Interior West Resource Inventory,
Monitoring, and Evaluation Program

FOREST SURVEY
FIELD PROCEDURES

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TABLE OF CONTENTS

Page

LIST OF FIGURES xii

CHAPTER 1 - INTRODUCTION 1-1

A. Program Purpose 1-1
B. Field Organization..... 1-1
C. Quality Control..... 1-2
D. Personal Conduct and Safety 1-3
E. Everyday Considerations..... 1-3
F. Vehicles 1-4
G. Equipment and Supplies..... 1-6

CHAPTER 2 - FINDING THE FIELD LOCATION CENTER..... 2-1

A. Land Owner/Management Agency Verification..... 2-1

B. Planning Travel to the Vicinity of the Field Location and LC Pinprick Verification 2-1

C. Finding the Field Location Center - New Field Locations 2-2
1. Establishing LC with the GPS Receiver..... 2-2
a. Verify PLGR Settings..... 2-2
b. Select the LC Waypoint from the Location Waypoint List..... 2-2
c. Select a Suitable RP..... 2-3
d. Find the Position of the RP..... 2-3
e. Chaining from the RP to the LC..... 2-3
f. LC Verification..... 2-3
2. Establishing a Baseline and Scale..... 2-5
a. Ground/Photo Method..... 2-5
b. Map/Photo Method..... 2-6
c. Selecting a reference point 2-8
d. Adjusting the photo scale reciprocal..... 2-9
e. Calculating azimuth and distance..... 2-10
f. Traversing to the LC..... 2-12
g. LC Verification..... 2-12
h. Moving the Pinprick..... 2-13
D. Finding the Field Location Center – Remeasurement Field Locations 2-14
1. RP Not Found 2-15
2. RP Found But Not Usable 2-20
3. Field Location Incorrectly Placed or Not Found 2-21

CHAPTER 3 - DEFINING THE CONDITION CLASS 3-1

A. Determining Condition Class: General Procedures..... 3-1
1. Condition Class Attributes..... 3-2
2. Delineating Condition Classes
Differing in Condition Status..... 3-3
*Exceptions to the size and width requirements..... 3-4

B. Condition Status Definitions 3-12
1. Accessible Forest Land 3-12
2. Nonforest Land..... 3-16
3. Noncensus Water..... 3-16
4. Census Water..... 3-16
5. Denied Access..... 3-16
6. Hazardous..... 3-16
7. Not in the Sample..... 3-17

C. Mapping the Condition Boundary..... 3-18
1. Locating the boundary..... 3-18
2. Delineating the boundary..... 3-19
3. Referencing the boundary..... 3-21

CHAPTER 4 - FIELD PROCEDURE OVERVIEW 4-1

A. Circumstances Precluding Field Location Establishment 4-1
1. Potential Situations..... 4-1
2. Procedures 4-4

B. Field Locations with Accessible Forest Land Present 4-5

C. Field Locations with No Accessible Forest Land Present,
(Nonforest Land and/or Water Only) 4-6

D. Remeasurement, P3, and Accounting Plots 4-7

E. Reserved Lands/Wilderness Areas..... 4-8

CHAPTER 5 - FIELD LOCATION LAYOUT AND TREE SAMPLING PROCEDURES 5-1

*Layout Type Terminology 5-1

A. Field Location Layout 5-5

B. Sampling Procedures 5-6
1. Subplot Tree Tally 5-6
2. Microplot Sapling Tally 5-10
3. Seedling Counts 5-11

CHAPTER 6 - FIELD LOCATION

REFERENCE ITEMS 6-1

A. Identification Items 6-1
B. Reference Point 6-1
C. Course to Location Center 6-2
D. LC Witness Trees 6-3
E. Baseline Information 6-5
F. Travel Description 6-5
G. Owner Information 6-6
H. Field Location Map 6-6
I. Field Crew 6-6
J. Photos 6-6
K. Editing 6-7
L. Map Name and Scale 6-7
M. Legal Description 6-7
N. Photographing the Field Location 6-8
0. Global Positioning System (GPS) Reference Data 6-9

CHAPTER 7 - FIELD LOCATION DESCRIPTION ITEMS

	CHAPTER 7 - FIELD LOCATION DESCRIPTION ITEMS	7-1
ITEM		
101	State (CORE – 1.1)	7-1
104	County (CORE – 1.2)	7-1
105	P2 Location Number (CORE – 1.3, Plot Number)	7-2
106	USGS Map Number	7-2
103	Consecutive Point Number (CPN)	7-2
121	Current Date (CORE – 1.6)	7-2
122	Crew Number(s)	7-3
123	Crew Type (CORE – 1.17)	7-3
124	QA Status (CORE – 1.16)	7-3
131	Sample Kind (CORE – 1.4)	7-4
128	Manual Version (CORE – 1.5)	7-4
129	Current Location Status	7-5
130	Condition Class Change	7-6
134	Range Data	7-7
132	Subplot Radius	7-7
133	Microplot Radius	7-7
135	Microplot Location	7-8
143	Trails or Roads (CORE – 1.8)	7-8
144	Horizontal Distance to Improve Road (CORE – 1.9)	7-9
145	Public Use Restrictions (CORE – 1.11)	7-10
149	Road Access (CORE – 1.10)	7-10
146	Recreation Use 1, 2, and 3 (CORE – 1.12-1.14)	7-11
150	Water on Plot (CORE – 1.15)	7-12
147	Water Proximity	7-13
148	Water Type	7-14
141	Size of Forested Area	7-15
171	GPS Unit (CORE – 1.18.3)	7-16
172	GPS Serial Number (CORE – 1.18.4)	7-16
173	Coordinate System (CORE – 1.18.5)	7-16
174	GPS Elevation (CORE – 1.18.14)	7-17
175	GPS Error (CORE – 1.18.15)	7-17
176	Number of GPS Readings (CORE – 1.18.16)	7-17
177	UTM Zone (CORE – 1.18.8)	7-17
178	Easting (X) UTM (CORE – 1.18.9)	7-17
179	Northing (Y) UTM (CORE – 1.18.10)	7-18
180	Azimuth to Plot Center (CORE – 1.18.12)	7-18
181	Distance to Plot Center (CORE – 1.18.13)	7-18
107	Future Forest Potential	7-19

CHAPTER 8 - CONDITION CLASS DESCRIPTION ITEMS 8-1

A. Condition Class Description 8-1

ITEM

201 Condition Class Number (CORE – 2.2.1) 8-2
203 Condition Class Status (CORE – DEFINING – 2.2.2)..... 8-2
204 Hazard Status..... 8-3
205 Reserved Status (CORE – DEFINING – 2.4.1) 8-3
207 Owner Group (CORE – DEFINING – 2.4.2)..... 8-4
209 Owner Class (CORE – 2.4.7) 8-4
210 Private Owner Industrial Status (CORE – 2.4.8)..... 8-6
221 Forest Type (CORE – DEFINING - 2.4.3) 8-7
219 Nonstocked Forest Type 8-18
222 Stand-size Class (CORE – DEFINING – 2.4.4)..... 8-19
223 Regeneration Status (CORE – DEFINING – 2.4.5)..... 8-22
225 Artificial Regeneration Species (CORE – 2.4.9)..... 8-23
224 Tree Density (CORE – DEFINING – 2.4.6) 8-23
244 Physiographic Class (CORE – 2.4.23)..... 8-25
232 Stand Age (CORE – 2.4.10)..... 8-28
220 Size of Condition 8-30
237 Width of Condition 8-30
234 Condition Habitat Type 8-31
233 Crown Cover 8-31
275 Ground Cover Transects 8-33
263 Disturbance 1 (CORE – 2.4.11)..... 8-35
264 Disturbance 1 Year (CORE – 2.4.12)..... 8-36
263 Disturbance 2 (CORE – 2.4.13)..... 8-36
264 Disturbance 2 Year (CORE – 2.4.14)..... 8-36
263 Disturbance 3 (CORE – 2.4.15)..... 8-36
264 Disturbance 3 Year (CORE – 2.4.16)..... 8-36
265 Treatment 1 (CORE – 2.4.17)..... 8-37
266 Treatment 1 Year (CORE – 2.4.18) 8-38
265 Treatment 2 (CORE – 2.4.19) 8-38
266 Treatment 2 Year (CORE – 2.4.20) 8-38
265 Treatment 3 (CORE – 2.4.21) 8-38
266 Treatment 3 Year (CORE – 2.4.22) 8-38
262 Past Nonforest / Inaccessible Land Use (CORE – 2.4.24)..... 8-39
263 Present Nonforest Land Use (CORE – 2.4.25)..... 8-41
264 Nonforest Year (CORE – 2.4.26)..... 8-42
270 Condition Status Change..... 8-42

B. Condition Class Diagram and Boundary Information..... 8-40

ITEM

281 Subplot Number (CORE – 3.2.1)..... 8-43
282 Mapping Plot Type (CORE – 3.2.2)..... 8-43
283 Boundary Change (CORE – 3.2.3)…….…… 8-44
284 Contrasting Condition Class Number (CORE – 3.2.4)..... 8-44
285 Azimuth Left and Right (CORE – 3.2.5, 3.2.8) 8-44
287 Corner Azimuth and Distance (CORE – 3.2.6, 3.2.7)…..... 8-45

CHAPTER 9 - SUBPLOT DESCRIPTION ITEMS 9-1

ITEM

300 Subplot Number (CORE – 4.1) …….…….. 9-1
301 Subplot Status (CORE – 4.7)..... 9-2
304 Subplot Condition List (CORE OPT – 4.8) 9-2
303 Subplot Center Condition Number (CORE – 4.2)…..... 9-3
307 Microplot Center Condition Number (CORE – 4.3)……..…….. 9-2
315 Subplot Slope (CORE – 4.4)…….....…..... 9-3
316 Subplot Aspect (CORE – 4.5)……..... 9-3
318 Snow/Water Depth (CORE – 4.6)…….…… 9-4
322 Root Disease Severity Rating .....……..... 9-5

