPTIONAL)

(Also see MORTALITY YEAR - item 5.22)
Record a mortality code for any tree that was live within the past five years but has died, regardless of cause of death. This information is needed to correctly assign volume information to the proper component of volume change.

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).
RM When collected: 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.
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:

0 No - tree does not qualify as mortality.
1 Yes – tree does qualify as mortality

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

5-needle pines:	Within past 5 years - some foliage remaining, >75% twigs and > 30% branches left; bark intact. More than 5 years - no foliage remaining, <75% of twigs left, many large limbs gone, much bark sloughing (except small trees).
Ponderosa pine:	Within past 5 years - some foliage remaining, >50% twigs and most branches left; most bark intact. More than 5 years - no foliage remaining, <50% of twigs left or branches left, most large limbs gone, much bark sloughing (except small trees).
Spruce:	Within past 5 years - some foliage remaining, >30% twigs and >50% of branches left; little bark sloughing. More than 5 years - no foliage remaining, <30% of

twigs left or >50% branches left, most large limbs gone, bark sloughing (except small trees).

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

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

5.8 SPECIES

Record the appropriate SPECIES code from the list in Appendix 3. If you encounter a species not listed in Appendix 3 and are not sure if it should be tallied as a tree, consult your Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use code 0299 for unknown dead conifer, 0998 for unknown dead hardwood when the genus or species codes cannot be used, and 0999 for other or unknown live tree. The generic code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. This is often the case with standing dead trees on newly established plots. In this case use the sample collections procedures described earlier in this paragraph. The species code list in Appendix 3 includes all tree species tallied in the Continental U.S. and Alaska. Species designated East/West are commonly found in those regions, although species designated for one region may occasionally be found in another. Species marked as Woodland designate species where DRC is measured instead of DBH. Species that have an "X" in the Core column are tallied in all regions. All other species on the list are "core optional".

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
RM When collected: All tally trees and nontallied site trees, including through growth (new trees ≥ 5.0 in DBH/DRC) on the formerly centered microplot, and 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
Values: See Appendix 3

5.9 DIAMETER

Diameters are measured at either breast height (DBH) or at the root collar (DRC). Species requiring DRC, referred to as woodland species, are denoted with a "w" in Appendix 3. Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-foot radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-foot radius subplots.

When Collected: All live tally trees > 1.0 in DBH/DRC and standing dead tally trees > 5.0 in DBH/DRC
RM When collected: All remeasurement trees
Field width: 4 digits (xxx.y)
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
For woodland species: +/- 0.2 in per stem
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: 001.0 to 999.9

5.9.1 PREVIOUS DIAMETER AT BREAST HEIGHT

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

5.9.2 DIAMETER AT BREAST HEIGHT (DBH)

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

RM - Measuring DBH. Tree diameter for 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.

RM - 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.

RM - 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 make a tree note.

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

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.

RM - 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.

For downed trees where it is not possible to get a diameter tape around the tree, estimate the diameter to the nearest inch by measuring ½ the circumference (with diameter tape) of the tree and multiply by 2.

Special DBH situations:

1. Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. 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 21). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 24 A-C). DBH is measured for each stem at 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 24-E), the rules in the next paragraph apply.

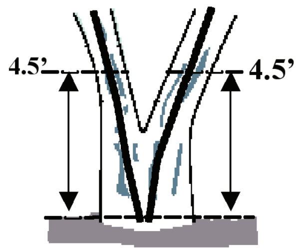


Figure 21. Forked below 1.0 ft.

- Trees forked between 1.0 foot and 4.5 feet. Trees forked in this region are also counted as separate trees (Figure 22), but only one distance and azimuth (to the central stump) is used for all (Figure 24 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in clockwise order (from front to back when one stem is directly in front of another). The DBH of each fork is measured at a point 3.5 feet above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 feet, the limiting distance is the same for all forks--they are either all on, or all off the plot.

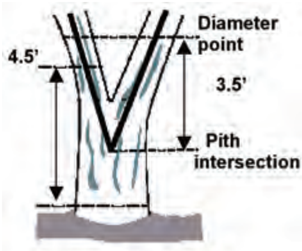


Figure 22. Forked between 1.0-4.5 ft.

Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 feet above the common pith intersection (Figure 24-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 24-E (i.e., do not move the point of diameter the entire 3.5 feet above the first fork).

- **Trees forked at or above 4.5 feet.** Trees forked in this region count as one single tree (Figure 23). If a fork occurs at or immediately above 4.5 feet, measure diameter below the fork just beneath any swelling that would inflate DBH.

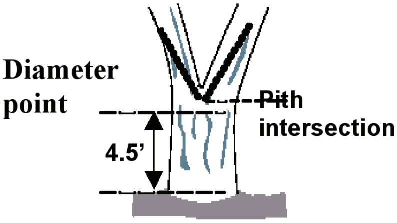


Figure 23. One tree.

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.

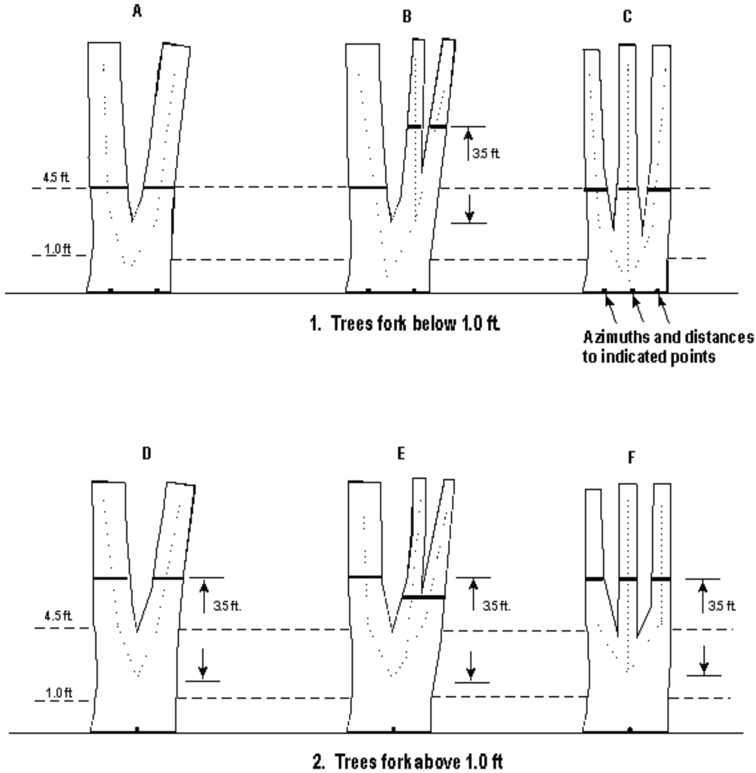


Figure 24. Summary of where to measure DBH, distance, and azimuth on forked trees.

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 25).

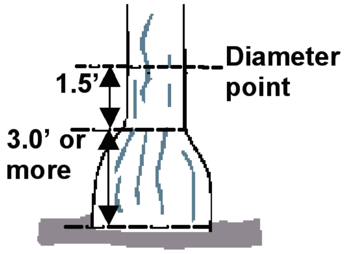


Figure 25. Bottleneck tree.

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

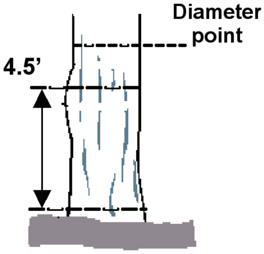


Figure 26. Tree with swelling.

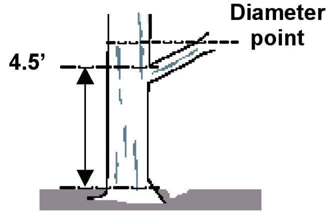


Figure 27. Tree with branch.

5. **Tree on slope:** Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 28).

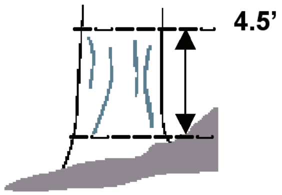


Figure 28. Tree on a slope.

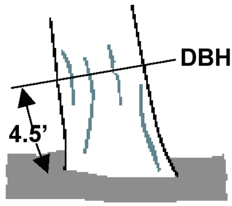


Figure 29. Leaning tree.

6. **Leaning tree:** Measure diameter at 4.5 feet from the ground along the bole. The 4.5-foot distance is measured along the underside face of the bole (Figure 29).

7. **Turpentine tree:** On trees with turpentine face extending above 4.5 feet, estimate the diameter at 10.0 feet above the ground and multiply by 1.1 to estimate DBH outside bark.

8. **Independent trees that grow together:** If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Estimate the diameter of each, set the “DIAMETER CHECK” code to 1, and explain the situation in the notes.

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 30). If a tree has a localized abnormality (gouge, depression, etc.) at the point of point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 26 and 27).

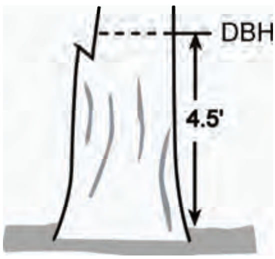


Figure 30. Tree with part of stem missing.

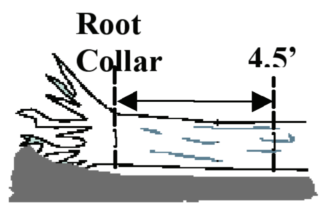


Figure 31. Tree on the ground.

10. Live windthrown tree: Measure from the top of the root collar along the length to 4.5 feet (Figure 31).

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

- If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 32)

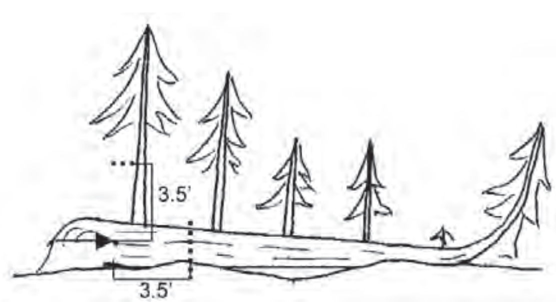


Figure 32. Down tree above duff.

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

- If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet point from the stump along the main bole, treat that branch as part of the main down bole.

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

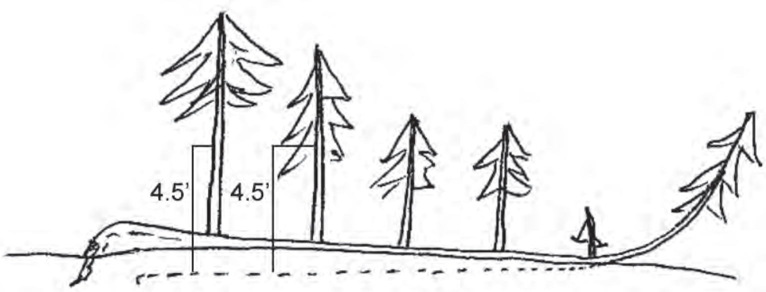


Figure 33. Down tree below duff.

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

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

5.9.3 PREVIOUS DIAMETER AT ROOT COLLAR

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.

5.9.4 DIAMETER AT ROOT COLLAR (DRC)

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

Measuring woodland stem diameters: Before measuring DRC, remove the loose material on the ground (e.g., litter) but not mineral soil. Measure just above any swells present, and in a location so that the diameter measurements are a good representation of the volume in the stems (especially when trees are extremely deformed at the base).

RM - Stems must be at least 1 foot in length and at least 1.0 inch in diameter 1 foot up from the stem diameter measurement point to qualify for measurement. Whenever DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme number of limbs), stems may be estimated and recorded to the nearest 1.0-inch class. Additional instructions for DRC measurements are illustrated in Figure 35. For each qualifying stem of the woodland tree, measure and record DRC STEM DIAMETER (5.9.4.1) and indicate the DRC STEM STATUS (5.9.4.2)

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

RM - Woodland species diameter groupings.

- Saplings (microplot) -- single-stemmed trees between 1.0 inch and 4.9 inches in diameter, and multistemmed trees with a cumulative DRC between 1.0 inch and 4.9 inches in diameter. For multistemmed trees, measure all stems 1.0 inch in diameter and larger, and at least 1 foot in length, to compute DRC (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

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

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 35 and 35a

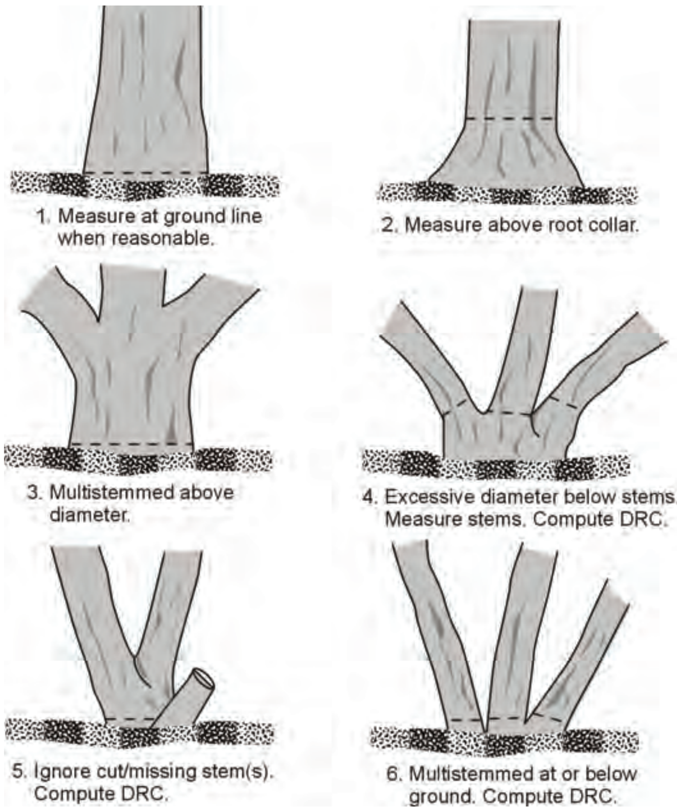
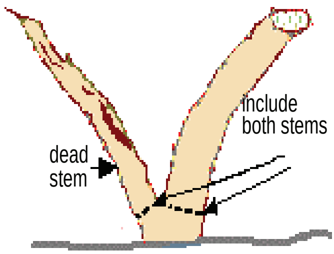
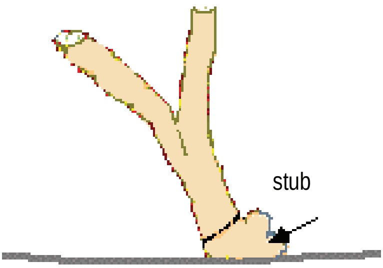


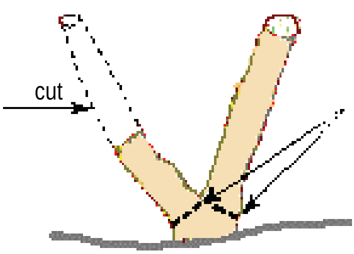
Figure 35. How to measure DRC in a variety of situations.



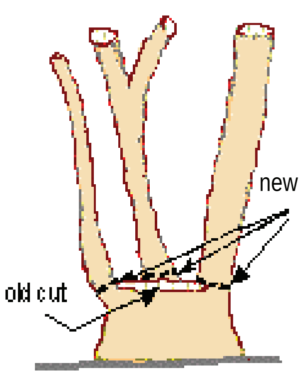
1. Measure the diameter of a dead stem if it is essentially intact, the volume is sound, and the stem represents a portion of the main tree form. Include the stem diameter in the DRC computation and record the appropriate percent of dead volume.



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.

RM Figure 35a . How to measure DRC in a variety of situations.

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

Use the following formula to compute DRC:

DRC = SQRT [SUM (stem diameter^2)]
Round the result to the nearest 0.1 inch. For example, a multi-stemmed woodland tree with stems of 12.2, 13.2, 3.8, and 22.1 would be calculated as:

DRC = SQRT ($12.2^2 + 13.2^2 + 3.8^2 + 22.1^2$)
= SQRT (825.93)
= 28.74
= 28.7

RM - 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.

RM - Recording DRC. Record the calculated DRC as a three-digit code to the last whole 0.1 inch.
If using field forms, record individual stem diameters for multistemmed woodland trees on the “Multistemmed Woodland Species Tally” supplemental form (appendix A.8). Note: If a multistemmed woodland tree has dead stems, place a “2” on the “Multistemmed Woodland Species Tally” form next to the individual diameter measurement of the dead stem.

5.9.4.1 DRC STEM DIAMETER

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

When collected: All stems on woodland tree species that are at least 1 ft in length and at least 1.0 in in diameter 1 ft up from the stem diameter measurement point
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.2 in per stem
MQO: At least 95% of the time
Values: 001.0 to 999.9

5.9.4.2 DRC STEM STATUS

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

When collected: All stems on woodland tree species that are at least 1 ft in length and at least 1.0 in in diameter 1 ft up from the stem diameter measurement point
Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 live stem
2 dead stem

5.10 PAST NUMBER OF STEMS

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

When collected: Value is preprinted for SAMPLE KIND = 2 locations
Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 99

5.11 CURRENT NUMBER OF STEMS

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

When collected: For tallied woodland species with at least one stem 1.0 in in diameter or larger; includes woodland species tallied on the microplot
Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 99

5.12 DIAMETER CHECK

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

When Collected: All live tally trees ≥ 1.0 in DBH/DRC and standing dead tally trees ≥ 5.0 in DBH/DRC
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

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

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

5.13 ROTTEN/MISSING CULL

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.

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

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

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

Use the following guidelines to estimate tree cull:

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

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

2. Woodland species, ≥ 5.0-inches DRC

   a. Rotten volume may be identified by visual evidence of cubical rot, or indirectly detected by a dull hollow sound when the segment is struck by the flat side of a hatchet. Also, if a tree segment is suspected of containing rot, bore into the segment (but only far enough to detect rot), and check the core for punky wood.

   b. Missing volume includes the merchantable portion of the tree that has been cut (e.g., for posts or firewood) or is broken off. If cutting or other damage (fire scar) on a stem is so old that the tree stem or stub has deteriorated or has been replaced with new growth, do not deduct volume for the original loss.

When Collected: CORE: All live tally trees ≥ 5.0 in DBH/DRC
CORE OPTIONAL: All live and standing dead tally trees ≥ 5.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 90% of the time
Values: 00 to 99

5.14 TOTAL LENGTH

Record the TOTAL LENGTH of the tree, to the nearest 1.0 foot from ground level to the top of the tree. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a missing top (top is broken and completely detached from the tree), estimate what the total length would be if there were no missing top. Forked trees should be treated the same as unforked trees.

When Collected: Phase 2 CORE - All live tally trees ≥ 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

RM When collected: All tally trees ≥1.0 inch DBH/DRC.
Phase 3 CORE - All live 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

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

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

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

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

5.14.1**RM** PAST TOTAL TREE LENGTH

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

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

5.15 ACTUAL LENGTH

For trees with missing tops (top on live trees is completely detached; top on dead trees is greater than 50 percent detached from the tree). If the top is intact, this item may be omitted. Record the ACTUAL LENGTH of the tree to the nearest 1.0 foot from ground level to the break. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader (dead or alive) is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk). Forked trees should be treated the same as unforked trees.

When Collected: Phase 2 CORE - All live and standing dead tally trees (with broken or missing tops) ≥ 5.0 in DBH/DRC
RM When collected: All tally trees ≥1.0 inch DBH/DRC.

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

5.15.1**RM** PAST ACTUAL TREE LENGTH

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

When collected: Verify for remeasure trees ≥1.0 inch DBH/DRC.
Field width: 3 digits.
Tolerance: ±10% of true length.

5.16 LENGTH METHOD

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

When Collected: Phase 2 CORE - All live tally trees ≥ 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
RM When collected: 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, relascope, tape)
2 Total length is visually estimated, actual length is measured with an instrument
3 Total and actual lengths are visually estimated

5.17 CROWN CLASS

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

When Collected: All live tally trees ≥ 1.0 in DBH/DRC

RM When collected: All live tally trees ≥ 1.0-in DBH/DRC, and nontallied site trees.
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time
Values:

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

2 Dominant – trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.

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

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

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

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

5.18 UNCOMPACTED LIVE CROWN RATIO (Phase 2 – CORE OPTIONAL, Phase 3 – CORE)

Record the UNCOMPACTED LIVE CROWN RATIO to the nearest one percent. UNCOMPACTED LIVE CROWN RATIO is the percentage of actual tree length supporting live foliage (or in cases of extreme defoliation should be supporting live foliage) that is effectively contributing to tree growth. UNCOMPACTED LIVE CROWN RATIO is determined by the ratio of live crown length to actual tree length (Figure 37). Live crown length is determined from the last live foliage at the crown top (dieback in the upper portion of the crown is not part of the live crown) to the “base of live crown”. Many times there are additional live branches below the “base of live crown”. These branches are only included if they have a basal diameter greater than 1 inch and are within 5 feet of the base of the obvious live crown. The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole.

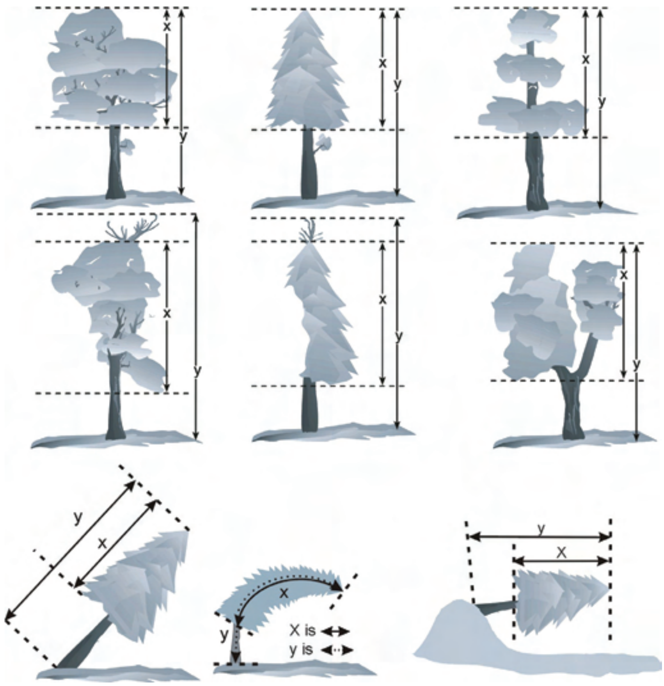


Figure 37. UNCOMPACTED LIVE CROWN RATIO examples.

Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by actual tree length. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live twig for saplings. The live crown base for saplings is different from trees 5.0 inches DBH/DRC and larger; the 1-inch/5-foot rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (Figure 38).
RM Note: See the definitions for sprig and twig in the glossary.

When collected: Phase 2 (CORE OPTIONAL) – All live tally trees ≥ 5.0 in DBH/DRC
RM When collected: All tally trees ≥1.0 inch DBH/DRC.
Phase 3 (CORE) – All live tally trees ≥ 1.0 in DBH/DRC
Field width: 2 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 00 to 99 percent

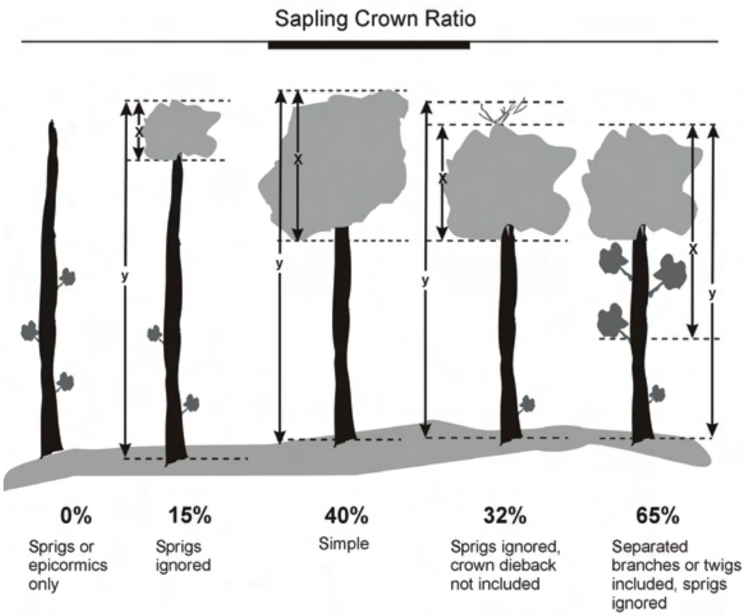


Figure 38. Sapling ratio determination examples.

5.19 COMPACTED CROWN RATIO

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 inch and larger, to the nearest one percent. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in the case of extreme defoliation should be supporting live foliage) and is expressed as a percentage of the actual tree length. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2 feet between whorls, do not compact crowns any tighter than the 2-foot spacing (Figure 39). Figure 40 shows an example of COMPACTED CROWN RATIO on a leaning tree.

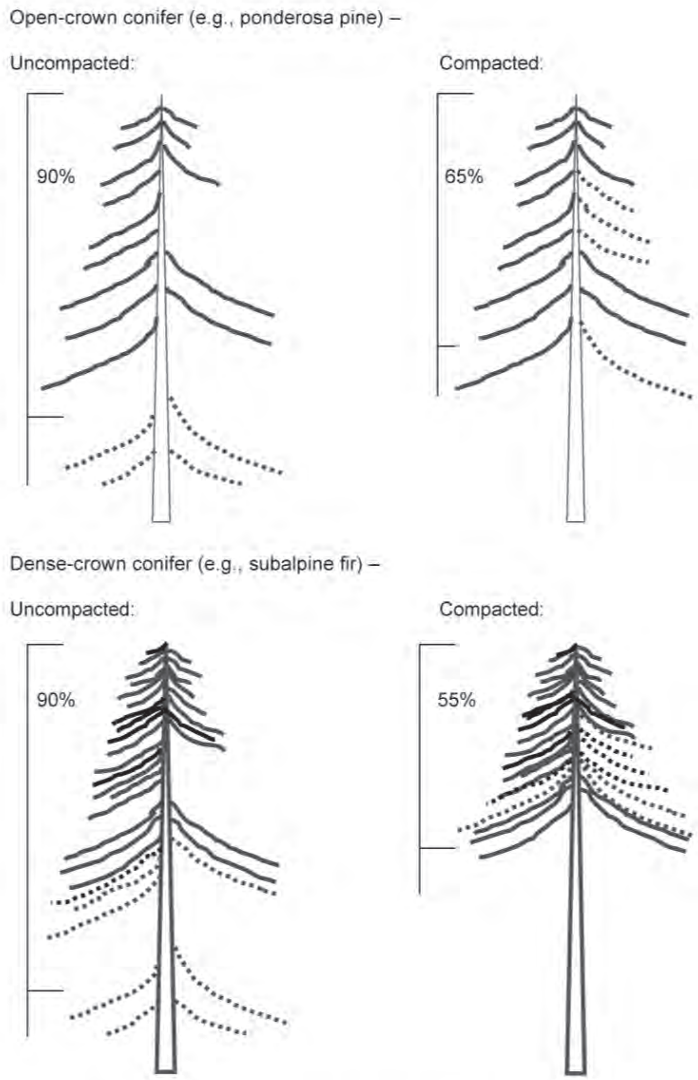


Figure 39. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of conifers.

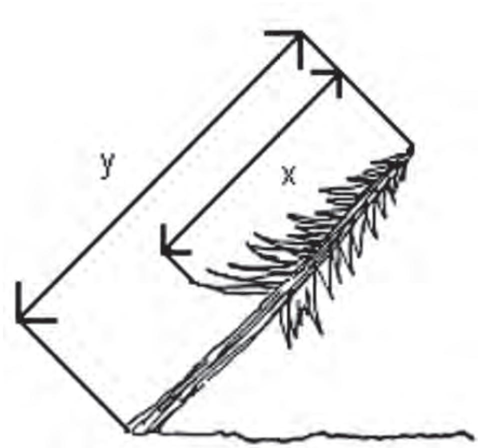


Figure 40. COMPACTED CROWN RATIO on a leaning tree. CROWN RATIO = (x/y)100.

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 41).

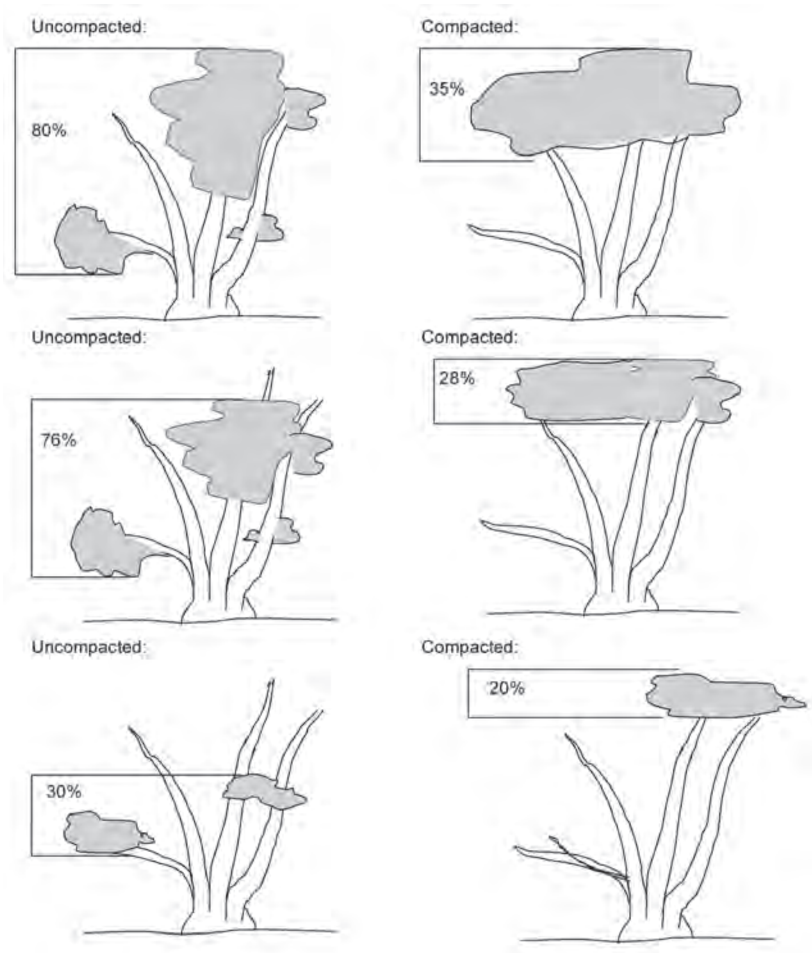


Figure 41. Examples of and comparison between COMPACTED CROWN RATIO and UNCOMPACTED LIVE CROWN RATIO of western woodland species.

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

5.20 TREE DAMAGE - (CORE OPTIONAL)

(Not used in RM)
Note: Figures 42 -51 are not used

5.20.1**RM** DAMAGE AGENT 1,2,3

Record a primary, secondary, and tertiary damage code for all live tally trees, 5.0-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 tally tree and nontallied site tree, select the most significant damages present. Record the most significant damage as the primary, the next as secondary, etc. Avoid selecting one of the "other, unidentified, or unknown" categories unless a more specific category cannot be determined. For insect and disease damage, base the ordering of most significant, second most significant, etc.

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

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

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

It is not necessary to code damage or typical form defects common to a particular tree species (such as forking on a cottonwood or juniper tree).

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

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

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

Definitions for Damage codes are described as follows:

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

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

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

Bark Beetles (codes 11, 15, 16): These are phloem-feeding insects that bore through the bark and create extensive galleries between the bark and the wood. Symptoms of beetle damage include fading or discolored tree crown (yellow or red), pitch tubes or pitch streaks on the bark, extensive egg galleries in the phloem, boring dust in the bark crevices or at the base of the tree. Bark chipping by woodpeckers may be conspicuous. Examples of tree damaging bark beetles include species of the genera 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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Excessive Crook, Sweep, or Taper (code 79): Record for timber species trees 5.0-inches DBH and larger that have abnormal diameter to height ratios, or severe sweeps and crooks that will significantly reduce the tree's quality or affect its marketable products.

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

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

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

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

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

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

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

When collected: All live tally trees ≥ 5.0 in DBH/DRC
Field Width: 2 digits
Tolerance: No errors
MQO: No errors 2 of 3 agents, 80% of the time.

5.20.2**RM** DAMAGE AGENT 2

Used the procedures described for DAMAGE AGENT 1.

5.20.3**RM** DAMAGE AGENT 3

Used the procedures described for DAMAGE AGENT 1.

5.21 CAUSE OF DEATH

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

When Collected: CORE: SAMPLE KIND = 2 plots: all PREVIOUS TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3
CORE OPTIONAL: SAMPLE KIND = 1 plots; all MORTALITY = 1
RM When collected: All dead tally trees when MORTALITY = 1
Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time

Values:
10 Insect
20 Disease
30 Fire
40 Animal
50 Weather
60 Vegetation (suppression, competition, vines/kudzu)
70 Unknown/not sure/other - includes death from human activity not related to silvicultural or landclearing activity (accidental, random, etc.). TREE NOTES required.

80 Silvicultural or landclearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to landclearing activity)

5.22 MORTALITY YEAR (CORE OPTIONAL)

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

When Collected: Plots where SAMPLE KIND = 2: all PREVIOUS TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3.
RM When collected: All dead tally trees when MORTALITY = 1
Field width: 4 digits
Tolerance: +/- 1 year for remeasurement cycles of 5 years
+/- 2 years for remeasurement cycles of > 5 years
MQO: At least 70% of the time
Values: 1995 or higher

5.23 DECAY CLASS

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

When Collected: All standing dead tally trees > 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:

Table 1: Decay Class Table

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

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

5.24 LENGTH TO DIAMETER MEASUREMENT POINT (CORE OPTIONAL)

(Not used by RM)

5.24.1**RM** PERCENT VOLUME MISSING TOP

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

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.

5.25 ROUGH CULL (CORE OPTIONAL)

(Not used by RM)

5.25.1**RM** SOUND DEAD
5.25.2**RM** FORM DEFECT

For each live tally tree 5.0 inches DBH/DRC and larger, record the total percentage of cubic-foot volume that is cull due to sound dead material or tree form. Record 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, and rough cull includes only sound dead.

The merchantable portion of a woodland species is defined as the portion of a tree, up to a minimum top diameter of 1.5-inches, and includes all merchantable segments above the place(s) of diameter measurement; do not include sections below the place(s) of diameter measurement. Merchantable segments are stems or branches that are a minimum of 1.0 foot in length and at least 1.5 inch in diameter (at the top). Branches and stems smaller than 1.5 inches in diameter (or portions of branches and stems smaller than1.5 inches in diameter, such as tips of branches) are not included when determining volume loss.

Refer to local defect guidelines (RM - Seen Defect Guidelines) as an aid in determining cull volume for various damages such as crook, fork, sweep, pistol butt, etc. Small trees (5-9 inches for softwoods and 5-11 inches for hardwoods) that have poor form and are not expected to ever produce merchantable material should be coded 99% rough cull.

Use the following guidelines to estimate tree cull:

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

   a. 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.

   b. 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.

2. Woodland species tally trees ≥ 5.0-inches DRC

   a. 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.

   b. Sound dead volume includes dead volume only in the merchantable portion; dead ends of branches and stems less than 1.5 inches in diameter are not part of the merchantable portion of the tree, and therefore are not included in determining percent dead volume. Be careful not to overestimate dead volume for trees with numerous dead branch tips.

When Collected: All tally trees ≥ 5.0 inches diameter (FORM DEFECT to be recorded only on live timber species ≥ 5.0 inches diameter, 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.
Tolerance: +/- 10 %

MQO: At least 90% of the time
Values: 00 to 99

5.25.3**RM** PAST TREE CLASS

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.

5.25.4**RM** CURRENT TREE CLASS

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 5.25, 5.25.1, and 5.25.2

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.

5 Hard dead

- a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).

6 Soft dead

- a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

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

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

Accounting plots:

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

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

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

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

1. Radial growth and age tree selection
   a. Timber species

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

      Age information is required for a minimum of one tree in each diameter class and species, and for one timber species seedling count per species (i.e., one count for each 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	0 - .9"
	1 – 2.9" (age at base): age only	1 – 2.9"
	3 – 4.9" (age at BH): age and radial	3 – 4.9"
2	5 – 8.9"	5 – 8.9"
		9 – 10.9"
3	9 – 12.9"	11 – 12.9"
	13 – 16.9"	13 – 16.9"
	17 – 20.0"	17 – 20.9"
	etc.	etc.

      1. Select the first timber species tallied by diameter class and species type across the subplots. Obtain age for all trees selected, and radial growth for trees in the 4-inch

diameter class and larger. For the seedling class, select the first seedling group counted in each species on the location and obtain AGE only.

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

Table 2: Age and Radial coding guide

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

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

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

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

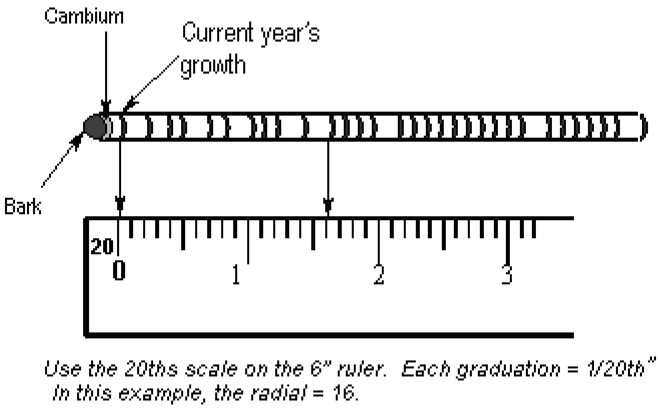
The “Control, Pop-Up” function on the Portable Data Recorder will show, by line number, the correct trees to age and obtain radial information for.

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.

b. Woodland species. For each woodland genus group tallied across the subplots, select one representative live tally tree within each size class tallied (refer to STAND-SIZE CLASS).

2. Radial-growth measurement (timber species, 4-inch diameter class and larger). Measure the last 10 years of RADIAL GROWTH from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. To reduce bias, bore on the side of the tree facing the subplot center, where reasonable. Using a ruler with a 1/20-inch scale, measure the length of the core from the inner edge of the last (most recent) complete summer wood ring to the inner edge of the summer wood ring 10 years previous (figure 52).

Figure 52. Radial growth measurement.



3. Age tree measurement (timber species).

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

- 2-inch diameter class (1.0- to 2.9-inches DBH) age trees: Measure and record total tree age. Use the following methods:

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

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

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

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

- **4-inch diameter class and larger age trees (3.0 to 4.9 inches DBH)**: Measure and record breast height (BH) age. Count the growth rings from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. Bore on the side of the tree facing the subplot center, where reasonable. Count every growth ring from the bark end to the pith (center of the tree). If the age is difficult to determine (e.g., due to indistinct rings, presence of rot), or if the pith was not reached (e.g., diameter too big to bore to center) estimate the age and note in the comments column.

4. **Radial-growth and age tree coding.**

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

When collected: All tally trees where RADIAL GROWTH and/or TREE AGE is collected.
Field width: Radial growth: 2 digits.
Tree age: 3 digits
Tolerance: Radial growth: ± 1
Tree age: ± 10%

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

When collected: All tally trees where RADIAL GROWTH and/or TREE AGE is collected.
Field width: 1 digit.
Tolerance: No errors.

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.

5.26 MISTLETOE CLASS (CORE OPTIONAL)

Rate all live conifer species, except juniper species, greater than or equal to 1.0 inch diameter for dwarf mistletoe (Arceuthobium spp.) infection. Use the Hawksworth six-class rating system: divide the live crown into thirds, and rate each third using the following scale (Figure 53):

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

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

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

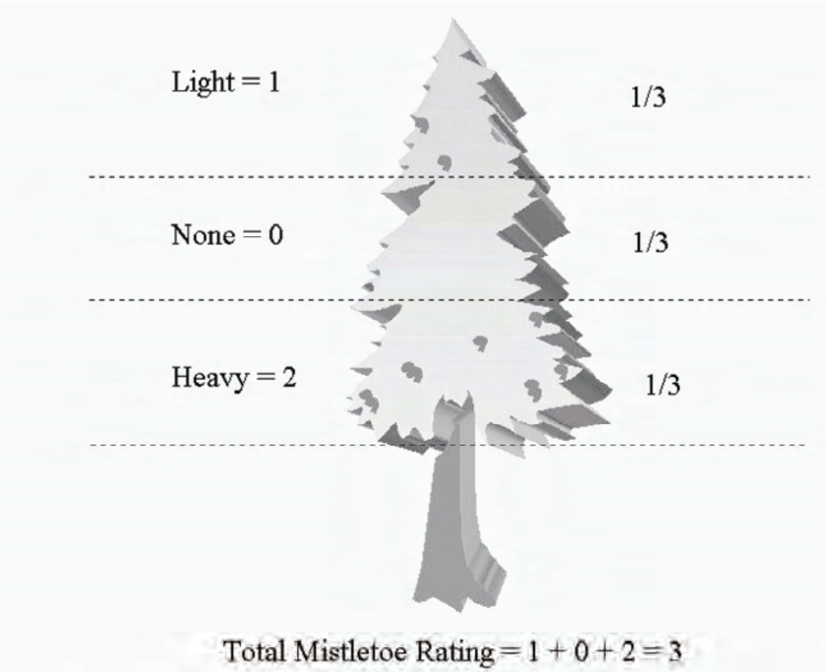


Figure 53. Example of the Hawksworth six-class rating system.

5.27 TREE NOTES

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

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

6.0 SEEDLING DATA

Stocking and regeneration information are obtained by counting live seedlings within the 6.8-foot radius microplot located 90 degrees and 12.0 feet from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH/DRC in order to qualify for tallying. For 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.

6.1 SUBPLOT NUMBER

Use the procedures outlined in Section 3.1.

When Collected: All counts of seedlings

6.2 SPECIES

Use the procedures outlined in Section 5.8.

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

6.3 CONDITION CLASS NUMBER

Use the procedures outlined in Section 2.0.

When Collected: All counts of seedlings

6.4 SEEDLING COUNT

On each microplot, record the number of live tally tree seedlings, by species and condition class. Count up to five individuals by species: estimate the total count if there are more than five individuals of any given species in any given condition class. When seedlings are distributed evenly on a microplot, a suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiply by four (given that there is only one condition class on the microplot). Repeat for each species. Conifer seedlings must be at least 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
RM When Collected: Each accessible forest land condition class on each microplot, not required for formerly centered microplot.
Field width: 3 digits
Tolerance: No errors for 5 or less per species; +/- 20% over a count of 5
MQO: At least 90% of the time
Values: 001 through 999

6.4.1**RM** COUNT CHECK

Record this code for seedling counts that are estimated.

When collected: Any time seedlings recorded
Field width: 1 digit.
Tolerance: No errors.
MQO: At least 90% of the time
Values: 0 or 1

Code	Definition
0	seedlings counted accurately.
1	seedling count estimated.

6.4.2**RM** SEEDLING AGE

Record this code to identify which seedlings were aged.

When collected: All seedling count records.
Field width: 1 digit.
Tolerance: No errors.
MQO: At least 90% of the timeValues: 0 or 1

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

6.4.3**RM** TOTAL SEEDLING AGE

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

When collected: When SEEDLING AGE = 1
Field width: 3 digits
Tolerance: ± 5 %
MQO: At least 90% of the time.
Values: 1 to 999

7.0 SITE TREE INFORMATION

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

7.1 SITE TREE SELECTION

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

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

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

1. **RM Site tree requirements**

   a. 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.

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

2. RM 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 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.

7.2 SITE TREE DATA VARIABLES

7.2.0**RM** TREE RECORD NUMBER

See procedures detailed in section 5.2

When collected: All site trees.

7.2.1 CONDITION CLASS LIST

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

7.2.2 SPECIES

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

When Collected: All site trees
Values: See Appendix 4

7.2.3 DIAMETER

Use the same procedures described in Section 5.9.

When Collected: All site trees

7.2.4 SITE TREE LENGTH

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

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

7.2.4.1**RM** SITE TREE

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 and larger:

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

Code	Site Tree
0	Not selected as a site tree
1	Suitable site tree
2	Unsuitable site tree

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

See procedures in section RM 5.25.7

When collected: All site trees.

7.2.5 TREE AGE AT DIAMETER

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

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

7.2.6 SITE TREE NOTES

Record notes pertaining to an individual site tree.

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

7.2.7 SUBPLOT NUMBER (CORE OPTIONAL)

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

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

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

7.2.8 AZIMUTH (CORE OPTIONAL)

Record the AZIMUTH from the subplot center; 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

7.2.9 HORIZONTAL DISTANCE (CORE OPTIONAL)

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

When Collected: All site trees
Field width: 4 digits (xxx.y)
Tolerance: +/- 5 ft
MQO: At least 90% of the time
Values: 0001 to 2000

8.0RM FIELD LOCATION REFERENCE ITEMS

This section describes items for referencing and relocating the plot center (PC), 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.

The information documented on the Field Location Reference record (Appendix A.1) will be used to find the plot in subsequent inventories. The information must be legibly recorded in understandable terms. Procedures for photographing the PC are provided at the end of this chapter.

The PDR reference file contains 6 menus that must be completed for each forested plot.

8.1 Plot Reference Data
8.2. Truck Coordinates
8.2 Reference Point
8.4 PC Witness Trees
8.5 Noxious Weeds
8.6 Travel Notes

(8.1 through 8.6: PDR Reference Menus)

8.7 Editing (Field Location Reference Record and Print-outs only)
8.8 Truck to PC and Boundary Maps (Field Location Reference Record only)
8.9 Photographing the Plot

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.

8.1RM IDENTIFICATION ITEM

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 Section 1 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, the full last names, and crew number of the cruiser(s) and the recorder.

8.1.1**RM** INVENTORY PHASE

For each Reference file (PDR option 10) record the whether the plot is either a P2 or P3 plot.

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

Values	Definition
2	P2 Plot
3	P2/P3 Plot

8.1.2**RM** OWNER CONTACT

Record if it was necessary to contact the landowner to access the location.

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

8.1.3**RM** 4 X 4

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

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

8.1.4**RM** ATV

Record if ATV use **would be helpful** (not necessarily used) to access the location.

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

8.1.5**RM** LOCKED GATE

Record if it was necessary to go through a locked gate to access the location.

When collected: All plots
Field width: 1 letter

Tolerance: No errors
Record "Y" for yes and "N" for no

8.1.6**RM** PHOTO PROJECT

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).

When collected: All plots
Field width: Up to 10 characters
Tolerance: No errors

8.1.7**RM** PHOTO ROLL

Record the roll number of the aerial photography as shown along the edge of the photos.

When collected: All plots
Field width: Up to 8 characters
Tolerance: No errors

8.1.8RM PHOTO NUMBERS

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.

When collected: All plots
Field width: Up to 15 characters
Tolerance: No errors

8.1.9**RM** PHOTO SCALE

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).

When collected: All plots
Field width: 5 digits
Tolerance: No errors

8.1.10**RM** PHOTO YEAR

Record the year of the aerial photography used for the location shown along the top edge of the photos.

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

8.1.11**RM** TOWNSHIP

Record the township where the plot 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.

When collected: All plots
Field width: 3 digits
Tolerance: No errors

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

8.1.12**RM** 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

8.1.13**RM** RANGE

Record the Range where the plot 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.

When collected: All plots
Field width: 3 digits
Tolerance: No errors

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

8.1.14**RM** 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

8.1.15**RM** SECTION

Record the Section where the plot 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.

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

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

8.1.16**RM** OWNER

Record “private landowner” or the name of the managing agency into the PDR. If a private landowner is listed record the address and telephone number, if known, on the plot packet and under Owner Information on the Field Location Reference form (this information is used for quality control and future crew access and remains confidential). Do not enter the owner’s name or any other confidential information such as addresses or phone numbers into the PDR.

When collected: All plots

8.2**R**M TRUCK/ATV COORDINATES

Record the Zone, Easting, and Northing for the Truck Coordinates on the Field Location Reference Record and electronically in the associated Reference file in the PDR. If ATV’s are used, also record the coorinates of where the ATV’s were parked (optional).

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 Appendix E for use on the Garmin GPS unit.

Collect GPS data at the following sites.

Truck Coordinates:

8.2.1**RM** GPS UNIT: Refer to Section 1.16.3

8.2.2**RM** TRUCK/ATV UTM ZONE: Refer to Section 1.16.9

8.2.3**RM** TRUCK/ATV UTM EASTING: Refer to Section 1.16.10

8.2.4**RM** TRUCK/ATV UTM NORTHING: Refer to Section 1.16.11

8.3**RM** GPS DISTANCE AND AZIMUTH TO PC FROM TRUCK

Record the GPS distance and azimuth from the truck parking spot to the PC. This helpful information can be used to give the next crew an idea of the hike and time involved to complete the plot. Record on the Field Location Reference Form only.

When collected: All field visited plots

8.4**RM** REFERENCE POINT

Record the following data for the Reference Point (RP) 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” (section 0.1.3.1RM).

Remeasurement locations and P3 plots: use the reference point from the previous inventory if it still meets the RP tree requirements.

Tagging the RP -- Attach to the RP, when appropriate, aluminum tags labeled “RP CO # LOC #”. If a tree is selected as the RP, nail aluminum tags on two sides of the tree approximately 6 feet above ground level, and with at least 1 inch of nail exposed (to allow for tree growth between inventories). Nail one of the tags facing in the general route of approach to the RP. Nail a third tag at ground level facing towards the plot center. If the RP is in a place where there is a high probability that a tag at 6 feet above the ground may be vandalized, only attach the tag at ground level and make a note on the Field Location Reference record.

Note: Use steel nails only on woodland species, 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 plot center; 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.

8.4.1**RM** PHOTO SCALE RECIPROCAL (PSR)

If a baseline is used to calculate azimuth and distance from the RP to PC, record the PSR used (See section 0.1.4RM Establishing a Baseline and Scale). If the GPS is used to obtain the azimuth and distance from the RP to PC, record 00000.

When collected: All plots
Field width: 5 digits

PSR = Horizontal Ground Distance/Photo Distance

8.4.2**RM** RP SPECIES

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.”

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

8.4.3**RM** RP 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.

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.

8.4.4**RM** RP AZIMUTH

Record the azimuth to the nearest degree from the RP to the PC.

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

8.4.5**RM** RP HORIZONTAL DISTANCE

Record the horizontal distance, to the nearest foot, from the RP to the PC.

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.

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.

8.4.6**RM** RP SLOPE DISTANCE

Record the slope distance, to the nearest foot, from the RP to the PC.

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.

8.4.7**RM** REMARKS 1-8

Record a description of the RP and its 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)

8.4.8**RM** GPS UNIT: See Section 1

8.4.9**RM** GPS ERROR: See Section 1

8.4.10**RM** NUMBER OF READINGS: See Section 1

8.4.11**RM** RP UTM ZONE: See Section 1

8.4.12**RM** RP UTM EASTING: See Section 1

8.4.13**RM** RP UTM NORTHING: See Section 1

8.5**RM** PC 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 PC with two witness trees (“X” and “Y” trees). On remeasurement locations, use previous witness trees where possible. Preferably, witness trees should be as follows:

“X” Tree

- On the extension of the RP to PC azimuth.
- Close to the PC

“Y” Tree

- As close to PC as possible.
- At a right angle to the X tree to PC azimuth.

“X and Y” trees should be

- Not likely to die within 10 years.
- A species easily located on the site (e.g., an Engelmann spruce in a lodgepole pine forest type). Note: Avoid aspen, if possible; if aspen is used, be sure it is off the subplot.
- At least 5.0-inches DBH for timber species and 3.0-inches DRC for woodland trees if possible.

If no live trees are within the vicinity of the PC (e.g., clearcut, burn area) 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
If the X and Y are trees with the minimum diameter requirements, label 2 silver, aluminum tags; one with “X CO # LOC #” (with the actual county and location numbers) and the other “Y CO # LOC #”. Nail each tag to the appropriate witness tree, at ground level, with the tags facing the PC stake. In addition a 2.5” x 2.5” black, heavy aluminum, diamond shaped tag (labeled as above) is placed at approximately 6 feet facing the PC on the X tree only. On multistemmed woodland witness trees, nail the tag at ground level to the stem measured for DRC, or at ground level below the stem measured for DRC if the stem originates above ground level. Note: When driving nails into trees, leave at least 1 inch exposed to allow for tree growth.

If a small tree is used, or if the location is in close proximity to private residence, do not tag. Use a paint pen, mark the witness tree in an inconspicuous location, and record a note under the “Witness Trees” section of the Field Location Reference record. Do not place tags or drive nails into any Populus species (Aspen/Cottonwood)

Where the witness is not a tree (e.g., rock), mark the object with a paint pen or tag the alternative landmark in some manner if appropriate, with aluminum tags, to aid field crews in re-locating the PC in future remeasurement inventories.

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

8.5.1**RM** X SPECIES
8.5.2**RM** Y SPECIES

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 PC 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 describe the X/Y tree/landmark in the notes fields. When a tally 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 nontally tree species is used, use the appropriate vegetation species code.

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

8.5.3**RM** X DIAMETER
8.5.4**RM** Y 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.

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

8.5.4**RM** X DISTANCE
8.5.5**RM** Y DISTANCE

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

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

8.5.6**RM** X AZIMUTH
8.5.7**RM** Y AZIMUTH

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

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

8.5.8**RM** NOTES

Record any notes that may assist crews locating/distinguishing the witness trees in the future.

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

8.6**RM** 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 Section 9 (Understory Vegetation Description).

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

8.7**RM** TRAVEL DESCRIPTION

Record road directions 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 in the vicinity of the RP. This space can also be used to record other travel information that will assist in relocating the plot (e.g., hiking distance and direction from parking location to RP, specific information about obtaining keys for locked gates).

Road directions should contain (at a minimum):
- Road names and route numbers.
- Major landmarks.
- Mileages between roads/landmarks.
- Direction of turns at intersections/forks.
- Description of parking area.

Walking directions should contain (at a minimum):
- Trail name/number if applicable.
- Drain/creek/stream/ridge etc., name if applicable.
- Major landmarks.
- Approximate distances between trails, creeks, landmarks etc.

8.8**RM** EDITING- Field Location Reference record only

Field Crew Edit

After measuring the plot , but before leaving the site, the crew supervisor must review the field forms to make sure the required data are correctly and legibly recorded. Examine the following checklist, as a minimum, for completeness:

- All photo work complete, with RP 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.

8.9**RM** FIELD LOCATION AND BOUNDARY MAP

On the top of the backside of the Field Location Reference record draw, including any helpful landmarks (old jeep roads, hiking/game trails, the RP, slope, cliffs, or openings), a map of the general area of the PC (including truck parking spot if possible) to aid future crews in locating the PC.
If boundaries occur within any of the 4 subplots draw a map indicating approximate boundary lines, labeling each condition class, on the backside of the Field Location Reference record.

8.10**RM** PHOTOGRAPHING THE PLOT

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

Procedure: At plot center, stand over the PC stake and take four photographs in the cardinal directions (i.e., take pictures facing north, east, south, and west). Include a placard in each picture, placed in the lower right-hand corner of the view, indicating the State, county, location number, year, and direction faced (N, E, S, or W). Be sure the placard is legible, but do not allow the placard to obstruct the view of the site.

It is best to take the photographs in moderate light conditions; shade the lens from direct sunlight when necessary, and use the flash in dark conditions (dense stands, cloudy days, etc.).

In the case of an all-nonforest location, if the crew identifies the PC on the ground, the PC will be photographed in the 4 cardinal directions. If the crew does not identify the PC but determines the approximate location or conditions of the PC, the crew will photograph the PC area (e.g., crew determines PC is on a hill side, but the hill is covered with nonforest species). Crews are required to get as close as necessary to positively identify the nonforest condition. Photographs taken when crew does not occupy the PC should be representative of the sample area.

9.0RM 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".

9.0.1**RM** 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.

9.0.2RM 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

9.0.3RM 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 $\geq$ 6.1 feet. Assign a percent cover to each plant group that occurs within each layer.

General Definitions

1. 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

      a. seedlings and saplings of both timber and woodland tally species (refer to tally tree species list , appendix 3),
      b. tree species defined by Little, 1979, as trees but not listed as tally species in appendix 3, such as serviceberry, some 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).

2. 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.

3. 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.

Entries to be Recorded:

9.1**RM** VEGETATION PROFILE DATA

Understory Vegetation Description record -- Part I

(Species List by Cover and Layer). If Recording the data on the Understory Vegetation Description record (paper), start with the first space (or block) under each plant group heading. Do not leave blank spaces above or between individual species listed.

9.1.1**RM** 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.

When Collected: All subplots where subplot center is in an accessible forest land condition and at least one lifeform has at least 5% canopy cover.
Field Width: varies with alphanumeric code
Tolerance: No errors

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 "<u>Plantus</u> <u>exampleis</u>" 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. 2000. 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:

<u>Trees</u>

Salix spp. (Salix) – (willow - Those species defined by Little, 1979, as trees; refer to Appendix C for the tree species list)

<u>Shrubs</u>

Rosa spp. (ROSA5) -- wild rose
Salix spp. (Salix) – Those species not defined by Little, 1979, as tree form; refer to Appendix C for the tree species list.

<u>Forbs</u>

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

Grasses

All Grasses – except habitat type indicators (these must be identified to the species level).

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 plot 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

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.

9.1.2**RM** 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.

When Collected: All subplots where subplot center is in an accessible forest land condition and at least one lifeform has at least 5% canopy cover.
Field Width: 3 digits
Tolerance: ± 10%

9.1.3**RM** SPECIES VEGETATION LAYER

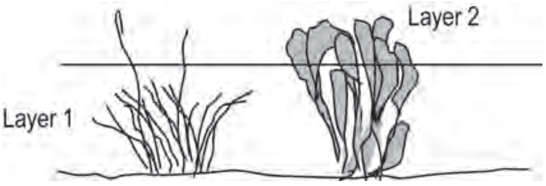
In this part (Part I), a plant species can be assigned only one vegetation layer. If a plant species is found in more than one layer, assign the enire plant to the layer where most of the cover occurs and not the layer the sead head tops out. (note: this layer is not necessarily where most of the plant bio-mass occurs). If a plant species occurs equally in more than one layer, record the highest layer where it occurs. (See the “Agave Rule”)
For each individual plant species recorded, assign one of the vegetation layers. These layers illustrate the vertical diversity of the

1/24-acre subplot.

When Collected: All subplots where subplot center is in an accessible forest land condition and at least one lifeform has at least 5% cover.
Field Width: 3 digits
Tolerance: No errors

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.



9.2**RM** UNDERSTORY LIFEFORM DATA

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 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.

9.2.1**RM** TREE COVER LAYER

Record a total canopy coverage for trees in Layer 1 (0-1.5’) to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist on the subplot in this layer, record 000

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.2**RM** TREE COVER LAYER 2

Record a total canopy coverage for trees in Layer 2 (1.6-6’) to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.

Field Width: 3 digits
Tolerance: ± 10%

9.2.3**RM** TREE COVER LAYER 3

Record a total canopy coverage for trees in Layer 3 (>6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.4**RM** TREE COVER – AERIAL VIEW

For the total cover, examine the total canopy cover of all tree species 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. If this lifeform does not exist anywhere on the subplot, record 000.

When collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.5**RM** SHRUB COVER LAYER 1

Record a total canopy coverage for shrubs in Layer 1 (0-1.5') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist on the subplot in this layer, record 000

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.6**RM** SHRUB COVER LAYER 2

Record a total canopy coverage for shrub in Layer 2 (1.6-6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.7**RM** SHRUB COVER LAYER 3

Record a total canopy coverage for shrubs in Layer 3 (>6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.
When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.8**RM** SHRUB COVER – AERIAL VIEW

For the total cover, examine the total canopy cover of all shrub species 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. If this lifeform does not exist anywhere on the subplot, record 000.

When collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.9**RM** FORB COVER LAYER 1

Record a total canopy coverage for forbs in Layer 1 (0-1.5') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist on the subplot in this layer, record 000

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.10**RM** FORB COVER LAYER 2

Record a total canopy coverage for forbs in Layer 2 (1.6-6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.11**RM** FORB COVER LAYER 3

Record a total canopy coverage for forbs in Layer 3 (>6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.12**RM** FORB COVER – AERIAL VIEW

For the total cover, examine the total canopy cover of all forb species 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. If this lifeform does not exist anywhere on the subplot, record 000.

When collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.13**RM** GRAMINOID COVER LAYER 1

Record a total canopy coverage for graminoids in Layer 1 (0-1.5') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist on the subplot in this layer, record 000

When Collected: All subplots where subplot center is in an accessible forest land condition.

Field Width: 3 digits
Tolerance: ± 10%

9.2.14**RM** GRAMINOID COVER LAYER 2

Record a total canopy coverage for graminoids in Layer 2 (1.6-6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.15**RM** GRAMINOID COVER LAYER 3

Record a total canopy coverage for graminoids in Layer 3 (>6') to the nearest percent. If lifeform cover cannot be determined for this layer due to snow cover, record 999. If this lifeform does not exist in this layer, record 000.

When Collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.2.16**RM** GRAMINOID COVER – AERIAL VIEW

For the total cover, examine the total canopy cover of all graminoid species 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. If this lifeform does not exist anywhere on the subplot, record 000.

When collected: All subplots where subplot center is in an accessible forest land condition.
Field Width: 3 digits
Tolerance: ± 10%

9.3**RM** 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. See table 10.1 for a complete list of valid species for each state.

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.

This information is recorded on the PDR in the separate “Option 10” (RM Plot Reference Items) file found in the TALLY MAIN MENU. Please see Item “E” in Section 8 – Field Location Reference Items

Table 9.1

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Abutilon theophrasti	Velvetleaf	ABTH		X						
Achnatherum brachychaetum	Puna grass	ACBR5	X							
Acroptilon repens	Russian knapweed	ACRE3	X	X	X	X	X	X	X	X
Aegilops cylindrica	Jointed goatgrass	AECY	X	X	X			X		
Alhagi maurorum	Camelthorn	ALMA12	X	X			X	X		
Alternanthera philoxeroides	Alligator weed	ALPH	X							
Ambrosia tomentosa	Skeletonleaf bursage	AMTO3			X					X
Anoda cristata	Crested anoda	ANCR2		X						
Anthemis arvensis	Scentless chamomile	ANAR6		X						
Anthemis cotula	Mayweed chamomile	ANCO2		X			X			
Arctium minus	Burdock	ARMI2		X						X
Artemisia absinthium	Absinthium	ARAB3		X						
Asphodelus fistulosus	Onionweed	ASFI2						X		
Bromus tectorum	Downy brome	BRTE		X						
Capsella bursa-pastoris	Shepherds purse	CABU2		X						
Cardaria chalepensis	Lenspod whitetop	CACH10	X							
Cardaria draba	Hoarycress	CADR	X	X	X	X	X	X	X	X
Cardaria pubescens	Hairy whitetop	CAPU6	X							X
Carduus acanthoides	Plumeless thistle	CAAC	X	X						X
Carduus nutans	Musk thistle	CANU4		X	X		X	X	X	X
Carum carvi	Wild caraway	CACA19		X						
Cenchrus echinatus	Southern sandbur	CEEC	X							
Cenchrus spinifex	Coastal sandbur	CESP4	X							
Centaurea biebersteinii	Spotted knapweed	CEBI2	X	X	X	X	X	X	X	X
Centaurea calcitrapa	Purple starthistle	CECA2	X				X	X		
Centaurea debeauxii	Meadow knapweed	CEDE5		X	X					
Centaurea diffusa	Diffuse knapweed	CEDI3	X	X	X	X	X	X	X	X
Centaurea iberica	Iberian knapweed	CEIB	X				X			
Centaurea melitensis	Malta starthistle	CEME2					X	X		
Centaurea solstitialis	Yellow starthistle	CESO3	X	X	X	X	X	X	X	

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Centaurea sulphurea	Sicilian starthistle	CESU	X							
Centaurea triumfetti	Squarrose knapweed	CETR8	X	X			X		X	
Chondrilla juncea	Rush skeletonweed	CHJU	X	X	X	X	X			
Cichorium intybus	Chicory	CIIN		X						
Cicuta maculata	Water hemlock	CIMA2					X			
Cirsium arvense	Canada thistle	CIAR4	X	X	X	X	X	X	X	X
Cirsium vulgare	Bull thistle	CIVU		X				X		
Clematis orientalis	Chinese clematis	CLOR		X						
Conium maculatum	Poison hemlock	COMA2		X	X		X	X		
Convolvulus arvensis	Field bindweed	COAR4	X	X	X	X		X	X	X
Coronopus squamatus	Creeping watercress	COSQ	X							
Crupina vulgaris	Common crupina	CRVU2		X	X	X	X			
Cucumis melo	Dudaim melon	CUME	X							
Cynodon dactylon	Bermudagrass	CYDA							X	
Cynoglossum officinale	Houndstongue	CYOF		X		X	X			X
Cyperus esculentus	Yellow nutsedge	CYES		X						
Cytisus scoparius	Scotch broom	CYSC4			X					
Dipsacus fullonum	Teasel	DIFU2		X				X		
Dipsacus laciniatus	Cutleaf teasel	DILA4	-	X						
Drymaria arenarioides	Alfombrilla	DRAR7	X					X		
Eichhornia azurea	Anchored waterhyacinth	EIAZ2	X							
Eichhornia crassipes	Water hyacinth	EICR	X							
Elaeagnus angustifolia	Russian olive	ELAN		X				X		
Elymus repens	Quackgrass	ELRE4	X	X					X	X
Erodium cicutarium	Redstem filaree	ERCI6		X						
Euphorbia cyparissias	Cyprus spurge	EUCY2		X						
Euphorbia dentata	Toothed spurge	EUDE4			X					
Euphorbia esula	Leafy spurge	EUES	X	X	X	X	X	X	X	X
Euphorbia myrsinites	Myrtle spurge	EUMY2		X						
Euryops multifidus	Hawk's eye	EUMU	X							
Galega officinalis	Goats rue	GAOF					X			

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Halogeton glomeratus	Halogeton	HAGL	X	X				X		
Helianthus ciliaris	Texes blueweed	HECI	X							
Hesperis matronalis	Dames rocket	HEMA3		X						
Hibiscus trionum	Flower of an hour	HITR		X						
Hieracium aurantiacum	Orange hawkweed	HIAU		X	X	X				
Hieracium ceaspitosum	Meadow hawkweed	HICA10			X	X				
Hieracium floribundum	Yellow devil hawkweed	HIFL3				X				
Hieracium piloselloides	Tall hawkweed	HIPI2				X				
Hydrilla verticillata	Hydrilla	HYVE3	X	X			X	X		
Hyoscyamus niger	Black henbane	HYNI		X	X		X	X		
Hypericum perforatum	St. Johnswort	HYPE		X		X	X			X
Ipomoea spp.	Morninglory	IPOMO	X							
Ipomoea triloba	Three lobed morningglory	IPTR2	X							
Iris pseudacorus	Yelloflag iris	IRPS				X				
Isatis tinctoria	Dyers woad	ISTI		X	X	X	X	X	X	X
Kochia scoparia	Mexican-fireweed	KOSC		X						
Lepidium latifolium	Pepperweed	LELA2		X	X	X	X	X	X	X
Lespedeza cuneata	Chinese lespedeza	LECU		X						
Leucanthemum vulgare	Oxeye daisy	LEVU		X		X				X
Linaria dalmatica	Dalmation toadflax	LIDA	X	X	X	X	X	X		X
Linaria genistifolia	Broomleaf toadflax	LIGE		X						
Linaria vulgaris	Butter and eggs	LIVU2		X	X	X	X	X		X
Lythrum salicaria	Purple loostrife	LYSA2	X	X	X	X	X	X	X	X
Lythrum virgatum	Wandlike loosestrife	LYVI3				X	X			
Medicago polymorpha	Burclover	MEPO3	X							
Milium vernale	Milium	MIVE3			X					
Myriophyllum spicatum	Eurasian watermilfoil	MYSP2		X	X	X	X	X		
Nardus stricta	Matgrass	NAST3			X					
Nassella trichotoma	Serrated tussock	NATR3	X							
Onopordum acanthium	Scotch thistle	ONAC	X	X	X		X	X	X	X
Onopordum tauricum	Bull cottonthistle	ONTA		X						

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Orobanche ramosa	Hemp broomrape	ORRA	X							
Panicum miliaceum	Wild proso millet	PAMI2		X						
Panicum repens	Torpedo grass	PARE3	X							
Peganum harmala	African rue	PEHA	X	X			X	X		
Pennisetum glaucum	Pearl millet	PEGL2		X						
Pennisetum setaceum	Green fountain grass	PESE3	-	-	-	-	X			
Portulaca oleracea	Common purslane	POOL	X							
Potentilla recta	Sulfer cinquefoil	PORE5		X		X	X			
Ranunculus acris	Tall buttercup	RAAC3				X				
Rorippa austriaca	Austrian fieldcress	ROAU	X				X			
Salvia aethiopis	Mediterranean sage	SAAE		X			X			
Salvinia molesta	Giant salvinia	SAMO5	X	X			X			
Saponaria officinalis	Bouncybet	SAOF4		X						
Senecio jacobaea	Groundsel	SEJA	X	X	X	X				
Senecio vulgaris	Old-man-in-the-spring	SEVU		X						
Setaria viridis	Green foxtail	SEVI4		X						
Sinapis arvensis	Charlock mustard	SIAR4		X						
Solanum carolinense	Carolina horsenettle	SOCA3	X				X			
Solanum elaegnifolium	Silverleaf nightshade	SOEL			X		X			
Solanum nigrum	Black nightshade	SONI		X						
Solanum rostratum	Buffalobur	SORO			X					
Solanum viarum	Tropical soda apple	SOVI2	X							
Sonchus arvensis	Perennial sowthistle	SOAR2	X	X	X		X			X
Sorghum almum	Perennial sorghum	SOAL					X		X	
Sorghum bicolor	Perennial sweet sudan	SOBI2					X		X	
Sorghum halepense	Johnsongrass	SOHA		X	X				X	
Sorghum propinquum	Sorghum	SOPR3					X			
Solanum physalifolium	Hoe nightshade	SOPH		X						
Sphaerophysa salsula	Austrian peaweed	SPSA3		X			X			
Striga spp.	Witchweed	STRIG	X							

SCIENTIFIC NAME	COMMON NAME	CODE	AZ	CO	ID	MT	NV	NM	UT	WY
Taeniatherum caput-medusae	Medusahead	TACA8		X			X		X	
Tamarix aphylla	Athel saltceder	TAAP						X		
Tamarix chinensis	Fivestamen tamarisk	TACH2								
Tamarix parviflora	Smallflower tamarisk	TAPA4		X			X	X		
Tamarix ramosissima	Saltceder	TARA		X			X	X		
Tamarix ssp.	Tamarisk	TAMAR2				X		X		X
Tanacetum vulgare	Tansy	TAVU		X		X				X
Trapa natans	Waterchestnut	TRNA	X							
Tribulus terrestris	Puncturevine	TRTE	X	X	X		X			
Tripleurospermum perforata	Scentless false mayweed	TRPE21		X						
Ulmus pumila	Siberian Elm	ULPU						X		
Verbascum blattaria	Moth Mullien	VEBL		X						
Verbascum thapsus	Mullein	VETH		X						
Zygophyllum fabago	Syrian beancaper	ZYFA			X					

15-feb. 2005 List generated from the PLANTS database

Key:

Weeds added

Weeds removed

Spelling/name changes

UNDERSTORY VEGETATION DESCRIPTION

Feb-00

STATE 04 MAP 811 CPN 147

COUNTY 15 LOC# 21

PART I

SUBPT	COND #	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

SUBPT	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
1	TREES	2	12	40	48
	SHRUBS	15	7	0	18
	FORBS	35	1	0	36
	GRASS	2	0	0	2
2	TREES	0	5	3	7
	SHRUBS	8	6	0	12
	FORBS	5	3	0	7
	GRASS	42	1	0	42
3	TREES	1	1	12	12
	SHRUBS	6	1	0	7
	FORBS	5	3	0	8
	GRASS	21	0	0	21
4	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 HEARTSHAPED LEAVES, BASAL

NOXIOUS WEEDS

SPECIES	PRESENT ON SUBPLOT? (Y OR N)			
(XXXXXXX)	1	2	3	4
EXTC	N	Y	N	N

Figure 56. Example of a completed understory vegetation description record.

9.4RM 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.

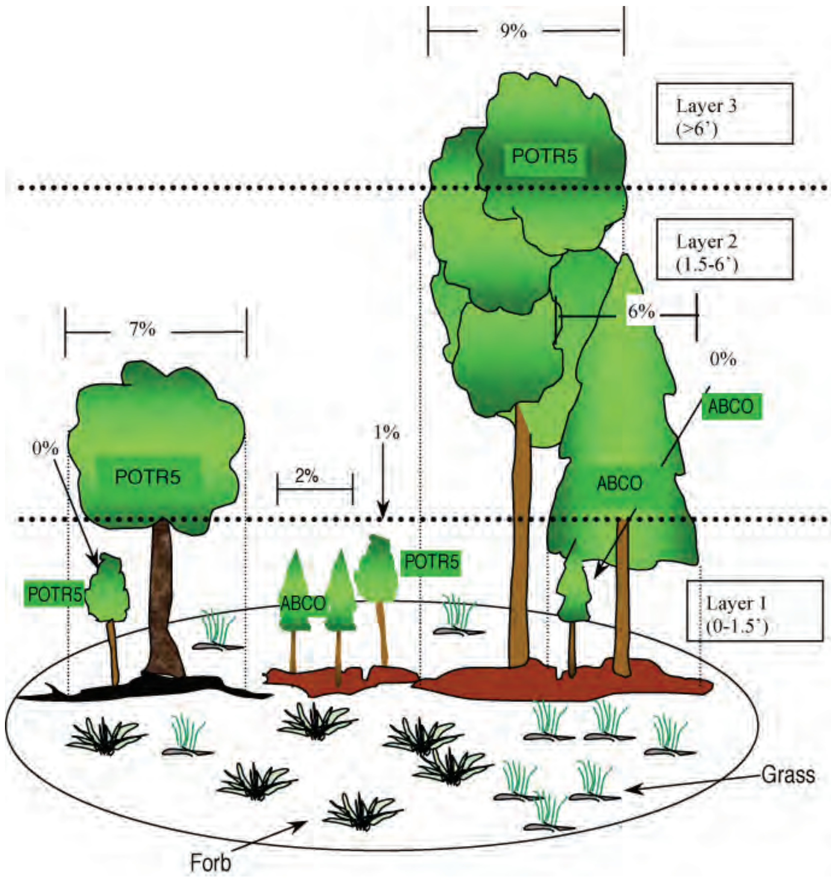
2. Fill Out an Unknown Identification Document (ID slip). These forms are located in the notebook included with the plant press. Fill out a form with the following information:

   ¤ 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 plot 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 Recreation, Heritage and Wilderness Resource (RHWR) Wilderness Manager. No archeological or vertebrate paleontological materials may be collected.