CHAPTER 10 - TREE DATA ITEMS 10-1

ITEM

401 Subplot Number (CORE – 5.1)..... 10-1
402 Tree Record Number (CORE – 5.2)..... 10-2
404 Azimuth (CORE – 5.4) 10-3
405 Horizontal Distance (CORE – 5.5) 10-3
406 Condition Class Number (CORE – 5.3)..... 10-4
410 Past Tree Status 10-5
411 Current Tree Status (CORE – 5.6) 10-6
413 New Tree Reconcile (CORE – 5.6.1)..... 10-7
412 Tree Lean Angle (CORE – 5.7) 10-8
415 Mortality (CORE OPT – 5.6.2) 10-8
417 Mortality Year (CORE – 5.20)..... 10-11
416 Species (CORE – 5.8) 10-12
420 Past DBH/DRC (CORE – 5.9.1, 5.9.3)..... 10-15
421 Current DBH/DRC (CORE – 5.9.2, 5.9.4) 10-15
422 Seedling Count (CORE – 6.4) 10-31
423 DBH/DRC/Count Check (CORE – 5.10) 10-32
425 Stump Diameter 10-32
426 Past Number of Stems..... 10-33
424 Number of Stems 10-33
440 Past Total Tree Length..... 10-33
441 Total Tree Length (CORE 5.12) 10-34
448 Past Actual Tree Length..... 10-35
446 Actual Tree Length (CORE – 5.13)..... 10-35
442 Length Method (CORE – 5.14)..... 10-36
443 Uncompacted Crown Ratio (CORE OPT – 5.16)..... 10-36
444 Compacted Crown Ratio (CORE – 5.17)..... 10-38
445 Crown Class (CORE – 5.15) 10-41
447 Cone Serotiny 10-43
456 Dwarf Mistletoe Class (CORE OPT – 5.25) 10-43
450 Damage..... 10-45
451 Damage Location 1 (CORE – 5.18.1)..... 10-46
452 Damage Type 1 (CORE – 5.18.2)..... 10-49
453 Damage Severity 1 (CORE – 5.18.3)..... 10-55
454 Damage Agent 1..... 10-70
451 Damage Location 2 (CORE – 5.18.4)..... 10-80
452 Damage Type 2 (CORE – 5.18.5)..... 10-80
453 Damage Severity 2 (CORE – 5.18.6)..... 10-80
454 Damage Agent 2..... 10-80
457 Other Damage Agent..... 10-80
458 Decay Class (CORE – 5.21)..... 10-81

465 Percent Missing Top..... 10-82
460 Percent Volume Loss - Rotten and Missing (CORE – 5.11)..... 10-82
461 Percent Volume Loss - Sound Dead (CORE OPT – 5.24)..... 10-82
462 Percent Volume Loss - Form Defect 10-82
463 Past Tree Class 10-85
464 Current Tree Class 10-85
430 Radial Growth 10-87
431 Tree Age 10-87
432 Radial Growth and Tree Age Check 10-94
414 Site Tree..... 10-94
455 Cause of Death (CORE – 5.19)..... 10-97
466 Utilization Class (CORE – 5.22)..... 10-97
470 Posts - Lines 10-98
471 Posts - Corners 10-98
472 Christmas Tree Grade 10-98

CHAPTER 11 - UNDERSTORY VEGETATION DESCRIPTION 11-1

A. Sample Subplot Size 11-1

B. Sample Identification 11-2

C. Vegetation Description 11-2
1. General Definitions 11-2
a. Plant groups 11-2
b. Percent cover 11-3
c. Layer codes 11-3
2. Entries to be Recorded 11-4
a. Understory Vegetation Description record - Part I .. 11-4
b. Understory Vegetation Description record - Part II . 11-7

D. Noxious Weeds 11-8

E. Instructions for Collecting Plant Sample "Unknowns" 11-10

CHAPTER 12 - ACCOUNTING PROCEDURES 12-1

A. Plot Layout 12-1
1. Variable Radius Plots 12-2
2. Fixed-Radius Plots 12-4

B. Sampling Methods 12-4
1. Main Plot/Quadrant 12-4
2. Sapling Microplot 12-5

C. Tree Data 12-5

ITEM

601 Point Number 12-5
602 Point History 12-5
603 Tree Number 12-6
604 Azimuth 12-6
605 Distance 12-6
610 Past Tree Status 12-7
611 Current Tree Status 12-7
613 New Tree Reconcile..... 12-8
612 Tree Lean Angle..... 12-9
616 Species 12-9
620 Past DBH/DRC 12-9
621 Current DBH/DRC 12-10
623 DBH/DRC Check..... 12-10
625 Stump Diameter..... 12-11
626 Past Number of Stems 12-11
624 Current Number of Stems 12-11
640 Past Total Tree Length 12-11
641 Current Tree Length 12-12
655 Cause of Death 12-12
663 Past Tree Class 12-13
664 Current Tree Class 12-13

GLOSSARY 13-1

APPENDICES 14-1

APPENDIX A: FIELD FORMS..... 14-3
A.1 Field Location Reference Record 14-4
A.2 Field Location Description
and Subplot Description Record 14-5
A.3 Condition Class Description Record 14-6
A.4 Condition Class Diagram and Boundary Record 14-7
A.5 Tree Data Record 14-8
A.6 Understory Vegetation Description Record 14-9
A.7 Tree-Check Form 14-10
A.8 Multistemmed Woodland Species Tally..... 14-11
A.9 Ground Cover Supplemental Data Form 14-12
A.10 Remeasurement Tree Data Record 14-13

APPENDIX B: MAP, PHOTO, AND TRAVERSING TABLES ... 14-15
B.1 Slope Correction Table 14-16
B.2 Map/Photo Scale Ratios 14-17

APPENDIX C: TREE DATA 14-19
C.1 Diameter Measurement Techniques for
Timber Species 14-20
C.2 Square-Foot Basal Area Values (DRC Calc) 14-22
C.3 Boring for Radial Growth and Age 14-23
C.4 Determining Tree Height 14-25
C.5 Circular Defect Deduction Table 14-28

APPENDIX D: TREE SPECIES LIST 14-29

APPENDIX E: ITEM CODING GUIDES 14-37
E.1 Location Reference Data 14-38
E.2 Location Description and Subplot Data 14-39
E.3 Condition Description Data 14-40
E.4 Tree Data 14-41

APPENDIX F: VARIABLE NAME ABBREVIATIONS..... 14-43

APPENDIX G – PLGR OPERATING INSTRUCTIONS..... 14-51

APPENDIX H – LASER 200 INSTRUCTIONS..... 14-57

STATE SUPPLEMENT 15-1

LIST OF FIGURES

Page

1. Examples for two methods of determining azimuth from RP to LC 2-11
2. The .001 foot scale method 2-17
3. The best fit method..... 2-19
4. Subplot within a small opening..... 3-4
5. Subplot within a maintained yard..... 3-5
6. Subplot within a power line right-of-way..... 3-5
7. Several alternating strips of forest and nonforest..... 3-6
8. Two alternating strips of forest and nonforest..... 3-7
9. Illustration of the 90 degree corner rule..... 3-8
10. Subplot within a linear water feature..... 3-9
11. Combining conditions that do not meet minimum size criteria..... 3-10
12. Subplot within a transition zone..... 3-13
13. Subplot at an indistinct boundary..... 3-15
14. Mapping along a stand boundary..... 3-20
15. Field location layout 5-5
16. Down tree limiting distance 5-9
17. Crown cover transects 8-33

**. Ground cover transects..... 8-34

18. Example condition class diagram and condition boundary information 8-46
19. Ragged Condition Class boundary and tree condition class designation..... 10-5
20. Points of diameter measurement for DBH trees..... 10-17
21. Points of diameter measurement on woodland species 10-27
22. Uncompacted crown ratio examples 10-37
23. Uncompacted crown ratio examples for saplings..... 10-38
24. Examples of Compacted Crown ratio of conifers..... 10-39
25. Examples of Compacted Crown ratio of western woodland species..... 10-40
26. (Deleted)
27. Examples of crown class definitions..... 10-42
28. Example six-class mistletoe rating..... 10-44
29. Location codes for damage..... 10-46
30. Damage location example..... 10-47
31. Example of damage threshold..... 10-56
32. Example of multiple damages..... 10-57
33. Examples of damage coding..... 10-62
34. Radial growth measurement 10-92
35. Christmas tree grades for pinyon 10-99
36. Example of a completed understory vegetation description record 11-9

**. Understory Vegetation examples..... 11-11

37. Previous variable-radius plot layout 12-3

CHAPTER 1 - INTRODUCTION

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

This manual is a combination of regional variables that pertain specifically to the interior west and national core variables. National core variables are variables collected by all Forest Inventory and Analysis units (FIA) across the U.S. to ensure a degree of consistency and uniformity in the data collection procedure. Throughout this manual national core variables will be indicated by shading of the text.

A. Program Purpose

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

B. Field Organization

Field work is administered by field supervisors and section leaders. Each field supervisor is responsible for coordinating the field effort for one or more individual field sections; duties include assigning work areas and transferring field crews between sections to meet work schedules. Field supervisors also assist the quality control staff in training field crews and in conducting periodic checks of field locations.

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

Field work is conducted by two- or three-person field crews. The crew leader directs the work of the field crew, but all crew members are responsible for accurate and efficient work, and for ensuring that the field crew has the proper equipment, maps, aerial photographs, field forms, and supplies before beginning each day's work.