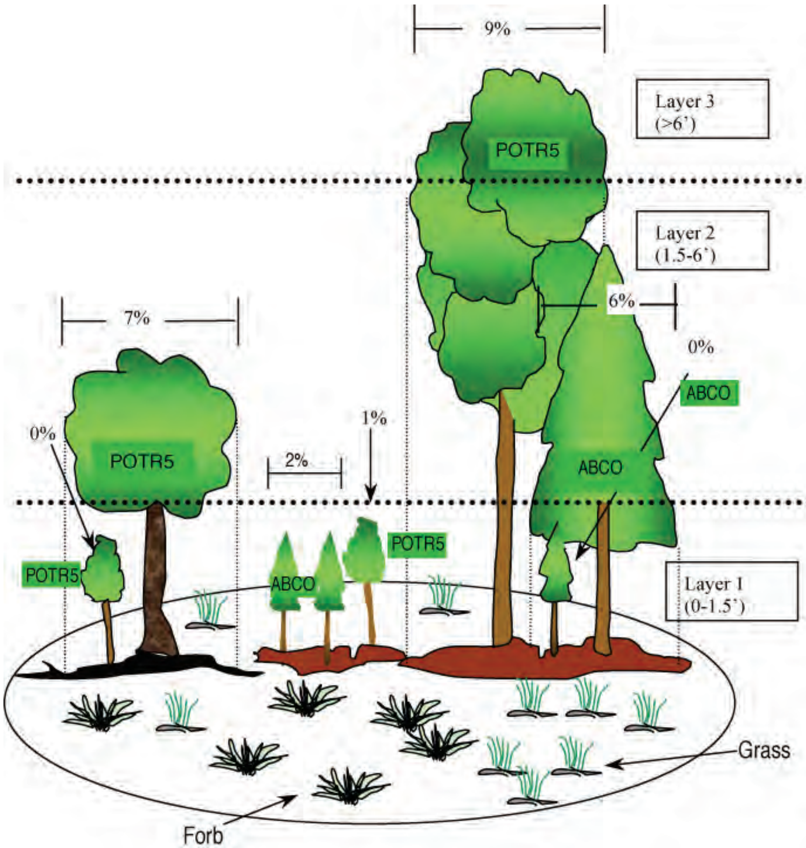
UNDERSTORY VEG EXAMPLES

Part I



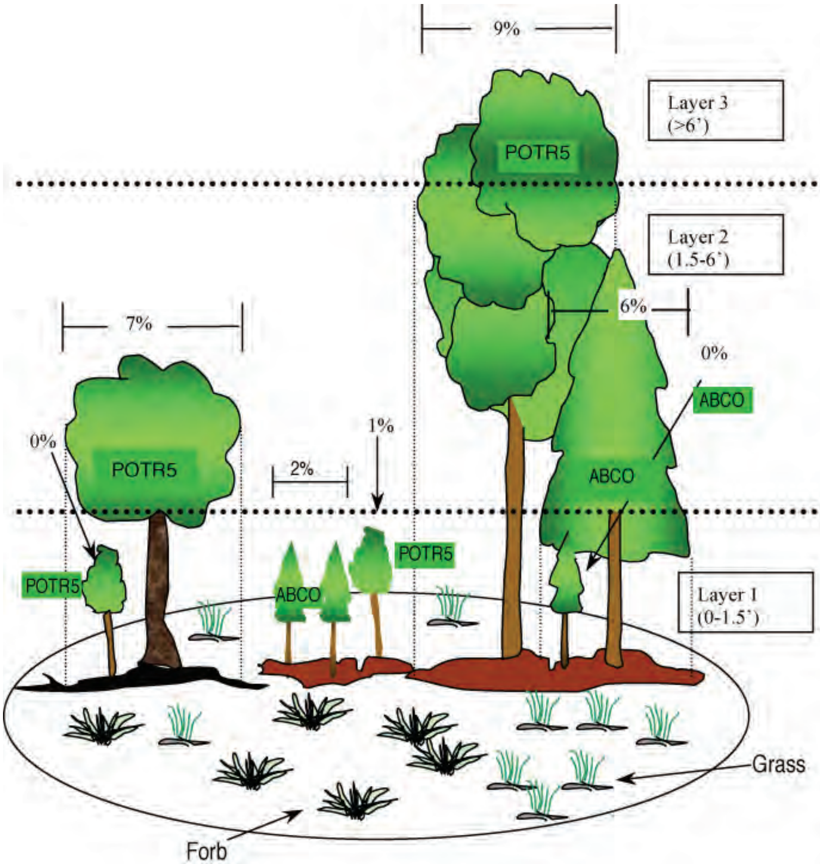
TREES			SHRUBS			FORBS			GRASS		
SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER
POTR5	17	3				ARCO9	5	1	POPR	5	1
ABCO	8	2									

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

10.0RM ACCOUNTING PROCEDURES

For this inventory, a portion of the plots measured during previous inventories may be revisited. In addition to the current location layout and sampling procedures for sampling trees, previously tallied trees on these locations will be accounted for using the original location layout and sampling procedures. The location center (PC) will be the same point for both samples. This chapter refers to data collected for RMRS only.
If the plot was not established at the correct map point during the previous inventory, determine whether the location placement meets the following criteria:

- The old plot was established in the correct condition class (refer to Section 2).
- 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.

10.0.1RM Plot Layout

In the previous inventory, the Sampling Factor designated the plot layout and sampling system used. For plots with the Sampling Factor coded as a 20 or 40, a 5-point, 7-point, or 10-point variable radius timberland plot was established. On locations with the Sampling Factor coded as 01, 02, 05, 91, 92, or 95, a fixed-radius woodland plot was established. For these fixed-radius woodland plots DO NOT ACCOUNT FOR TREES OR SAPLINGS. However, the new plot layout will be established at the old location center (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).

10.0.2**RM** Variable-Radius Plots.

The PC was designated as point 1 of 5, 7, or 10 points on the plot. Points 2 through 5, 7, or 10 were distributed around the PC, and within the condition of the PC, using a triangular grid pattern with 100-foot or 70-foot intervals (figure 54). The spacing and orientation of the primary point positions was as follows:

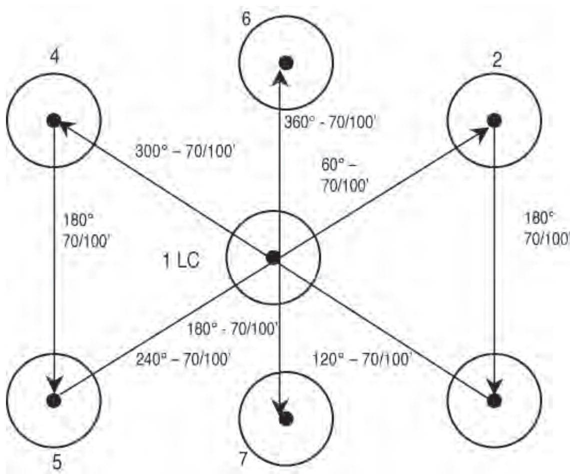
5/7-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from PC (1) to	2	60		70/100
	3	120		70/100
	4	300		70/100
	5	240		70/100
	6	180		70/100
	7	360		70/100
10-point layout				
from PC (1) to	2	360		70
	3	120		70
	4	180		70
	5	180		70
	6	240		70
	7	300		70
	8	360		70
	9	360		70

In the previous inventory, when points 2 through 5, 7, or 10 fell into vegetation conditions different than the condition at the PC, those points were redistributed back into the PC condition. Refer to the previous plot map to determine the actual point placement established.

At each of the points, timber species 5.0-inches DBH and larger, and woodland species 3.0-inches DRC and larger, were tallied on a variable-radius main plot; a 20 or 40 basal area factor (BAF) angle gauge, depending on forest type, was used to select tally trees:

Sampling Factor	Basal Area Factor	Forest Types	Limiting Distance to Geographic Center
20	20	Ponderosa Pine	DBH/DRC X 1.945
40	40	All other Conifer	DBH/DRC X 1.375

In addition, saplings were tallied or counted, and seedlings were counted, on a 1/300 acre fixed-radius microplot centered on the point stake.



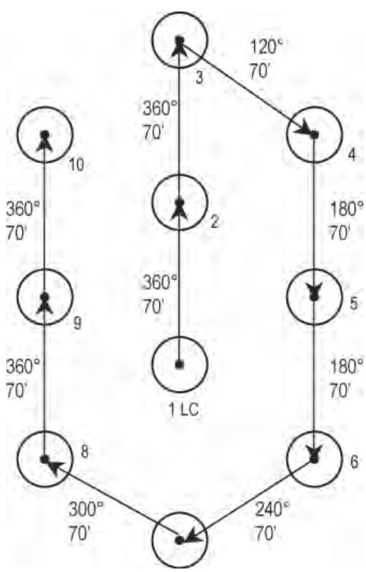


Figure 54. Previous variable-radius plot layouts.

10.1RM Fixed-radius plots

Woodland fixed-radius plots will be relocated, but no tree accounting information will be collected.

10.1.1RM Sampling Methods

Locate and account for all trees preprinted on the Accounting Tree Data record (appendix A.10) using the preprinted Sampling Factor code and the plot diagram on the old field form as a reference for the plot layout. Only points 1-5 will be accounted for. If a preprinted tree cannot be relocated and the reason cannot be determined, code CURRENT TREE STATUS = 0 and make a note in comments.

On the microplot: Locate and account for all trees preprinted on the Accounting Tree Data record and measure and record all new live trees ≥ 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.

10.2**RM** Plot and Tree Data

10.2.1**RM** MONTH

Record the month that the accounting plot was completed.

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

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

10.2.3**RM** DAY

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

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

10.2.4**RM** YEAR

Record the year that the accounting plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: > 2004

10.2.5**RM** 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

10.2.6**RM** 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 (when field supervisor determines crew should not return to the location to finish the plot)

10.2.7**RM** 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

10.2.8**RM** 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

10.2.9**RM** 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

10.2.10**RM** POINT NUMBER

For preprinted trees, verify/correct if an obvious error exists. For new trees, record the point number where the tree occurs.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Valid codes = 1 to 5

10.2.11**RM** TREE RECORD NUMBER

For preprinted trees, verify/correct if an obvious error exists. Record next available tree number for new tally trees.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.

Field width: 3 digits.
Tolerance: No errors.
Values: 1 to 999

10.2.12**RM** AZIMUTH

Record azimuth to the nearest degree for new tally trees. Record 360 for due north.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: ≥ 10 degrees.

10.2.13**RM** DISTANCE

This value is the slope distance from the center stake or microplot stake to the center of single-stemmed trees or to the geographic center of multistemmed trees.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 2 digits.
Tolerance: ± 1 foot

10.2.14**RM** PREVIOUS TREE STATUS

Only live trees are pre-printed. If a tree is not on the pre-printed form (other than through growth) ignore.

When collected: Value is preprinted.
Field width: 1 digit.
Tolerance: No errors.
Values:
1 Live Tree – alive at the previous inventory

1O.2.15**RM** CURRENT TREE STATUS

(Current Tree History)
Record a present TREE STATUS for each preprinted tree and new microplot tree. This code is used to track the status of sample trees over time. This information is needed to correctly assign volume information to the proper component of volume change.

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.

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 (new, remeasured, or ingrowth), regardless of cause of death. Includes down mortality trees, all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural or land clearing activity, and are assumed not to have been utilized.
3	Removed - a tree that has been cut and removed by direct human activity related to harvesting, silviculture or land clearing (remeasurement plots only). The tree is assumed to have been utilized.

10.2.16**RM** RECONCILE

Record a NEW TREE RECONCILE for any new tally tree on the microplot that was not tallied in the previous inventory; this code is used to identify the reason a new tree appeared in the inventory. This information is needed to correctly assign volume information to the proper component of volume change. Codes 1,3, and 4 will not be used for accounting purposes.

When Collected: When CURRENT TREE STATUS = 0 and when New tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.

Code	Tree Status
0	Tree not measured – For Example: Use when hazardous, ran out of time, access denied, or could not find plot.
2	Through growth - new tally tree 5 inches DBH/DRC and larger, within the microplot.
5	Shrank – live tree that shrank below threshold diameter on microplot/subplot/macroplot

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.

10.2.17**RM** SPECIES

For preprinted trees, verify/correct if an obvious error exists. Record for new tally trees. Refer to section 9.12 for species list; for preprinted species no longer valid. Assign CURRENT TREE STATUS = 0 and RECONCILE code 8. If preprinted species is incorrect, code delete the preprinted code and record the correct species code.

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.

10.2.18**RM** PAST DBH/DRC

If the preprinted past diameter appears to be incorrect (e.g., past DBH larger than current DBH, and the tree is still alive and growing) delete the preprinted value and record a past DBH/DRC estimate.

When collected: Value is preprinted.
Field width: 4 digits (xxx.y).
Tolerance: No errors.

10.2.19**RM** CURRENT DBH/DRC

Record as directed in Tree Data for each preprinted and new tally tree. If individual stems are nailed, measure the stems at (above) the nail.

When collected: Record only for live previously tallied trees; record for new live tally trees on microplot ≥ 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.

10.2.20RM DBH/DRC CHECK

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

When collected: All tally trees ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.

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.

10.2.21RM PAST NUMBER OF STEMS

If the past number of stems does not equal the current number of stems, do not change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

When collected: Value is preprinted.
Field width: 2 digits.
Tolerance: No errors.

10.2.22RM CURRENT NUMBER OF STEMS

Record for each preprinted and new tally woodland species with at least one stem 1.0 inch in diameter or larger and 1 foot in length

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0” DRC.
Field width: 2 digits.
Tolerance: No errors.

10.2.23RM PAST TOTAL TREE LENGTH

For preprinted trees, verify/correct if an obvious error exists.

When collected: Value is preprinted.
Field width: 3 digits.
Tolerance: No errors.

10.2.24**RM** CURRENT TOTAL TREE LENGTH

Determine Total Tree Length for new tally trees as directed in Section 5.

When collected: New tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: ± 10% of true length.
Note: Do not collect CURRENT TOTAL TREE LENGTH for preprinted trees, only for new microplot trees.

10.2.25**RM** CAUSE OF DEATH

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

When collected: Record for previously tallied trees that have died since the previous inventory and new tally trees ≥ 5.0 in DBH/DRC that grew onto a microplot and died since the previous inventory.
Field width: 2 digits.
Tolerance: No errors.

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.

10.2.26**RM** PAST TREE CLASS

Refer to CURRENT TREE CLASS for codes. For preprinted tees, if the PAST TREE CLASS appears to be incorrect (e.g., tree was coded as rotten in first inventory, but is sound), delete the preprinted code and record an estimate of the correct PAST TREE CLASS.

When collected: Preprinted for previously tallied trees.
Field width: 1 digit.
Tolerance: No errors.

10.2.27**RM** CURRENT TREE CLASS

Record the CURRENT TREE CLASS for each previously tallied and new tree.

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.

Code	Tree Class
1	Sound (live) - timber species

1 Sound (live) - timber species
- a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor.
- a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.

2 All live woodland species

3 Rough (live) - timber species
- a live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a sound tree of good form, 5.0-inches DBH or larger.
- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
- a live tree, 5.0-inches DBH or larger, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

4 Rotten (live) - timber species
- a live tree, 5.0-inches DBH or larger, with 67 percent or more

of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.

5 Hard dead
- a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).

6 Soft dead
- a standing dead or mortality tree, 1.0-inch DBH/DRC or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

11.0RM DOWN WOODY MATERIAL PILOT (DWM)

11.0.1RM Down Woody Material (DWM) Pilot Overview

In 2004 and 2005, DWM Pilot studies were conducted on National Forest System (NFS) lands on Phase 2 (P2) plots in Montana. The transect design implemented in 2004 included a subset of the national Phase 3 (P3) Coarse Woody Debris (CWD) transects, in addition to three 120-foot “traverse” transects between subplots 1 and 2, subplots 1 and 3, and subplots 1 and 4. The purposes of the pilots were threefold: first to maximize total transect length, second to separate fuel-loading estimates by type of transect (P3 vs. traverse) for statistical analysis, and third to identify the most efficient transect design that would meet our needs for P2 National Forest level fuel-loading estimates.

Preliminary analysis of the 2004 data showed that the P3 CWD transects were more time-consuming and had much higher variability in fuel-loading estimates than the “traverse” transects. Efficiency was also gained because “traverse” transects share the same horizontal line used to chain between subplots. As a result, in 2005 we decided to use only the “traverse” transect design for sampling all DWM components.

Another major time-saving change was the elimination of measuring end-point diameters and lengths of CWD pieces. Even though individual measurement of endpoint diameters and lengths of CWD pieces help improve volume estimates and subsequent fuel loadings, it’s expected that longer “traverse” transects will help recover this loss by reducing variability in estimates.

Elimination of the large-end diameters of CWD also compromises information on structural diversity, which is important for assessing wildlife habitat. In 2005, in order to better address wildlife structure related to large-end diameter, Region 1 NFS provided five broad structure-related diameter classes, which field crews assigned to individual CWD pieces. Generally, it is much quicker to assign a class than to measure each piece directly.

Future P2 DWM analysis will combine data from both 2004 and 2005 pilots for better estimates of variability in fuel loading and structure information at the National Forest level, and possibly identify further refinements in P2 DWM protocols in 2006. The results of this analysis, along with field crew feedback and time/logistics considerations will ultimately determine what final DWM methods are used on P2 plots in future inventories. Therefore, YOUR FEEDBACK IS VERY

IMPORTANT. Please take notes in your field notebook as situations arise (either positive or negative). If you do not write it down when it occurs, there is a good chance that you will not remember the situation or the details when your input is requested.

The methods presented here are highly dependent upon use of P3 DWM field procedures. The 2006 P2 DWM inventory will use many of the established P3 methods under the "traverse" CWD transect design.

11.0.2**RM** Introduction

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

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

DWM is only sampled in accessible forest conditions intersected by the transect. If a transect crosses a nonforest condition, the boundaries of the condition are recorded (see section 11.2) but no DWM or fuels measurements are taken along this portion of the transect. The majority of DWM in the inventory is sampled using the line intersect sampling method (also called planar intercept method). In this method, transects are established, and individual pieces of CWD or Fine Woody Debris (FWD) are tallied if the central axis of the piece is intersected by the plane of the transect. In addition, each piece must meet specified dimensions and other criteria before being selected for tally. Special procedures apply when a CWD piece lays across a condition class boundary (section 11.1).

11.0.3**RM** Definition of Down Woody Materials

CWD – In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth. CWD also includes dead timber and single-stemmed woodland trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical. Also included are non-machine processed round wood such as fence posts and cabin logs. For standing multi-stemmed woodland trees such as juniper, only tally stems that are dead, detached, and on the ground. For all dead multi-stemmed woodland trees that do not qualify as standing dead woodland trees (Section 0.4.3) tally all stems attached or detached that meet the size requirements for CWD pieces.

CWD does not include:

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

FWD – In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

1. Woody pieces ≥ 3.0 inches in diameter at the point of intersection with the transect.
2. Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
3. Dead foliage (i.e., pine or fir needles, or leaf petioles).
4. Bark fragments or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
5. Small pieces of decomposed wood (i.e., chunks of cubical rot)

11.0.4**RM** Use of hardcopy data sheets

Every plot needs to have the time study completed on the hardcopy form and included in the field packet before submission. This information is not included on the PDR. **All other field data** for the DWM P2 pilot will be collected on the PDR; however, hardcopy forms can be used as a backup. If a transect has no DWM you must still complete the first line of that portion of the data sheet with dashes to show there is no DWM. If there is data for a line and the same line has a box with “Y – N” you must circle either “Y” or “N”. You may not leave the “Y – N” option blank.

11.0.5**RM** Recording “Time to complete” box on Form 1

The time study portion of this pilot is very important. **You must completely fill out the “Time to complete” section in the upper right hand portion of Form 1 on each plot to the nearest 15 minutes.** An example of recording “Total” time would be: if two crew people spend a total of 45 minutes on the DWM study then enter 1.50 for Total hours, since we want total crew-person hours. Also record **only** the total time spent on making the calls on the large-end diameter classes. This will give an idea how long it takes to assess this variable. If less than 7.5 minutes record zero.

11.1**RM** **Traverse Transect Sampling**

11.1.1**RM** Locating and Establishing Line Transects

Traverse transects are established between each of subplots 1 and 2, subplots 1 and 3, and subplots 1 and 4, if accessible forest land is sampled on any of the 24.0-foot radius subplots (CONDITION CLASS STATUS = 1). If so, 360 feet of traverse transect length needs to be accounted for by condition, horizontal distance , and sampled horizontal distance (Figure 55).

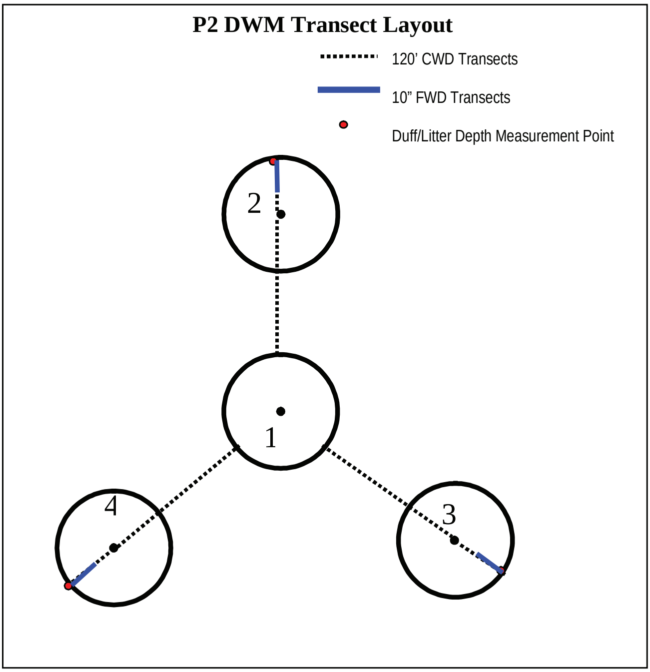


Figure 55. Traverse transect plot layout

11.1.2**RM** CWD transects

Transects begin at the subplot 1 perimeter (24.0 horizontal feet) and extend 120 horizontal feet through the subplot centers to the farther edge of subplots 2, 3, and 4 at 360, 120, and 240 degrees azimuth, respectively (Figure 55).

11.2**RM** Transect Line Segmenting

Any traverse transect that meets the criteria for establishment (See section 11.1) will be segmented by condition class. Transect lines are segmented to determine the length of transect that occurs within each condition class intersecting the line. A segment is a length of transect that is in one condition.

Starting at the subplot 1 perimeter and working towards the other fixed radius plot boundary, each segment of transect line in a different condition class is delineated and recorded as a separate record (no more than two conditions per traverse will be segmented—see hierarchical rules below). The transect must extend a total of 120.0 feet horizontal distance. Each time a condition boundary is crossed the segment is recorded (Figure 56)

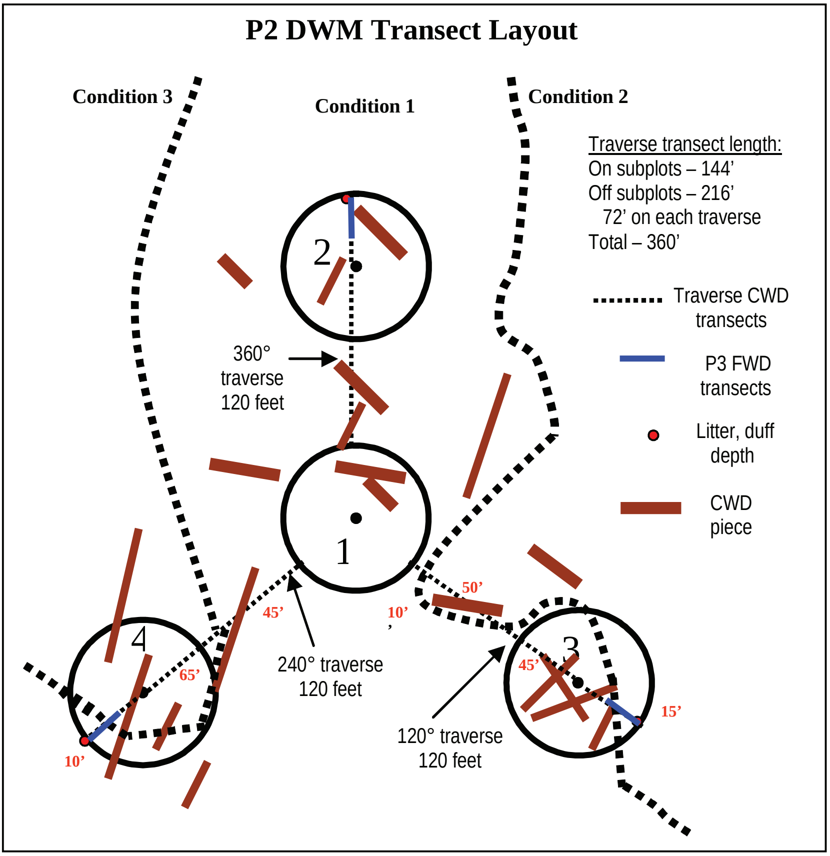


Figure 56. Transect Layout with 3 different conditions.

Application of traverse condition rules for segmentation:

	Condition	H distance	Sampled H distance
Subplot 2	1	120	120
Subplot 3	1	10	10
	2	50	50
	1	45	45
	2	15	15
Subplot 4	1	45	45
	3	65	65
	1	10	10

For remeasurement plots: If the location of subplots 2, 3, and 4 are not obvious from subplot 1(e.g. dense brush, other obstacles blocking view, etc.) it may be easier to start at subplots 2,3, and 4 and work in reverse direction for tallying DWM components. This will help avoid missing the subplot 2, 3, and 4 stakes, which could cause a break in CWD transects. It could also cause inaccurate sample locations for FWD or duff/litter, which are tied to subplots 2, 3, and 4 stakes.
Note: Regardless of the order of CWD tally, use the same condition numbers assigned on the subplot.

Do not sample DWM on transect segments in conditions that are not accessible forest land (e.g. nonforest , noncensus water, hazardous, etc.). However, all 360.0 horizontal feet of transect length are accounted for by condition, horizontal distance, and sampled horizontal distance regardless of condition status.

Since conditions aren't necessarily mapped or identified between subplots and only two conditions will be segmented per traverse the following hierarchical rules will be used to make traverse transect segmenting more simple and consistent with the core condition and subplot information:

1. Only those conditions identified on the subplots and also recorded on the condition description will be considered legitimate for traverse transect segments. Any other conditions encountered on the traverses between subplots will be ignored. In other words, no new conditions will be considered due to traverse transect sampling.

2. If in doubt about whether a condition should be segmented, do not segment.

3. No more than two conditions per traverse will be considered and segmented. Use hierarchical priority rules (see next two rules) to choose among conditions when more than two conditions are encountered on a traverse. This should rarely occur.

4. Condition boundaries that occur on the subplots have first priority for traverse transect segmenting.

5. Conditions that occur between subplots will have the next priority for traverse transect segmenting (see rule # 8 for exception).

6. Distinct condition boundaries between subplots will be identified

and recorded to the nearest horizontal foot by condition.

7. Indistinct condition boundaries (transition zones) between subplots will be split mid way between the subplots at 36 feet. The first condition will be assigned the first 36 feet and the second the next 84 feet.

8. Ignore linear features that are exceptions to the size and width requirements that occur between the subplots (less than 1.0 acre in size and 120 feet wide) like improved roads, maintained rights-of-way, etc. that cross the traverse transects, and assign conditions as though they weren't there.

   Note: Do not include portions of transects that cross linear features for total SAMPLED HORIZONTAL DISTANCE (see 11.2.3)

By no means will these rules cover all possible scenarios. Use them with the idea in mind that for most plots a procedure for assigning conditions to traverse transect pieces has been documented and followed to capture most of the condition variability. Please make notes of any different situations encountered.

11.2.1**RM** CONDITION CLASS NUMBER

Record the code indicating the number of the condition class for the transect segment. Use the same code assigned to the condition class on the subplot or elsewhere on the plot.
When collected: All tally segments
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

11.2.2**RM** HORIZONTAL DISTANCE

Starting at the subplot 1 perimeter record the traverse transect length in horizontal feet (nearest foot) segmented by condition class. See section 11.2 for specifics on condition segmenting rules.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 001 to 120

11.2.3RM SAMPLED HORIZONTAL DISTANCE

Record the SAMPLED HORIZONTAL DISTANCE (nearest foot) for each segment. Most of the time this is a repetition of the horizontal distance. However, for conditions other than accessible forest land (see section 11.2 for specifics) the SAMPLED HORIZONTAL DISTANCE is recorded as zero. Also, transect segments or portions of segments within accessible forest land conditions that cannot be accurately sampled due to snow/water or that cross nonforest linear features (see not in 11.2 item 8) are not included in SAMPLED HORIZONTAL DISTANCE.

When collected: All tally segments
Field width: 3 digits
Tolerance: +/- 1.0 ft
MQO: At least 95% of the time
Values: 000 to 120

11.3RM Sampling Methods for Coarse Woody Debris (CWD)

11.3.1RM Tally Rules for Coarse Woody Debris (CWD)

1. Coarse woody debris (CWD) is sampled in accessible forest land conditions only.
   Tally a piece if its central longitudinal axis intersects the transect, and the condition class is accessible forest land at the point of intersection (Figure 57). The entire piece is assigned to this condition

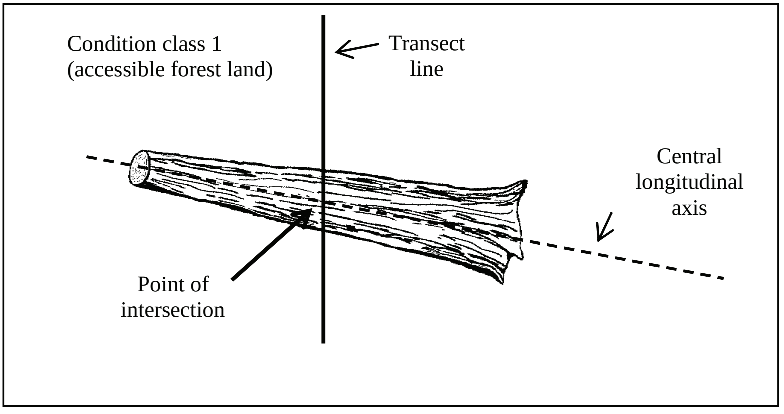


Figure 57. Tally rules for CWD.

2. Tally dead trees, shrubs, and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or shrubs. Do not

tally standing dead trees and tall stumps (≥ 3.0 feet in length) that are still upright and leaning < 45 degrees from vertical. Follow the same rules for down trees as outlined in section 5.0 'Tree and Sapling Data. Most CWD will be laying on the ground.

3. Tally the portions of standing dead shrubs that intersect the transect line. The pieces must still meet the minimum length and diameter requirements.

4. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3 feet, measure the length to the nearest 0.1 foot to determine if it is >3.0 feet.

5. Decay class of the piece determines which variables to collect (see section 11.3.3).

   For decay classes 1 to 4: tally a piece if it is > 3.0 inches in diameter at the point of intersection with the transect. The piece must be > 3.0 feet in length and > 3.0 inches or more in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece qualifies (Figure 58).

   Note: The 3.0 inch requirement along the 3.0 foot minimum length is derived from P3 protocol which states "the piece ends where it becomes smaller than 3.0 inches".

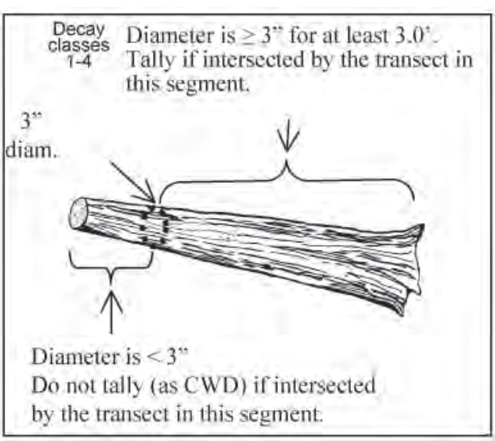


Figure 58. CWD tally rules for decay classes 1-4.

For decay class 5: tally a piece if it is > 5.0 inches in diameter at the point of intersection and > 5.0 inches high from the ground at the point of intersection. The piece must be > 3.0 feet in length and > 5.0 inches in diameter along that length. The reason for treating decay class 5 pieces differently is because they are difficult to identify, especially when heavily decomposed. Only pieces that still have some shape and log form are tallied—humps of decomposed wood that are becoming part of the duff layer are not tallied.

6. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting. Estimate the required data for pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" at the bottom of a steep-sided ravine.

7. Tally a piece only if the point of intersection occurs above the ground. If one end of a piece is buried in the litter, duff mineral soil, or water the piece ends at the point where it is no longer visible. Clarification: In order to be tallied the piece needs to have three consecutive feet of exposed visible length above ground at the point of intersection. Do not consider things like small shrubs, grasses or forbs that may lay across a piece as below ground, but do consider litter, duff, mineral soil, or water on top of the piece as below ground.

8. If the central longitudinal axis of a piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (Figure 59).

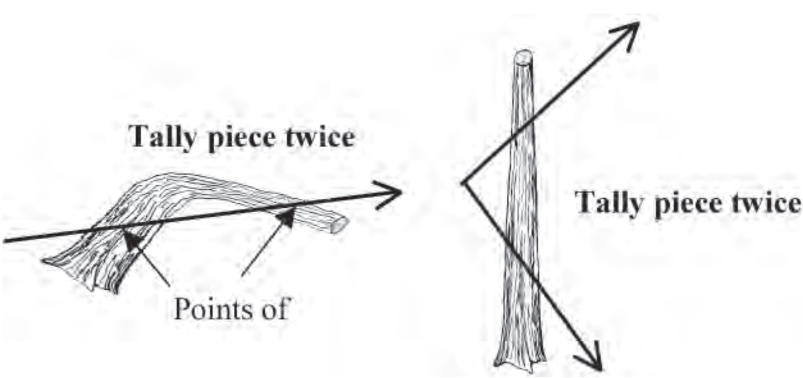


Figure 59. Tally a CWD piece each time it crosses the transect

9. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

10. Do not tally a piece if it intersects the transect on the root side of the root collar. Do not tally roots.

11. When the transect crosses a forked down tree bole or large branch connected to a down tree, tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements.

12. In the case of forked trees, consider the “main bole” to be the piece with the largest diameter at the fork. Variables for this fork such as DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (Figure 60).

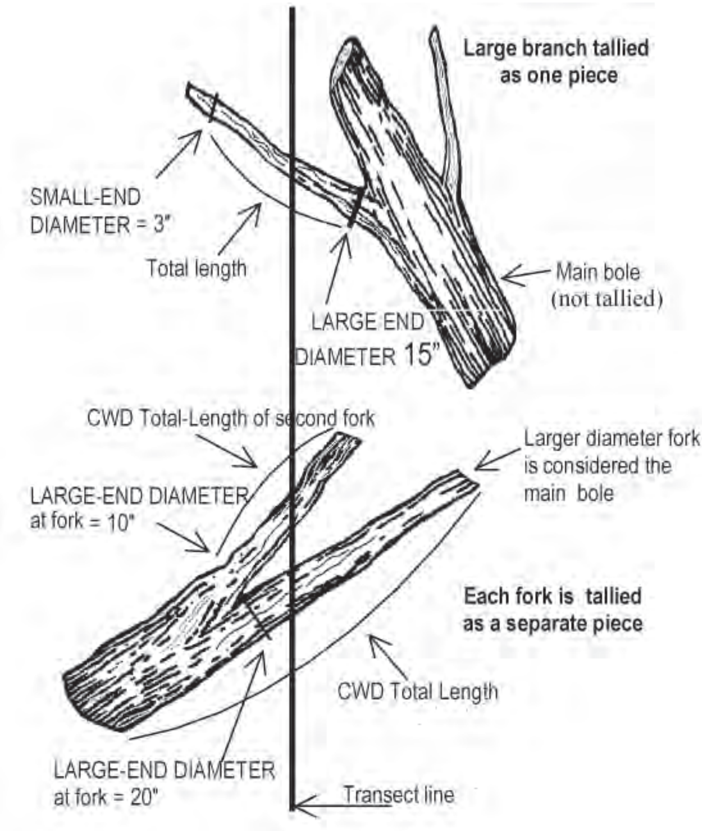


Figure 60. CWD tally rules for forked trees.

13. If a transect intersects a nonforest condition, no CWD is tallied in the nonforest condition.

11.3.2**RM** Recording Procedures for CWD

The tolerance for the total number of pieces ($\geq$ 3.0 inches, transect diameter) tallied across all transects on the plot is : +/- 2 piece or +/- 5%, whichever is greater for the plot. Note: always round up to a whole piece count when using the 5% option.

11.3.3**RM** DECAY CLASS

Record a 1-digit code indicating the decay class of the piece. Code the decay class which predominates along the observed total length of the piece. Use the guide in Section 5.23 to determine the DECAY CLASS.

When Collected: All tally pieces
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 1-5 (described in Section 5.23)

Note: DECAY CLASS 5 pieces can be difficult to identify because they often blend into the duff and litter layers. They must still resemble a log, therefore, the first tally rule is that they must be > 5.0 inches in diameter, > 5.0 inches from the surface of the ground, and at least 3.0 feet long. Decomposed logs that are slightly elevated 'humps' on the ground are not tallied.

DECAY CLASS: The table in Section 5.23 was developed primarily for Douglas-fir in the Pacific Northwest. At the present time, there are no other tables available to use to describe decay classes for other species or locations. Concentrate on the structural integrity and texture when estimating a decay class for CWD logs.

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

11.3.4**RM** SPECIES

Record the code indicating the species of the piece. Since CWD pieces are not necessarily always tally species, record the most detailed available species codes. Some species codes are only genus specific (e.g. Prunus), or hardwood-softwood specific. Search for the species code that has the most detail for the identified piece. Enter a code of '0001' for SPECIES if the tally piece is a shrub or vine. However, if a specific code exists (e.g. pin cherry) then use it instead of the generic shrub code.

Species identification may be uncertain for some pieces. The piece's bark (either attached or sloughed and laying beside the piece), branching pattern (if the branches are still present), or heartwood smell (particularly if cedars, Douglas-fir, or western hemlock) may provide clues. On remeasurement plots, see what tree species were tallied in past inventories. One way to distinguish hardwoods from softwoods is by the type of decay present. Hardwoods usually have a white or grayish stringy rot, while softwoods usually have a reddish-brown blocky rot. If it is not possible to identify the species, attempt to estimate if it is softwood or hardwood. Enter code 0299 for unknown conifer or 0998 for unknown hardwood. If all else fails, enter the unknown SPECIES code (0999).

When Collected: DECAY CLASS = 1 to 4
Field width: 4 digits
Tolerance: No errors
MQO: At least 80% of the time
Values: See species codes in Appendix 3.

11.3.5**RM** DIAMETER AT POINT OF INTERSECTION (transect diameter)

Record the code indicating the piece's diameter at the point where the transect intersects the longitudinal center of the piece. If the diameter is close to 3 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually >3.0 inches and a valid tally piece. Mark the location of the transect diameter for decay classes 1-4 with a crayon to aid in remeasurement by QA crews. Do not mark pieces in reserved areas. The diameter is recorded to the nearest inch.

When Collected: All tally pieces
Field width: 3 digits
Tolerance: Pieces < 20.0 in diameter: +/- 3 in
Pieces > 20.0 in diameter: +/- 20%
MQO: At least 90% of the time
Values: 003 to 200

11.3.6**RM** LARGE END DIAMETER CLASS

Estimate the appropriate class code for the large end diameter for each CWD piece. If the large end diameter is close to a class breaking point it may be necessary to directly measure the diameter.

The large end will occur either at a broken or sawn end, at a fracture, or at the root collar. If the end is splintered or decomposing (sloughing off), measure the diameter at the point where it best represents the overall log volume.

The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length. It is useful to carry a steel carpenters retracting tape to measure diameters. Other methods include wrapping a tape around the bole if possible, holding a straight-edge ruler above the piece, or using calipers.

For pieces that are not round in cross-section because of missing chunks of wood or "settling" due to decay, measure the diameter in two directions and take an average. Estimate the longest and shortest axis of the cross-section ("A" and "B" in Figure 61), and enter the average in the diameter field. This technique applies to intersect large-end diameters.

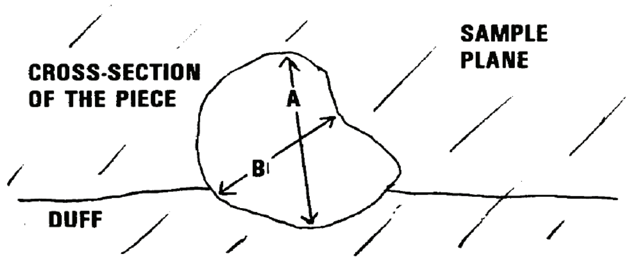


Figure 61. Estimating the diameter of pieces that are not round in cross-section.

If the transect intersects the log at the decayed or splintered end (Figure 62) (i.e., the portion where we do not consider it part of the log because it is falling apart), record the diameter at this location as the intersect diameter, but record the large end diameter class according to our established rules (i.e., at the points where they best represent the log volume). If you have a major split located just at the end, treat it as one log and take a diameter around the end (take two measurements if it is odd shaped). Length would be measured between the large and small end diameters. Piece length ends when log diameter becomes <3.0 inches in diameter.

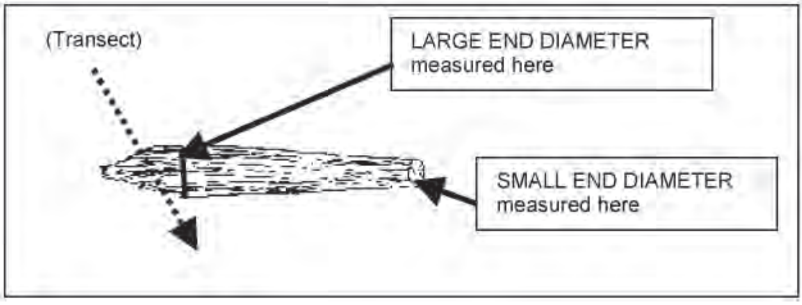


Figure 62. Example of decayed end intersection the transect.

When Collected: DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: 1 to 5

Code	Diameter Class
1	3.0" to 4.9"
2	5.0" to 8.9"
3	9.0" to 14.9"
4	15.0" to 20.9"
5	21.0"+

11.3.7**RM** CONDITION CLASS NUMBER

Record the code indicating the number of the condition class that contains each CWD piece. Use the piece's central axis at the transect point of intersection to assign each piece to the appropriate condition. If there is only one condition on the traverse assign all pieces to that condition. If a piece is borderline between two conditions, assign it to the first condition on the traverse. See Section 11.2 for rules for assigning conditions.

Field width: 1 digit
Tolerance: correct
MQO: At least 90% of the time
Values: 1 - 9

11.3.8**RM** IS THE PIECE HOLLOW?

Record the code indicating whether or not the piece is hollow (Figure 63). A piece is considered hollow if a cavity extends at least 2 feet along the central longitudinal axis of the piece, and the diameter of the entrance to the cavity is at least 1/4 of the diameter of the piece where the entrance occurs. The entrance occurs at the point where the circumference of the cavity is whole -- the point where wood is present completely around the circumference of the cavity. The length of the cavity begins at this point.

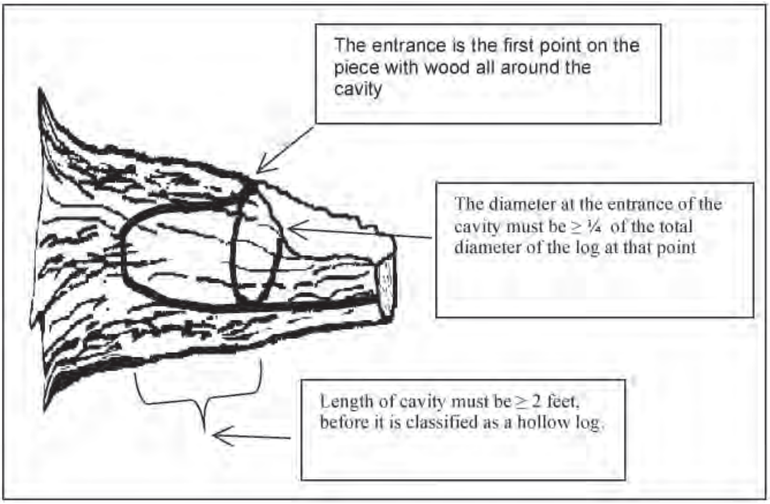


Figure 63. Determining if the piece is hollow.

When Collected: DECAY CLASS = 1 to 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: Y or N

Code

Y	Meets the criteria for a hollow log.
N	Does not meet criteria for being a hollow log

11.3.9**RM** IS THE PIECE ON A SUBPLOT?

Record the code indicating whether or not the piece is on the subplot. Use the pieces central axis at transect point of intersection to determine if the piece falls within the 24.0 horizontal perimeter of the farther subplot. If a piece falls exactly on the subplot 1 perimeter, record "N" for piece not on a subplot. If a piece falls exactly on subplot 2, 3, or 4 perimeter, record "Y" for piece is on a subplot.

Values: N or Y
Field width: 1 digit
Tolerance: correct
MQO: At least 90% of the time

11.4RM SAMPLING RESIDUE PILES

In some circumstances, piles or windrows created directly by human activity and log piles at the bottom of steep-sided ravines will be encountered on a transect. If this is encountered, estimate the number, diameter, and other required data of CWD pieces that intersect the traverse, and record as separate pieces as best as possible.

11.5RM Sampling Methods for Fine Woody Debris (FWD)

1. Fine Woody Debris (FWD) is sampled when transect starting point occurs in accessible forest land conditions (CONDITION CLASS STATUS = 1). The length of FWD transects are measured in slope distance--no correction is applied to obtain a horizontal distance. The FWD transects start at 14.0 feet slope distance from the subplot stake and extends for 6.0 or 10.0 feet slope distance. Estimates of FWD biomass calculated in the office, will include a slope correction factor obtained from the FWD transect (See FWD TRANSECT PERCENT SLOPE).

2. Only sample FWD that intersects a plane from the ground to a height of 6 feet.

3. FWD is sampled in three size classes. Two of the FWD size classes (0.01 to 0.24 inches and 0.25 to 0.9 inches) are counted on a 6-foot transect, from 14 to 20 feet. Pieces in the third size class (1.0 to 2.9 inches) are counted on a 10-foot transect, from 14 to 24 feet (see section 11.1.1 for details on transects). These transects overlap. Note: individual diameters are not recorded for FWD.

4. Count a piece of FWD if it intersects the transect. Only count twigs, branchs, wood fragments, or shrub/tree boles which are woody. Do not count needles or non-woody parts of a tree or shrub.

5. Accumulate the number of pieces counted within each size class and enter the total count on one record for the subplot. If there is no tally on a transect, enter zeros for the count.

6. Accurate counts of FWD can be conducted efficiently up to about 50 pieces for small and medium size classes, and up to 20 pieces for the large size class. After that, crews can begin estimating

counts in a systematic fashion. Transects that fall on very dense FWD where counting is nearly impossible, can be subsampled and calculated. For example, an accurate count can be conducted on a 2.0-foot section of the transect and then multiplied by 3 to provide an estimate for the 6 foot transect, as long as the crew feels that the remaining transect has a similar density of FWD pieces.

7. If a transect intersects a large pile of material such as a wood rat's nest or a recently fallen tree (with many attached fine branches), crews should estimate a count based on #6 above, but also enter a code indicating that this is an unusual situation (see section 11.5.9).

8. If rocks, logs, or other obstructions are present along the transect (14- to 24-foot section) include any FWD that is present on top of these obstructions in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.

9. If any portion of the FWD transect is covered by snow or water, do not sample FWD. Either the whole transect is sampled or none.

11.5.1**RM** FWD transects

FWD transects that originate in accessible forest land conditions are sampled. Either the whole transect is sampled or none. See instructions for FWD sampled (Section 11.5).

Establish FWD transects at the end of subplots 2, 3, and 4 traverse transects (360, 120, and 240 degrees azimuth. Figure 55).
FWD is tallied within 3 size classes. Because FWD is generally present in higher densities, a shorter transect will pick up an acceptable amount of tally. The transect begins at 14 feet (slope distance) from subplots centers' 2, 3, and 4 and extends out either 6 or 10 feet (slope distance) depending on the FWD size class, as follows:

Category of FWD	Size Class	Diameter range	Transect length (slope distance)	Transect location (slope distance)
Small FWD	1	.01 in to 0.24 in	6 feet	14 to 20 feet
Medium FWD	2	0.25 in to 0.9 in	6 feet	14 to 20 feet
Large FWD	3	1.0 in to 2.9 in	10 feet	14 to 24 feet

Note that the FWD transects are slope distance not horizontal distance. The formulas used to estimate biomass from the data contain an adjustment for slope. It is helpful to have a size gauge available until your eye is 'trained' to recognize the 3 size classes. Examples include a plastic or cardboard card with 3 notches cut for each size class, or a set of 3 dowels representing each size class.

11.5.2**RM** FWD SAMPLED

If the FWD transect originates in a nonforest condition or if snow/water covers any portion of the FWD transect then do not sample any FWD.

When collected: Each traverse transect
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 2

Code	
1	All FWD sampled
2	No FWD sampled

11.5.3**RM** FWD TRANSECT PERCENT SLOPE

Record the percent slope to the nearest 5% for the FWD transect, from sampling starting point (14 feet slope distance from subplot center) to the ending point (24 feet slope distance from subplot center).

When Collected: When FWD SAMPLED = 1
Field width: 3 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 5% increments from 0 to 120

11.5.4**RM** CONDITION CLASS NUMBER

FWD is assigned to only one condition class per transect.
Record the code indicating the number of the condition class where FWD sampling begins (14 feet slope distance from the subplot centers).

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

11.5.5 **RM** SMALL FWD COUNT

Record the number of pieces counted in this size class (0.01 to 0.24-inch diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see 11.5, #6)

When collected: When FWD SAMPLED = 1
Field width: 3 digits
Tolerance:0 to 50 = +/- 20% of the total count for the transect
51 to 100 = +/- 25% of the total count for the transect
100 + = +/- 50% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 999

11.5.6 **RM** MEDIUM FWD COUNT

Record the number of pieces counted in this size class (0.25 to 0.9-inch diameter) along the transect segment. An accurate count should be conducted up to 50 pieces. If the count exceeds 50, the transect can be subsampled to estimate a total count for the transect segment (see11.5, #6)

When collected: When FWD SAMPLED = 1
Field width: 3 digits
Tolerance: +/- 20% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 999

11.5.7 **RM** LARGE FWD COUNT

Record the number of pieces counted in this size class (1.0 to 2.9 inch diameter) along the transect segment. An accurate count should be conducted up to 20 pieces. If the count exceeds 20, the transect can be subsampled to estimate a total count for the transect segment (see section 11.5, #6).

When collected: When FWD SAMPLED = 1
Field width: 3 digits
Tolerance: +/- 20% of the total count for the transect
MQO: At least 90% of the time
Values: 000 to 500

11.5.8**RM** HIGH COUNT REASON

Enter a code if any of the counts on a transect are greater than 100 pieces.

When Collected: When the count on the transect >100
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values: 0 - 4

Code
0 FWD is not unusually high
1 High count is due to an overall high density of FWD across the transect
2 Wood Rat's nest located on transect
3 Tree or shrub laying across transect
4 Other reason

11.6**RM** DUFF and LITTER DEPTH MEASUREMENTS

Depth measurements are sampled only in accessible forest land conditions (Condition class status =1). The depth of the duff layer and litter layer are important components of fire models used to estimate fire behavior, fire spread, fire effects, and smoke production. An average depth will be calculated in the office and stored with other information about the condition class on the plot. If a log, rock, or other obstruction intersects the measurement location, do not measure the duff or litter depth.

11.6.1**RM** Definitions

1. **Litter** is the layer of freshly fallen leaves, needles, twigs (< 0.25 inch in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer.

   Litter is flash fuel – so think about it as the loose material that is exposed to the air, capable of igniting quickly and carrying a fire across the surface of the forest floor.

   Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e., if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter – fire would burn differently if it hit a pile of rotten punky wood chips, cradled by the unrotted sapwood shell). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer.

Litter does not include animal manure.

2. **Duff** is the layer just below litter. It consists of decomposing leaves and other organic material. You should see no recognizable plant parts, the duff layer is usually dark decomposed organic matter. When moss is present, the top of the duff layer is just below the green portion of the moss. The bottom of this layer is the point where mineral soil (A horizon) begins.

   Crews should be absolutely sure they are measuring deep duff depths, instead of mineral soil layers or parts of the litter layer. Duff can easily weigh more than 6 times that of litter. If unsure of the bottom of the duff layer, crews should feel the texture of the suspect material in their hand. Rub the soil between your fingers. Does it crumble (duff) or feel more like modeling clay (mineral).

11.6.2**RM** Overview of Measurements

Depth measurements will be taken at the end of each 120-foot horizontal traverse transect that is within an accessible forest land condition. See P2 DWM TRANSECT LAYOUT for transect details.

The duff and litter variable has two options for indicating if duff and litter were measured at each sample location. A value of 1 is entered if duff and litter were sampled (no obstruction). A value of 2 is entered if no duff and litter are sampled (obstruction).

11.6.2.1**RM** How to sample Duff and Litter

Carefully expose a shallow profile of the forest floor by digging out an area at the sample point using a knife, hatchet, or other tool. Estimate the depth of each layer with a ruler to the nearest 0.1 inch.

As you dig the hole for this measurement, if you encounter a rock, root, or buried log – stop the depth measurement at this point.

The height of the litter should be measured at the top of the loose material located at the sample point on the transect. Try to preserve the conditions of this location by walking around this point, so the QA staff will measure the same height as the original crew.

11.6.3**RM** SAMPLED

Record the code indicating if the depth of the duff and litter layer was measured.

When collected: For each traverse transect
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 or 2

1 All sampled: Duff and litter
2 Nothing sampled

11.6.4**RM** DUFF DEPTH

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

When collected: When SAMPLED = 1
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 99.9

11.6.5**RM** LITTER DEPTH

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

When collected: When SAMPLED = 1
Field width: 3 digits
Tolerance: +/- 0.5 inch
MQO: At least 90% of the time
Values: 00.0 to 99.9

11.7**RM** ACKNOWLEDGEMENTS

Contact information for the National Advisor for this indicator is: Chris Woodall, USDA Forest Service, North Central Research Station, 1992 Folwell Ave, St. Paul, MN 55108, cwoodall@fs.fed.us, http:\\ncrs2.fs.fed.us\4801\DWM .

11.8**RM** P2 DWM Traverse Data Sheets

P2 DWM Traverse Data Sheet

State ____ Co ___ ____ P2# ________ Page__of__
Form 1

SUBPLOT 2 TRAVERSE

Transect 360 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Time to complete (est. nearest .25 hour) x.xx	
LgDiaCl	
Total	

Transect 360 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 360 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 360 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled___ %Slp______ CndCl____ S ______ ______ M ______ ______ L ________ Reason_____

Transect 360 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

SUBPLOT 3 TRAVERSE

Transect 120 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Transect 120 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 120 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 120 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled___ %Slp______ CndCl____ S ______ ______ M ______ ______ L ________ Reason_____

Transect 120 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

SUBPLOT 4 TRAVERSE

Transect 240 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Transect 240 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 240 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 240 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled___ %Slp______ CndCl____ S ______ ______ M ______ ______ L ________ Reason_____

Transect 240 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

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

(04) **Arizona**
(001) Apache
(003) Cochise
(005) Coconino
(007) Gila
(009) Graham
(011) Greenlee
(012) La Paz
(013) Maricopa
(015) Mohave
(017) Navajo
(019) Pima
(021) Pinal
(023) Santa Cruz
(025) Yavapai
(027) Yuma

(06) **California**
(001) Alameda
(003) Alpine
(005) Amador
(007) Butte
(009) Calaveras
(011) Colusa
(013) Contra Costa
(015) Del Norte
(017) El Dorado
(019) Fresno
(021) Glenn
(023) Humboldt
(025) Imperial
(027) Inyo
(029) Kern
(031) Kings
(033) Lake
(035) Lassen
(037) Los Angeles
(039) Madera
(041) Marin
(043) Mariposa
(045) Mendocino
(047) Merced
(049) Modoc
(051) Mono
(053) Monterey
(055) Napa
(057) Nevada
(059) Orange
(061) Placer
(063) Plumas
(065) Riverside
(067) Sacramento
(069) San Benito
(071) San Bernardino
(073) San Diego
(075) San Francisco
(077) San Joaquin
(079) San Luis Obispo
(081) San Mateo
(083) Santa Barbara
(085) Santa Clara
(087) Santa Cruz
(089) Shasta
(091) Sierra
(093) Siskiyou
(095) Solano
(097) Sonoma
(099) Stanislaus
(101) Sutter
(103) Tehama
(105) Trinity
(107) Tulare
(109) Tuolumne
(111) Ventura
(113) Yolo
(115) Yuba

(08) **Colorado**
(001) Adams
(003) Alamosa
(005) Arapahoe
(007) Archuleta
(009) Baca
(011) Bent
(013) Boulder
(015) Chaffee
(017) Cheyenne
(019) Clear Creek
(021) Conejos
(023) Costilla
(025) Crowley
(027) Custer
(029) Delta
(031) Denver
(033) Dolores
(035) Douglas
(037) Eagle
(039) Elbert
(041) El Paso
(043) Fremont
(045) Garfield
(047) Gilpin
(049) Grand
(051) Gunnison
(053) Hinsdale
(055) Huerfano
(057) Jackson
(059) Jefferson
(061) Kiowa
(063) Kit Carson
(065) Lake
(067) La Plata
(069) Larimer
(071) Las Animas
(073) Lincoln
(075) Logan
(077) Mesa
(079) Mineral
(081) Moffat
(083) Montezuma
(085) Montrose
(087) Morgan
(089) Otero
(091) Ouray
(093) Park

(095) Phillips
(097) Pitkin
(099) Prowers
(101) Pueblo
(103) Rio Blanco
(105) Rio Grande
(107) Routt
(109) Saguache
(111) San Juan
(113) San Miguel
(115) Sedgewick
(117) Summit
(119) Teller
(121) Washington
(123) Weld
(125) Yuma

(16) Idaho
(001) Ada
(003) Adams
(005) Bannock
(007) Bear Lake
(009) Benewah
(011) Bingham
(013) Blaine
(015) Boise
(017) Bonner
(019) Bonneville
(021) Boundary
(023) Butte
(025) Camas
(027) Canyon
(029) Caribou
(031) Cassia
(033) Clark
(035) Clearwater
(037) Custer
(039) Elmore
(041) Franklin
(043) Fremont
(045) Gem
(047) Gooding
(049) Idaho
(051) Jefferson
(053) Jerome
(055) Kootenai
(057) Latah
(059) Lemhi
(061) Lewis
(063) Lincoln
(065) Madison
(067) Minidoka
(069) Nez Perce
(071) Oneida
(073) Owyhee
(075) Payette
(077) Power
(079) Shoshone
(081) Teton
(083) Twin Falls
(085) Valley
(087) Washington
(089) Yellowstone National Park

(20) Kansas
(001) Allen
(003) Anderson
(005) Atchison
(007) Barber
(009) Barton
(011) Bourbon
(013) Brown
(015) Butler
(017) Chase
(019) Chautauqua
(021) Cherokee
(023) Cheyenne
(025) Clark
(027) Clay
(029) Cloud
(031) Coffey
(033) Comanche
(035) Cowley
(037) Crawford
(039) Decatur
(041) Dickinson
(043) Doniphan
(045) Douglas
(047) Edwards
(049) Elk
(051) Ellis
(053) Ellsworth
(055) Finney
(057) Ford
(059) Franklin
(061) Geary
(063) Gove
(065) Graham
(067) Grant
(069) Gray
(071) Greeley
(073) Greenwood
(075) Hamilton
(077) Harper
(079) Harvey
(081) Haskell
(083) Hodgeman
(085) Jackson
(087) Jefferson
(089) Jewell
(091) Johnson
(093) Kearny
(095) Kingman
(097) Kiowa
(099) Labette
(101) Lane
(103) Leavenworth
(105) Lincoln
(107) Linn
(109) Logan
(111) Lyon
(113) McPherson
(115) Marion
(117) Marshall
(119) Meade
(121) Miami
(123) Mitchell
(125) Montgomery
(127) Morris
(129) Morton
(131) Nemaha

(133) Neosho
(135) Ness
(137) Norton
(139) Osage
(141) Osborne
(143) Ottawa
(145) Pawnee
(147) Phillips
(149) Pottawatomie
(151) Pratt
(153) Rawlins
(155) Reno
(157) Republic
(159) Rice
(161) Riley
(163) Rooks
(165) Rush
(167) Russell
(169) Saline
(171) Scott
(173) Sedgwick
(175) Seward
(177) Shawnee
(179) Sheridan
(181) Sherman
(183) Smith
(185) Stafford
(187) Stanton
(189) Stevens
(191) Sumner
(193) Thomas
(195) Trego
(197) Wabaunsee
(199) Wallace
(201) Washington
(203) Wichita
(205) Wilson
(207) Woodson
(209) Wyandotte

(30) Montana
(001) Beaverhead
(003) Big Horn
(005) Blaine
(007) Broadwater
(009) Carbon
(011) Carter
(013) Cascade
(015) Chouteau
(017) Custer
(019) Daniels
(021) Dawson
(023) Deer Lodge
(025) Fallon
(027) Fergus
(029) Flathead
(031) Gallatin
(033) Garfield
(035) Glacier
(037) Golden Valley
(039) Granite
(041) Hill
(043) Jefferson
(045) Judith Basin
(047) Lake
(049) Lewis and Clark
(051) Liberty
(053) Lincoln
(055) McCone
(057) Madison
(059) Meagher
(061) Mineral
(063) Missoula
(065) Musselshell
(067) Park
(069) Petroleum
(071) Phillips
(073) Pondera
(075) Powder River
(077) Powell
(079) Prairie
(081) Ravalli
(083) Richland
(085) Roosevelt
(087) Rosebud
(089) Sanders
(091) Sheridan
(093) Silver Bow
(095) Stillwater
(097) Sweet Grass
(099) Teton
(101) Toole
(103) Treasure
(105) Valley
(107) Wheatland
(109) Wibaux
(111) Yellowstone
(113) Yellowstone National Park

(31) Nebraska
(001) Adams
(003) Antelope
(005) Arthur
(007) Banner
(009) Blaine
(011) Boone
(013) Box Butte
(015) Boyd
(017) Brown
(019) Buffalo
(021) Burt
(023) Butler
(025) Cass
(027) Cedar
(029) Chase
(031) Cherry
(033) Cheyenne
(035) Clay
(037) Colfax
(039) Cuming
(041) Custer
(043) Dakota
(045) Dawes
(047) Dawson
(049) Deuel
(051) Dixon
(053) Dodge
(055) Douglas
(057) Dundy
(059) Fillmore
(061) Franklin

(063)	Frontier
(065)	Furnas
(067)	Gage
(069)	Garden
(071)	Garfield
(073)	Gosper
(075)	Grant
(077)	Greeley
(079)	Hall
(081)	Hamilton
(083)	Harlan
(085)	Hayes
(087)	Hitchcock
(089)	Holt
(091)	Hooker
(093)	Howard
(095)	Jefferson
(097)	Johnson
(099)	Kearney
(101)	Keith
(103)	Keya Paha
(105)	Kimball
(107)	Knox
(109)	Lancaster
(111)	Lincoln
(113)	Logan
(115)	Loup
(117)	McPherson
(119)	Madison
(121)	Merrick
(123)	Morrill
(125)	Nance
(127)	Nemaha
(129)	Nuckolls
(131)	Otoe
(133)	Pawnee
(135)	Perkins
(137)	Phelps
(139)	Pierce
(141)	Platte
(143)	Polk
(145)	Red Willow
(147)	Richardson
(149)	Rock
(151)	Saline
(153)	Sarpy
(155)	Saunders
(157)	Scotts Bluff
(159)	Seward
(161)	Sheridan
(163)	Sherman
(165)	Sioux
(167)	Stanton
(169)	Thayer
(171)	Thomas
(173)	Thurston
(175)	Valley
(177)	Washington
(179)	Wayne
(181)	Webster
(183)	Wheeler
(185)	York

(32)	Nevada
(001)	Churchill
(003)	Clark
(005)	Douglas
(007)	Elko
(009)	Esmeralda
(011)	Eureka
(013)	Humboldt
(015)	Lander
(017)	Lincoln
(019)	Lyon
(021)	Mineral
(023)	Nye
(027)	Pershing
(029)	Storey
(031)	Washoe
(033)	White Pine
(510)	Carson City

(35)	New Mexico
(001)	Bernalillo
(003)	Catron
(005)	Chaves
(006)	Cibola
(007)	Colfax
(009)	Curry
(011)	De Baca
(013)	Dona Ana
(015)	Eddy
(017)	Grant
(019)	Guadalupe
(021)	Harding
(023)	Hidalgo
(025)	Lea
(027)	Lincoln
(028)	Los Alamos
(029)	Luna
(031)	McKinley
(033)	Mora
(035)	Otero
(037)	Quay
(039)	Rio Arriba
(041)	Roosevelt
(043)	Sandoval
(045)	San Juan
(047)	San Miguel
(049)	Santa Fe
(051)	Sierra
(053)	Socorro
(055)	Taos
(057)	Torrance
(059)	Union
(061)	Valencia

(38)	North Dakota
(001)	Adams
(003)	Barnes
(005)	Benson
(007)	Billings
(009)	Bottineau
(011)	Bowman
(013)	Burke
(015)	Burleigh
(017)	Cass
(019)	Cavalier
(021)	Dickey
(023)	Divide
(025)	Dunn

(027)	Eddy
(029)	Emmons
(031)	Foster
(033)	Golden Valley
(035)	Grand Forks
(037)	Grant
(039)	Griggs
(041)	Hettinger
(043)	Kidder
(045)	La Moure
(047)	Logan
(049)	McHenry
(051)	McIntosh
(053)	McKenzie
(055)	McLean
(057)	Mercer
(059)	Morton
(061)	Mountrial
(063)	Nelson
(065)	Oliver
(067)	Pembina
(069)	Pierce
(071)	Ramsey
(073)	Ransom
(075)	Renville
(077)	Richland
(079)	Rolette
(081)	Sargent
(083)	Sheridan
(085)	Sioux
(087)	Slope
(089)	Stark
(091)	Steele
(093)	Stutsman
(095)	Towner
(097)	Traill
(099)	Walsh
(101)	Ward
(103)	Wells
(105)	Williams

(41)	Oregon
(001)	Baker
(003)	Benton
(005)	Clackamas
(007)	Clatsop
(009)	Columbia
(011)	Coos
(013)	Crook
(015)	Curry
(017)	Deschutes
(019)	Douglas
(021)	Gilliam
(023)	Grant
(025)	Harney
(027)	Hood River
(029)	Jackson
(031)	Jefferson
(033)	Josephine
(035)	Klamath
(037)	Lake
(039)	Lane
(041)	Lincoln
(043)	Linn
(045)	Malheur
(047)	Marion
(049)	Morrow
(051)	Multnomah
(053)	Polk
(055)	Sherman
(057)	Tillamook
(059)	Umatilla
(061)	Union
(063)	Wallowa
(065)	Wasco
(067)	Washington
(069)	Wheeler
(071)	Yamhill

(46)	South Dakota
(003)	Aurora
(005)	Beadle
(007)	Bennett
(009)	Bon Homme
(011)	Brookings
(013)	Brown
(015)	Brule
(017)	Buffalo
(019)	Butte
(021)	Campbell
(023)	Charles Mix
(025)	Clark
(027)	Clay
(029)	Codington
(031)	Corson
(033)	Custer
(035)	Davison
(037)	Day
(039)	Deuel
(041)	Dewey
(043)	Douglas
(045)	Edmunds
(047)	Fall River
(049)	Faulk
(051)	Grant
(053)	Gregory
(055)	Haakon
(057)	Hamlin
(059)	Hand
(061)	Hanson
(063)	Harding
(065)	Hughes
(067)	Hutchinson
(069)	Hyde
(071)	Jackson
(073)	Jerauld
(075)	Jones
(077)	Kingsbury
(079)	Lake
(081)	Lawrence
(083)	Lincoln
(085)	Lyman
(087)	McCook
(089)	McPherson
(091)	Marshall
(093)	Meade
(095)	Mellette
(097)	Miner
(099)	Minnehaha
(101)	Moody
(103)	Pennington
(105)	Perkins

(107) Potter
(109) Roberts
(111) Sanborn
(113) Shannon
(115) Spink
(117) Stanley
(119) Sully
(121) Todd
(123) Tripp
(125) Turner
(127) Union
(129) Walworth
(135 Yankton
(137) Ziebach

(49) Utah
(001) Beaver
(003) Box Elder
(005) Cache
(007) Carbon
(009) Daggett
(011) Davis
(013) Duchesne
(015) Emery
(017) Garfield
(019) Grand
(021) Iron
(023) Juab
(025) Kane
(027) Millard
(029) Morgan
(031) Piute
(033) Rich
(035) Salt Lake
(037) San Juan
(039) Sanpete
(041) Sevier
(043) Summit
(045) Tooele
(047) Uintah
(049) Utah
(051) Wasatch
(053) Washington
(055) Wayne
(057) Weber

(53) Washington
(001) Adams
(003) Asotin
(005) Benton
(007) Chelan
(009) Clallam
(011) Clark
(013) Columbia
(015) Cowlitz
(017) Douglas
(019) Ferry
(021) Franklin
(023) Garfield
(025) Grant
(027) Grays Harbor
(029) Island
(031) Jefferson
(033) King
(035) Kitsap
(037) Kittitas
(039) Klickitat
(041) Lewis
(043) Lincoln
(045) Mason
(047) Okanogan
(049) Pacific
(051) Pend Oreille
(053) Pierce
(055) San Juan
(057) Skagit
(059) Skamania
(061) Snohomish
(063) Spokane
(065) Stevens
(067) Thurston
(069) Wahkiakum
(071) Walla Walla
(073) Whatcom
(075) Whitman
(077) Yakima

(56) Wyoming
(001) Albany
(003) Big Horn
(005) Campbell
(007) Carbon
(009) Converse
(011) Crook
(013) Fremont
(015) Goshen
(017) Hot Springs
(019) Johnson
(021) Laramie
(023) Lincoln
(025) Natrona
(027) Niobrara
(029) Park
(031) Platte
(033) Sheridan
(035) Sublette
(037) Sweetwater
(039) Teton
(041) Uinta
(043) Washakie
(045) Weston

Appendix 2. FIA Forest Type Codes

This following list includes all forest types in the Continental U.S. and Alaska Types designated East/West are commonly found in those regions, although types designated for one region may occasionally be found in another.

East	West	Code	Species Type
			White / Red / Jack Pine Group
E		101	Jack pine
E		102	Red pine
E		103	Eastern white pine
E		104	Eastern white pine / Eastern hemlock
E		105	Eastern hemlock
			Spruce / Fir Group
E		121	Balsam fir
E		122	White spruce
E		123	Red spruce
E		124	Red spruce / balsam fir
E	W	125	Black spruce
E		126	Tamarack
E		127	Northern white-cedar
			Longleaf / Slash Pine Group
E		141	Longleaf pine
E		142	Slash pine
			Loblolly / Shortleaf Pine Group
E		161	Loblolly pine
E		162	Shortleaf pine
E		163	Virginia pine
E		164	Sand pine
E		165	Table-mountain pine
E		166	Pond pine
E		167	Pitch pine
E		168	Spruce pine
			Pinyon / Juniper Group
E		181	Eastern redcedar
E	W	182	Rocky Mountain juniper
	W	183	Western juniper
E	W	184	Juniper woodland
E	W	185	Pinyon juniper woodland
			Douglas-fir Group
E	W	201	Douglas-fir
	W	202	Port-Orford-cedar
			Ponderosa Pine Group
E	W	221	Ponderosa pine
	W	222	Incense cedar

East	West	Code	Species Type
	W	223	Jeffrey pine / Coulter pine / bigcone Douglas-fir
	W	224	Sugar pine
			Western White Pine Group
	W	241	Western white pine
			Fir / Spruce / Mountain Hemlock Group
	W	261	White fir
	W	262	Red fir
	W	263	Noble fir
	W	264	Pacific silver fir
	W	265	Engelmann spruce
	W	266	Engelmann spruce / subalpine fir
	W	267	Grand fir
	W	268	Subalpine fir
	W	269	Blue spruce
	W	270	Mountain hemlock
	W	271	Alaska-yellow-cedar
			Lodgepole Pine Group
	W	281	Lodgepole pine
			Hemlock / Sitka Spruce Group
	W	301	Western hemlock
	W	304	Western redcedar
	W	305	Sitka spruce
			Western Larch Group
	W	321	Western larch
			Redwood Group
	W	341	Redwood
	W	342	Giant sequoia
			Other Western Softwoods Group
	W	361	Knobcone pine
	W	362	Southwest white pine
	W	363	Bishop pine
	W	364	Monterey pine
	W	365	Foxtail pine / bristlecone pine
	W	366	Limber pine
	W	367	Whitebark pine
	W	368	Misc. western softwoods
			California Mixed Conifer Group
	W	371	California mixed conifer
			Exotic Softwoods Group
E		381	Scotch pine
E	W	382	Australian pine
E	W	383	Other exotic softwoods
E		384	Norway spruce
E		385	Introduced larch

East	West	Code	Species Type
			Oak / Pine Group
E		401	Eastern white pine / N. red oak / white ash
E		402	Eastern redcedar / hardwood
E		403	Longleaf pine / oak
E		404	Shortleaf pine / oak
E		405	Virginia pine / southern red oak
E		406	Loblolly pine / hardwood
E		407	Slash pine / hardwood
E		409	Other pine / hardwood
			Oak / Hickory Group
E		501	Post oak / blackjack oak
E		502	Chestnut oak
E		503	White oak / red oak / hickory
E		504	White oak
E		505	Northern red oak
E		506	Yellow-poplar / white oak / N. red oak
E		507	Sassafras / persimmon
E		508	Sweetgum / yellow-poplar
E		509	Bur oak
E		510	Scarlet oak
E		511	Yellow-poplar
E		512	Black walnut
E		513	Black locust
E		514	Southern scrub oak
E		515	Chestnut oak / black oak / scarlet oak
E		519	Red maple / oak
E		520	Mixed upland hardwoods
			Oak / Gum / Cypress Group
E		601	Swamp chestnut oak / cherrybark oak
E		602	Sweetgum / Nuttall oak / willow oak
E		605	Overcup oak / water hickory
E		606	Atlantic white-cedar
E		607	Baldcypress / water tupelo
E		608	Sweetbay / swamp tupelo / red maple
			Elm / Ash / Cottonwood Group
E		701	Black ash / American elm / red maple
E		702	River birch / sycamore
E	W	703	Cottonwood
E	W	704	Willow
E		705	Sycamore / pecan / American elm
E		706	Sugarberry / hackberry / elm / green ash
E		707	Silver maple / American elm
E		708	Red maple / lowland
E	W	709	Cottonwood / willow
	W	722	Oregon ash
			Maple / Beech / Birch Group
E		801	Sugar maple / beech / yellow birch
E		802	Black cherry
E		803	Cherry / ash / yellow-poplar

East	West	Code	Species Type
E		805	Hard maple / basswood
E		807	Elm / ash / locust
E		809	Red maple / upland
			Aspen / Birch Group
E	W	901	Aspen
E	W	902	Paper birch
E	W	904	Balsam poplar
			Alder / Maple Group
	W	911	Red alder
	W	912	Bigleaf maple
			Western Oak Group
	W	921	Gray pine
	W	922	California black oak
	W	923	Oregon white oak
	W	924	Blue oak
E	W	925	Deciduous oak woodland
	W	926	Evergreen oak woodland
	W	931	Coast live oak
	W	932	Canyon live oak / interior live oak
			Tanoak / Laurel Group
	W	941	Tanoak
	W	942	Califonia laurel
	W	943	Giant chinkapin
			Other Western Hardwoods Group
	W	951	Pacific madrone
E	W	952	Mesquite woodland
	W	953	Cercocarpus woodland
	W	954	Intermountain maple woodland
E	W	955	Misc. western hardwood woodlands
			Tropical Hardwoods Group
E		981	Sabal palm
E		982	Mangrove
E		989	Other tropical
			Exotic Hardwoods Group
E		991	Paulownia
E		992	Melaluca
E	W	993	Eucalyptus (RM - not a valid code)
E	W	995	Other exotic hardwoods

For non-stocked stands, see section 2.5.3 for procedures to determine FOREST TYPE.