C. Quality Control

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

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

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

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

2. To hold technique errors to a minimum.

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

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

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

D. Personal Conduct and Safety

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

It is particularly important that field crews obtain permission to enter or pass through private land. Be careful to not cause any property damage. Also, leave all gates as they are found.

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

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

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

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

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

E. Everyday Considerations

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

Follow these suggestions:

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

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

3. Record your plot destination on the location log in your trailer or attached to the outside of the door for any other housing facility.

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

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

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

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

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

F. Vehicles

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

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

The crew leader (or field supervisor/section leader) may authorize other employees to use the vehicle; however, the operator of a vehicle is responsible for that vehicle and it's equipment while using it. Vehicles must be returned to the assigned driver in good condition.

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

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

The following schedule of servicing and inspection must be followed:

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

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

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

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

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

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

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

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

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

G. Equipment and Supplies

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

CHAPTER 2 - FINDING THE FIELD LOCATION CENTER

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

A. Land Owner/Management Agency Verification

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

Before visiting each field location, it is particularly important that field crews contact private land owners or lessees to obtain permission to enter or pass through private land. Information about best travel route, locked gates, etc., may also be obtained. If the crew is unable to make contact (no permission letter received, unable to reach owner by phone or by visiting ranch house, etc.), the location will be classified as
"access denied"; notify the supervisor immediately.

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

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

1. Verify the Placement of the LC Pinprick.

Before going to any field location, first verify that the LC pinprick on the photo is in the same location as the map grid intersection.
If they are not the same, inform the section leader.

2. **Determine Travel Route.**

With the packet items, determine the best route of travel to the field location. As a safety precaution, the crew supervisor will maintain a daily record of planned locations to be visited and/or routes to be traveled; keep this log up to date and accessible in the crew supervisor's trailer or other housing facility.

C. Finding the Field Location Center - New Field Locations

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

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

1. Establishing LC with the Precision Lightweight GPS Receiver

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

Important: Each day in the field, set up the PLGR in an open area (e.g., campground) for at least 15 minutes to load the daily almanac. The daily almanac can also be loaded while traveling to plot with the PLGR connected to the vehicles power source. Also, check map datum in the lower left corner of the topographic map. Refer to Appendix G.

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

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

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

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

Pinprick the RP on the aerial photograph with the LC pinprick. Circle and label the pinpricked RP on the back of the photograph. Refer to page 6-2 for instructions on tagging the RP.

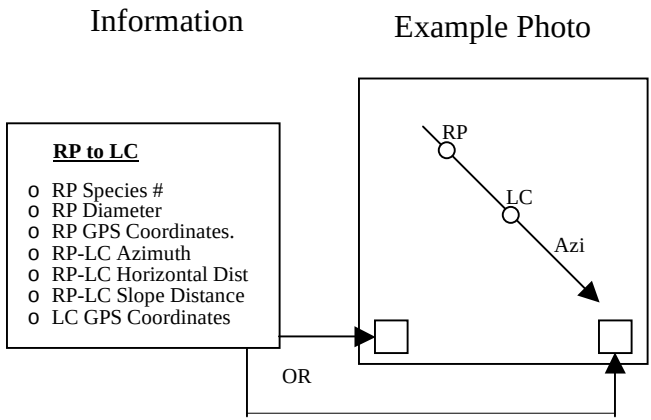
d. **Find the Position of the RP.**
Tolerance: EHE ≤ 70 feet.
Use the **"Position"** (POS) feature of the PLGR to provide coordinates for the position of the RPon the Universal Transverse Mercator (UTM) grid system. Refer to Appendix G. If the 180 hit averaged EHE is > 70 feet, check satellite strength meter, map datum, and PLGR settings, then try again. If the EHE is still > 70 feet, refer to Chapter 2 **"Establishing a Baseline and Scale"** to locate the LC.

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

f. **LC Verification.**
Tolerance: ±6 feet per 100 feet chained. ± 30 foot maximum error.
Upon arrival at the LC, put a stake in the ground and use the **Position (POS)** function of the PLGR to collect UTM coordinates for the LC. If a 180 hit averaged EHE of ≤ 70 feet for the LC cannot be obtained, it will be necessary to chain to an opening and use the **RangeCalc** function of the PLGR to calculate the coordinates of the LC (the RP coordinates, distance, and azimuth can be used for the calculation.)

For correct placement of the LC, chaining error should be no more than ±6 feet per 100 feet of chaining distance up to ± 30 feet. Check photos and topo map to verify the LC Position. If the LC pinprick and PLGR placement disagree by more than 0.1 inches, re-pinprick the photo, and begin referencing the plot. Use procedures listed on pg. 2-13, "**Moving the Pinprick**."

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



2. **Establishing a Baseline and Scale.**

Use this technique in the field when an open area for running a baseline is available.

a. **Ground/Photo Method.**

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

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

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

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

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

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

Determine the "slope correction factor" (SCF) for the angle of the slope using a clinometer with a SCF option, or determine the slope percent with a clinometer and find the associated SCF listed in appendix B.1.

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

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

b. Map/Photo Method.

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

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

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

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

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

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

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

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

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

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

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

Adjusted Azimuth = original map azimuth –
(MN declination ± GN declination)

Examples of computation for both situations:

Example A:

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

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

Example B:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

For example:

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

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

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

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

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

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

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

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

If a secondary baseline is used, first determine the azimuth of the secondary baseline by positioning the protractor (**wrong-side** up) over the intersection of the original and secondary baselines, lining up the correct azimuth for the original baseline, and reading the azimuth corresponding to the secondary baseline. After the azimuth for the secondary baseline is determined, place the protractor over the intersection of the secondary baseline and the RP-LC line to obtain the RP to LC azimuth.

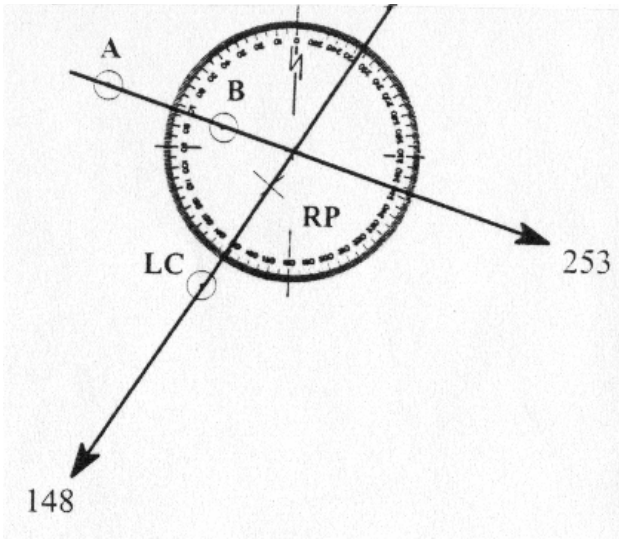
On the back of the photo, record the azimuths along each traverse line. Also record the following information on the back of the aerial photograph containing the LC pinprick in the lower left or right hand corner (depending on photo pinprick location):

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

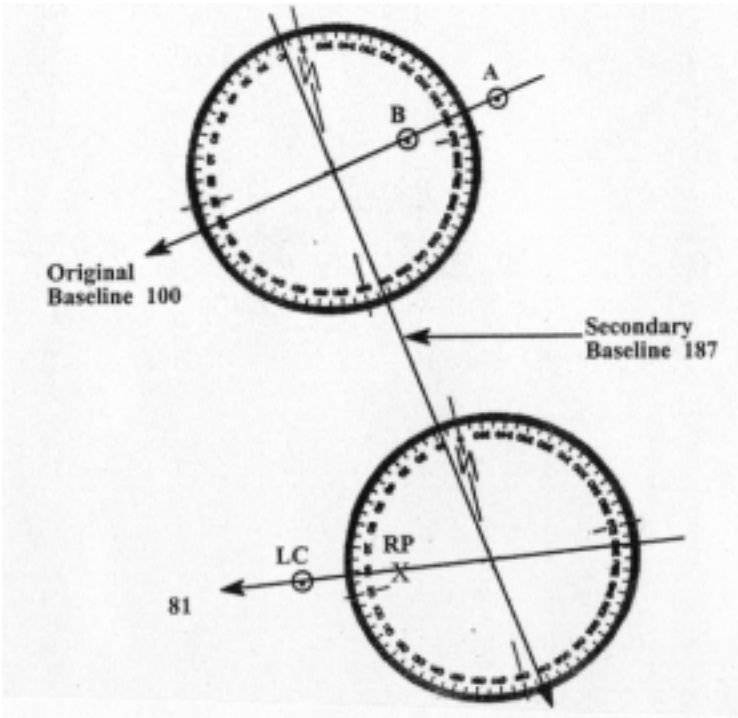
*Record only if baseline method is used.

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

Example 1:



Example 2:



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

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

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

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

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

f. Traversing to the LC. Using a compass and tape, run a traverse from the RP to the LC along the calculated azimuth and horizontal ground distance. Make distance corrections for slope whenever the slope is 10 percent or greater. Use a clinometer to determine the appropriate slope correction for each distance segment traversed (or if needed, appendix B.1 provides a slope correction table for distance). Place a stake at the end of the traverse.

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

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

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

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

h. Moving the Pinprick.

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

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

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

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

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

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

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

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

D. Finding the Field Location Center - Remeasurement Locations

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

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

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

Run the traverse from the RP to the LC using the azimuth and horizontal distance recorded under "Course to Sample Location" on the old Field Location Record sheet and/or old photos. If the slope exceeds 10 percent, horizontal distances must be adjusted for slope (determine the slope correction factor, SCF, using a clinometer with a SCF option, or determine the slope percent with a clinometer and find the associated SCF listed in appendix B.1).

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

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

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

1. <u>RP Not Found</u>.

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

a. Follow the procedures described under "Finding the Field Location Center - New Field Location" (page 2-2), and use the ground/photo method for establishing a baseline.

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

The .001-Foot Scale Method:

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

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

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

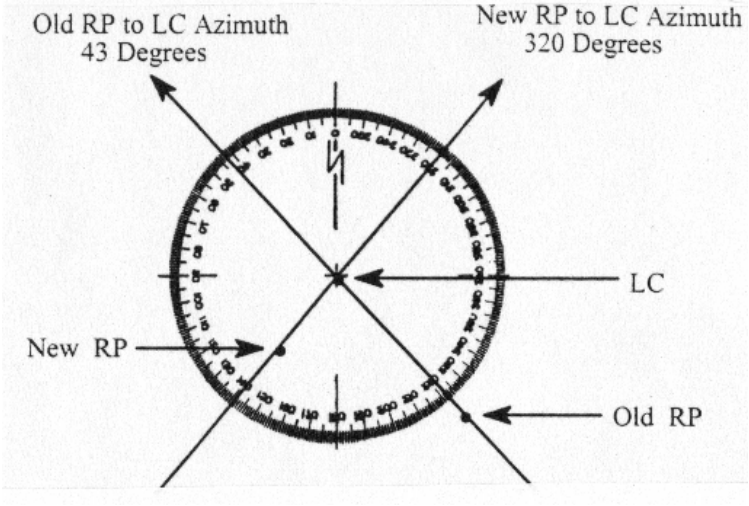
- Using the old RP to LC line, measure the distance between the RP and LC pinpricks (with the .001 foot scale) on the back of the old photo. In example 2, the distance is .141 foot.

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

Figure 2. The .001-foot scale method.

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

(back of old photo)

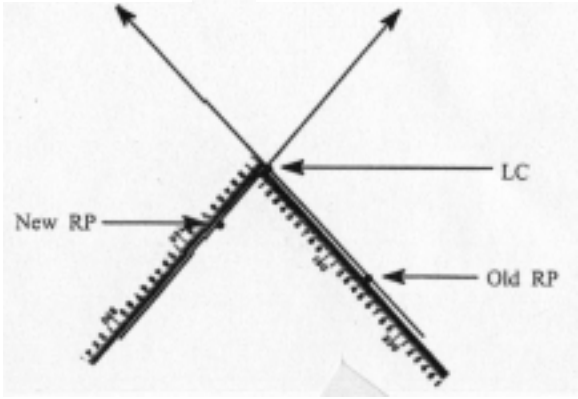


Example 2. The .001- foot method, determining the new horizontal ground distance.

(back of old photo)

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

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



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

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

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

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

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

The Best-Fit Method

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

(2) Calculate the **horizontal ground distance** from the new RP to the LC:

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

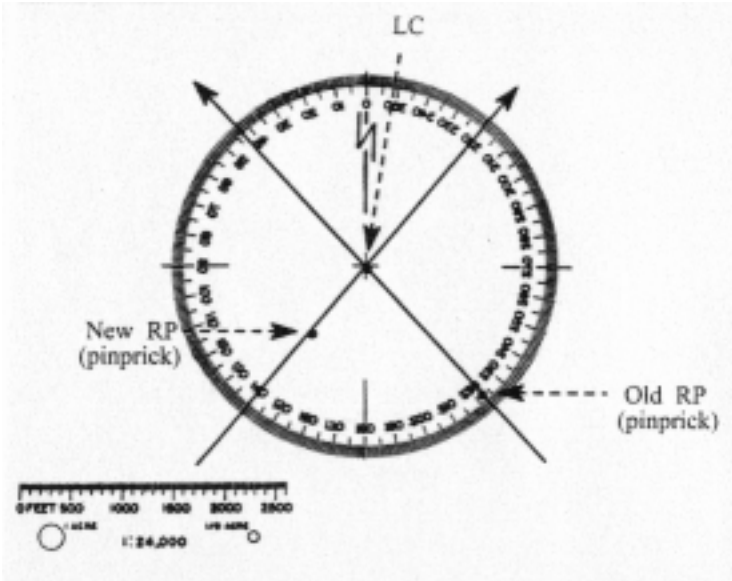
Figure 3. The best fit method.

Aerial Photo Scale Protractor:

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

On the back of the old photo

Previously calculated	New calculation
Old RP to LC:	New RP to LC:
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.)

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

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

2. <u>RP Found But Not Usable</u>.

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

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

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

b. Locate a new RP that is discernible on both the old and new photos. Using the old photo, a new course from the RP to LC can be computed. Refer to page 2-15 for examples.

3. <u>Field Location Incorrectly Placed or Not Found</u>.

Spend at least 30 minutes (no more than 1 hour) to thoroughly search the area at the end of the RP-LC chain (within approximately 500 feet); circumstances dictate the actual amount of time to spend (e.g., stand density, site disturbance). Factors that might explain why a field location cannot be found include the following: azimuth and/or distance incorrectly calculated, compass not set at 0° declination, compass not used properly, or corrections for slope were not made while chaining.

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

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

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

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

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

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

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

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

d. Inform section leader.

CHAPTER 3 - DEFINING THE CONDITION CLASS

This chapter describes the condition class, provides guidelines for determining condition class on the field location sample (A. below), provides definitions necessary for classifying condition class (B. page 3-12), and provides guidelines for mapping condition classes (C. page 3-18).

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

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

A. Determining Condition Class: General Procedures

Every field plot samples at least one condition (the condition at the LC).

Step 1: Delineate the plot area by CONDITION STATUS

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

1. Accessible forest land
2. Nonforest land
3. Noncensus water
4. Census water
5. Denied access area
6. Area too hazardous to visit
7. Area that is not in the sample, e.g., in Canada or Mexico
8. Not Sampled (out of time)

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

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 within the sampled area in any of the following attributes:

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.

1. <u>Condition Class Attributes</u>.

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

a. Attributes where a change causes a separate condition class:

- Reserved Status
- Owner Group
- Forest Type
- Stand Size
- Regeneration Status
- Tree Density

b. Ancillary – changes do not delineate a new condition class:

- Owner Class
- Private Owner Industrial Status
- Artificial Regeneration Species
- Stand age
- Disturbance (up to 3 coded)
- Disturbance Year (1 per disturbance)
- Treatment (up to 3 coded)
- Treatment Year (1 per treatment)
- Physiographic Class
- Other Regional variables

Three additional attributes require classification in specific situations:

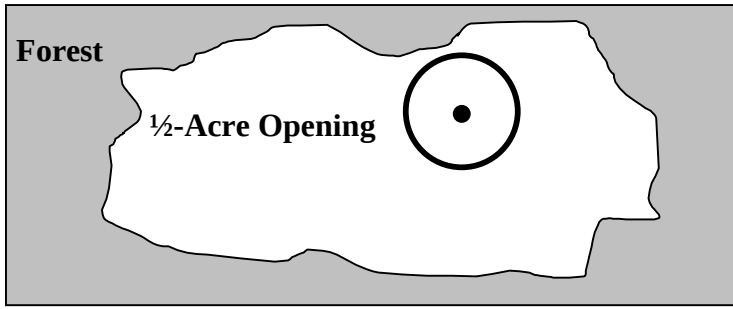
- Past Nonforest / Inaccessible Land Use (for area afforested since last inventory).
- Present Nonforest Land Use (for area converted from accessible forest land condition class to nonforest land since last inventory).
- Nonforest Year (estimate year that accessible forest land condition class was converted to nonforest).

2. Delineating Condition Classes Differing in Condition Status:

The first step in delineating condition classes is to recognize differences in CONDITION 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 ac in size, and each is at least 120.0 ft 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 ac in size and less than 120.0 ft in width are considered forest land and are not delineated and classified as a separate nonforest condition class (figure 4).

Figure 4. Subplot within small opening.



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

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

Five exceptions to these size and width requirements apply:

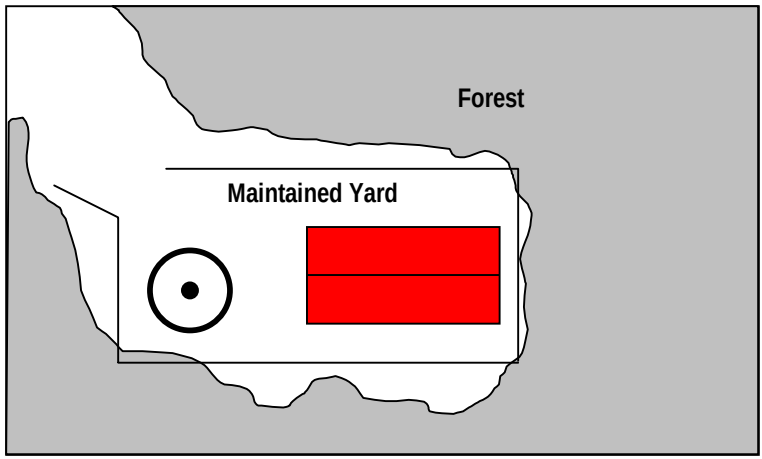
1. Developed nonforest condition: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 ac in size and 120.0 ft in width and are surrounded by forest land. All extensions from developed nonforest inclusions are nonforest condition classes regardless of length or width. There are three kinds of developed nonforest inclusions that do not have to meet area or width requirements.

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

   b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs (figure 6).