RM - FOREST TYPE

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

Determine FOREST TYPE as follows:

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

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

RM - Examples:

1. A 10-BAF gauge is used, and the condition consists of 40 ft² of Western hemlock, 30 ft² of Western redcedar, and 60 ft² 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 ft^2 of Southwestern white pine, 20 ft^2 of Mexican pinyon pine, and 30 ft^2 of Alligator juniper. Looking through the stocking group list you would find Southwestern white pine in the Other Western Pines stocking group.

   The Mexican pinyon pine and alligator juniper are both in the Pinyon Juniper stocking group so their basal area would be summed to arrive at 50 ft^2. Southwestern white pine is the only species in the Other Western Pine group with a total of 40 ft^2. 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.

   RM - 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
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 not valid for RM)
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 (not valid for RM)
Geographic area - planted primarily in CA, becoming naturalized

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

Appendix 3. FIA Tree Species Codes

This list includes all tree species tallied in the Continental U.S. and Alaska. Species designated East/West are commonly found in those regions, although species designated for one region may occasionally be found in another. Woodland species designate species where DRC is measured instead of DBH. Species that have an "X" in the *Core* column are tallied in all regions. All other species on the list are "core optional".

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E	W		0010	ABIES	Fir spp.	Abies	spp.
X		W		0011	ABAM	Pacific silver fir	Abies	amabilis
X	E	W		0012	ABBA	balsam fir	Abies	balsamea
X		W		0014	ABBR	Santa Lucia fir, bristlecone fir	Abies	bracteata
X		W		0015*	ABCO	white fir	Abies	concolor
X	E			0016	ABFR	Fraser fir	Abies	fraseri
X		W		0017*	ABGR	grand fir	Abies	grandis
X		W		0018*	ABLAA	corkbark fir	Abies	lasiocarpa var. arizonica
X		W		0019*	ABLA	subalpine fir	Abies	lasiocarpa
X		W		0020*	ABMA	California red fir	Abies	magnifica
X		W		0021*	ABSH	Shasta red fir	Abies	shastensis
X		W		0022*	ABPR	noble fir	Abies	procera
	E	W		0040	CHAMA4	cedar spp.	Chamaecyparis	spp.
X		W		0041	CHLA	Port-Orford-cedar	Chamaecyparis	lawsoniana
X		W		0042	CHNO	Alaska yellow-cedar	Chamaecyparis	nootkatensis
X	E			0043	CHTH2	Atlantic white-cedar	Chamaecyparis	thyoides
		W		0050	CUPRE	cypress	Cupressus	spp.
X		W		0051*	CUAR	Arizona cypress	Cupressus	arizonica
X		W		0052	CUBA	Baker cypress, Modoc cypress	Cupressus	bakeri
X		W		0053	CUFO2	tecate cypress	Cupressus	forbesii
X		W		0054	CUMA2	Monterey cypress	Cupressus	macrocarpa
		W		0055	CUSA3	Sargent's cypress	Cupressus	sargentii

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X		W		0056	CUMA	MacNab's cypress	Cupressus	macnabiana
	E	W		0057	JUNIP	redcedar, juniper spp.	Juniperus	spp.
X		W	w	0058*	JUPI	Pinchot juniper	Juniperus	pinchotii
X		W	w	0059*	JUCO11	redberry juniper	Juniperus	coahuilensis
X	E			0061	JUAS	Ashe juniper	Juniperus	ashei
X		W	w	0062*	JUCA7	California juniper	Juniperus	californica
X		W	w	0063*	JUDE2	alligator juniper	Juniperus	deppeana
X		W		0064*	JUOC	western juniper	Juniperus	occidentalis
X		W	w	0065*	JUOS	Utah juniper	Juniperus	osteosperma
X	E	W	w	0066*	JUSC2	Rocky Mountain juniper	Juniperus	scopulorum
	E			0067	JUVIS	southern redcedar	Juniperus	virginiana var. silicicola
X	E			0068*	JUVI	eastern redcedar	Juniperus	virginiana
X		W	w	0069*	JUMO	oneseed juniper	Juniperus	monosperma
	E	W		0070	LARIX	larch spp.	Larix	spp.
X	E	W		0071	LALA	tamarack (native)	Larix	laricina
X		W		0072*	LALY	subalpine larch	Larix	lyallii
X		W		0073*	LAOC	western larch	Larix	occidentalis
X		W		0081*	CADE27	incense-cedar	Calocedrus	decurrens
	E	W		0090	PICEA	spruce spp.	Picea	spp.
X	E			0091	PIAB	Norway spruce	Picea	abies
X		W		0092	PIBR	Brewer spruce	Picea	breweriana
X		W		0093*	PIEN	Engelmann spruce	Picea	engelmannii
X	E	W		0094*	PIGL	white spruce	Picea	glauca
X	E	W		0095	PIMA	black spruce	Picea	mariana
X	E	W		0096*	PIPU	blue spruce	Picea	pungens
X	E			0097	PIRU	red spruce	Picea	rubens
X		W		0098	PISI	Sitka spruce	Picea	sitchensis
	E	W		0100	PINUS	pine spp.	Pinus	spp.
X		W		0101*	PIAL	whitebark pine	Pinus	albicaulis
X		W		0102*	PIAR	Rocky Mountain bristlecone pine	Pinus	aristata
X		W		0103*	PIAT	knobcone pine	Pinus	attenuata

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X		W		0104*	PIBA	foxtail pine	Pinus	balfouriana
X	E			0105	PIBA2	jack pine	Pinus	banksiana
X		W	w	0106*	PIED	Common pinyon, two-needle pinyon	Pinus	edulis
X	E			0107	PICL	sand pine	Pinus	clausa
X		W		0108*	PICO	lodgepole pine	Pinus	contorta
X		W		0109	PICO3	Coulter pine	Pinus	coulteri
X	E			0110	PIEC2	shortleaf pine	Pinus	echinata
X	E			0111	PIEL	slash pine	Pinus	elliottii
X		W		0112*	PIEN2	Apache pine	Pinus	engelmannii
X		W		0113*	PIFL2	limber pine	Pinus	flexilis
X		W		0114*	PIST3	southwestern white pine	Pinus	strobiformis
X	E			0115	PIGL2	spruce pine	Pinus	glabra
X		W		0116*	PIJE	Jeffrey pine	Pinus	jeffreyi
X		W		0117*	PILA	sugar pine	Pinus	lambertiana
X		W		0118*	PILE	Chihuahua pine	Pinus	leiophylla
X		W		0119*	PIMO3	western white pine	Pinus	monticola
X		W		0120	PIMU	bishop pine	Pinus	muricata
X	E			0121	PIPA2	longleaf pine	Pinus	palustris
X	E	W		0122*	PIPO	ponderosa pine	Pinus	ponderosa
X	E			0123	PIPU5	Table Mountain pine	Pinus	pungens
X		W		0124	PIRA2	Monterey pine	Pinus	radiata
X	E			0125	PIRE	red pine	Pinus	resinosa
X	E			0126	PIRI	pitch pine	Pinus	rigida
X		W		0127	PISA2	gray pine, California foothill pine	Pinus	sabiniana
X	E			0128	PISE	pond pine	Pinus	serotina
X	E			0129	PIST	eastern white pine	Pinus	strobus
X	E			0130*	PISY	Scotch pine	Pinus	sylvestris
X	E			0131	PITA	loblolly pine	Pinus	taeda
X	E			0132	PIVI2	Virginia pine	Pinus	virginiana
X		W	w	0133*	PIMO	singleleaf pinyon	Pinus	monophylla

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X		W	w	0134*	PIDI3	border pinyon	Pinus	discolor
X		W		0135*	PIAR5	Arizona pine	Pinus	arizonica
X	E			0136*	PINI	Austrian pine	Pinus	nigra
X		W		0137*	PIWA	Washoe pine	Pinus	washoensis
X		W		0138	PIQU	four-leaf pine, Parry pinyon pine	Pinus	quadrifolia
X		W		0139	PITO	Torrey pine	Pinus	torreyana
X		W	w	0140*	PICE	Mexican pinyon pine	Pinus	cembroides
X		W		0142*	PILO	Great Basin bristlecone pine	Pinus	longaeva
X		W	w	0143*	PIMOF	Arizona pinyon pine	Pinus	monophylla var. fallax
X	E			0144	PIELE2	Carribean pine	Pinus	elliottii var. elliottii
		W		0200	PSEUD7	Douglas-fir spp.	Pseudotsuga	spp.
X		W		0201	PSMA	bigcone Douglas-fir	Pseudotsuga	macrocarpa
X		W		0202*	PSME	Douglas-fir	Pseudotsuga	menziesii
X		W		0211	SESE3	redwood	Sequoia	sempervirens
X		W		0212	SEGI2	giant sequoia	Sequoiadendron	giganteum
	E			0220	TAXOD	cypress spp.	Taxodium	spp.
X	E			0221	TADI2	baldcypress	Taxodium	distichum
X	E			0222	TAAS	pondcypress	Taxodium	ascendens
	E	W		0230	TAXUS	yew spp.	Taxus	spp.
		W		0231*	TABR2	Pacific yew	Taxus	brevifolia
X	E			0232	TAFL	Florida yew	Taxus	floridana
	E	W		0240	THUJA	Thuja spp.	Thuja	spp.
X	E			0241	THOC2	northern white-cedar	Thuja	occidentalis
X		W		0242*	THPL	western redcedar	Thuja	plicata
	E	W		0250	TORRE	torreya (nutmeg) spp.	Torreya	spp.
X		W		0251	TOCA	California torreya (nutmeg)	Torreya	californica
X	E			0252	TOTA	Florida torreya (nutmeg)	Torreya	taxifolia
	E	W		0260	TSUGA	hemlock spp.	Tsuga	spp.
X	E			0261	TSCA	eastern hemlock	Tsuga	canadensis

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X	E			0262	TSCA2	Carolina hemlock	Tsuga	caroliniana
X		W		0263*	TSHE	western hemlock	Tsuga	heterophylla
X		W		0264*	TSME	mountain hemlock	Tsuga	mertensiana
X	E	W		0299	2TE	unknown dead conifer	Tree	evergreen
	E	W	w	0300	ACACI	acacia spp.	Acacia	spp.
	E	W		0303	ACFA	sweet acacia	Acacia	farnesiana
	E	W		0304	ACGR	catclaw acacia	Acacia	greggii
	E	W		0310	ACER	maple spp.	Acer	spp.
X	E			0311	ACBA3	Florida maple	Acer	barbatum
X		W		0312	ACMA3	bigleaf maple	Acer	macrophyllum
X	E	W		0313*	ACNE2	boxelder	Acer	negundo
X	E			0314	ACNI5	black maple	Acer	nigrum
X	E			0315	ACPE	striped maple	Acer	pensylvanicum
X	E			0316	ACRU	red maple	Acer	rubrum
X	E			0317	ACSA2	silver maple	Acer	saccharinum
X	E			0318	ACSA3	sugar maple	Acer	saccharum
	E			0319	ACSP2	mountain maple	Acer	spicatum
	E			0320	ACPL	Norway maple	Acer	platanoides
		W	w	0321	ACGL	Rocky Mountain maple	Acer	glabrum
		W	w	0322*	ACGR3	bigtooth maple	Acer	grandidentatum
X	E			0323	ACLE	chalk maple	Acer	leucoderme
	E	W		0330	AESCU	buckeye, horsechestnut spp.	Aesculus	spp.
X	E			0331	AEGL	Ohio buckeye	Aesculus	glabra
X	E			0332	AEFL	yellow buckeye	Aesculus	flava
		W		0333	AECA	California buckeye	Aesculus	californica
	E			0334	AEGLA	Texas buckeye	Aesculus	glabra var. arguta
	E			0336	AEPA	red buckeye	Aesculus	pavia
X	E			0337	AESY	painted buckeye	Aesculus	sylvatica
X	E			0341	AIAL	ailanthus	Ailanthus	altissima
X	E	W		0345	ALJU	mimosa/silktree	Albizia	julibrissin
		W		0350	ALNUS	alder spp.	Alnus	spp.

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X		W		0351*	ALRU2	red alder	Alnus	rubra
X		W		0352*	ALRH2	white alder	Alnus	rhombifolia
X		W		0353*	ALOB2	Arizona alder	Alnus	oblongifolia
X	E			0355	ALGL2	European alder	Alnus	glutinosa
	E	W		0356	AMELA	serviceberry spp.	Amelanchier	spp.
	E	W		0357	AMAR3	common serviceberry	Amelanchier	arborea
	E	W		0358	AMSA	roundleaf serviceberry	Amelanchier	sanguinea
		W		0360	ARBUT	Madrone spp.	Arbutus	spp.
X		W		0361*	ARME	Pacific madrone	Arbutus	menziesii
X		W		0362*	ARAR2	Arizona madrone	Arbutus	arizonica
X	E			0367	ASTR	Pawpaw	Asimina	triloba
	E	W		0370	BETUL	birch spp.	Betula	spp.
X	E			0371	BEAL2	yellow birch	Betula	alleghaniensis
X	E			0372	BELE	sweet birch	Betula	lenta
X	E			0373	BENI	river birch	Betula	nigra
X	E			0374	BEOC2	water birch	Betula	occidentalis
X	E	W		0375*	BEPA	paper birch	Betula	papyrifera
X	E			0377	BEUB	Virginia roundleaf birch	Betula	uber
X		W		0378	BEUT	northwestern paper birch	Betula	X utahensis
X	E			0379	BEPO	gray birch	Betula	populifolia
	E			0381	SILAL3	Chittamwood, gum bumelia	Sideroxylon	lanuginosum ssp. lanuginosum
X	E			0391	CACA18	American hornbeam, musclewood	Carpinus	caroliniana
	E			0400	CARYA	hickory spp.	Carya	spp.
X	E			0401	CAAQ2	water hickory	Carya	aquatica
X	E			0402	CACO15	bitternut hickory	Carya	cordiformis
X	E			0403	CAGL8	pignut hickory	Carya	glabra
X	E			0404*	CAIL2	pecan	Carya	illinoinensis
X	E			0405	CALA21	shellbark hickory	Carya	laciniosa
X	E			0406	CAMY	nutmeg hickory	Carya	myristiciformis

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X	E			0407	CAOV2	shagbark hickory	Carya	ovata
X	E			0408	CATE9	black hickory	Carya	texana
X	E			0409	CAAL27	mockernut hickory	Carya	alba
X	E			0410	CAPA24	sand hickory	Carya	pallida
X	E			0411	CAFL6	scrub hickory	Carya	floridana
X	E			0412	CAOV3	red hickory	Carya	ovalis
X	E			0413	CACA38	southern shagbark hickory	Carya	carolinae-septentrionalis
	E	W		0420	CASTA	chestnut spp.	Castanea	spp.
	E			0421	CADE12	American chestnut	Castanea	dentata
X	E			0422	CAPU9	Allegheny chinkapin	Castanea	pumila
	E			0423	CAPUO	Ozark chinkapin	Castanea	pumila var. ozarkensis
X	E	W		0424	CAMO83	Chinese chestnut	Castanea	mollissima
		W		0431	CHCHC4	giant chinkapin, golden chinkapin	Chrysolepis	chrysophylla var. chrysophylla
	E			0450	CATAL	catalpa spp.	Catalpa	spp.
X	E			0451	CABI8	southern catalpa	Catalpa	bignonioides
X	E			0452	CASP8	northern catalpa	Catalpa	speciosa
	E	W		0460	CELTI	hackberry spp.	Celtis	spp.
X	E	W		0461	CELA	sugarberry	Celtis	laevigata
X	E	W		0462*	CEOC	hackberry	Celtis	occidentalis
	E	W		0463	CELAR	netleaf hackberry	Celtis	laevigata var. reticulata
X	E			0471	CECA4	eastern redbud	Cercis	canadensis
		W	w	0475*	CELE3	curlleaf mountain-mahogany	Cercocarpus	ledifolius
X	E			0481	CLKE	yellowwood	Cladrastis	kentukea
	E	W		0490	CORNU	dogwood spp.	Cornus	spp.
X	E			0491	COFL2	flowering dogwood	Cornus	florida
X		W		0492*	CONU4	Pacific dogwood	Cornus	nuttallii
	E			0500	CRATA	hawthorn spp.	Crataegus	spp.
	E			0501	CRCR2	cockspur hawthorn	Crataegus	crus-galli

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	E			0502	CRMO2	downy hawthorn	Crataegus	mollis
	E			0503	CRBR3	Brainerd hawthorn	Crataegus	brainerdii
	E			0504	CRCA	pear hawthorn	Crataegus	calpodendron
	E			0505	CRCH	fireberry hawthorn	Crataegus	chrysocarpa
	E			0506	CRDI	broadleaf hawthorn	Crataegus	dilatata
	E			0507	CRFL	fanleaf hawthorn	Crataegus	flabellata
	E			0508	CRMO3	oneseed hawthorn	Crataegus	monogyna
	E			0509	CRPE	scarlet hawthorn	Crataegus	pedicellata
	E			5091	CRPH	Washington hawthorn	Crataegus	phaenopyrum
	E			5092	CRSU5	fleshy hawthorn	Crataegus	succulenta
	E			5093	CRUN	dwarf hawthorn	Crataegus	uniflora
	E	W		0510	EUCAL	eucalyptus spp.	Eucalyptus	spp.
X		W		0511	EUGL	Tasmanian bluegum	Eucalyptus	globulus
X	E			0512	EUCA2	river redgum	Eucalyptus	camaldulensis
X	E			0513	EUGR12	grand eucalyptus	Eucalyptus	grandis
X	E			0514	EURO2	swamp mahogany	Eucalyptus	robusta
	E			0520	DIOSP	persimmon spp.	Diospyros	spp.
X	E			0521	DIVI5	common persimmon	Diospyros	virginiana
X	E			0522	DITE3	Texas persimmon	Diospyros	texana
X	E			0531	FAGR	American beech	Fagus	grandifolia
	E	W		0540	FRAXI	ash spp.	Fraxinus	spp.
X	E			0541	FRAM2	white ash	Fraxinus	americana
X		W		0542	FRLA	Oregon ash	Fraxinus	latifolia
X	E			0543	FRNI	black ash	Fraxinus	nigra
X	E			0544*	FRPE	green ash	Fraxinus	pennsylvanica
X	E			0545	FRPR	pumpkin ash	Fraxinus	profunda
X	E			0546	FRQU	blue ash	Fraxinus	quadrangulata
X		W		0547*	FRVE2	velvet ash	Fraxinus	velutina
X	E			0548	FRCA3	Carolina ash	Fraxinus	caroliniana
X	E			0549	FRTE	Texas ash	Fraxinus	texensis
	E			0550	GLEDI	locust spp.	Gleditsia	spp.
X	E			0551	GLAQ	waterlocust	Gleditsia	aquatica

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X	E			0552*	GLTR	honeylocust	Gleditsia	triacanthos
X	E			0555	GOLA	loblolly bay	Gordonia	lasianthus
X	E	W		0561	GIBI2	Ginkgo, maidenhair tree	Ginkgo	biloba
X	E			0571	GYDI	Kentucky coffeetree	Gymnocladus	dioicus
	E			0580	HALES	silverbell spp.	Halesia	spp.
X	E			0581	HACA3	Carolina silverbell	Halesia	carolina
X	E			0582	HADI3	two-wing silverbell	Halesia	diptera
X	E			0583	HACA3	little silverbell	Halesia	parviflora
X	E			0591	ILOP	American holly	Ilex	opaca
	E	W		0600	JUGLA	walnut spp.	Juglans	spp.
X	E			0601	JUCI	butternut	Juglans	cinerea
X	E	W		0602*	JUNI	black walnut	Juglans	nigra
		W		0603	JUHI	Northern California black walnut	Juglans	hindsii
X		W		0604	JUCA	Southern California black walnut	Juglans	californica
	E	W		0605	JUMI	Texas walnut	Juglans	microcarpa
X		W		0606*	JUMA	Arizona walnut	Juglans	major
X	E			0611	LIST2	sweetgum	Liquidambar	styraciflua
X	E			0621	LITU	yellow-poplar	Liriodendron	tulipifera
X		W		0631	LIDE3	tanoak	Lithocarpus	densiflorus
X	E			0641	MAPO	Osage-orange	Maclura	pomifera
	E			0650	MAGNO	magnolia spp.	Magnolia	spp.
X	E			0651	MAAC	cucumbertree	Magnolia	acuminata
X	E			0652	MAGR4	southern magnolia	Magnolia	grandiflora
X	E			0653	MAVI2	sweetbay	Magnolia	virginiana
X	E			0654	MAMA2	bigleaf magnolia	Magnolia	macrophylla
X	E			0655	MAFR	mountain magnolia, Fraser magnolia	Magnolia	fraseri
X	E			0657	MAPY	pyramid magnolia	Magnolia	pyramidata
X	E			0658	MATR	umbrella magnolia	Magnolia	tripetala
	E	W		0660	MALUS	apple spp.	Malus	spp.

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X		W		0661	MAFU	Oregon crabapple	Malus	fusca
X	E			0662	MAAN3	southern crabapple	Malus	angustifolia
X	E			0663	MACO5	sweet crabapple	Malus	coronaria
X	E			0664	MAIO	prairie crabapple	Malus	ioensis
	E			0680	MORUS	mulberry spp.	Morus	spp.
X	E			0681	MOAL	white mulberry	Morus	alba
X	E			0682	MORU2	red mulberry	Morus	rubra
	E	W		0683	MOMI	Texas mulberry	Morus	microphylla
X	E			0684	MONI	black mulberry	Morus	nigra
	E			0690	NYSSA	tupelo spp.	Nyssa	spp.
X	E			0691	NYAQ2	water tupelo	Nyssa	aquatica
X	E			0692	NYOG	Ogeechee tupelo	Nyssa	ogeche
X	E			0693	NYSY	blackgum	Nyssa	sylvatica
X	E			0694	NYBI	swamp tupelo	Nyssa	biflora
X	E			0701	OSVI	eastern hophornbeam	Ostrya	virginiana
X	E			0711	OXAR	sourwood	Oxydendrum	arboreum
X	E			0712	PATO2	paulownia, empress-tree	Paulownia	tomentosa
	E	W		0720	PERSE	bay spp.	Persea	spp.
X	E			0721	PEBO	redbay	Persea	borbonia
X		W		7211	PEAM3	avocado	Persea	americana
X	E			0722	PLAQ	water-elm, planertree	Planera	aquatica
	E	W		0729	PLATA	sycamore spp.	Platanus	spp.
X		W		0730	PLRA	California sycamore	Platanus	racemosa
X	E			0731	PLOC	American sycamore	Platanus	occidentalis
X		W		0732*	PLWR2	Arizona sycamore	Platanus	wrightii
	E	W		0740	POPUL	cottonwood and poplar spp.	Populus	spp.
X	E	W		0741*	POBA2	balsam poplar	Populus	balsamifera
X	E			0742*	PODE3	eastern cottonwood	Populus	deltoides
X	E			0743	POGR4	bigtooth aspen	Populus	grandidentata
X	E			0744	POHE4	swamp cottonwood	Populus	heterophylla

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X	E	W		0745*	PODEM	plains cottonwood	Populus	deltoides ssp. monilifera
X	E	W		0746*	POTR5	quaking aspen	Populus	tremuloides
X		W		0747*	POBAT	black cottonwood	Populus	balsamifera ssp. trichocarpa
X		W		0748*	POFR2	Fremont's cottonwood	Populus	fremontii
X		W		0749*	POAN3	narrowleaf cottonwood	Populus	angustifolia
X	E			0752	POAL7	silver poplar	Populus	alba
X	E			0753	PONI	Lombardy poplar	Populus	nigra
	E	W	w	0755	PROSO	mesquite spp.	Prosopis	spp.
X	E	W	w	0756*	PRGL2	honey mesquite	Prosopis	glandulosa
X	E	W	w	0757*	PRVE	velvet mesquite	Prosopis	velutina
X	E	W	w	0758*	PRPU	screwbean mesquite	Prosopis	pubescens
	E	W		0760	PRUNU	cherry and plum spp.	Prunus	spp.
	E	W		0761	PRPE2	pin cherry	Prunus	pensylvanica
X	E			0762	PRSE2	black cherry	Prunus	serotina
	E	W		0763	PRVI	common chokecherry	Prunus	virginiana
	E			0764	PRPE3	peach	Prunus	persica
X	E			0765	PRNI	Canada plum	Prunus	nigra
X	E			0766	PRAM	American plum	Prunus	americana
		W		0768	PREM	bitter cherry	Prunus	emarginata
	E			0769	PRAL5	Allegheny plum	Prunus	alleghaniensis
	E	W		0770	PRAN3	Chickasaw plum	Prunus	angustifolia
X	E			0771	PRAV	sweet cherry (domesticated)	Prunus	avium
	E			0772	PRCE	sour cherry (domesticated)	Prunus	cerasus
	E			0773	PRDO	European plum (domesticated)	Prunus	domestica
	E			0774	PRMA	Mahaleb plum (domesticated)	Prunus	mahaleb
	E	W		0800	QUERC	oak – deciduous spp.	Quercus	spp.
X		W		0801	QUAG	California live oak	Quercus	agrifolia
X	E			0802	QUAL	white oak	Quercus	alba

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X		W	w	0803*	QUAR	Arizona white oak	Quercus	arizonica
X	E			0804	QUBI	swamp white oak	Quercus	bicolor
		W		0805	QUCH2	canyon live oak	Quercus	chrysolepis
X	E			0806	QUCO2	scarlet oak	Quercus	coccinea
X		W		0807	QUDO	blue oak	Quercus	douglasii
X	E			0808	QUSIS	Durand oak	Quercus	sinuata var. sinuata
X	E			0809	QUEL	northern pin oak	Quercus	ellipsoidalis
X		W	w	0810*	QUEM	Emory oak	Quercus	emoryi
X		W		0811	QUEN	Engelmann oak	Quercus	engelmannii
X	E			0812	QUFA	southern red oak	Quercus	falcata
X	E			0813	QUPA5	cherrybark oak	Quercus	pagoda
X		W	w	0814*	QUGA	Gambel oak	Quercus	gambelii
X		W		0815	QUGA4	Oregon white oak	Quercus	garryana
X	E			0816	QUIL	scrub oak	Quercus	ilicifolia
X	E			0817	QUIM	shingle oak	Quercus	imbricaria
X		W		0818	QUKE	California black oak	Quercus	kelloggii
X	E			0819	QULA2	turkey oak	Quercus	laevis
X	E			0820	QULA3	laurel oak	Quercus	laurifolia
X		W		0821	QULO	California white oak	Quercus	lobata
X	E			0822	QULY	overcup oak	Quercus	lyrata
X	E			0823*	QUMA2	bur oak	Quercus	macrocarpa
X	E			0824	QUMA3	blackjack oak	Quercus	marilandica
X	E			0825	QUMI	swamp chestnut oak	Quercus	michauxii
X	E			0826*	QUMU	chinkapin oak	Quercus	muehlenbergii
X	E			0827	QUNI	water oak	Quercus	nigra
X	E			0828	QUBU2	Nuttall oak	Quercus	buckleyi
X		W	w	0829*	QUOB	Mexican blue oak	Quercus	oblongifolia
X	E			0830	QUPA2	pin oak	Quercus	palustris
X	E			0831	QUPH	willow oak	Quercus	phellos
X	E			0832	QUPR2	chestnut oak	Quercus	prinus
X	E			0833	QURU	northern red oak	Quercus	rubra
X	E			0834	QUSH	Shumard’s oak	Quercus	shumardii

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0835	QUST	post oak	Quercus	stellata
	E			0836	QUSI2	Delta post oak	Quercus	similis
X	E			0837	QUVE	black oak	Quercus	velutina
X	E			0838	QUVI	live oak	Quercus	virginiana
X		W		0839	QUWI2	interior live oak	Quercus	wislizeni
X	E			0840	QUMA6	dwarf post oak	Quercus	margarettiae
X	E			0841	QUMI2	dwarf live oak	Quercus	minima
X	E			0842	QUIN	bluejack oak	Quercus	incana
X		W	w	0843*	QUHY	silverleaf oak	Quercus	hypoleucoides
X	E			0844	QUOG	Oglethorpe oak	Quercus	oglethorpensis
	E			0845	QUPR	dwarf chinkapin oak	Quercus	prinoides
X		W	w	0846*	QUGR3	gray oak	Quercus	grisea
X		W	w	0847*	QURU4	netleaf oak	Quercus	rugosa
		W	w	0850	QUERC	oak – evergreen spp.	Quercus	spp.
	E			0852	AMEL	torchwood	Amyris	elemifera
	E			0853	ANGL4	pond apple	Annona	glabra
	E			0854	BUSI	gumbo limbo	Bursera	simaruba
	E			0855	CASUA	sheoak spp.	Casuarina	spp.
X	E			0856	CAGL11	gray sheoak	Casuarina	glauca
X	E			0857	CALE28	Australian pine	Casuarina	lepidophloia
	E			0858	CICA	camphor tree	Cinnamomum	camphora
	E			0859	CIFR	fiddlewood	Citharexylum	fruticosum
	E			0860	CITRU2	citrus spp.	Citrus	spp.
	E			0863	CODI8	pigeon plum, tietongue	Coccoloba	diversifolia
	E			0864	COEL2	soldierwood	Colubrina	elliptica
	E			0865	COSE2	geiger tree	Cordia	sebestena
	E			0866	CUAN4	carrotwood	Cupaniopsis	anacardioides
	E			0873	EURH	red stopper	Eugenia	rhombea
	E			0874	EXPA	Inkwood, butterbough	Exothea	paniculata
	E			0876	FIAU	strangler fig	Ficus	aurea
	E			0877	FICI	shortleaf fig, wild banyantree	Ficus	citrifolia

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E			0882	GUDI	Blolly, beeftree	Guapira	discolor
	E			0883	HIMA2	manchineel	Hippomane	mancinella
	E			0884	LYLA3	false tamarind	Lysiloma	latisiliquum
	E			0885	MAIN3	mango	Mangifera	indica
	E			0886	METO3	poisonwood	Metopium	toxiferum
	E			0887	PIPI3	fishpoison tree	Piscidia	piscipula
	E			0888	SCAC2	schefflera, octopus tree	Schefflera	actinophylla
	E			0890	SIFO	false mastic	Sideroxylon	foetidissimum
	E			0891	SISA6	white bully, willow bustic	Sideroxylon	salicifolium
	E			0895	SIGL3	paradise tree	Simarouba	glauca
	E			0896	SYCU	Java plum	Syzygium	cumini
	E			0897	TAIN2	tamarind	Tamarindus	indica
X	E	W		0901*	ROPS	black locust	Robinia	pseudoacacia
		W	w	0902	RONE	New Mexico locust	Robinia	neomexicana
	E			0906	ACWR4	paurotis palm	Acoelorraphe	wrightii
	E			0907	COAR	silver palm	Coccothrinax	argentata
	E			0908	CONU	coconut palm	Cocos	nucifera
	E			0909	ROYST	royal palm spp.	Roystonea	spp.
X	E			0912	SAPA	cabbage palmetto	Sabal	palmetto
	E			0913	THMO4	key thatch palm	Thrinax	morrisii
	E			0914	THRA2	Florida thatch palm	Thrinax	radiata
	E			0915	ARECA	other palms	Family Arecaceae	not listed above
	E	W		0919	SASAD	western soapberry	Sapindus	saponaria var. drummondii
	E	W		0920	SALIX	willow spp.	Salix	spp.
	E	W		0921	SAAM2	peachleaf willow	Salix	amygdaloides
	E	W		0922	SANI	black willow	Salix	nigra
	E	W		0923	SABE2	Bebb willow	Salix	bebbiana
		W		0924	SABO	red willow	Salix	bonplandiana
X	E			0925	SACA5	coastal plain willow	Salix	caroliniana
X	E			0926	SAPY	balsam willow	Salix	pyrifolia

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
	E	W		0927	SAAL2	white willow	Salix	alba
		W		0928	SASC	Scouler's willow	Salix	scouleriana
X	E			0929	SASE10	weeping willow	Salix	sepulcralis
X	E			0931	SAAL5	sassafras	Sassafras	albidum
	E			0934	SORBU	mountain ash spp.	Sorbus	spp.
	E			0935	SOAM3	American mountain ash	Sorbus	americana
X	E			0936	SOAU	European mountain ash	Sorbus	aucuparia
X	E			0937	SODE3	northern mountain ash	Sorbus	decora
	E			0940	SWMA2	mahogany	Swietenia	mahagoni
	E			0950	TILIA	basswood spp.	Tilia	spp.
X	E			0951	TIAM	American basswood	Tilia	americana
	E			0952	TIAMH	white basswood	Tilia	americana var. heterophylla
	E			0953	TIAMC	Carolina basswood	Tilia	americana var. caroliniana
	E			0970	ULMUS	elm spp.	Ulmus	spp.
X	E			0971	ULAL	winged elm	Ulmus	alata
X	E			0972*	ULAM	American elm	Ulmus	americana
X	E			0973	ULCR	cedar elm	Ulmus	crassifolia
X	E			0974*	ULPU	Siberian elm	Ulmus	pumila
X	E			0975	ULRU	slippery elm	Ulmus	rubra
X	E			0976	ULSE	September elm	Ulmus	serotina
X	E			0977	ULTH	rock elm	Ulmus	thomasii
X		W		0981	UMCA	California-laurel	Umbellularia	californica
		W		0982	YUBR	Joshua tree	Yucca	brevifolia
	E			0986	AVGE	black mangrove	Avicennia	germinans
	E			0987	COER2	buttonwood mangrove	Conocarpus	erectus
	E			0988	LARA2	white mangrove	Laguncularia	racemosa
X	E			0989	RHMA2	American mangrove	Rhizophora	mangle
		W	w	0990	OLTE	desert ironwood	Olneya	tesota
	E	W		0991	TAMAR2	saltcedar	Tamarix	spp.

Core	East	West	Woodland	Code	Code	Common Name	Genus	Species
X	E			0992	MEQU	melaleuca	Melaleuca	quinquenervia
X	E			0993	MEAZ	chinaberry	Melia	azedarach
X	E			0994	TRSE6	Chinese tallowtree	Triadica	sebifera
X	E			0995	VEFO	tungoil tree	Vernicia	fordii
X	E			0996	COOB2	smoketree	Cotinus	obovatus
	E	W		0997	ELAN	Russian-olive	Elaeagnus	angustifolia
X	E	W		0998	2TB	unknown dead hardwood	Tree	broadleaf
X	E	W		0999	2TREE	other, or unknown live tree	Tree	unknown

(*) associated with the species code denotes species tallied in the Rocky Mountain Region.