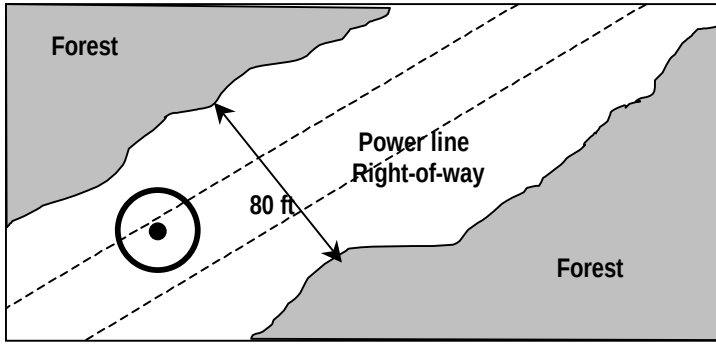
   c) Developments: structures and the maintained area next to a structure, all less than 1.0 ac in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds (figure 5).

Figure 5. Subplot within a maintained yard.



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

Figure 6. Subplot within a power line right-of-way.

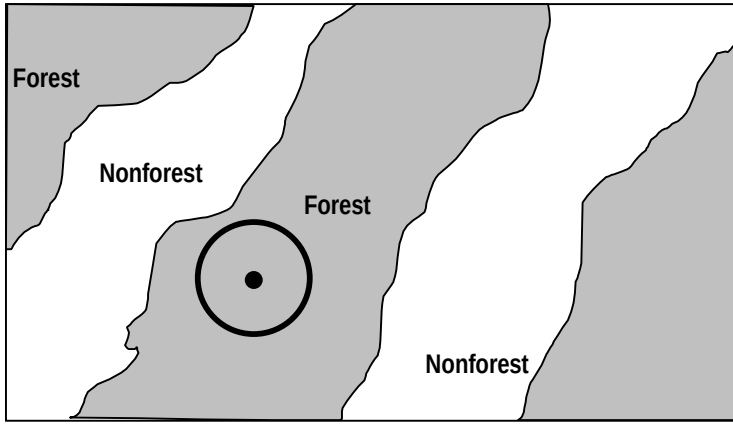


The subplot falls in a power line right-of-way. Although the right-of-way is less than 120-feet wide, maintained roads and rights-of-way are exemptions to the size rule and are considered ***NONFOREST LAND*** *regardless of width.*

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 ac in size and less than 120.0 ft 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.

   For many small-intermingled strips, determine the total area that the alternating strips occupy, and classify according to the CONDITION STATUS (forest land or nonforest land) that occupies the greater area (figure 7). If the area of alternating strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.

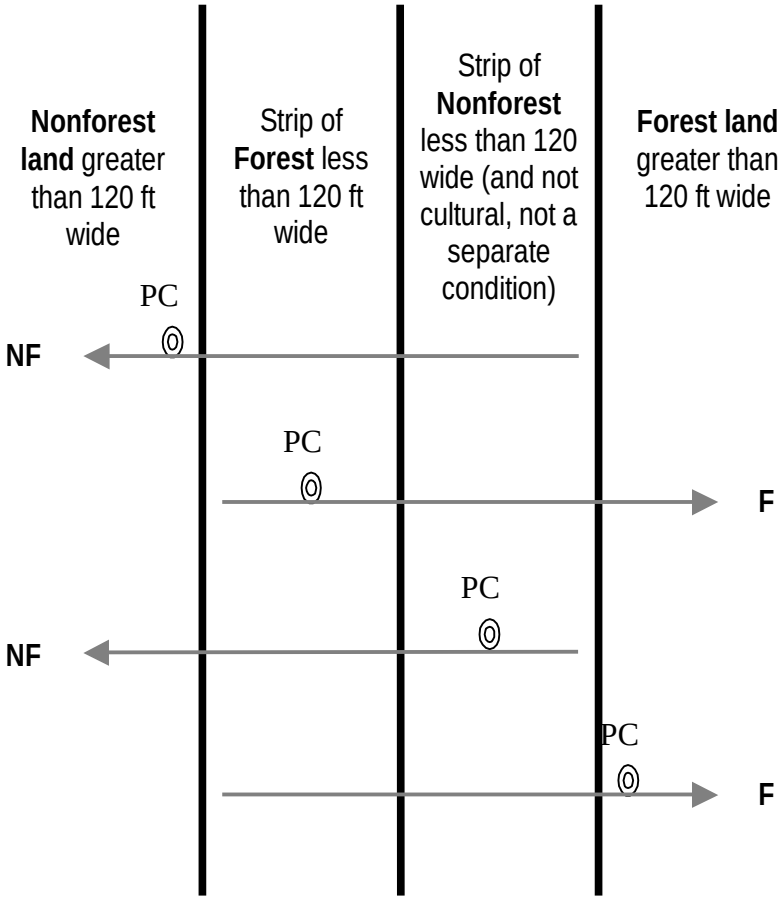
Figure 7. Several alternating strips of forest and nonforest.



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

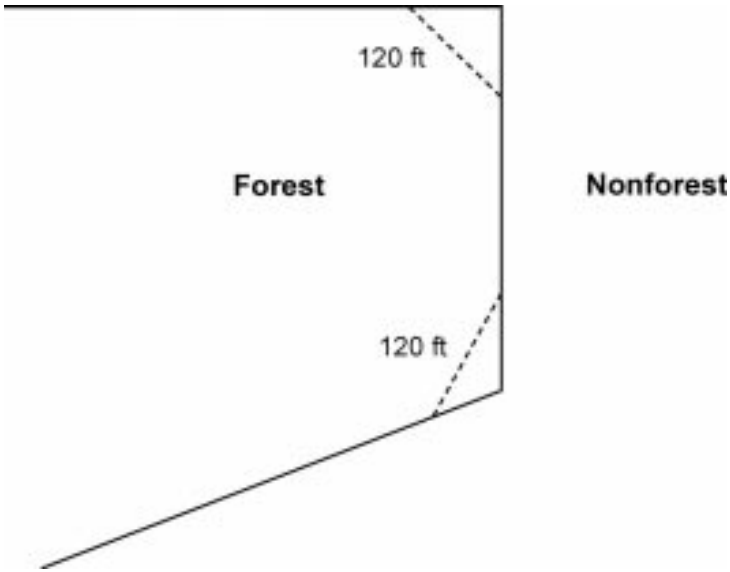
For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, refer to figure 8. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type.

Figure 8. Two alternating strips of forest and nonforest.



3. The 120 foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (figure 9).

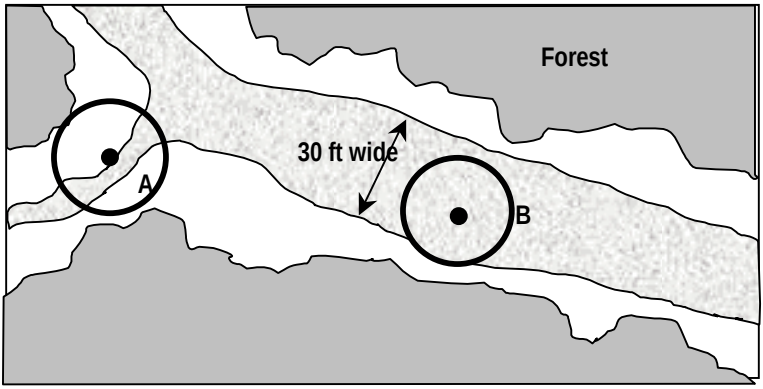
Figure 9. Illustration of 90 degree corner rule.



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 (figure 10). Therefore, a linear water feature must be at least 30.0 ft wide and cover at least 1.0 ac. 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 which 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 ac requirement; use professional judgment and common sense on any linear water feature.

Figure 10. 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.***

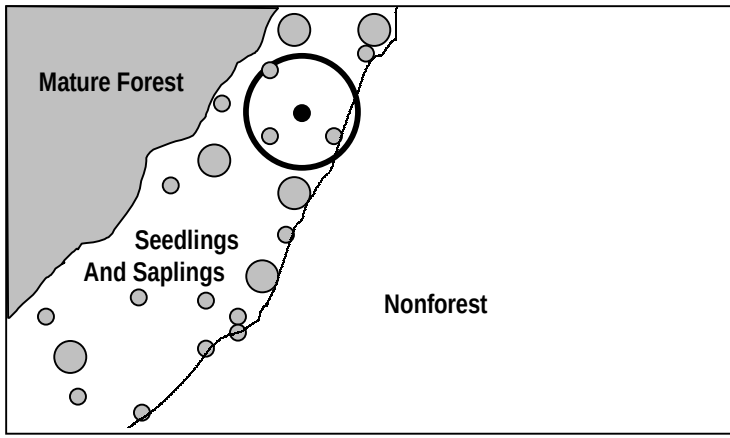
5. Hazardous or denied access conditions within accessible forest land are delineated, regardless of size, as a separate condition.

3. 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 A, steps 1 and 2 on page 3-1 and 3-2 apply when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in chapter 8. "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 ac in size and at least 120.0 ft in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained (figure 11).

Figure 11. 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. For each condition class recognized, there are many "ancillary attributes" that help describe the condition will be collected, but will not be used for delineation purposes (see page 3-3).

General instructions for delineating condition classes within accessible forest lands:

- Distinct boundary within an annular plot (if applicable), subplot, or microplot: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by a distinct, abrupt boundary. The boundary is referenced; see page 3-21.

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

  Example: The 4 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 seedling-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.

- 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.

- Riparian forest area: A riparian forest area is defined as a forest area between 30.0 and 120.0 ft wide, and 1.0 ac or more in size, cumulative, but not necessarily present on both sides of and adjacent to a naturally occurring or artificially

created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated "within forest" and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class.

Note: When the width of forest adjacent to a stream is between 120.0 ft and 150.0 ft and the width of the riparian forest is at least 30.0 ft wide, the rules for identifying the non-riparian forest (at least 30.0 ft but less than 120.0 ft) need to be modified. The non-riparian forest can be between 30.0 ft and 120.0 ft 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.

B. Condition 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 of any size (page 10-11 to 10-14) 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

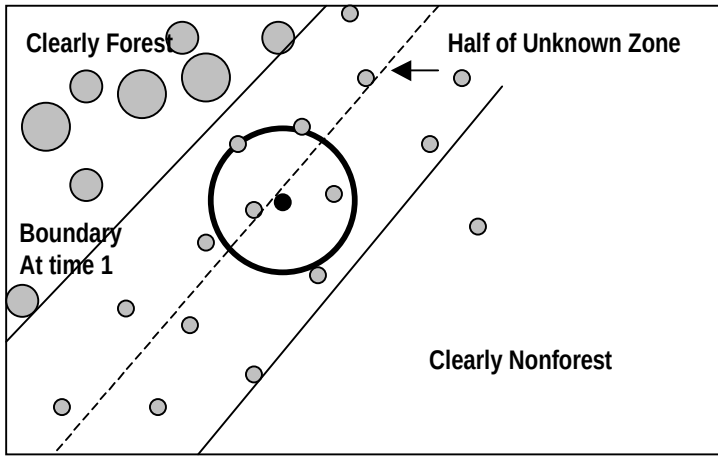
(b) in several western woodland types where stocking cannot be determined, and the condition has at least 5 percent crown cover by trees of any size (page 10-11 to 10-14), or has had at least 5 percent cover in the past. Additionally, the condition is not subject to nonforest use that prevents normal 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 ac in size and 120.0 ft wide measured stem-to-stem. Forested strips must be 120.0 ft wide for a continuous length of at least 363.0 ft in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

- Transition zones and forest/nonforest encroachment. When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area

meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10% 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 12).

Figure 12. Subplot within a transition zone.



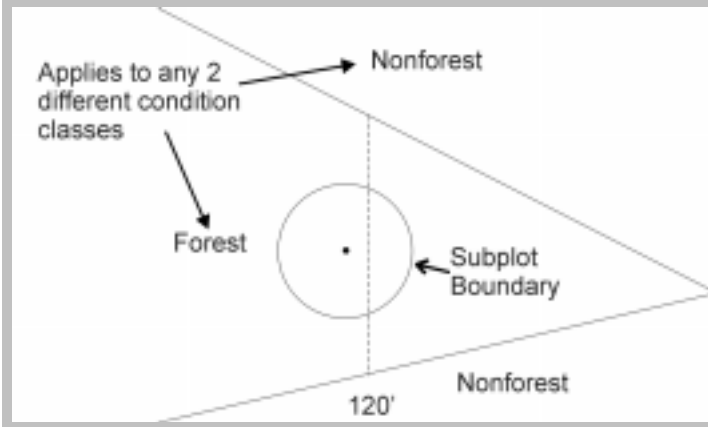
For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone 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 land owner 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 ft) 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 figure 13. 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.

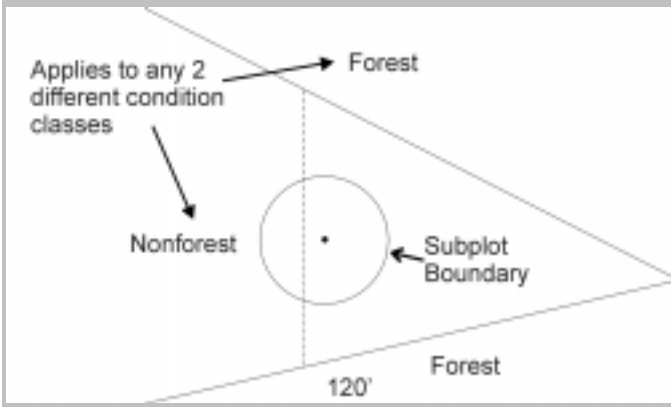
Figure 13. Subplot at an indistinct boundary

A.



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 ft wide. In this example, the entire subplot is classified as forest.

B.



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 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 STATUS values defined below. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, with 5 exceptions discussed previously (see pages 3-4 to 3-9). 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 occasion to see if it has become forest land.

3. **Noncensus Water**

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

4. **Census Water**

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

5. **Denied Access**

Any area within the sampled area on a plot on which access is denied by the legal owner of the land the plot falls on, or by an owner of the only reasonable route to the plot. 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.

6 **Hazardous**

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 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.

Note: When a crew cannot complete all 4 subplots in a full day of fieldwork (refer to 8-3), and the field supervisor determines that the crew should not return to the location to finish the plot, record a hazardous condition for the subplot, and record a HAZARD STATUS of 1. All sampling must be completed for a subplot; partial subplots are not permitted.

7. **Not In The Sample**

Any area within the sampled area on a plot that is not within the boundaries of the sample population of interest. Examples of areas out of the sample would be plots or portions of plots falling in Mexico or Canada. A condition outside the sample area remains in the potential population of interest and is re-examined at the next occasion to determine if it becomes part of the population of interest. There are no minimum size or width requirements for a condition class delineated as out of the sample.

C. Mapping the Condition Boundary

Boundary reference data are used to compute the percentage of area assigned to each condition class sampled on the plot, and they are used for remeasurement classifications.

Whenever a boundary is recognized between distinct condition classes (meeting the minimum area and width requirements), sketch the boundary on the condition class diagram. In addition, if the recognized boundary occurs on the subplot, reference the boundary by recording azimuths and distances as described below. **Only map abrupt boundaries between distinctly different condition classes** on the subplots.

1. Locating the Boundary.

Use the following guidelines to determine whether to map recognized condition classes on a subplot or microplot:

- **Distinct boundary within a subplot or microplot**. When a clear boundary between two or more distinct condition classes occurs within a subplot (or microplot), recognize separate condition classes on the subplot, and map and reference the boundary.

- **Indistinct boundary on a subplot or microplot.** When two or more condition classes occur on a subplot, but the boundary between the condition classes is a transition zone or not clearly an abrupt boundary, do not recognize or map separate condition classes on the subplot. Instead, only recognize the individual condition class that predominates the subplot.

Example: The 4 subplots all sample only 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 transition zone between a stand of large diameter trees and a stand of seedling/saplings. Within this transition zone, the large trees phase into a sapling stand. Because subplot 2 is within the transition zone, it must not be divided into two mapped condition classes. Instead, the subplot must be treated entirely as part of the large diameter tree condition class or 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 seedling/saplings than a stand of large diameter trees, and the boundary is assumed to occur between subplot 1 and 2.

- **Condition Boundary or Transition Zone Between Subplots.** When a boundary (either distinct and abrupt or a transition zone) between two or more condition classes occurs between subplots, recognize and classify the separate condition classes, but do not map or reference a boundary on the subplot. Instead, only sketch the boundary on the condition class diagram.

  Example: The northern most subplot (2) samples entirely forest land. The other three subplots, 1, 3, and 4, fall clearly in a nonforest land 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: forest land sampled on subplot 2, and non-tree land sampled on the other subplots. The boundary is documented by a sketch on the condition class diagram.

2. <u>Delineating the Boundary</u>.

Use the following guidelines for identifying where, on the ground, to map a boundary:

- When the boundary between **any two condition classes** is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridgeline, water's edge along a stream course, ditch, or canal.

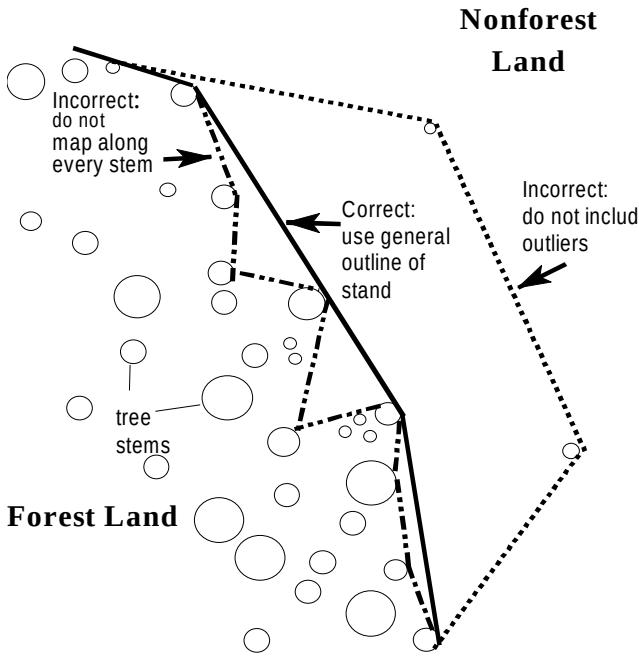
- When a boundary between **forest land and nonforest land** is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the tree stems of the trees at the forest edge
  In other words, map along the outermost edge of the tree stems/boles.

- When the boundary between two contrasting **forest land condition classes** is not clearly marked, map along the stems of the contrasting condition class (furthest from the subplot center). 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 the subplot center, of the inclusion (along the stems/boles of the contrasting condition class).

- If the boundary between two contrasting forest land conditions is not abrupt and obvious, assume the boundary occurs between, but not on, the subplots.

- When a boundary between **any two condition classes** is a transition zone, assume the boundary occurs between the subplots and not on the subplot.

Figure 14. Mapping along a stand boundary.



To map a stand boundary, follow the general outline of the stand: as a rule of thumb, the general line should not create inclusions or fingers less than 120-feet wide, and it should not include single or small groups of outlier trees.

3. Referencing the Boundary.

A condition class boundary is approximated by a straight line or by a straight line with one corner.

When a boundary between two distinct condition classes crosses through the subplot or microplot, record the azimuths and distances from the subplot center to specific reference points.