Appendix 4. Site Tree Selection Criteria and Species List

Western U.S. Site-Tree Selection Criteria

Ideally, site trees in the western U.S. should be between 35-80 years old. If preferred trees cannot be found in this age range, expand the age range to 15-250 years. Reject trees outside the 15-250 year age range, trees that exhibit signs of damage, trees with ring patterns that show signs of suppression, trees less than 5.0 inches DBH, trees with abnormalities at DBH, trees with rotten cores, and woodland species. A list of preferred site-tree species is provided. Site trees should be selected in the following order of preference:

1st Choice: representative of the stand, on the list for your region.
2nd Choice: representative of the stand, on the list for an adjoining western region.
3rd Choice: not representative of the stand, on the list for your region.
4th Choice: not representative of the stand, on the list for an adjoining western region.

Note: PNW = Pacific Northwest FIA, RMRS = Rocky Mountain FIA

Code	Common Name	Region
	-------------------- Softwood Species --------------------	
0011	Pacific silver fir	PNW
0015	white fir	RMRS, PNW
0017	grand fir	RMRS, PNW
0018	corkbark fir	RMRS
0019	subalpine fir	RMRS, PNW
0020	California red fir	RMRS, PNW
0021	shasta red fir	PNW
0022	noble fir	PNW
0073	western larch	RMRS, PNW
0081	incense-cedar	RMRS, PNW
0093	Engelmann spruce	RMRS, PNW
0094	white spruce	RMRS, PNW
0095	black spruce	PNW
0096	blue spruce	RMRS
0098	sitka spruce	PNW
0104	foxtail pine	RMRS
0108	lodgepole pine	RMRS, PNW
0109	Coulter pine	PNW
0112	Apache pine	RMRS
0116	Jeffrey pine	RMRS, PNW
0117	sugar pine	RMRS, PNW
0119	western white pine	RMRS, PNW
0120	bishop pine	PNW
0122	ponderosa pine	RMRS, PNW

Code	Common Name	Region
0135	Arizona pine	RMRS
0201	bigcone Douglas-fir	PNW
0202	Douglas-fir	RMRS, PNW
0211	redwood	PNW
0231	Pacific yew	PNW
0242	western redcedar	RMRS, PNW
0263	western hemlock	RMRS, PNW
0264	mountain hemlock	RMRS, PNW
	-------------------- Hardwood Species --------------------	
0312	bigleaf maple	PNW
0351	red alder	PNW
0375	paper birch	RMRS, PNW
0741	balsam poplar	RMRS, PNW
0745	plains cottonwood	RMRS
0746	quaking aspen	RMRS, PNW
0747	black cottonwood	RMRS, PNW
0748	Fremont poplar	RMRS
0749	narrowleaf cottonwood	RMRS

Appendix 5. Stocking Chart - Not used in the Rocky Mountain Region

Appendix 6. Glossary

Accessible Forest Land – Land that is within sampled area (the population of interest), is accessible and can safely be visited, and meets at least one of the two following criteria:

(a) the condition is at least 10-percent stocked by trees (appendix 3) of any size or has been at least 10-percent stocked in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, grazing, or recreation activities, or
b) in several western woodland types where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size, or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevent normal regeneration and succession such as regular mowing, grazing, or recreation activities.

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

Agricultural Land – Land managed for crops, pasture, or other agricultural use. Evidence includes geometric field and road patterns, fencing, and the traces produced by livestock or mechanized equipment. The area must be at least 1.0 acre in size and 120.0 feet. wide at the point of occurrence.

ALLUVIAL FAN - RM - A fan-shaped deposit of unconsolidated material and debris, forming at the point where a stream emerges from a narrow valley onto a broader, less sloping valley floor.

Alpine- RM - The zone of low arctic-type vegetation above tree line.

Annular plot – a circular ring with a beginning radius of 24.0 feet from subplot center and an ending radius of 58.9 feet.

Artificial Regeneration Species – Indicates the predominant species that is planted or seeded in an artificially regenerated condition.

AZIMUTH - RM - The horizontal angle or bearing of a point, measured clockwise from north. Note: The azimuth plus or minus 180 degrees is termed the back azimuth.

Bajada -RM - A broad, gently inclined slope formed by the lateral blending of a series of alluvial fans, and having a broadly undulating profile.

Basal Area (BA) - RM - The cross-sectional area of a tree stem at the point where diameter (DBH/DRC) is measured, inclusive of bark; BA is expressed in square feet. The BA per acre is often used to represent tree stocking.

Basal Area Factor (BAF) - RM - The basal area factor is an index for the sampling angle used in variable-radius plot tree cruising. The BAF is the amount of basal area each tally tree on a sample point represents per acre.

Baseline - RM - A reference line of sight, located and measured on both the aerial photo and the ground.

Bench - RM - A nearly level to gently inclined surface developed on resistant strata in areas where valleys are cut, and forming a shelf above the level of the valley bottom.

BH - RM - Breast height: 4.5 feet above the ground. BH is in reference to the place of diameter measurement for timber species.

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

Bole – The main stem of a tree, extending from one foot above the ground to the point on the tree where DOB reaches 4 inches

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

BUREAU OF LAND MANAGEMENT LANDS - RM - Public lands administered by the Bureau of Land Management (BLM), U.S. Department of the Interior.

Census Water – Rivers and streams that are more than 200 feet wide and bodies of water that are greater than 4.5 acres in size.

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

Chaining (woodland treatment method) - RM - A mechanical method of land clearing (or possible type conversion) to reduce or eliminate undesirable vegetation (e.g., reduce the number of juniper trees to enhance herbage production for livestock use). With this method, a heavy chain is dragged between two tractors for the purpose of uprooting the undesirable vegetation.

Cirque - RM - A semicircular, concave, bowl-like area with a steep face, primarily resulting from erosive activity of a mountain glacier. A glacial cirque appears as an amphitheater-like carving in the mountainside, with steep slopes providing headwaters for drainage.

Cliff - RM - A high, very steep to perpendicular or overhanging face of rock or earth.

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

Condition - RM - An area of relatively uniform ground cover, such as a homogeneous vegetation cover.

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

Conk - RM - The fruiting body of a wood-destroying fungus that projects from the bole, roots, or other tree parts. The size, shape, and color of conks will vary depending on the fungus species.

Contrasting Condition Class - RM - Any qualifying condition class that is different than a previously assigned class based on the defining attributes.

Cord - RM - A stack of wood equivalent to 128 cubic feet of wood and air space, having standard dimensions of 4 by 4 by 8 feet.

Crook - RM - An abrupt curvature or bend in a tree bole.

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

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

CROWN COVER - RM - The ground area covered by a plant crown, as defined by the vertical projection of its outermost perimeter. The field location Crown Cover only includes trees 1.0-inch DBH/DRC and larger.

CROWN RATIO - RM - The portion of tree bole supporting live, healthy foliage, expressed as a percent of either total tree height (Uncompacted) or total tree length (Compacted).

CUBIC-FOOT CULL - RM - An assessment of the rotten, missing, or otherwise defective portions of a tree bole that are unsuitable for industrial wood products. Cubic-foot cull is expressed as a percentage of the entire bole.

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

Cull Tree - RM - A live timber species that fails to meet the specifications for a sound tree now or prospectively (see Rotten Tree and Rough Tree).

Diameter at Breast Height (DBH) – The diameter of the bole of a tree at breast height (4.5 feet above the ground), measured outside of the bark.

Dead Volume - RM - That part of a tree's merchantable portion, consisting of sound dead wood (expressed as a percent).

Diameter Class - RM - A grouping of tree diameters (DBH or DRC). For the current inventory, 2-inch diameter classes are used, with the even-inch the appropriate mid-point for a class. For example, the 6-inch class includes trees 5.0- to 6.9-inches DBH inclusive.

DIB - RM - Diameter inside bark.

Downed Tree - RM - For single-stemmed trees -- a tree 1.0-inch in diameter or larger, lying along the ground and usually with a portion of the stem or bole resting on the ground. For multi-stemmed trees -- a tree 1.0-inch DRC or larger, with more than 2/3 of the present volume no longer attached or upright; do not consider cut and removed volume.

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

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

Ephemeral Stream - RM - See "Stream, Ephemeral."

Established Seedling - RM - A live tree smaller than 1.0-inch DBH/DRC, having a root system in mineral soil, and at least 6.0-inches tall for softwoods (e.g., pines, firs, spruces, pinyon, juniper), or 12.0-inches tall for hardwoods (e.g., aspen, cottonwood, oak, maple, mountain-mahogany). A seedling is not considered established if it will not survive due to form defects, insect infestation, or disease.

Face - RM - A section of the tree surface (usually within the butt sixteen feet) that is ¼ of the circumference of the tree and extending the full length of the log.

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

Field Location - RM - A reference to the sample site; an area containing the field location center and all sample points, distributed over an area approximately 2.5 acres in size. A field location consists of four fixed-radius subplots for sampling trees and understory vegetation and 4 microplots for sampling seedlings and saplings.

Fixed-Radius Plot - RM - A circular sample plot of a specified horizontal radius:

Microplot:	1/300 acre = 6.8-foot radius
Subplot:	1/24 acre = 24.0-foot radius

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

Forest Land - RM - Land that is at least 10 percent stocked by forest trees of any size (or 5 percent crown cover where stocking cannot be determined), or land formerly having such tree cover, and is not currently developed for a nonforest use. The minimum area for classification as forest land is one acre. Roadside, stream-side, and shelterbelt strips of timber must be at have a crown width at least 120 feet wide to qualify as forest land. Unimproved roads and trails or natural clearings in forested areas shall be classified as forest, if less than 120 feet in width or an acre in size. Streams and other bodies of water within forest will be considered forest land if they are less than 1 acre and 30-feet wide. Grazed woodlands, reverting fields, and pastures that are not actively maintained are included if the above qualifications are satisfied. (Also see definitions of nonforest land, idle farmland and improved/maintained pasture.)

Note: In some instances, areas previously stocked with woodland species that have had some type of treatment (e.g., chaining or other mechanical treatment) are classified as nonforest land.

Forest Trees – Plants having a well-developed, woody stem and usually more than 12 feet in height at maturity.

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

Geographic Tree Center - RM - The physical center of a single stemmed tree or the physical center of all the stems of a multistemmed woodland tree (defined as the center of a polygon scribed by connecting the centers of the outermost stems in the tree at the DRC point; stems of any diameter are to be used).

Glacial Moraine - RM - An accumulation of rock material built chiefly by the direct action of glacial ice, glacial drift, or by running water emanating from the glacier. Moraines may be classified as lateral or terminal depending on their relationship to the movement of the ice mass.

> Lateral Moraine -- A ridge-like moraine carried on and deposited at the side margin of a valley glacier, composed chiefly of rock fragments derived from valley walls.
>
> Terminal Moraine -- A moraine produced at the front end of an actively flowing glacier. This moraine marks the glacier's farthest advance, and usually has the form of a massive curved ridge or complex of ridges.

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

Hard Dead Tree - RM - A standing dead tally tree, 1.0-inch DBH/DRC or larger, that has a minimum of 1/3 of the original merchantable volume sound (less than 2/3 rotten and/or missing). Formerly called "salvable". Also, a down dead tally tree, 1.0-inch DBH/DRC or larger, with a minimum of 1/3 of the original merchantable volume sound and intact.

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

Herbaceous - RM - Of or relating to a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue, and dies down at the end of a growing season.

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

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

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

Improved Road - RM - All roads graded or otherwise regularly maintained for long-term continuing use. These roads are generally paved or graveled, and may have culverts; however, some temporary logging roads appear as improved roads; reference field maps.

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

Industrial Wood – All roundwood products, except firewood.

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

Inhibiting Vegetation - RM - Includes all vegetation considered to repress the natural establishment of tree seedlings.

Intermittent Stream - RM - See "Stream, Intermittent."

Land - RM - This includes (1) areas of dry ground and ground temporarily or partly covered by water, such as marshes, swamps, and river flood plains, (2) streams, sloughs, estuaries, and canals less than 30 feet in width, and (3) lakes, reservoirs, and ponds smaller than 1 acre in size.

Land Area – As defined by the Bureau of the Census: The area of dry land and land temporarily or partially covered by water such as marshes, swamps, and river flood plains (omitting tidal flats below mean tide); streams, sloughs, estuaries and canals less than 200 feet in width, and ponds less than 4.5 acres in area.

Land Use - RM - The classification of a land condition class by use or type.

Limbs - RM - That part of a tree above the stump which does not meet the requirements for sawlog and upper-stem portions, including all live, sound branches to a minimum of 4 inches DOB at the knot collar.

Limiting Distance - RM - The maximum horizontal distance a tree can be from the plot center and still be considered for tally. In reference to fixed-area plots, limiting distance is determined by the size of the sample; for a 1/24-acre sample, the limiting distance to the geographic center of the tree at the base is 24 feet; for a 1/300-acre sample, the limiting distance is 6.8 feet. In reference to variable-radius plot sampling, limiting distance is a function of the selected basal area factor (e.g., 20 or 40) and the diameter of the tree; the distance is measured from the plot center to the center of a single-stemmed tree (to the face of the tree if table is used) at the diameter point or to the geographic center of a multistemmed woodland tree at the average diameter height. A tally tree is one that is at or within its limiting distance from the point stake.

Litter - RM - The uppermost layer of organic debris on a forest floor; that is, essentially the freshly fallen, or only slightly decomposed material, mainly foliage, but also bark fragments, twigs, flowers, fruits, and so forth. For the ground cover transect, litter also includes any dead organic material including carcasses, feces, etc. Note: Litter and humus together are often termed duff.

Location Center (LC) - RM - The LC is the intersection of map grid lines as established on the ground; it becomes the center point of the field location, and the center of subplot 1 on the location layout. On previously established locations, the LC is either point 1 of a 5-point “timberland” location layout, or the center of the 1/10-acre or 1/20-acre fixed-radius “woodland” location layout.

Logging - RM - The felling and extraction of timber.

Macroplot – A circular, fixed area plot with a radius of 58.9 feet. Macroplots may be used for sampling relatively rare events.

Main Plot (OLD PLOT DESIGN) - RM - For previously sampled “timberland” field location sample points, the main plot is the variable-radius plot. For previously sampled “woodland” field locations, the main plot is the quadrant area sample on a 1/10-acre or 1/20-acre fixed-radius plot. The quadrant area is synonymous with the term “point.”

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

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

Measurement Quality Objective (MQO) – Describes the acceptable tolerance for each data element. MQOs consist of two parts: a statement of the tolerance and a percentage of time when the collected data are required to be within tolerance.

Merchantable Bole - RM - On timber species 5.0-inches DBH and larger: the portion of a tree bole between a 1-foot stump and a 4.0-inch top (DOB).

Merchantable Bolt - RM - On timber species 5.0-inches DBH and larger: a solid 8-foot section of tree bole with a large-end diameter of at least 5.0 inches and a small-end diameter of at least 4.0 inches.

Merchantable Portion (woodland species) - RM - For woodland trees, the merchantable portion includes all qualifying segments above the place(s) of diameter measurement for any tree with at least one 3.0-inch stem; sections below the place(s) of diameter measurement are not included. Qualifying segments are stems or branches that are a minimum of 1 foot in length and at least 1.5 inches in diameter; portions of stems or branches smaller than 1.5 inches in diameter, such as branch tips, are not included in the merchantable portion of the tree.

Merchantable Top – The point on the bole of trees above which merchantable material cannot be produced. Merchantable top is 1.5 inches for western woodland species and 4.0 inches for all other species.

Mesa - RM - A broad, nearly flat-topped, and usually isolated land formation with steep sides.

Microplot – A circular, fixed-radius plot with a radius of 6.8 feet that is used to sample trees less than 5.0 inches at DBH, as well as other vegetation.

Mortality Tree - RM - A standing or downed tree, 1.0-inch DBH/DRC and larger, that was live within the past 5 years or at the last inventory.

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

National Park Land - RM - Public lands administered by the Park Service, U.S. Department of the Interior, such as National Parks, National Monuments, National Historic Sites (such as National Memorials and National Battlefields), and some National Recreation Areas.

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

Net Volume - RM - Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

NFS - RM - An abbreviation for "National Forest System."

Non-census Water* – Portions of rivers, streams, sloughs, estuaries, and canals that are 30 to 200 feet wide and at least 1 acre in size; and lakes, reservoirs, and ponds 1 to 4.5 acres in size. Portions of rivers and streams not meeting the criteria for census water, but at least 30 feet wide and 1 acre in size, are considered noncensus water. Portions of braided streams not meeting the criteria for census water, but at least 30 feet in width and 1 acre in size and more than 50 percent water at normal high-water level are considered noncensus water. Ephemeral and intermittent streams are classified as land.

Nonforest Land* -- This is land that (1) has never supported forests (e.g., barren, alpine tundra), or (2) was formerly tree land, but has been converted to a non-tree land status (e.g., cropland, improved pasture).

Other examples of nonforest land are improved roads of any width, graded or otherwise regularly maintained for long-term continuing use, and rights-of-way of all powerlines, pipelines, other transmission lines, and operating railroads. If intermingled in forest areas, unimproved roads and nonforest strips must be at least 120-feet wide and 1 acre in size to qualify as non-tree land.

This category also includes formerly stocked woodland areas if they are currently nonstocked due to a treatment (e.g., chaining, other land clearing). These areas are treated to eliminate woodland trees for the purpose of enhancing or providing for non-wood commodities or uses (e.g., increasing herbage production). Chained woodland areas remain nonforest until they meet stocking with new reproduction.

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

Nonstocked Forest Land - RM - Formerly stocked forest land that currently has less than 10 percent stocking (as represented in the field by 5 percent crown cover or adequate reproduction) but has the potential to again become 10 percent stocked. For example, recently harvested, burned, or windthrow-damaged areas.

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

Outcrop - RM - Surface exposure of a significant geologic strata.

Overgrown Knot - RM - The scar left in the bark by a limb that has been completely overgrown, but still outlined by the circular configuration in the bark.

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

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

Pathogen - RM - An organism capable of causing disease.

Perennial Stream - RM - See "Stream, Perennial."

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

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

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

Plot – A cluster of four subplots that samples approximately 1/6 acre. The subplots are established so that subplot 1 is centered within the sample and the centers of subplots 2, 3,and 4 are located 120.0 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and macroplot.

Poletimber Trees - RM - See "Tree Size Class."

Primary Wood Processing Plant - RM - An industrial plant that processes roundwood products such as sawlogs, pulpwood bolts, or veneer logs.

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

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

Production plot – a plot that belongs to the 6000-acre grid database. It may also be used for training purposes.

Reference Point (RP) - RM - A landmark readily identifiable on both ground and aerial photographs. Examples include the following: a prominent tree or rock; a sharp bend in a road or drainage ditch; a fence corner. The RP for field locations should be either a tree not likely to die, or a landmark not likely to be removed, within the next 10-15 years, and if possible, located at least 100 feet from the location center.

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

Remeasurement Location - RM - A field location originally established and measured in a previous inventory.

Reserved Land – Land reserved from wood products utilization through statute or administrative designation. Reserved land is withdrawn through administrative designation, based on a written document(s), which carries the weight of legal authority, prohibiting the management of land for the production of wood products (not merely controlling wood harvesting methods). Such authority is usually vested in a public agency, department, etc., and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but is rather permanent in nature. Examples include Wilderness areas and National Parks and Monuments.

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

Rotation - RM - The period of years between establishment of a stand of timber and the time when it is considered ready for cutting and regeneration.

Rotation Age - RM - The age of a stand when it is considered ready for harvesting. Rotation age is 80 years for aspen and paper birch, and 120 years for all other timber species.

Rotten Tree - RM - A live timber species, 5.0-inch DBH and larger, with 2/3 (67 percent) or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing cubic-foot volume loss.

Rotten/Missing Volume - RM - The part of a tree’s merchantable portion that is rotten and/or missing (expressed as a percent). This does NOT include missing volume from a broken or missing top.

Rough Tree - RM - A live timber species, 5.0-inch DBH and larger, with 2/3 (67 percent) or more of the merchantable volume cull, and more than half of this cull due to sound dead wood cubic-foot volume loss or severe form-defect volume loss (e.g., severe sweep and crook, forks, extreme form reduction). Also, a live timber species sapling (1.0- to 4.9-inches DBH) that is not expected to become a sound tree with good form and vigor due to defect, or a timber species (5.0-inches DBH and larger) that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

Roundwood prodcuts – Logs, bolts or other round sections cut from trees for industrial or consumer uses. (Note: includes sawlogs veneer logs and bolts; cooperage logs and bolts; pulpwood, fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Saplings – Live trees 1.0 to 4.9 inches DBH.

Seedlings – Live trees less than 1.0 DBH that are at least one foot tall.

Site Tree - RM - A tree used to provide an index of site quality.

Slash - RM - Unmerchantable tree residue on the ground from logging activities or from natural breakup of trees caused by insects, disease, weather, etc. Slash includes logs, stems, heavier branch wood, stumps, etc.

SOD - RM - A continuous cover of grass and/or herbaceous plants.

Soft Dead Tree - RM - A standing dead tally tree, 1.0-inch DBH/DRC or larger, that has less than 1/3 of the original merchantable volume sound (more than 2/3 rotten/missing). Also, a down dead tree, 1.0-inch DBH/DRC or larger, with less than 1/3 of the original merchantable bole sound and intact. Formerly called “nonsalvable”.

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

Sound Tree - RM - Formerly called “growing-stock tree.” A live timber species, 5.0-inches DBH or larger, that has less than 2/3 (67 percent) of the merchantable volume cull, and contains at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole. Also, a live timber-species sapling (1.0- to 4.9-inches DBH) that is expected to become a sound live tree with good form and vigor, 5.0-inches DBH or larger

Sprig - RM - Any woody or non-woody lateral growth, without secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

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

STAND DENSITY – A stand descriptor that indicates the relative tree density of a condition class. The classification is based on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition which are not overtopped, compared to any previously defined condition class tree density.

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

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

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

Stream - RM - A body of running water. Note: For purposes of this inventory, ephemeral and intermittent streams are classified as land.

> Ephemeral: A stream that flows only in direct response to precipitation or surface run-off.
>
> Intermittent: A stream that flows for protracted periods only when it receives ground water discharge or long-continued contributions from melting snow or other surface and shallow subsurface sources.
>
> Perennial: A stream that flows year-round.

Stream Bottom - RM - A gently sloping stream pathway subject to frequent flooding.

Stream Terrace - RM - A nearly level strip of land with a more or less abrupt descent along the margin of a river or stream, but not subject to frequent flooding.

Stump Height - RM - For purposes of this inventory, stump height for timber species is the height on a tree from ground level to the top of a 1.0-foot stump.

Sound Knot or Limb - RM – Knots or limbs that are intergrown, or encased, with the surrounding wood, and that show no sign s of decay. Bark may not be present on the limbs.

Subplot – A circular, fixed-area plot with a radius of 24.0 feet. Each subplot represents ¼ of the fixed plot sample unit.

Suppression - RM - The process whereby certain trees, shrubs, etc., in a community become weakened and/or stunted, essentially due to competition by surrounding trees, shrubs, etc., in the immediate environment (natural suppression). Suppression may also be the result of human intervention (e.g., selective lopping, girdling, cutting back) or selective browsing by animals (artificial suppression).

Sweep - RM - A curve in a tree bole, not an abrupt bend (crook).

Tally Tree - RM - Tree species listed in this manual (chapter 10) as timber or woodland trees and measured for volume, growth, and mortality.

Talus - RM - The accumulated mass of loose, broken rock fragment derived from and lying at the base of a cliff or steep rock slope.

Timberland - RM - In previous inventories, this was forest land (including areas with mixtures of timber species and woodland trees) where timber species have 5 percent or more crown cover, or forest land with sufficient timber species reproduction (minimum of 40 saplings and/or established seedlings per acre). The timberland designation required the establishment of a 5-point variable-radius tree sample.

Timber Species - RM - Tally tree species measured at breast height; these include all species of conifers, except pinyon, or juniper. In addition, hardwoods included in this category are aspen, paper birch, cottonwood (Populus spp.), two oak species (macrocarpa and muehlenbergii) and boxelder. Western juniper is measured as a timber species, though measured for age and radial growth using woodland species rules.

Timber Stand Improvement - RM - A term comprising all intermediate cuttings or treatments made to improve the composition, health, and growth of the remaining trees (TSI) in the stand. Trees removed are often smaller than sawtimber size.

Total Height - RM - The vertical distance between ground level to the tip of the apical meristem (tree) or to the highest tip of other vegetation. In contrast to length, height is reduced with increasing angle of lean.

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

Trail - RM - A pathway consistently used by wildlife, domestic animals, or humans.

improved trail: used for human recreation/travel, maintained through tree removal and brush clearing, often with posted signs at a trailhead or fork, and documented on forest/recreation maps.

unimproved trail: used for human recreation/travel, sometimes documented on a forest/recreation map, but rarely cleared or posted.

wildlife/animal trail: not cleared, maintained, posted, or documented for human use.

Training plot – a plot established for training or certification purposes only. It does NOT belong to the 6000-acre grid database.

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

Tree Class - RM - A classification system based on a tree's physical characteristics, and used to classify all live timber species as sound, rough, or rotten trees, and dead timber and dead woodland species as either hard or soft.

Twig - RM - Any woody lateral growth, with secondary branching, less than 1.0 inch in diameter at the base above the swelling at the point of attachment to a branch or crown stem.

Unimproved Road - RM - A road not regularly maintained for long-term continuing use, such as a jeep trail, old logging road, etc. These may or may not be posted with road signs.

Upper Stem Portion - RM - The part of the bole of sawtimber trees above the sawlog top to a minimum top diameter of 4.0 inches DOB, or to the point where the central stem breaks into limbs.

Urban Areas - RM - Nonsampled tree land or non-tree land within the legal boundaries of cities and towns (e.g., school yards, cemeteries, airports, golf courses).

Variable Radius Plot - RM - A plot, used in previous inventories, where a predetermined critical angle is projected from a central point and swept in a full circle to determine the basal area (tree count) and volume per unit of area. The radius of this plot is a function of an individual tree's size and distance from the point center.

Water - RM - In terms of a Ground Cover Classification, water is defined as streams, sloughs, estuaries, and canals more than 30 feet in width; and lakes, reservoirs, and ponds more than 1 acre in size.

For use in determining the "water proximity" or "water type" nearest the field location center, water implies any reliable source of water for wildlife, livestock, recreators, etc.

Wilderness - RM - An area of undeveloped land currently included in the Wilderness System, managed so as to preserve its current conditions and retain its natural character and influence.

Woodland - RM - In previous inventories, this was forest land with 10 percent or more crown cover in (1) woodland trees, or (2) timber species and woodland trees, but less than 5 percent crown cover in timber species; or forest land with sufficient woodland species reproduction (minimum of 40 saplings and/or established seedlings per acre).

Woodland Species - RM - Tally tree species measured at ground level (DRC); these include pinyon, juniper (except Western juniper), oak, mesquite, mountain-mahogany, and bigtooth maple.

* Indicates a National definition that has been edited or modified.

Appendix 7. Tolerance / MQO / Value / Units Table

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

Variable Name	Tolerance	MQO	Values	Units
General Description				
New Subplot Location	+/- 7 feet	95% of the time	n/a	feet
New Microplot Location	+/- 1 foot	95% of the time	n/a	feet
Plot Level Data				
STATE	No errors	99% of the time	Appendix 1	n/a
COUNTY	No errors	99% of the time	Appendix 1	n/a
PLOT NUMBER	No errors	99% of the time	00001 to 99999	n/a
PLOT STATUS	No errors	99% of the time	1 to 3	n/a
PLOT NONSAMPLED REASON	No errors	99% of the time	01 to 03 and 05 to 10	n/a
SUBPLOTS EXAMINED	No errors	90% of the time	1, 4	n/a
SAMPLE KIND	No errors	99% of the time	1 to 3	n/a
PREVIOUS PLOT NUMBER	No errors	99% of the time	00001 to 99999	n/a
FIELD GUIDE VERSION	No errors	99% of the time	3.0	n/a
YEAR	No errors	99% of the time	≥ 2003	year
MONTH	No errors	99% of the time	Jan – Dec (01 – 12)	month
DAY	No errors	99% of the time	01 to 31	day
DECLINATION	No errors	99% of the time	-359.0 to 359.0	degrees
HORIZONTAL DISTANCE TO IMPROVED ROAD	No errors	90% of the time	1 to 9	n/a
WATER ON PLOT	No errors	90% of the time	0 to 5, 9	n/a
QA STATUS	No errors	99% of the time	1 to 7	n/a
CREW TYPE	No errors	99% of the time	1, 2	n/a
GPS UNIT	No errors	99% of the time	0 to 4	n/a
GPS SERIAL NUMBER	No errors	99% of the time	000001 to 999999	n/a
GPS DATUM	No errors	99% of the time	NAD27, NAD83, WGS84	n/a
COORDINATE SYSTEM	No errors	99% of the time	1, 2	n/a
LATITUDE DEGREES	No errors	99% of the time		degrees
LATITUDE MINUTES	No errors	99% of the time	1 – 59	minutes
LATITUDE SECONDS	+/- 140 ft	99% of the time	0.00 – 59.99	seconds
LONGITUDE DEGREES	No errors	99% of the time		degrees
LONGITUDE MINUTES	No errors	99% of the time	1 – 59	minutes
LONGITUDE SECONDS	+/- 140 ft	99% of the time	0.00 – 59.99	seconds
UTM ZONE	No errors	99% of the time	03-19Q and 03-19W	n/a
EASTING (X) UTM	+/- 140 ft	99% of the time		
NORTHING (Y) UTM	+/- 140 ft	99% of the time		

Variable Name	Tolerance	MQO	Values	Units
AZIMUTH TO PLOT CENTER	+/- 3 degrees	99% of the time	000 at plot center 001 to 360 not at plot center	degrees
DISTANCE TO PLOT CENTER	+/- 6 ft	99% of the time	000 at plot center 001 to 200 if a Laser range finder not used 001 to 999 if a Laser range finder is used	feet
GPS ELEVATION		99% of the time	-00100 to 20000	feet
GPS ERROR	No errors	99% of the time	000 to 070 if possible 071 to 999 if an error < 70 cannot be obtained	feet
NUMBER OF READINGS	No errors	99% of the time	001 to 999	n/a
GPS FILENAME	No errors	99% of the time	Letters and numbers	n/a
MACROPLOT BREAKPOINT DIAMETER	No errors	99% of the time	21, 24, and 30	inches
PLOT-LEVEL NOTES	n/a	n/a	English, alpha-numeric	n/a
Condition Class Information				
CONDITION CLASS NUMBER	No errors	99% of the time	1 to 9	n/a
CONDITION CLASS STATUS	No errors	99% of the time	1 to 5	n/a
CONDITION NONSAMPLED REASON	No errors	99% of the time	01, 02, 03, 10	n/a
RESERVED STATUS	No errors	99% of the time	0, 1	n/a
OWNER GROUP	No errors	99% of the time	10, 20, 30, 40	n/a
FOREST TYPE	No errors	99% of the time in group 95% of the time in type no MQO when STAND SIZE CLASS = 0	Appendix 2	n/a
STAND SIZE CLASS	No errors	99% of the time	0 to 6	class
REGENERATION STATUS	No errors	99% of the time	0, 1	n/a
TREE DENSITY	No errors	99% of the time	1 to 3	n/a
OWNER CLASS	No errors	99% of the time	11-13; 21-25; 31-33; 41-45	class
PRIVATE OWNER INDUSTRIAL STATUS	No errors	99% of the time	0, 1	n/a
ARTIFICIAL REGENERATION SPECIES	No errors	99% of the time	Appendix 3	n/a
STAND AGE	+/- 10%	95% of the time	000 to 997, 998, 999	year
DISTURBANCE 1	No errors	99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a

Variable Name	Tolerance	MQO	Values	Units
DISTURBANCE YEAR 1	+/- 1 year for 5-year measure. cycles +/ 2 years for > 5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year
DISTURBANCE 2	No errors	99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a
DISTURBANCE YEAR 2	+/- 1 year for 5-year measure. cycles +/ 2 years for > 5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year
DISTURBANCE 3	No errors	99% of the time	00; 10-12; 20-22; 30-32;40-46; 50-55; 60; 70; 80	n/a
DISTURBANCE YEAR 3	+/- 1 year for 5-year measure. cycles +/ 2 years for > 5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time; 9999 if disturbance occurs continuously over time	year
TREATMENT 1	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a
TREATMENT YEAR 1	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
TREATMENT 2	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a
TREATMENT YEAR 2	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
TREATMENT 3	No errors	99% of the time	00, 10, 20, 30, 40, 50	n/a

Variable Name	Tolerance	MQO	Values	Units
TREATMENT YEAR 3	+/- 1 year for 5-year measure. cycles +/- 2 years for >5-year measure. cycles	99% of the time	Since the previous plot visit, or the past 5 years for plots visited for the first time	year
PHYSIOGRAPHIC CLASS	No errors	80% of the time	xeric: 11, 12, 13, 19 mesic: 21, 22, 23, 24, 25, 29 hydric: 31, 32, 33, 34, 35, 39	n/a
PRESENT NONFOREST LAND USE	No errors	99% of the time	10-15; 20; 30-33; 40	n/a
Subplot Information				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
SUBPLOT/ MACROPLOT STATUS	No errors	99% of the time	1 to 3	n/a
SUBPLOT NONSAMPLED REASON	No errors	99% of the time	01 to 05, 10	n/a
SUBPLOT CENTER CONDITION	No errors	99% of the time	1 to 9	n/a
MICROPLOT CENTER CONDITION	No errors	99% of the time	1 to 9	n/a
SUBPLOT SLOPE	+/- 10 %	90% of the time	000 to 155	percent
SUBPLOT ASPECT	+/- 10 degrees	90% of the time	000 to 360	degrees
SNOW/WATER DEPTH	+/- 0.5 ft	at the time of measurement	0.0 to 9.9	feet
SUBPLOT/ MACROPLOT CONDITION LIST	No errors	99% of the time	1000 to 9876	n/a
Boundary Data				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
PLOT TYPE	No errors	99% of the time	1 to 3	n/a
BOUNDARY CHANGE	No errors	99% of the time	0 to 3	n/a
CONTRASTING CONDITION	No errors	99% of the time	1 to 9	n/a
LEFT AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
CORNER AZIMUTH	+/- 10 degrees	90% of the time	000 to 360	degrees
CORNER DISTANCE	+/- 1 ft	90% of the time	microplot: 01 to 07 (6.8 ft actual limiting distance) subplot: 01 to 24 macroplot: 01 to 59 (58.9 ft actual limiting distance)	feet
RIGHT AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees

Variable Name	Tolerance	MQO	Values	Units
Tree and Sapling Data				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
TREE RECORD NUMBER	No errors	99% of the time	000, 001 to 999	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1 to 9	n/a
AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
HORIZONTAL DISTANCE	microplot:+/- 0.2 ft microplot woodland species: +/- 0.4 ft subplot: +/- 1.0 ft subplot woodland species: +/- 2.0 ft annular plot: +/- 3.0 ft annular plot woodland species: +/- 6.0 ft	90% of the time	microplot: 00.1 to 06.8 subplot: 00.1 to 24.0 annular plot: 24.1 to 58.9	feet
PREVIOUS TREE STATUS	No errors	95% of the time	1, 2	n/a
PRESENT TREE STATUS	No errors	95% of the time	0 to 3	n/a
RECONCILE	No errors	95% of the time	1 to 4: valid for new trees on the plot 5 to 9: valid for remeasured trees that no longer qualify as tally	n/a
STANDING DEAD	No errors	99% of the time	0, 1	n/a
MORTALITY	No errors	85% of the time	0, 1	n/a
SPECIES	No errors	99% of the time for genus 95% of the time for species	Appendix 3	n/a

Variable Name	Tolerance	MQO	Values	Units
DIAMETER	+/- 0.1 inch per 20.0 inch increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2 +/-1.0 inch per 20.0 inch increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5 For woodland species: +/- 0.2 inch per stem	95% of the time	001.0 to 999.9	inches
DRC STEM DIAMETER	+/- 0.2 inch per stem	95% of the time	001.0 to 999.9	inch
DRC STEM STATUS	No errors	95% of the time	1, 2	n/a
PAST NUMBER OF STEMS	No errors	90% of the time	1 to 99	n/a
CURRENT NUMBER OF STEMS	No errors	90% of the time	1 to 99	n/a
DIAMETER CHECK	No errors	99% of the time	0 to 2	n/a
ROTTEN / MISSING CULL	+/- 10%	90% of the time	00 to 99	percent
TOTAL LENGTH	+/- 10% of true length	90% of the time	005 to 400	feet
ACTUAL LENGTH	+/- 10% of true length	90% of the time	005 to 400	feet
LENGTH METHOD	No errors	99% of the time	1 to 3	n/a
CROWN CLASS	No errors	85% of the time	1 to 5	n/a
UNCOMPACTED LIVE CROWN RATIO	+/- 10%	90% of the time	00 to 99	percent
COMPACTED CROWN RATIO	+/- 10%	80% of the time	00 to 99	percent
DAMAGE LOCATION 1	+/- 1 location class	80% of the time	0 to 9	class
DAMAGE TYPE 1	No errors	80% of the time	1-5; 11-13; 20-25; 31	n/a
DAMAGE SEVERITY 1	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	80% of the time	Defined for each DAMAGE TYPE	class
DAMAGE LOCATION 2	+/- 1 location class	80% of the time	0 to 9	class
DAMAGE TYPE 2	No errors	80% of the time	1-5; 11-13; 20-25; 31	n/a