Each boundary is referenced, or marked, by a maximum of three reference points: two where the boundary intersects the circumference of the subplot or microplot, and one corner point between the two end points, if necessary. Only the corner point requires a distance, because the distance from the center point to the circumference is always equal to the fixed plot radius.

When a boundary line crosses through the subplot and the microplot, crews must ensure that the reference points provided are along the same approximate boundary line. Circumference azimuths for the subplot and microplot are rarely the same.

Because the approximated boundary is referenced as a straight line, or two straight lines with a corner, the lines will not always follow the actual condition boundaries precisely. Therefore, assign all trees sampled along a boundary to the actual condition class that they occur in, regardless of which side of the approximated "boundary line" they occur.

Crews must take extra care to ensure that boundary line references approximate the actual condition classes. If the boundary is not clear or is difficult to determine, do not map and reference the boundary within the subplot area.

CHAPTER 4 - FIELD PROCEDURE OVERVIEW

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

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

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

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

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

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

If a previously established subplot was not established in the correct location see Chapter 9.

A. Circumstances Precluding Field Location Establishment

1. Potential Situations.

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

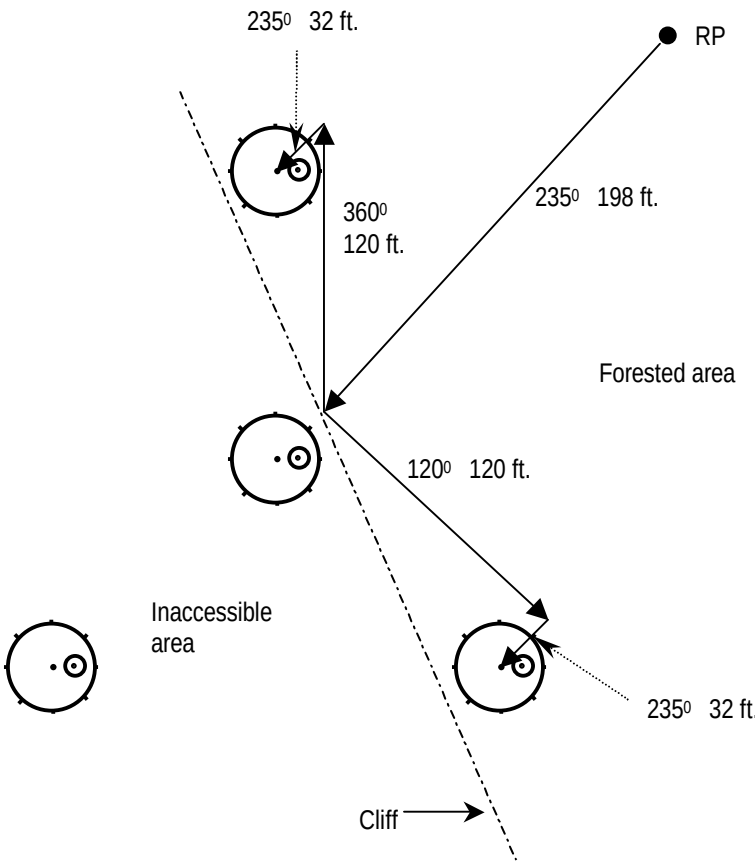
- **Field location currently being logged**. If the field location is currently being logged, determine when the logging will be completed (ask the foreman), and establish and measure the location only after logging is complete.

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

- **Hazardous.** The crew cannot reach or measure the field location center (LC) because of permanent physical conditions (e.g., cliffs) restricting access. Crews are required to establish other subplots if accessible (figure 15).

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

Figure 15. Establishing Subplots When the Location Center is Inaccessible



This example depicts a situation where the location center is inaccessible (hazardous due to cliffs) but subplots 2 and 3 are in accessible forest land. All of subplots 1 and 4 are classified as condition status = 6 (Area too hazardous to visit). Subplots 2 and 3 must be established since they are in accessible forest land.

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

2. Procedures.

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

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

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

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

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

B. Field Locations with Accessible Forest Land Present

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

For previously established locations using another sample design, re-establish the LC where it was placed before, and sample the location using current inventory procedures. In addition, account for the tally tree species **(TIMBER PLOTS ONLY, DO NOT ACCOUNT FOR TREES ON PREVIOUSLY ESTABLISHED WOODLAND PLOTS)** using the layout and sampling rules from the previous inventory as described in chapter 12.

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 E for specific items to record:

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

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

3. The **Condition Class Description** data (chapter 8) for the condition containing the LC and for any additional conditions occurring on the subplots.

4. The **Condition Class Diagram** and **Boundary Information** data (chapter 8).

5. The **Subplot Description** data (chapter 9) for each of the four subplots.

6. The **Tree Data** (chapter 10); record all tally trees present within accessible forest land conditions. If only a portion of a subplot occurs in accessible forest land, only tally the trees within that portion. Refer to chapter 5 for tally tree selection.

7. The **Understory Vegetation Description** data (chapter 11) for each subplot that occurs in an accessible forest land condition.

8. If necessary, the **Accounting Tree** data (chapter 12).

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

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

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

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

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

3. The **Condition Class Description** data (chapter 8).

4. The **Subplot Description** data (chapter 9) for each of the four subplots.

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

   - Current Date
   - Crew Number
   - Condition Status

D. Remeasurement, P3, and Accounting Plots

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

Remeasurement plots indicate a resource inventory plot of the same design was previously established at a location: crews will relocate the field plot, remeasure the trees from the previous inventory, and tally any new trees on the plot. Remeasure plots use the same basic layout as the current inventory (refer to chapter 5), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 10). The microplot, however, is located at the subplot center for these plots, so crews will need to establish new offset microplots in this inventory. Old reference and witness trees can be reused if appropriate.

P3 plots are remeasured every one to four years; some P3 plots will be revisited this year, and others in future years. **In Utah**, these plots use the same layout as the current inventory (refer to chapter 5), so the subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 10). **In Arizona**, some P3 plots will be established for the first time, while others will be co-located with previously established Rocky Mountain 4-point center micro plots. The current P3 plot will use the same basic plot layout as the previously established plot (refer to chapter 5), so most subplot tree information will reflect previous measurements (e.g., tree number, azimuth, distance -- refer to chapter 10). The microplot of the previously established Rocky Mountain 4-point center micro plot, however, is located at the subplot center, so crews will need to establish new offset microplots in this inventory.

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

E. Reserved Lands/Wilderness Areas

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

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

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

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

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

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

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

Sample Plot Monumentation:

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

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

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

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

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

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

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

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

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

Wildlife Interaction

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

CHAPTER 5 - FIELD LOCATION LAYOUT AND TREE SAMPLING PROCEDURES

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

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 16).

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 16). 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 is used in states still conducting the "periodic inventory". This is the same plot design as National 4-point offset. However, data collected on these locations differ slightly from the current "National Core".

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

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

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

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

Remeasurement Plots: Current National 4-point offset co-located with a previously established Rocky Mountain 4-point center. A portion of the field locations measured during previous inventories will be revisited during the current inventory. For remeasurement locations that cannot be found, or are mislocated, refer to chapter 2 for instructions. Remeasurement locations will be sampled and remeasured using current inventory procedures, including accounting for the previously established center microplots. New offset microplots will be established for the current inventory. Remeasurement locations will have past data downloaded to the Data Recorder. In addition, preprinted field forms will be included with the field packets. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused.

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

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

Accounting Plots: A portion of the field locations measured during previous inventories using the Old variable-radius plot (timberland plot) design will be revisited during the current inventory. On these locations past tree data will be accounted for using the previous location layout and sampling procedures and the location will be sampled using the current location layout sampling procedures. Accounting locations will have previous tree data downloaded to the Data Recorder, and will have a separate set of preprinted field forms included with the field packet; refer to chapter 12 for accounting field location layout and accounting procedures. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused. . For accounting locations that cannot be found, or are mislocated, refer to chapter 2 for instructions.

New plots: A portion of the field locations will be installed for the first time using current inventory procedures. Some plots that are considered "new" may be co-located with previously established "woodland" fixed-radius plots, "other tree land" plots, or old P3 plots. In these situations DO NOT remeasure or account for any trees from the previous inventory (do reuse past tree numbers on previously established P3 plots). Sample the location using current inventory procedures. If the previously established LC is in the correct location (correct map grid point, or within 500 feet of correct map grid point and in the same condition), witness trees may be reused.

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

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

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

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

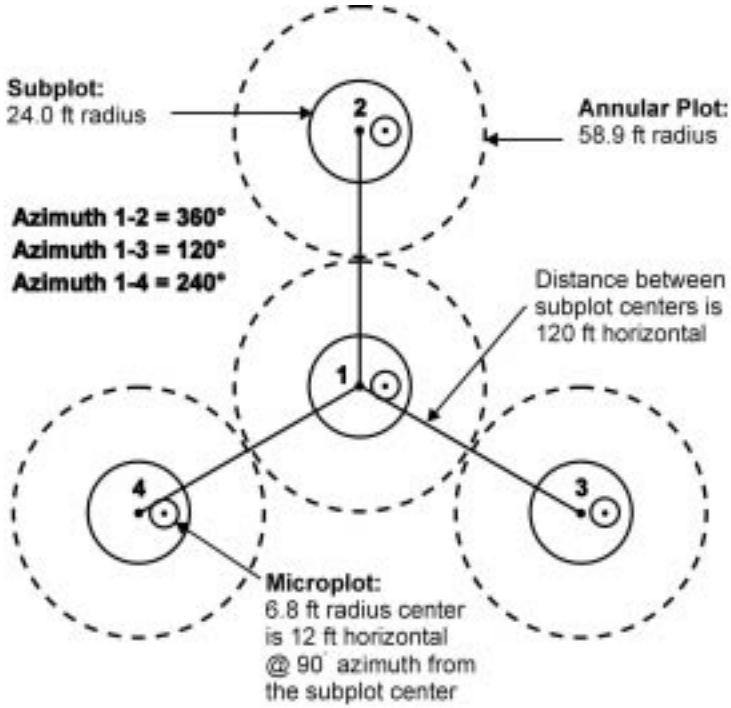
A. Field Location Layout

The field location layout (figure 16) consists of 4 fixed-radius subplots for tree and understory measurements and condition class mapping, 4 fixed-radius microplots for seedling and sapling tally and mapping, and 4 fixed-radius annular plots for sample intensification or sampling relatively rare events.