Variable Name	Tolerance	MQO	Values	Units
DAMAGE SEVERITY 2	+/- 1 valid class unless otherwise defined by the DAMAGE TYPE	80% of the time	Defined for each DAMAGE TYPE	class
CAUSE OF DEATH	No errors	80% of the time	10 to 80	n/a
MORTALITY YEAR	+/- 1year for 5-year measure. cycles +/- 2years for > 5-year measure. cycles	70% of the time	1995 or higher	year
DECAY CLASS	+/- 1 class	90% of the time	1 to 5	class
LENGTH TO DIAMETER MEASUREMENT POINT	+/- 0.2 ft	90% of the time	00.1 to 15.0	feet
ROUGH CULL	+/- 10 %	90% of the time	00 to 99	percent
MISTLETOE CLASS	+/- 1 class	90% of the time	0 to 6	class
TREE NOTES	n/a	n/a	English, alpha-numeric	n/a
Seedling Data				
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
SPECIES	No errors	90% of the time for genus 85% of the time for species	Appendix 3	n/a
CONDITION CLASS NUMBER	No errors	99% of the time	1-9	n/a
SEEDLING COUNT	No errors for 5 or less per species +/- 20% over a count of 5	90% of the time	001-999	number
Site Tree Information				
CONDITION CLASS LIST	No errors	99% of the time	1 to 9 or 10000 to 98765	n/a
SPECIES	No errors	99% of the time for genus 95% of the time for species	Appendix 3	n/a
DIAMETER	+/- 0.1 inch per 20 inches of diameter on trees with a measured diameter	95% of the time	001.0 to 999.9	inches

Variable Name	Tolerance	MQO	Values	Units
SITE TREE LENGTH	+/- 10% of true length	90% of the time	005 to 999	feet
TREE AGE AT DIAMETER	+/- 5 years	95% of the time	001 to 999	year
SITE TREE NOTES	n/a	n/a	English, alpha-numeric	n/a
SUBPLOT NUMBER	No errors	99% of the time	1 to 4	n/a
AZIMUTH	+/- 10 degrees	90% of the time	001 to 360	degrees
HORIZONTAL DISTANCE	+/-5 ft	90% of the time	000.1 to 200.0	feet

Appendix 8. Tree Coding Guide for RECONCILE

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
SAMPLE KIND 1 or 3						
	Live 1.0+DBH/ DRC		1			
	Dead 5.0+ DBH/DRC		2			
SAMPLE KIND 2 (Remeasure)						
Live 5.0+ DBH/ DRC	Live 5.0+ DBH/DRC	1	1			
Live 1.0-4.9 DBH/ DRC on microplot	Live 5.0+ DBH	1	1			
Live 1.0-4.9 DBH/ DRC on microplot	Live 1.0-4.9 DBH/DRC on microplot	1	1			
Live 5.0+ DBH/ DRC	Live but shrank < 5.0 and on microplot	1	1			
Live 1 inch +	Live but land no longer qualifies as forest	1	1			
Live 5.0+ DBH/ DRC	Standing dead 5.0+	1	2		1	10-80
Live 5.0+ DBH/ DRC	Down dead 5.0+	1	2		0	10-80
Live 1.0-4.9 DBH/ DRC on microplot	Dead 1.0-4.9 DBH/DRC	1	2		0	10-80
Live 1.0-4.9 DBH/ DRC on microplot	Dead 5.0+ (standing or down)	1	2		0 or 1	10-80
RM Live 1.0-4.9” DBH/DRC	Dead tree shrank <1,0”	1	2		0	10-80

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Live 1.0+ DBH/ DRC	Cruiser unable to locate tree due to a weather (including geologic, such as landslide) or fire event & assume tree is down dead or you can see tree and it is dead and off the plot	1	2		0	30 or 50
Live 1.0+ DBH/ DRC	Cut and left in the woods	1	2		0	80
Live 1 inch +	Dead and land no longer qualifies as forest (land clearing or conversion to nonforest land use)	1	2		0 or 1	10-80
Live 1.0+ DBH/ DRC	Tree removed (cut and hauled away)	1	3			80
Live 1 inch +	Gone (cut and removed?) and land no longer qualifies as forest	1	3			80
Dead 5.0+ DBH/ DRC	Dead standing 5.0 DBH/DRC	2	2		1	
Dead 5.0+ DBH/ DRC	Dead down 5.0+	2	2		0	
Dead 5.0+ DBH/ DRC	Dead DBH/ DRC < 5.0	2	2		0	
Dead 5.0+ DBH/ DRC	Cruiser is unable to locate tree due to a weather (including geologic) or fire event & assume it is down dead	2	2		0	

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Dead 5.0+ DBH/ DRC	Tree removed (cut and hauled away)	2	3			
RM Live 5.0+ DBH/DRC	Dead tree shrank <5.0"	1	2		0	10-80
Live 5.0+ DBH/ DRC	(RM Live) tree shrank <5.0 and NOT on microplot	1	0	5		
Live 1.0-4.9 DBH/ DRC	(RM Live) Tree shrank <1.0	1	0	5		
Live 1.0-4.9 DBH/ DRC	Live 1.0-4.9 DBH/DRC, shouldn't have been tallied—beyond 6.8—cruiser error	1	0	7		
Live 5.0+ DBH/ DRC	Live 5.0+ DBH/ DRC, shouldn't have been tallied –beyond 24.0—cruiser error	1	0	7		
Live 1.0+ DBH/ DRC	No longer a tally species	1	0	8		
Live 1.0+ DBH/ DRC	Tree moved off plot due to a geologic (i.e., slight earth movement) or weather event (i.e., hurricane) and you can still see it (Live before, live now)	1	0	6		
Live 1 inch +	Nonsampled area now	1	0	9		
Dead 5.0+ DBH/ DRC	No longer a tally soecies	2	0	8		

Previous Measurement	Present Measurement	PREVIOUS TREE STATUS	PRESENT TREE STATUS	RECONCILE	Standing Dead	CAUSE OF DEATH
Dead 5.0 DBH/ DRC	Tree moved off plot due to a geologic (i.e., small earth movement) or weather event (i.e., hurricane) and you can still see the tree	2	0	6		
Dead 5 inch +	Nonsampled area now	2	0	9		
Missed live	Live 1.0+ DBH/DRC	-	1	3		
< 5.0 live	5.0+ DBH/DRC live (not on the microplot)	-	1	1		
< 1.0 live	1.0-4.9 DBH/ DRC live	-	1	1		
< 1.0 live	5.0+ DBH/ DRC live (on the microplot) (Through growth)	-	1	2		
Nonsampled area before	Live 1 inch +	-	1	3		
Nonforest before	Forest now, Live 1 inch+	-	1	1		
Missed dead	Dead 5.0+ DBH/DRC	-	2	4	1	
Missed live	Dead 5.0+ DBH/DRC	-	2	3	1	10-80
< 5.0 live	5.0+ DBH/DRC dead (very rare)	-	2	1	0 or 1	10-80
Nonsampled area before	Standing Dead 5 inch+	-	2	3 or 4		
Nonforest before	Forest now, Statnding Dead 5 inch+	-	2	1		

RM Appendix A. Field Forms

APPENDIX A.1

Field Location Reference

STATE ________ COUNTY ________ P2 Plot # ________ MAP ________
CPN ________

FIELD CREW (first intial, last name, crew number)
RECORDER ________ CRUISER 1 ________ CRUISER 2 ________ CRUISER 3 ________
crew # ________ crew # ________ crew # ________ crew # ________

TRUCK COORDINATES
ZONE ________ EASTING ________ NORTHING ________

ATV COORDINATES (if used and optional):
ZONE ________ EASTING ________ NORTHING ________

APPROXIMATE GPS DISTANCE AND AZIMUTH TO PC FROM PARKING SPOT:
DISTANCE ________ AZIMUTH ________

REFERENCE POINT DESCRIPTION AND TRAVERSE INFO. TO PC
RP SPECIES ________ DIAMETER ________ AZIMUTH ________ H. DISTANCE ________
SLOPE DIST. ________
RP DESCRIPTION: ________

RP COORDINATES
ERROR ________ # READINGS ________ ZONE ________ EASTING ________
NORTHING ________

PC WITNESS TREES
X SPECIES ________ X DIAMETER ________ X AZIMUTH ________ X DISTANCE ________
Y SPECIES ________ Y DIAMETER ________ Y AZIMUTH ________ Y DISTANCE ________
NOTES: ________

PC COORDINATES
GPS NUMBER ________ ERROR ________ # READINGS ________ ELEVATION ________
ZONE ________ EASTING ________ NORTHING ________

If Coordinates not taken at the PC: DISTANCE TO PC ________ AZIMUTH TO PC ________

OWNER INFORMATION (do not put private land owner info. In PDR) - include all relevant owner info. to get to the PC

FIELD CREW EDIT:
NAME ________ DATE ________

Revised 11/15/06

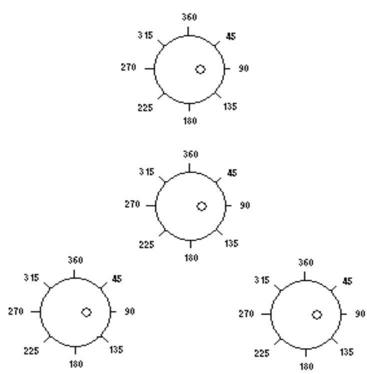
APPENDIX A.2 Field Location Map and Condition Boundary Map

FIELD LOCATION MAP
(Draw roads/landmarks/features helpful to the next crew)

N

PC REFERENCE &
CONDITION BOUNDARY MAP

N



APPENDIX A.3

Field Location Description and Subplot Description Record

PLOT ID DATA

State ______ County ______ P2 Location # ______ USGS Ma
CPN ______ P3 Hex # ______ P3 Plot # ______ Date (mm/dd/

FIELD CREW

Crew #1 ______ Crew # 2 ______ Crew #3 ______ Crew

Crew Type ______ QA Status ______

PLOT DESCRIPTION

Sample Kind ______ Plot Status ______ Condition Change ______ Previous Plot

nproved Road ______ Water on Plot ______

LC COORDINATES

GPS Unit ______ GPS Serial # ______ GPS Error ______ # of Readi
UTM Zone ______ Easting ______ Northing ______ Azimuth to
GPS Elevation ______ Dist to LC ______

OTHER

Future Forest Potential ______

NOTES: ______

SUBPLOT DESCRIPTION

	SUBPLOT 1	SUBPLOT 2	SUBPLOT 3	SUBPLOT4	
Point Status					NOTES:
Nonsampled Reason					
Subplot Cntr Cond.					
Micro Cntr Cond.					
% Slope					
Aspect					
Water Depth					
Condition List					
Root Disease (MT,ID)					

BOUNDARY INFORMATION

	SUBPLOT 1			SUBPLOT 2			SUBPLOT 3			SUBPLOT4			
Subplot #													Notes:
Plot Type													
Bndry Change													
Contrasting Cond #													
Azimuth left													
Corner Azimuth													
Corner Dist													
Azimuth Right													

PLOT NOTES: ______

APPENDIX A.4

Condition Class Description Record

State ________ County ________ P2 Location # ________ P3 Hex # ________

	Condition 1	Condition 2	Condition 3	Condition 4
Condition Class #				
Condition Status				
Reserved Status				
Owner Group				
Owner Class				
Forest Type				
Stand Size				
Regeneration Status				
Regeneration Species				
Tree Density				
Physiographic Class				
Stand Age				
Habitat Type 1				
Habitat Type 2				
Crown Cover				
% Bare Ground				
Disturbance 1				
Dist. Year 1				
Disturbance 2				
Dist. Year 2				
Disturbance 3				
Dist. Year 3				
Treatment 1				
Treatment Year 1				
Treatment 2				
Treatment Year 2				
Treatment 3				
Treatment Yr 3				

Condition Class Comments: ________

APPENDIX A.5 Tree Data

APPENDIX A.5

TREE DATA

STATE: COUNTY: LOCATION: HEX: PAGE OF

Revision 2/03

Subplot Number	Tree Record Number	Horizontal Distance	Azimuth	Condition Class	Tree Status	Reconcile	Standing Dead	Species	Current DBH/DRC	Diameter Check	Number of Stems	Total Tree Length	Actual Tree Length	Length Method (Ht Check)	Height to Crown	Uncompacted Crown	Compacted Crown	Crown Light (P3)	Crown Position (P3)	Crown Class	Crown Density (P3)	Crown Dieback (P3)	Foliage Transparency (P3)	Dwarf Mistletoe	Damage Agent 1	Damage Agent 2	Damage Agent 3	Damage 1 LOCATION (P3)	Damage 1 TYPE (P3)	Damage 1 SEVERITY (P3)	Damage 2 LOCATION (P3)	Damage 2 TYPE (P3)	Damage 2 SEVERITY (P3)	Decay Class	% Rotten & Missing	% Vol Missing Top	% Sound Dead	% Form Defect	Current Tree Class	Radial Growth	Tree Age	Growth/Age Check	Site Tree	Mortality	Mortality Year	Cause of Death	
	xxx	xxx	xxx	x	x	x	x	xxx	xxxx	x	xx	xxx	xxx	x	xxx	xx	xxx	xx	x	x	xx	xx	xx	x	xx	xx	xx	x	xx	xx	xx	xx	xx	x	xx	xxx	xx	xxx	x	xx	xxx	xxx	x	x	xxxx	xx	

APPPENDIX A.6 Sapling and Seedling Data

APPENDIX A.5 Sapling and Seedling Data

STATE: COUNTY: LOCATION: HEX:

Updated 2/03

SAPLING DATA

Field	Format
Subplot Number	x
Tree Record Number	xxx
Horizontal Distance	xxx
Azimuth	xxx
Condition Class	x
Tree Status (Tree History)	x
New Tree Reconcile	x
Current Lean Angle	xx
Species	xxx
Current DBH/DRC	xxxx
Diameter Check	x
Number of Stems	xx
Total Tree Length	xxx
Actual Tree Length	xxx
Length Method (Ht. Check)	x
Height To Crown	xxx
Uncompacted Crown **(P3)**	xx
Compacted Crown	xx
Crown Light **(P3)**	xx
Crown Position **(P3)**	xx
Crown Class	x
Crown Vigor **(P3)**	x
Dwarf Mistletoe Class	x
Tree Class	x
Radial Growth	xx
Tree Age	xxx
Utilization Class	x

SEEDLING DATA

Field	Format
SUBPLOT #	x
Condition Class	x
Species	xxx
Seedling Count	x
Seedling Age	xx

APPENDIX A.7 UNDERSTORY VEGETATION DESCRIPTION

Feb-00

STATE ____ MAP ____ CPN ____

COUNTY ____ LOC# ______

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

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

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: ______________________________

NOXIOUS WEEDS

SPECIES (XXXXXXX)	PRESENT ON SUBPLOT? (Y OR N)			

APPENDIX A.8 MULTISTEMMED WOODLAND SPECIES TALLY

MULTISTEMMED WOODLAND SPECIES TALLY

STATE ________ **P2 #** ________

COUNTY ________ **P3 HEX #** ________

SUBPLOT NUMBER	TREE NUMBER	INDIVIDUAL STEM DIAMETERS Place a small "d" next to each dead stem																			NUMBER OF STEMS	COMPUTED DRC

APPENDIX A.9

APPENDIX A.9 CROWN/GROUND COVER SUPPLEMENTAL DATA FORM

(Note: Save this record. Transfer percentages to Condition Description record) 1/07

STATE: __________ COUNTY:__________ LOCATION:__________ HEX:__________

* Method 2 is optional in determining % bare ground. Use if % bare ground is very high, as a calibration tool, or if crew is uncomfortable with an estimate.

COND # ________	Subplot																	
	1				2				3				4					
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	TOTAL	COND. %
Feet of Crown Intercept																		→ =
Total Feet in Transect																		
To calculate Condition % Crown Cover - Divide the total crown intercept by the total length of transect for each condition																		
Bare Ground (Method 2)*																		→ =
Total Points in Transect																		
To Calculate Condition % Bare Ground (Method 2) - Divide the total number of bare ground "points" by the total number of "points" in the condition																		
% Bare Ground (Method 1)																		→ =
To Calculate Condition % Bare Ground (Method 1) - Divide the visually estimated total % bare ground by the number of subplots sampled																		

COND # ________	Subplot																	
	1				2				3				4					
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	TOTAL	COND. %
Feet of Crown Intercept																		→ =
Total Feet in Transect																		
To calculate Condition % Crown Cover - Divide the total crown intercept by the total length of transect for each condition																		
Bare Ground (Method 2)*																		→ =
Total Points in Transect																		
To Calculate Condition % Bare Ground (Method 2) - Divide the total number of bare ground "points" by the total number of "points" in the condition																		
% Bare Ground (Method 1)																		→ =
To Calculate Condition % Bare Ground (Method 1) - Divide the total % bare ground by the number of subplots sampled																		

COND # ________	Subplot																	
	1				2				3				4					
	N	S	E	W	N	S	E	W	N	S	E	W	N	S	E	W	TOTAL	COND. %
Feet of Crown Intercept																		→ =
Total Feet in Transect																		
To calculate Condition % Crown Cover - Divide the total crown intercept by the total length of transect for each condition																		
Bare Ground (Method 2)*																		→ =
Total Points in Transect																		
To Calculate Condition % Bare Ground (Method 2) - Divide the total number of bare ground "points" by the total number of "points" in the condition																		
% Bare Ground (Method 1)																		→ =
To Calculate Condition % Bare Ground (Method 1) - Divide the total % bare ground by the number of subplots sampled																		

Notes: ____________________

APPENDIX A.10 Accounting Tree Data Record

ACCOUNTING TREE DATA RECORD

State _____ County _____ Inv. Date

Map _____ Location _____

Revised 2/03

Point Number	Point History	Tree Number	Azimuth	Distance	Previous Tree Status	Current Tree Status	New Tree Reconcile	Tree Lean Angle	Species	Past DBH/DRC	Current DBH/DRC	DBH/DRC Check	Past Number of Stems	Current Number of Stems	Past Tree Length	Current Tree Length	Cause of Death	Past Tree Class	Current Tree Class	Comments

APPENDIX A.11 P2 DWM Traverse Data Sheet

P2 DWM Traverse Data Sheet

State ____ Co ___ ____ P2# ________ Page __ of __
Form 1

SUBPLOT 2 TRAVERSE

Transect 360 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Time to complete (est. nearest .25 hour) x.xx	
LgDiaCl	
Total	

Transect 360 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 360 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 360 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled __ %Slp ______ CndCl ____ S ______ M ______ L ________ Reason ____

Transect 360 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

SUBPLOT 3 TRAVERSE

Transect 120 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Transect 120 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 120 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 120 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled __ %Slp ______ CndCl ____ S ______ M ______ L ________ Reason ____

Transect 120 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

SUBPLOT 4 TRAVERSE

Transect 240 Az - SEGMENTS

CndCl x	HDist xxx	SampHDist xxx
Total	120	

Transect 240 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

Transect 240 Az - Coarse Woody Debris - (Trans Dia >3" and > 3 ft length)

DecayCl x	Species xxxx	TrDia xxx	LgDiaCl x	CndCl x	Hollow?	On subplot?
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N
					Y - N	Y - N

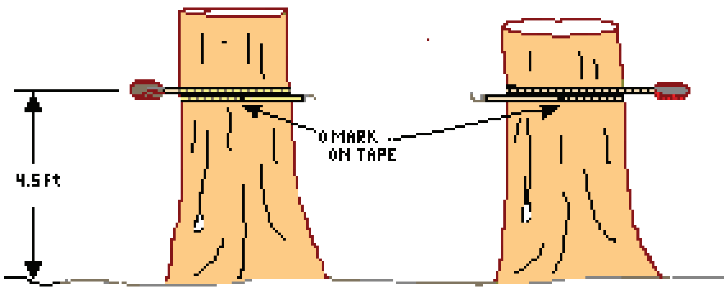
Transect 240 Az - Fine Woody Debris - S (0.01-0.24") M (0.25"-0.9") L (1.0-2.9")
Sampled __ %Slp ______ CndCl ____ S ______ M ______ L ________ Reason ____

Transect 240 Az - Duff / Litter depth
Sampled ______ Duff (XX.X in) ______ Litter (XX.X in) ______

RM Appendix B. Tree Data Techniques

RM Appendix B.1 Diameter Measurement Techniques for Timber Species

Correct method: | Alternate left-handed method:

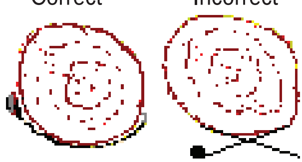


End of tape (with 0 mark) or hook crossed under

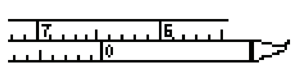
End of tape crossed under (Careful! Readings will be from an upside down d-tape)

Press tape firmly against the tree; Do not pull it out at a tangent to the tree at the point of measurement.

Correct | Incorrect



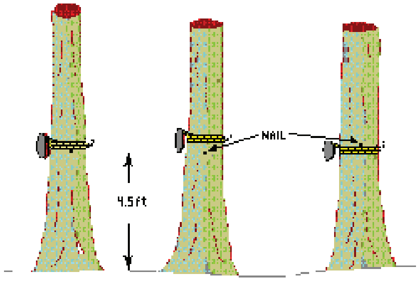
The diameter must be read at the exact point marked -- above the 0 mark.
Always round down to the nearest 0.1 inch:



In this example, the diameter reading is 6.4-inches. Be carefull not to incorrectly read 7.5-inches. Examine the digits preceding and following the point above the 0 mark.

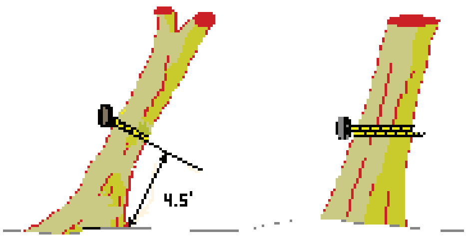
-

Place the diameter tape directly above the nail:



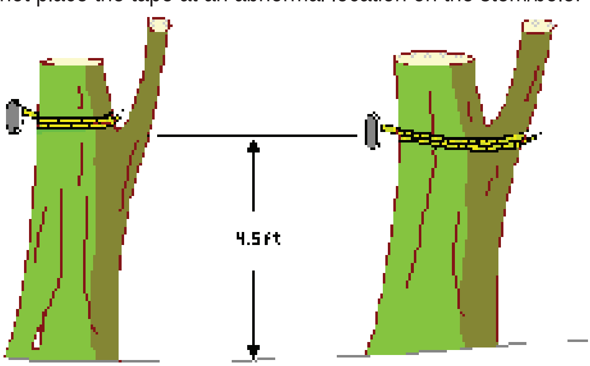
Correct Incorrect Incorrect

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



Correct Incorrect

Do not place the tape at an abnormal location on the stem/bole:



Correct Incorrect

RM Appendix B.2 Boring for Radial Growth and Age

Despite their appearance, increment borers are delicate and expensive equipment items. Extreme care must be exercised in their use.

Borers consist of three parts:
- a handle,
- a bit, and
- an extractor.

The tip of the bit is made of fine, thin steel and is easily damaged. Because the bit of an increment borer narrows at the tip, the resulting wood cores are smaller than the internal tube of the borer and can be easily extracted. If the cutting edge on the bit is nicked, it is not possible to adequately resharpen the bit because of this small tapering. For this reason, the following rules must be observed:

1. Keep the bit stored inside the bore handle when not in use.
2. Do not allow the tip of the bit to contact hard objects such as the ground or other field equipment.
3. If a core becomes jammed, do not use a nail or other hard object to attempt to push it out. Trying to push the core out through the narrowed tip will only cause further jamming. The best means for removing a severely jammed core is to place it in a low heat oven (200 degrees) for a couple of hours. This will reduce the moisture content of the wood, causing it to shrink without ruining the temper of the steel.
4. If, while boring a tree, the borer suddenly becomes very easy to turn, STOP! The bit may have contacted rotted wood, which is very difficult to remove from the bit. Extract the bit and examine it for signs of rot (dark, crumbled wood).
5. Be careful not to bore completely through small trees or the increment bore may get stuck in the tree.
6. Be careful when boring woodland trees; they are often very hard. Do not bore cercocarpus species.
7. Do not dull the bit by boring hard, dead wood.

When boring for age start the increment borer immediately below the point of diameter measurement and bore into the center of the tree. Every effort must be made to reach the pith (center). When boring for growth, start with the increment borer immediately below the point of diameter measurement and bore into the tree just a few turns (note: for timber species, bore for growth on the side of the tree facing the point center, where reasonable, to reduce bias).

RM Appendix B.3 Determining Tree Height

Whenever possible, take tree height measurements standing on a level plane approximately even with the base of the tree or on a level above the tree base. The most important factor, however, is to be able to see both the tree base and the tree top. If the tree is leaning, stand perpendicular to the plane of the tree's lean. For trees with an excessive lean, visually "upright" the tree, and measure the top of the tree as if it were standing straight. If a tree has a missing top or has several leaders as a result of a broken top, estimate the height that the tree would have been had this loss of height not occurred. Record the estimate, and make a note on the data record indicating that tree height was estimated.

Determine tree height using a clinometer. The following examples are based on using a Suunto "percent / slope" clinometer. The clinometer wheel, as viewed internally, contains a percent (%) scale on the right side of the wheel and a "slope correction" (SC) scale on the left side of the wheel. Use the percent scale when making tree readings of the top or base of the tree
(note: the percent scale may also be used to determine % slope on the ground). If it is necessary to determine tree height on a slope (i.e., cruiser not on a level plane with the tree base), use the slope correction scale to determine a SC factor (refer to the tree height formula below). The clinometer scales are illustrated below (internal view of clinometer):

```
                          _____________
                         |             |
                         |       | - 30 |
                         | 103|--  -   |
                         |     |-- 20  |
                         | 101|--  -   |
                         |1005|-- 10   |
                         |     |--     |
slope correction scale   | 100|- -  0% |    percent (%)
                         |     |- +    |
                         |1005|- 10    |
                         |  101|- +    |
                         |     |- 20   |
                         |  103|- +    |
                         |     |- 30   |
                         |_____________|
```

The formula for tree height with a “percent / slope” clinometer is as follows:

$$\text{Tree Height} = \frac{[T + B] \times (D/100)}{SC}$$

where:

T = percent scale reading for the top of the tree.

B = percent scale reading for the base of the tree at ground level.

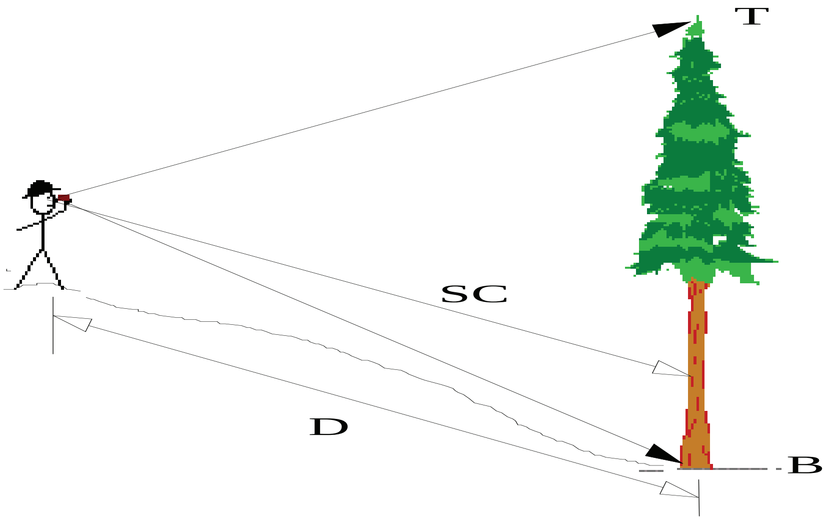
D = slope ground distance (between cruiser and tree, to the nearest foot).

SC = slope correction factor, taken to two decimal places. For example, a number of 103 on the SC scale (associated with 25% slope) would be converted to 1.03 for use in the formula. Note: The number 1005 (10% slope) on the SC scale would be converted to 1.005. Also, the SC factor is 1.00 if on a level plane (0% slope) with the tree.

Numbers or tree readings from the percent scale can be either positive (+) or negative (-). As shown by the above formula, add T and B if the two readings are opposite signs (+ and -); on the other hand, subtract T and B if both readings are the same sign (+ and +, or - and -).

To determine a SC factor, look through the clinometer at eye level on the tree along the slope and distance used to obtain tree height (e.g., if your eye level is at 5 feet, then look through the clinometer at a level of 5 feet above the ground on the tree); look at the SC scale and read the SC factor directly. This slope correction must be parallel to the slope of the measured distance.

The following example illustrates tree height calculation:



Distance (D) = 120 feet
SC = 1.03 (25 percent slope)

$$\text{Tree Height} = \frac{[T + B] \times (D/100)}{SC}$$

$$\text{Tree Height} = \frac{[28 + 30] \times (120/100)}{1.03}$$

Tree Height = 67 feet

RM Appendix B.4 - DEFECT CHART and GUIDELINES

<table>
<tr><th rowspan="2">Total Height</th><th colspan="10">Defect Height</th></tr>
<tr><th>20</th><th>34</th><th>50</th><th>67</th><th>83</th><th>100</th><th>116</th><th>133</th><th>149</th><th>166</th></tr>
<tr><td>179</td><td colspan="6">1</td><td colspan="2">0.5</td><td>0.2</td><td>0.1</td></tr>
<tr><td>163</td><td colspan="6">1</td><td>0.5</td><td>0.2</td><td colspan="2">0.1</td></tr>
<tr><td>147</td><td>2</td><td colspan="4">1</td><td>0.5</td><td>0.2</td><td colspan="3">0.1</td></tr>
<tr><td>131</td><td>2</td><td colspan="3">1</td><td colspan="2">0.5</td><td colspan="4">0.2</td></tr>
<tr><td>115</td><td>2</td><td colspan="3">1</td><td colspan="6">0.5</td></tr>
<tr><td>98</td><td colspan="2">2</td><td colspan="2">1</td><td colspan="6">0.5</td></tr>
<tr><td>82</td><td colspan="2">2</td><td colspan="8">1</td></tr>
<tr><td>65</td><td>3</td><td>2</td><td colspan="8">1</td></tr>
<tr><td>49</td><td>4</td><td colspan="9">2</td></tr>
<tr><td>32</td><td colspan="10">5</td></tr>
<tr><td></td><td>20</td><td>34</td><td>50</td><td>67</td><td>83</td><td>100</td><td>116</td><td>133</td><td>149</td><td>166</td></tr>
</table>

BROKEN TOP
- Allow 2 additional feet of defect below break

DEAD TOP
- Highest set of live limbs is the defect height

HEARTWOOD SCARS
- Severity Indicators
  - Grey wood, Worm Holes, Long Cracks, Rot = Bad Scar
  - Pitched over and healed = Minor Scar
- Use simple Pie Cut fractions
- True fir and Aspen = cull entire section
- 3 or more severity indicators = double pie cut fraction

WOUNDS AT BASE
- Allow 2 additional feet of defect above wound

WOUNDS NOT AT BASE
- Allow 2 additional feet of defect above and below wound
- Use % per foot value at the center of the wound

FROST CRACKS
- Severity indicators
  - Closed wounds with no pitch or moisture = Minor Wound
  - Open cracks with pitch, moisture or rot = Severe Wound
- Use simple pie cut fractions
- Allow 2 additional feet of defect above wound
- Minor wound = ¼ pie cut fraction
- Severe wound = double pie cut fraction
-Multiple frost cracks = cull entire section of tree

LIGHTNING SCARS
- Allow 2 additional feet of defect above and below wound

CROOKS
- Severe crook = top to bottom deduction
- Minor crook = Use a simple fraction
- 8 feet of straight material must be between crooks not to cull

SWEEP
- Determine severity of sweep
- Severe sweep = no straight 8 foot material
- Use a simple fraction

FORKS
- Simple fork = small bark seam, straight logs above
- Complex fork = multiple bark seams, related defects such as crook etc.
- Simple forks = 2 foot deduction
- Complex forks = 4 foot deduction

Other defects occurring on a fork
- Divide the defect % by the number of merch. stems at defect height

CONKS
- Fomes Pini = 4 feet above, 8 feet below (DF,SP)
- Indian Paint = 8 feet above, 8 feet below (TF,SP)
- Velvet Top/Cow Dung = Look for scar or butt swell (ALL SPECIES)
  Scar = 2 feet above
  Butt swell = Use this height
  No butt swell = 4 feet

CANKERS

2 To 4 foot deduction at canker (TF,ASPEN)

RM Appendix C. Little's Tree Species List

Note: this is NOT the TALLY Tree Species List

Taken from:

Little, Elbert L. Jr. 1979. Checklist of United States trees (native and naturalized). U.S. Dep. Agric., Agriculture Handbook No. 541. 375 p.

List updated using USDA NRCS PLANTS database symbols and names: 2000.

SCI_NAME	SYMBOL	COM_NAME
Abies concolor	ABCO	white fir
Abies concolor var. concolor	ABCOC	white fir
Abies concolor var. lowiana	ABCOL	white fir
Abies grandis	ABGR	grand fir
Abies lasiocarpa	ABLA	subalpine fir
Abies lasiocarpa var. arizonica	ABLAA	corkbark fir
Abies lasiocarpa var. lasiocarpa	ABLAL	subalpine fir
Abies magnifica	ABMA	California red fir
Acacia farnesiana	ACFA	sweet acacia
Acer glabrum	ACGL	Rocky Mountain maple
Acer glabrum var. diffusum	ACGLD3	Rocky Mountain maple
Acer glabrum var. douglasii	ACGLD4	Douglas maple
Acer glabrum var. glabrum	ACGLG2	Rocky Mountain maple
Acer glabrum var. neomexicanum	ACGLN2	New Mexico maple
Acer glabrum var. torreyi	ACGLT2	Torrey maple
Acacia greggii	ACGR	catclaw acacia
Acer grandidentatum	ACGR3	bigtooth maple
Acer grandidentatum var. grandidentatum	ACGRG	bigtooth maple
Acacia greggii var. greggii	ACGRG3	catclaw acacia
Acer grandidentatum var. sinuosum	ACGRS	canyon maple
Acer negundo	ACNE2	boxelder
Acer negundo var. arizonicum	ACNEA	Arizona boxelder
Acer negundo var. interius	ACNEI2	boxelder maple
Acer negundo var. negundo	ACNEN	boxelder
Acer negundo var. texanum	ACNET	ashleaf maple
Acer negundo var. violaceum	ACNEV	boxelder
Aesculus glabra	AEGL	Ohio buckeye
Ailanthus altissima	AIAL	tree of heaven
Alnus incana	ALIN2	mountain alder
Alnus incana ssp. tenuifolia	ALINT	thinleaf alder
Albizia julibrissin	ALJU	silktree
Alnus oblongifolia	ALOB2	Arizona alder
Alnus rhombifolia	ALRH2	white alder
Alnus rubra	ALRU2	red alder
Alnus viridis	ALVI5	sitka alder
Alnus viridis ssp. crispa	ALVIC	American green alder
Alnus viridis ssp. sinuata	ALVIS	Sitka alder
Amelanchier alnifolia	AMAL2	Saskatoon serviceberry
Amelanchier alnifolia var. alnifolia	AMALA	Saskatoon serviceberry
Amelanchier alnifolia var. cusickii	AMALC	Cusick's serviceberry
Amelanchier pallida	AMPA2	pale serviceberry
Amelanchier utahensis	AMUT	Utah serviceberry
Amelanchier utahensis ssp. covillei	AMUTC	Coville's serviceberry
Amelanchier utahensis ssp. utahensis	AMUTU	Utah serviceberry
Arbutus arizonica	ARAR2	Arizona madrone

Arbutus xalapensis	ARXA80	Texas madrone
Betula X eastwoodiae	BEEA	Eastwood's birch
Betula occidentalis	BEOC2	water birch
Betula papyrifera	BEPA	paper birch
Betula papyrifera var. commutata	BEPAC	western paper birch
Betula papyrifera var. papyrifera	BEPAP	paper birch
Betula pendula	BEPE3	European white birch
Betula X utahensis	BEUT	northwestern paper birch
Bursera fagaroides	BUFA	fragrant bursera
Bursera fagaroides var. elongata	BUFAE	fragrant bursera
Bursera microphylla	BUMI	elephanttree
Catalpa bignonioides	CABI8	southern catalpa
Calocedrus decurrens	CADE27	incense cedar
Castela emoryi	CAEM4	thorn of christ
Caesalpinia gilliesii	CAGI	bird-of-paradise shrub
Carnegia gigantea	CAGI7	saguaro
Canotia holacantha	CAHO3	crucifixion thorn
Catalpa speciosa	CASP8	northern catalpa
Cercis canadensis	CECA4	eastern redbud
Celtis laevigata	CELA	sugarberry
Celtis laevigata var. brevipes	CELAB	sugarberry
Celtis laevigata var. reticulata	CELAR	netleaf hackberry
Celtis laevigata var. texana	CELAT8	Texan sugarberry
Cercocarpus ledifolius	CELE3	curlleaf mountain mahogany
Cercocarpus ledifolius var. intercedens	CELEI	curlleaf mountain mahogany
Cercocarpus ledifolius var. intermontanus	CELEI4	curlleaf mountain mahogany
Cercocarpus ledifolius var. ledifolius	CELEL	curlleaf mountain mahogany
Celtis occidentalis	CEOC	common hackberry
Cephalanthus occidentalis	CEOC2	common buttonbush
Celtis occidentalis var. occidentalis	CEOCO2	western hackberry
Cercis orbiculata	CEOR9	Fabaceae
Chilopsis linearis	CHLI2	desert willow
Chilopsis linearis ssp. arcuata	CHLIA	desert willow
Chilopsis linearis ssp. linearis	CHLIL2	desert willow
Condalia globosa	COGL	bitter snakewood
Condalia globosa var. pubescens	COGLP	bitter snakewood
Cornus nuttallii	CONU4	Pacific dogwood
Cornus sericea	COSE16	redosier dogwood
Cornus sericea ssp. occidentalis	COSEO	western dogwood
Cornus sericea ssp. sericea	COSES	redosier dogwood
Crataegus chrysocarpa	CRCH	fireberry hawthorn
Crataegus columbiana var. columbiana	CRCOC4	Columbian hawthorn
Crataegus douglasii	CRDO2	black hawthorn
Crataegus douglasii var. douglasii	CRDOD	Douglas' hawthorn
Crataegus douglasii var. duchesnensis	CRDOD2	Duchesne black hawthorn
Crataegus erythropoda	CRER	cerro hawthorn
Crataegus monogyna	CRMO3	oneseed hawthorn
Crataegus rivularis	CRRI	river hawthorn
Crataegus saligna	CRSA2	willow hawthorn
Crataegus succulenta	CRSU5	fleshy hawthorn
Crataegus wootoniana	CRWO	Wooton's hawthorn
Cupressus arizonica	CUAR	Arizona cypress
Cupressus arizonica ssp. arizonica	CUARA	Cupressaceae
Cupressus glabra	CUGL6	Arizona smooth cypress
Diospyros virginiana	DIVI5	common persimmon
Dodonaea viscosa	DOVI	Florida hopbush
Elaeagnus angustifolia	ELAN	Russian olive

Euonymus atropurpurea	EUAT3	eastern wahoo
Eysenhardtia polystachya	EYPO	kidneywood
Fagus grandifolia	FAGR	American beech
Forestiera shrevei	FOSH	desert olive
Frangula alnus	FRAL4	buckthorn
Fraxinus americana	FRAM2	white ash
Fraxinus anomala	FRAN2	singleleaf ash
Fraxinus anomala var. anomala	FRANA	singleleaf ash
Fraxinus anomala var. lowellii	FRANL	singleleaf ash
Fraxinus berlandieriana	FRBE	Mexican ash
Frangula betulifolia ssp. betulifolia	FRBEB	beechleaf frangula
Fremontodendron californicum	FRCA6	California flannelbush
Fraxinus cuspidata	FRCU	fragrant ash
Fraxinus dipetala	FRDI2	two petal ash
Fraxinus gooddingii	FRGO	Goodding's ash
Fraxinus greggii	FRGR2	Gregg's ash
Fraxinus papillosa	FRPA4	Chihuahuan ash
Fraxinus pennsylvanica	FRPE	green ash
Frangula purshiana	FRPU7	Pursh's buckthorn
Fraxinus velutina	FRVE2	velvet ash
Gleditsia triacanthos	GLTR	honeylocust
Juniperus ashei	JUAS	Ashe's juniper
Juniperus californica	JUCA7	California juniper
Juniperus deppeana	JUDE2	alligator juniper
Juniperus coahuilensis	JUCO11	redberry juniper
Juglans major	JUMA	Arizona walnut
Juglans microcarpa	JUMI	little walnut
Juglans microcarpa var. microcarpa	JUMIM	little walnut
Juniperus monosperma	JUMO	oneseed juniper
Juglans nigra	JUNI	black walnut
Juniperus occidentalis	JUOC	western juniper
Juniperus occidentalis var. australis	JUOCA	western juniper
Juniperus occidentalis var. occidentalis	JUOCO	western juniper
Juniperus osteosperma	JUOS	Utah juniper
Juniperus pinchotii	JUPI	Pinchot's juniper
Juniperus scopulorum	JUSC2	Rocky Mountain juniper
Koeberlinia spinosa	KOSP	crown of thorns
Koeberlinia spinosa var. spinosa	KOSPS	crown of thorns
Koeberlinia spinosa var. tenuispina	KOSPT	crown of thorns
Larix lyallii	LALY	subalpine larch
Larix occidentalis	LAOC	western larch
Leucaena leucocephala	LELE10	white leadtree
Leucaena retusa	LERE5	littleleaf leadtree
Malus coronaria	MACO5	sweet crabapple
Maclura pomifera	MAPO	osageorange
Malus pumila	MAPU	cultivated apple
Malus sylvestris	MASY2	apple
Melia azedarach	MEAZ	Chinaberrytree
Morus alba	MOAL	white mulberry
Morus microphylla	MOMI	Texas mulberry
Nicotiana glauca	NIGL	tree tobacco
Olneya tesota	OLTE	desert ironwood
Ostrya knowltonii	OSKN	Knowlton's hophornbeam
Ostrya virginiana	OSVI	eastern hophornbeam
Ostrya virginiana var. virginiana	OSVIV	Virginia hophornbeam
Parkinsonia aculeata	PAAC3	Jerusalem thorn
Parkinsonia florida	PAFL6	blue paloverde
Parkinsonia microphylla	PAMI5	yellow paloverde
Pinus albicaulis	PIAL	whitebark pine

Pinus aristata	PIAR	bristlecone pine
Pinus arizonica	PIAR5	Arizona pine
Pinus arizonica var. arizonica	PIARA	Arizona pine
Pinus arizonica var. stormiae	PIARS2	Arizona pine
Pinus cembroides	PICE	Mexican pinyon
Pinus contorta	PICO	lodgepole pine
Pinus contorta var. latifolia	PICOL	tall lodgepole pine
Pinus contorta var. murrayana	PICOM	Murray lodgepole pine
Pinus discolor	PIDI3	border pinyon
Pinus edulis	PIED	twoneedle pinyon
Pinus edulis var. edulis	PIEDE	twoneedle pinyon
Picea engelmannii	PIEN	Engelmann's spruce
Pinus engelmannii	PIEN2	Apache pine
Pinus flexilis	PIFL2	limber pine
Picea glauca	PIGL	white spruce
Pinus jeffreyi	PIJE	Jeffrey pine
Pinus lambertiana	PILA	sugar pine
Pinus leiophylla	PILE	Chihuahuan pine
Pinus leiophylla var. chihuahuana	PILEC	Chihuahuan pine
Pinus longaeva	PILO	Great Basin bristlecone pine
Pinus monophylla	PIMO	singleleaf pinyon
Pinus monticola	PIMO3	western white pine
Pinus monophylla var. fallax	PIMOF	Pinaceae
Pinus ponderosa	PIPO	ponderosa pine
Pinus ponderosa var. ponderosa	PIPOP	ponderosa pine
Pinus ponderosa var. scopulorum	PIPOS	ponderosa pine
Picea pungens	PIPU	blue spruce
Pinus strobiformis	PIST3	southwestern white pine
Pinus washoensis	PIWA	Washoe pine
Platanus wrightii	PLWR2	Arizona sycamore
Populus X acuminata	POAC5	lanceleaf cottonwood
Populus alba	POAL7	white poplar
Populus angustifolia	POAN3	narrowleaf cottonwood
Populus balsamifera	POBA2	balsam poplar
Populus balsamifera ssp. balsamifera	POBAB2	balsam poplar
Populus balsamifera ssp. trichocarpa	POBAT	black cottonwood
Populus X brayshawii	POBR7	Brayshaw's poplar
Populus X canadensis	POCA19	Canada poplar
Populus deltoides	PODE3	eastern cottonwood
Populus deltoides ssp. deltoides	PODED	eastern cottonwood
Populus deltoides ssp. monilifera	PODEM	plains cottonwood
Populus deltoides ssp. wislizeni	PODEW	Rio Grande cottonwood
Populus fremontii	POFR2	Fremont's cottonwood
Populus fremontii ssp. fremontii	POFRF3	Fremont's cottonwood
Populus fremontii ssp. mesetae	POFRM	Fremont's cottonwood
Populus X hinckleyana	POHI8	Hinckley poplar
Populus X jackii	POJA2	Jack's poplar
Populus nigra	PONI	Lombardy poplar
Populus tremuloides	POTR5	quaking aspen
Prunus americana	PRAM	American plum
Prunus angustifolia	PRAN3	Chickasaw plum
Prunus angustifolia var. angustifolia	PRANA	Chickasaw plum
Prunus angustifolia var. watsonii	PRANW	Watson's plum
Prunus armeniaca	PRAR3	apricot
Prunus avium	PRAV	sweet cherry
Prunus cerasus	PRCE	sour cherry
Prunus domestica	PRDO	European plum
Prunus emarginata	PREM	bitter cherry

Prunus emarginata var. emarginata	PREME	bitter cherry
Prosopis glandulosa	PRGL2	honey mesquite
Prosopis glandulosa var. glandulosa	PRGLG	honey mesquite
Prosopis glandulosa var. torreyana	PRGLT	western honey mesquite
Prunus mahaleb	PRMA	Mahaleb cherry
Prunus pensylvanica	PRPE2	pin cherry
Prunus persica	PRPE3	peach
Prunus pensylvanica var. pensylvanica	PRPEP	fire cherry
Prunus pensylvanica var. saximontana	PRPES	fire cherry
Prosopis pubescens	PRPU	screwbean mesquite
Prunus serotina	PRSE2	black cherry
Prunus serotina var. rufula	PRSER2	black cherry
Prunus serotina var. virens	PRSEV	black cherry
Prunus spinosa	PRSP	blackthorn
Prosopis velutina	PRVE	velvet mesquite
Prunus virginiana	PRVI	common chokecherry
Prunus virginiana var. demissa	PRVID	western chokecherry
Prunus virginiana var. melanocarpa	PRVIM	black chokecherry
Pseudotsuga menziesii	PSME	Douglas fir
Pseudotsuga menziesii var. glauca	PSMEG	Rocky Mountain Douglas fir
Pseudotsuga menziesii var. menziesii	PSMEM	Douglas fir
Psorothamnus spinosus	PSSP3	smoketree
Ptelea trifoliata	PTTR	common hoptree
Ptelea trifoliata ssp. angustifolia	PTTRA	common hoptree
Ptelea trifoliata ssp. angustifolia var. angustifolia	PTTRA2	common hoptree
Ptelea trifoliata ssp. pallida var. cognata	PTTRC	common hoptree
Ptelea trifoliata ssp. pallida var. confinis	PTTRC2	common hoptree
Ptelea trifoliata ssp. pallida var. lutescens	PTTRL	common hoptree
Ptelea trifoliata ssp. pallida	PTTRP	common hoptree
Ptelea trifoliata ssp. polyadenia	PTTRP2	common hoptree
Ptelea trifoliata ssp. pallida var. pallida	PTTRP4	pallid hoptree
Ptelea trifoliata ssp. trifoliata	PTTRT	common hoptree
Purshia mexicana	PUME	Mexican cliffrose
Purshia stansburiana	PUST	Stansbury cliffrose
Pyrus communis	PYCO	common pear
Quercus arizonica	QUAR	Arizona white oak
Quercus chrysolepis	QUCH2	canyon live oak
Quercus chrysolepis var. chrysolepis	QUCHC	canyon live oak
Quercus dunnii	QUDU3	Palmer oak
Quercus emoryi	QUEM	Emory’s oak
Quercus gambelii	QUGA	Gambel’s oak
Quercus gambelii var. bonina	QUGAB2	Gambel’s oak
Quercus gambelii var. gambelii	QUGAG	Gambel’s oak
Quercus grisea	QUGR3	gray oak
Quercus hypoleucoides	QUHY	silverleaf oak
Quercus macrocarpa	QUMA2	bur oak
Quercus macrocarpa var. macrocarpa	QUMAM	bur oak
Quercus mohriana	QUMO	Mohr’s oak
Quercus muehlenbergii	QUMU	chinkapin oak
Quercus oblongifolia	QUOB	Mexican blue oak
Quercus X organensis	QUOR	oak
Quercus X palmeriana	QUPA3	Palmer’s oak
Quercus X pauciloba	QUPA4	wavyleaf oak
Quercus pungens	QUPU	pungent oak
Quercus pungens var. pungens	QUPUP	pungent oak
Quercus rugosa	QURU4	netleaf oak
Quercus toumeyi	QUTO2	Toumey’s oak
Quercus turbinella	QUTU2	shrub live oak
Quercus turbinella var. ajoensis	QUTUA	shrub live oak

Quercus turbinella var. turbinella	QUTUT	shrub live oak
Rhamnus cathartica	RHCA3	common buckthorn
Rhus glabra	RHGL	smooth sumac
Rhus hirta	RHHI2	staghorn sumac
Rhus kearneyi	RHKE	Kearney's sumac
Rhus lanceolata	RHLA3	prairie sumac
Rhus ovata	RHOV	sugar sumac
Rhus virens var. choriophylla	RHVIC	evergreen sumac
Ricinus communis	RICO3	castorbean
Robinia X holdtii	ROHO	Holdt's locust
Robinia neomexicana	RONE	New Mexico locust
Robinia neomexicana var. neomexicana	RONEN	New Mexico locust
Robinia neomexicana var. rusbyi	RONER	Rusby's locust
Robinia pseudoacacia	ROPS	black locust
Salix X alba	SAAL17	Salicaceae
Salix alba	SAAL2	white willow
Salix alba var. vitellina	SAALV	golden willow
Salix amygdaloides	SAAM2	peachleaf willow
Salix babylonica	SABA2	weeping willow
Salix bebbiana	SABE2	Bebb willow
Sapium biloculare	SABI4	Mexican jumpingbean
Salix bonplandiana	SABO	red willow
Sambucus cerulea var. cerulea	SACEC	blue elderberry
Salix discolor	SADI	pussy willow
Salix exigua	SAEX	sandbar willow
Salix fragilis	SAFR	crack willow
Salix geyeriana	SAGE2	Geyer's willow
Salix gooddingii	SAGO	Goodding's willow
Salix lasiolepis	SALA6	arroyo willow
Salix lasiolepis var. lasiolepis	SALAL2	Tracy willow
Salix ligulifolia	SALI	strapleaf willow
Salix lucida	SALU	shining willow
Salix lucida ssp. caudata	SALUC	greenleaf willow
Salix lucida ssp. lasiandra	SALUL	Pacific willow
Salix melanopsis	SAME2	dusky willow
Salix monticola	SAMO2	park willow
Sambucus nigra ssp. canadensis	SANIC4	Caprifoliaceae
Sambucus nigra ssp. cerulea	SANIC5	Caprifoliaceae
Salix petiolaris	SAPE5	meadow willow
Salix prolixa	SAPR3	MacKenzie's willow
Sambucus racemosa var. racemosa	SARAR3	Caprifoliaceae
Salix X rubens	SARU3	rubens willow
Sapindus saponaria	SASA4	wingleaf soapberry
Sapindus saponaria var. drummondii	SASAD	western soapberry
Salix scouleriana	SASC	Scouler's willow
Salix X sepulcralis	SASE10	sepulcral willow
Salix sitchensis	SASI2	Sitka willow
Salix taxifolia	SATA	yewleaf willow
Shepherdia argentea	SHAR	silver buffaloberry
Sorbus aucuparia	SOAU	European mountainash
Sophora secundiflora	SOSE3	mescal bean
Sorbus sitchensis	SOSI2	western mountainash
Sorbus sitchensis var. sitchensis	SOSIS2	Sitka mountainash
Tamarix africana	TAAF	African tamarisk
Tamarix aphylla	TAAP	Athel tamarisk
Taxus brevifolia	TABR2	Pacific yew
Tamarix canariensis	TACA9	Canary Island tamarisk
Tamarix chinensis	TACH2	fivestamen tamarisk
Tamarix gallica	TAGA	French tamarisk

Tamarix parviflora	TAPA4	smallflower tamarisk
Tamarix ramosissima	TARA	saltcedar
Tecoma stans	TEST	yellow trumpetbush
Thuja plicata	THPL	western redcedar
Tsuga heterophylla	TSHE	western hemlock
Tsuga mertensiana	TSME	mountain hemlock
Ulmus americana	ULAM	American elm
Ulmus pumila	ULPU	Siberian elm
Ungnadia speciosa	UNSP	Mexican buckeye
Vauquelinia californica	VACA5	Arizona rosewood
Vauquelinia californica ssp. californica	VACAC	California rosewood
Vauquelinia californica ssp. pauciflora	VACAP	Arizona rosewood
Vauquelinia californica ssp. sonorensis	VACAS	Sonora rosewood
Viburnum lantana	VILA	wayfaringtree
Viburnum lentago	VILE	nannyberry
Washingtonia filifera	WAFI	California fan palm

RM Appendix D. Item Coding Guide

Included with crew leader field forms

RM Appendix E. Garmin Operating Instructions

Use the instructions below for setting up and operating the Garmin GPSMAP 76S GPS receiver. Before verifying the initial settings and navigating with the unit, become familiar with installing batteries, the function of each key/rocker, and using/connecting the external antenna and power source by reading the owner's manual and quick start guide.

The purpose of this appendix is not to rewrite the owner's manual, but to document the initial settings and enable crews to collect the necessary data for plot establishment. Please refer to Section 00 (General Description and Section 8 (Location Reference Items) for more details on what data is collected.

1.0RM Verify Garmin Settings

The proper initial settings are necessary for positioning and navigational accuracy and once selected, become the default values each time the GPS is turned on.

With fresh batteries, turn the unit on and once the WARNING screen appears, press the PAGE key. The unit now starts "Acquiring Satellites" and will display the satellite strength signals, date, time, and UTM coordinates.

Press MENU twice to navigate to the Main Menu
Toggle down using the rocker pad to "Setup" and press ENTER

At the top of this screen there are 8 "tabs" that can be navigated through using the rocker pad. Verify the GPS settings using the information below:

With the "General" tab highlighted:
Mode = Normal
WAAS = Enabled
Backlight Timeout = 15 seconds
Beeper = On or Off (user preference)
Language = English

With the “Altimeter” tab highlighted:

Altimeter Auto Cal. = On
Altimeter = On
Pressure Units = Millibars
Barometer Mode = Variable Elevation

With the “Compass” tab highlighted:

Compass = On
Use GPS if Speed is Above = 10 mph
Use Compass if Below 10 mph for at least = 1 ½ minutes

With the “Time” tab highlighted:

Time Format = 12 Hour
Time Zone = Mountain
Daylight Savings Time = Auto (Arizona does not observe daylight saving time)
Current Date = (Correct Current Date)
Current Time = (Correct Current Time)

With the “Units” tab highlighted:

Elevation = Feet
Vertical Speed = ft/min
Distance and Speed = Statute
Depth = Feet
Temperature = Fahrenheit
Direction Display = Numeric Degrees
Speed Filter = Auto

With the “Location” tab highlighted:

Location Format = UTM UPS
Map Datum = NAD27 CONUS
North Reference = Magnetic
Magnetic Variation = Automatically changes with new location.

With the “Alarms” tab highlighted:

Anchor Drag = Off
Approach and Arrival = Auto
Off Course = Off
Shallow Water = Off
Deep Water = Off

With the “Interface” tab highlighted:
Serial Data Format = Garmin

Once all the settings have been verified, the GPS unit can be used for plot navigation and data collection.

2.0RM Data Collection

Averaged coordinates (count of 180 or better) will be collected in 3 different locations; at the truck parking spot, Reference Point (RP), and Location Center (PC).

Obtaining an averaged location:

- With the unit on, press and hold the ENTER/MARK key for 2 seconds until the Mark Waypoint screen appears.
- Press the MENU key and a separate screen appears with Average Location highlighted.
- Press ENTER and the Average Location screen appears and if there is good satellite reception, the Measurement Count will start.
- Record on the Field Location Reference sheet (“Brown Sheet”) the Location UTM coordinates after the count reaches 180.
- Repeat this process at the Truck parking spot, RP, and PC and record on the “Brown sheet”.

Using Waypoints:
A waypoint is a specific location entered in the GPS unit for future reference. Examples of potential waypoints include the location of the truck, a trailhead, a critical junction on a travel route to the plot, the reference point, or the plot center location. There are three ways to enter waypoints into the Garmin: by uploading the waypoints from a laptop computer using the Map Source software (not described below), by using the MARK key, or by manual input of the UTM coordinates. Use generic waypoint names like RP, PC, TRUCK, or GENERAL, so future waypoints can be edited instead of adding a new one and renaming it (see Editing Waypoints).

Instructions for using the MARK key and manual input of the coordinates for establishing a waypoint:

1. Using the MARK key
    - Once you are standing at a desired waypoint (i.e. RP, trail intersection, prominent landmark, or important navigational aid), press and hold the MARK key until the Mark Waypoint screen appears.
    - If the GPS unit is receiving satellite reception, the UTM coordinates will be shown in the Location block.
    - Once the unit has established reception, change the name of the waypoint (using the rocker) as desired.
    - Save the waypoint by highlighting OK and press ENTER.
    - You will now be able to use this waypoint for navigational purposes in the future.

2. Manually entering Waypoints (also see Editing Waypoints)
    - From the “Map Page”, press and hold the ENTER/MARK key until the Mark Waypoint screen appears.
    - Use the rocker until the Location (UTMs) is highlighted, press ENTER, and change the coordinates as needed.
    - Once the coordinates are correctly entered, use the rocker to highlight the name of the waypoint and change as desired.
    - Save the waypoint by scrolling down until OK or Goto are highlighted and press ENTER.

3. Acquiring RP to PC Distance and Azimuth

    To acquire the distance and azimuth from the RP to PC use the “Routes” function.
    - In order to use the “Route” function, waypoints for the RP and PC have to already be saved in the unit (see 1,2, and 5).
    - From the “Map Page” or any page after turning the unit on, press the MENU key twice.
    - The Main Menu will appear and from here, use the rocker and scroll down to “Routes” and press the ENTER key.
    - The “Routes” screen now appears. With “New” hightlighted, press ENTER.
    - A new “Route” screen appears and use the rocker to select the empty field below Waypoint, and press the ENTER key.
    - A separate “Points” screen appears, highlight and select “Waypoints”.

- The “Nearest Waypoints” screen appears and select “RP” (or the waypoint you named representing the RP).
- The Waypoint screen comes up with the “OK” tab highlighted and press ENTER.
- The “Route” screen appears again, toggle down to the empty field below the RP waypoint name, and press ENTER.
- Select “Waypoints” again (as above)
- Select the PC waypoint (as above)
- Seclect the OK tab (as above)
    - o The “Route” screen should now say RP-PC. The GPS unit can now calculate the distance and azimuth between the two waypoints selected.
- Toggle down to PC and then toggle to the right to switch between Distance (in ft. or miles) and Course (in degrees). To do this, keep toggling to the right to switch fields.

Helpful Suggestion: Once desired routes are established in the GPS unit (ie. RP - PC, TRUCK - PC, PC - Truck, etc.), edit the waypoints on the next plot (see Editing Waypoints) using the same waypoint names so new routes do not have to set up again.

4. Using Waypoints for Navigation:

Once a waypoint has been named and stored you can then later use that waypoint for navigational purposes.

- From the Map page, press the NAV key.
- A small screen appears - highlight “Go To Point” and press ENTER.
- The “Points” screen appears – select “Waypoints”.
- The “Waypoints by Name” screen appears - use the rocker to scroll through the list until the desired waypoint is selected and press ENTER.
- The “Waypoint” screen is now shown - select “Goto”.
- This brings you out to the Map page where you can navigate from using the “Bearing” and “Distance to Next”.

5. Editing Waypoints:

Use the “Points” function to edit coordinates of previously named waypoints. This makes using the “Routes” function easier, faster, and more convenient.

Some example waypoint names are: TRUCK, RP, PC, and, GENERAL (GENERAL is a generic waypoint and could be a trail intersection, prominent landmark, creek crossing, etc.)

Editing the same waypoints on every plot limits the number of waypoints stored in the GPS and enables you to choose previously used routes without adding a new one.

Some example routes are: TRUCK to PC, RP to PC, GENERAL to PC, PC to TRUCK, etc.

To edit a waypoint using the "Points" function:

- From the "Map Page" or any page after turning the unit on, press the MENU key twice.
- Choose "Points"
- Choose Waypoints in the pop-up screen.
- Select the waypoint you would like to edit and press "Enter".
- The "Waypoint" screen appears for that specific waypoint and you can now edit the coordinates or average the location using the same name.

6. Range Calculation – Finding the location of a subplot if the PC is inaccessible:

If the PC is inaccessible/hazardous but other subplots can be established, the GPS unit can be used to calculate the location of the accessible/non-hazardous subplot(s).

Throughout the west, different declination values will be experienced. If a GPS unit is used to establish a subplot, declination compensations must be made so the same location is established whether measuring out from the PC or using the GPS. Crews may encounter declination ranges of 9 to 17 degrees west of true north. Use of Figure 65 and Table 2 will enable crews to place subplot centers by using a GPS.

To use Table 2 (see below), change the UTM values for each respective subplot from the original PC coordinates. Use Figure 65 (see below) to decide which declination change best represents where the plot is being established. For example, if you were in Ogden, UT, the 14 degree declination would be used.

- From a reference point close to the subplot to be established, use the "Points" function (see Editing Waypoints) to edit the PC coordinates. Add or subtract the correct number of meters to the easting and northing for the subplot to be established. Use Figure 65 to decide which declination to use.
- Rename and save this waypoint.
- Use the "Mark" function and average the location of the reference point you will use to run the traverse from.
- Rename and save this waypoint.
- Use the "Route" function (see Acquiring RP to PC Distance and Azimuth) to obtain a distance and azimuth between these two waypoints, run the traverse, and establish the subplot.

Note: A reference point close to the subplot to be established is only used to reduce bias in the subplot placement. This reference point does not have to be marked or tagged in any way (it could be as simple as just where you are standing).

Example:
The PC coordinates for CO 99 LOC 999, located in central Montana are: easting 123000 and northing 4567000. Using Figure 65, the 14 degree declination best represents where this plot is being established.

In this plot the PC is hazardous but the other 3 subplots can be established.

To get to subplot 2:
- Edit the PC coordinates so the easting is 123009 and the northing is 4567035 where you are adding 9 meters to the easting and adding 35 meters to the northing (see Figure 64 or table 2 to obtain numbers in bold for a 14 degree declination)
- Rename this waypoint as SP 2 and save it.
- Average the location of the reference point (could be where you are standing) and save this waypoint as RP 2.
- Use the "Route" function to obtain the distance and azimuth from RP 2 to SP 2.
- Run the traverse from the reference point and establish the subplot.

To get to subplot 3:

- Edit the PC coordinates so the easting is 123026 and the northing is 4566975 where you are adding 26 meters to the easting and subtracting 25 meters from the northing.
- Rename this waypoint as SP 3 and save it.
- Average the location of the reference point (could be where you are standing) and save this waypoint as RP 3.
- Use the “Route” function to obtain the distance and azimuth from RP 3 to SP 3.
- Run the traverse from the reference point and establish the subplot.

Repeat the process for subplot 4

Subplot 2
e XXX009
n XXXX035
(+9m, +35m

Subplot 4
e XXX965
n XXXX990
(-35m, -10m)

Subplot 3
e XXX026
n XXXX975
(+26m, -25m)

Figure 64. Range Calculation Coordinates used for a 14 degree declination (used in example above).

Declination	Easting			Northing		
	Subplot 2	Subplot 3	Subplot 4	Subplot 2	Subplot 3	Subplot 4
10 degree	eXXX006 +6m	eXXX028 +28m	eXXX966 -34m	nXXXX036 +36m	nXXXX976 -24m	nXXXX987 -13m
12 degree	eXXX008 +8m	eXXX027 +27m	eXXX965 -35m	nXXXX036 +36m	nXXXX976 -24m	nXXXX989 -11m
14 degree	eXXX009 +9m	eXXX026 +26m	eXXX965 -35m	nXXXX035 +35m	nXXXX975 -25m	nXXXX990 -10m
16 degree	eXXX010 +10m	eXXX025 +25m	eXXX965 -35m	nXXXX035 +35m	nXXXX974 -26m	nXXXX991 -9m

Table 2: Range Calculation Coordinates

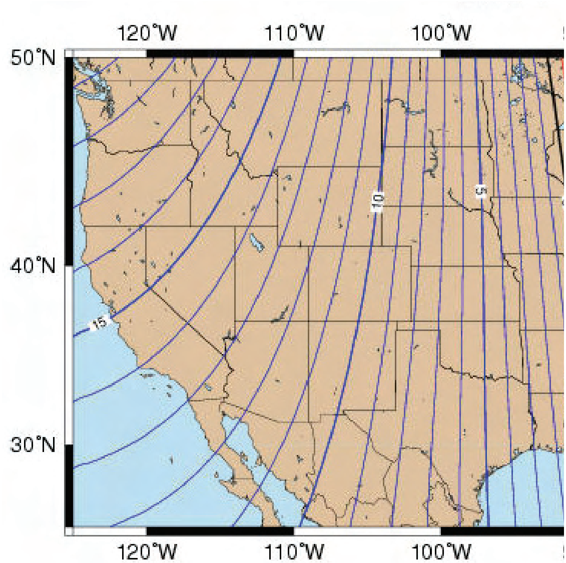


Figure 65. Magnetic Declination for the Wester U.S.

Other GPS Suggestions:

GPS UNIT should be recorded as 2 – "Other brand capable of field averaging" when using the Garmin and an averaged location has been obtained. See chapter 7, Field Location Description Items for more detail.

Use the external remote antenna to improve satellite reception when under heavy canopy/cloud cover, north facing slopes, or any other area that may have poor reception. The external antenna will improve the GPS performance by about 15-20%.

RM Appendix F. Laser 200 Instructions

1.0RM Overview

Accurate heights are necessary in our inventory in order to determine volume. The Laser can be used to get fast and accurate tree heights. It can also be used to measure distances and % slope. This instrument is more fragile than the GPS units. Some precautions must be taken with the Lasers to keep them working properly. These are:

1. Never look at the sun through the scope. Looking directly at the sun can permanently damage your eyes.
2. Never point the Laser directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.
3. Do not expose the Laser to extreme temperatures. It is rated for a temperature range of -22 deg. F to +140 deg. F. Don't leave the instrument in the vehicle during the heat of the day.
4. Do not use batteries with "voltage check" features built on the batteries. The battery case of the Laser is too narrow for these batteries, and they could get stuck in the instrument.
5. Do not drop the Laser. Immediately return it to it's case when you get back to the vehicle. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

2.0RM Basic operation

All directions for using the Laser buttons are given assuming you are holding the instrument with the LCD display screen facing you and the 2 round lenses are facing the object you want to measure. The buttons will be referred to as:

L1	the left button closest to you
L2	the left button in the middle
L3	the left button furthest away from you
R1	the right button closest to you
R2	the right button in the middle
R3	the right button furthest away from you

Turn the Laser on by pushing L1 or R1
Turn it off by pushing L2 and L3 at the same time. The Laser may turn itself off after a period of inactivity. Once the instrument is on, push the R1 button to make the red dot appear in the sighting scope. If there is no red sighting dot, repeatedly push the L2 button until the red dot

appears and is the correct brightness. To light up the display screen, press L3. Press L3 again to turn off the light.

3.0**RM** Settings

Make sure the settings are correct before using the Laser. To set the correct measurement units, go into the main menu and:

1. Press R2 or R3 to scroll through the menu until SYS is displayed in the upper right hand corner of the screen.
2. Press R1. ON or OFF will show in the center of the screen. FILTER will flash at the bottom.
3. Press R2 until OFFSET is flashing. The number displayed should be 0000.00.
4. Press R2 until PIVOT is flashing. The number displayed should be 0000.59. When this number is set at 0.00, the Laser is set to calculate heights using a tripod attached to the center of the instrument. The pivot point is the center of the Laser. We use the pivot value at 0.59 because this sets the pivot point at the rear of the instrument, and this allows you to shoot a height while using your head as the pivot point. To change this number, press L1 until the number you want to change is flashing. Press L2 or L3 until the correct number is showing. When the number is set at 0000.59, press R1.
5. Press R2 until UNITS is flashing. Select F (feet) using the R1 button.
6. Press R2 again and D (degrees) should be flashing. If not, press R1 to toggle on D.
7. Press R2 again and % should be flashing. It should say ON. If not, press R1.
8. Press R3 twice to accept the new settings and back out to the main display.

4.0**RM** Filter and Reflectors

When you are working in areas of dense brush, you need to make sure the Laser is giving you the distance to the correct target. The best way to do this is to use a reflector as a target and use the filter option on the Laser. The Laser will only lock onto the highly reflective targets and ignore the less reflective brush. To use the filter option:

1. Place a reflector (or have someone hold it) on the tree where it can be seen from the required distance. The

Laser will not work in the filter mode without a reflector as a target.

2. Go to the main menu on the Laser and push R2 or R3 until SYS is displayed on the screen.
3. Press R1 to select the SYS option. The FILTER option will blink, and it will say the FILTER is OFF or ON.
4. Push R1 to toggle FILTER between ON and OFF.
5. Press R3 to save the desired setting and to back out into the main display. When the FILTER is on, FILTER will appear at the bottom of the screen when the Laser is measuring distances.

5.0**RM** Distances and % slope

Horizontal distance (HD): Turn the Laser on. The top-middle of the LCD screen will say HD. Point the red sighting dot at the target. Press R1 and hold it down until the Laser locks on the target, then release. You can tell when the instrument locks onto it's target by sound. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If you get an error message, simply aim again and press R1.

Slope distance (SD) and Vertical distance (VD): Push R2 or R3 until the correct display is shown. Then aim and press R1 until the Laser locks on target. Or, measure a horizontal distance, then push R2 until the correct display is shown.

% slope: Press R2 or R3 until INC is displayed. Then aim and press R1.

6.0**RM** Tree heights

The best way to measure a tree height is to make sure you have a clear shot at the leader or a clear shot of the tree trunk. Make sure you are getting a distance to the tree trunk, and not some branches in front of it. If you can't get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once you are in position with your target in sight, go to the main menu:

1. Push R2 or R3 until HT is displayed in the upper left of the screen.
2. Push R1 once, aim at the target, then push R1 until the Laser locks on target. This will measure the horizontal distance.

3. The down arrow will flash. Aim at the base of the tree and push R1 to get the % slope.
4. The up arrow will flash. Aim at the top of the tree and push R1 again to get another % slope.
5. Press R1 once more and the Laser will display the height. Make sure this height is reasonable before recording it in the PDR.

7.0**RM** Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help you make sure you are hitting the right target when objects near you or just beyond your target might give you false readings. You don't have to set both gates. You will probably only need to set the short gate because of brush or fog between you and your target. You can set a gate by shooting a target or by entering distances into the instrument. To set a short gate by laser, go to the main menu and:

1. Press R2 or R3 until GATE is shown on the display.
2. Push R1 to select the gate option.
3. Press R1 to toggle the gate between ON and OFF.
4. Push R2. The S indicator will flash.
5. Aim at a target that is at the distance you want to set as the short gate and press R1.
6. Now you can either set a long gate, or press R3 to go back to save the short gate and return to the main menu. The S will be displayed when you are measuring distances to show the short gate is on.

To set a long gate:

7. Push R2. The L indicator will flash.
8. Aim at an appropriate target and press R1
9. Press R3 to save the gate and go back to the main display. The L will be displayed when measuring distances.

The gates are reset to OFF when the Laser is turned off, but gate values are saved in memory. This means that if you have saved a gate and turn off the instrument, when you turn it back on the gate will be set to OFF. If you go back into the gate option and turn the gate ON, it will remember the last distances you shot for the long and short gates.

To clear out a gate value: Display the gate values by following the instructions in this section (section G). When the desired gate value is displayed, press and hold down R3 until the number is deleted.

8.0RM Cumulative distances

A cumulative distance measurement allows you to move from one target point to the next, stopping at each one to measure the distance to the next target point. The Laser accumulates the measured distances in both slope and horizontal distances (SD and HD) to give you a running total.

To take a cumulative distance, go to the main menu and:

1. Press R2 or R3 until MULTI is displayed on the screen.
2. Press R1 to enter the MULTI option. DIFF will be displayed.
3. Press R2 once. CUM will be displayed.
4. Press R1. Either SEL or a number will be displayed. If SEL is displayed, HD will flash on and off. Press R1 to toggle between HD and SD. Press R2 when the correct indicator is flashing. If a number is displayed, that means there is already a cumulative distance saved on this instrument. You can either clear out this distance by holding down R3 until 0.00 appears, or continue to add to the distance by going to step 5.
5. Aim at the target and press R1 to fire the laser.
6. If you are not satisfied with the measurement, repeat step 5 to retake the measurement. If you are satisfied with the measurement, and wish to add it to your total, press R2. The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

You can choose whether you want horizontal or slope distances at any time. If a distance has been measured, you can change from slope or horizontal distance by pressing R3 twice. SEL will be displayed. Push R1 to toggle between SD and HD. Press R2 twice to get back to the total distance. Go to step 5 to add more distances.

The cumulative measurement total is saved in memory even if the instrument is turned off. Turn the instrument on and scroll back to

the MULTI-CUM option and resume the procedure with step 5.
To clear out the current total and begin another series of measurements, hold down R3 while the cumulative distance is showing until the number is deleted.

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