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

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

Figure 16. Field location layout.



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

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

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

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

B. Sampling Procedures

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

1. Subplot Tree Tally

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

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

b. Qualifying trees.

(1) **Live timber species trees** (refer to pages 10-11 to 10-14)
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 pages 10-11 to 10-14) 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 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 (Lean Angle = 0). 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 (Lean Angle = 0). For multistemmed trees at least one stem must be 1.0-inch DRC or larger, and at least 1/3 of the volume must be attached and upright; do not consider cut and removed volume. Trees supported by other trees or by their own branches are considered standing.

To determine if a downed tree is within the subplot, visually upright the tree at its origin (e.g., base of broken tree stem or bole, root system depression) and determine if the center of the tree at its base would fall within the maximum subplot distance for tally (refer to figure 17 for an example). If point of origin for a downed tree cannot be determined, use the center of its base where it lies for a measurement point.

(5) **Down dead timber species** 5.0-inches DBH and larger. Downed timber species are those with the main stem/bole broken off below 4.5 feet or those with a lean angle of more than 45 degrees from vertical (Lean Angle = 1). Tally down dead timber species only if the center of the stem at DBH is above the duff layer. Do not tally trees that are no longer cylindrical due to being severely decayed. Note any questionable trees

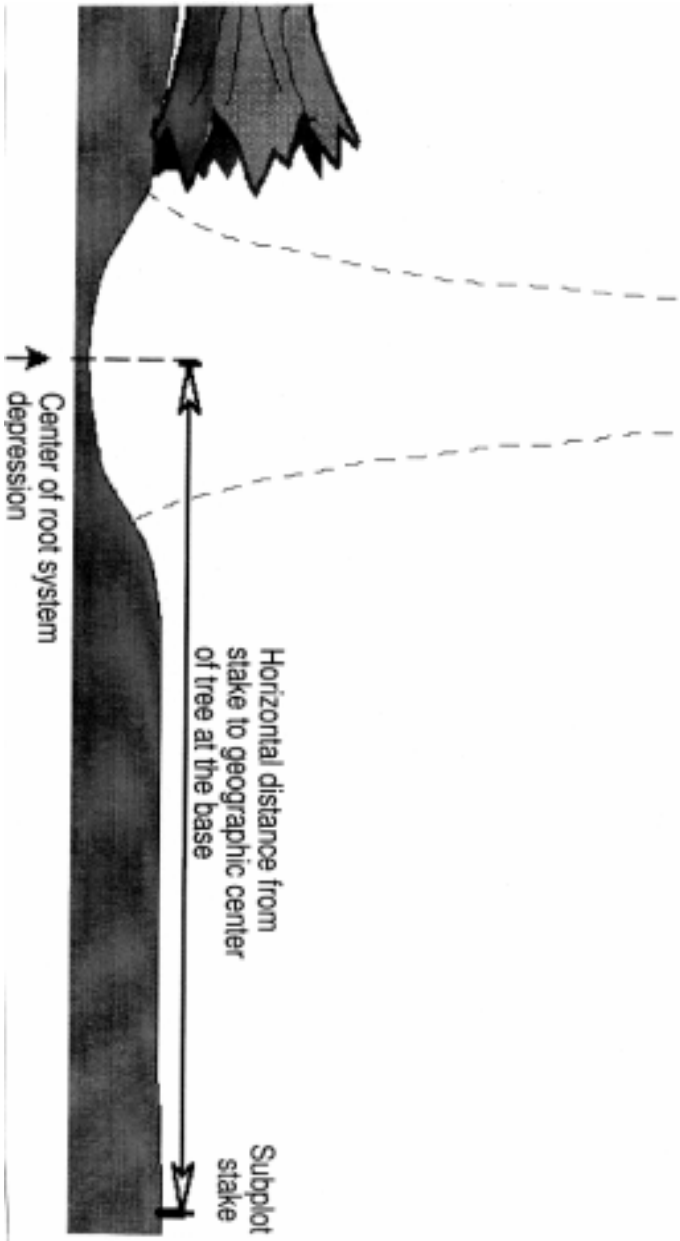
(6) **Down dead woodland trees** with a single stem of at least 5.0-inches DRC or a cumulative (calculated) DRC of at least 5.0-inches. Single stem downed woodland trees are those with the main stem/bole broken off below 4.5 feet or those with some part of the bole touching the ground. For multistemmed trees, at least one stem must be 1.0-inch DRC or larger, but more than 2/3 of the volume is not attached or upright; do not consider cut and removed volume.

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

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

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

Figure 17. Down tree limiting distance.



2. Microplot Sapling Tally.

a. Procedure. The microplot is a 1/300-acre fixed-radius plot (6.8-foot radius) located 12 feet horizontal at an azimuth of 90 degrees from the subplot center (see Figure 16 Location layout). At each microplot, stand directly over the center (stake), and starting at 1° azimuth, rotate clockwise and tally qualifying trees that fall within the microplot. Include only those trees within accessible forest land condition classes. For a qualifying tree to be tallied, the horizontal distance from the subplot center stake to the geographic center of the stem(s) at the base of the tree must be 6.8 feet or less.

b. Qualifying trees.

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

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

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

(2) **Live and dead 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, standing or down. For multistemmed trees, at least one stem must be 1.0-inch DRC or larger.

3. <u>Seedling Counts</u>.

Using the same microplot as in 2. above, record the number of live tally tree seedlings, by species and condition class. Count up to 5 individuals by species: estimate the total count if there are more than 5 individuals of any given species in any given condition class. A suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiplying by 4 (given that there is only one condition class on the microplot). Repeat for each species.

Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting . For western woodland species, each stem on a single tree must be less than 1.0 inch at DRC.

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

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

CHAPTER 6 - FIELD LOCATION REFERENCE ITEMS

This chapter describes items for referencing and relocating the field location center (LC), and provides procedures for monumenting the location.

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

A. Identification Items

Write the State, Map, CPN, County, and Field Location numbers in the spaces provided at the top of the Field Location Reference record.

B. Reference Point

Tolerance: Identification - No errors.
Diameter - 0.2 inch per 20 inches of diameter.

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" (page 2-3).

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

When a tree is used as an RP, record species and diameter at breast height (DBH) or diameter at root collar (DRC) as appropriate. If a multistemmed woodland tree is selected, measure only one stem, preferably the largest or main stem. Also give a description of the RP and its location, for example, "large ponderosa pine located on the southwest corner of the meadow" or "six-stemmed juniper with a dead top on ridgeline."

If other landmarks are used for an RP, such as a sharp bend in road, a corner of building, the intersection of two fence lines, etc., leave species and DBH/DRC blank and provide an adequate description of the RP selected.

Tagging the RP -- Attach to the RP, when appropriate, aluminum tags labeled "RP LOC #" (Item 105). If a tree is selected as the RP, nail aluminum tags on two sides of the tree approximately 6 feet above ground level, and with at least 1 inch of nail exposed (to allow for tree growth between inventories). Nail one of the tags facing in the general route of approach to the RP. Nail a third tag at ground level facing towards the field location. If the RP is in a place where there is a high probability that a tag at 6 feet above the ground may be vandalized, only attach the tag at ground level and make a note on the Field Location Reference record.

Note: Use steel nails only on woodland species, and avoid tagging aspen trees.

No RP tags are needed if the RP is permanent and readily identifiable, such as the corner of a building or a road intersection. **Never** nail a tag to a private building or other private structure.

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

C. Course to Location Center

Tolerance: Azimuth ±2 degrees.
Distance ±6 feet per 100 feet of transect, maximum tolerance of 30 feet.
Record the azimuth (to the nearest degree), horizontal distance (to the nearest foot), and slope distance (to the nearest foot) from the RP to the location center (LC).

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

D. LC Witness Trees

1. Selection.

Reference the LC with two witness trees ("X" and "Y" trees).
On **remeasurement locations**, use previous witness trees where possible. Preferably, witness trees should be as follows:

"X" Tree

- On the extension of the RP to LC azimuth.
- Ideally, a distance of 25-30' from LC. Blazed with an "X".
- If there are no suitable trees at 25-30', use a tree within the subplot radius (24.0' or less). Tag only, no blaze.

"Y" Tree

- As close to LC as possible.
- At a right angle to the RP to LC azimuth.

"X and Y" trees should be:

- Not likely to die within 10 years.
- A species easily located on the site (e.g., an Engelmann spruce in a lodgepole pine forest type). **Note**: Avoid aspen, if possible; if aspen is used, be sure it is off the subplot and tag only. Do not blaze.
- At least 5.0-inches DBH for timber species and 3.0-inches DRC for woodland trees if possible.

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

2. **Recording.**

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

a. **Species**. If the witness is not a tree, indicate what was used (e.g., large boulder). **MQO**: No errors.

b. **DBH/DRC** to the last whole 0.1 inch. If a multistemmed woodland tree is used as a witness tree, measure and record the DRC of one stem (the largest or main stem). **MQO**: ±0.2 inch per 20 inches diameter.

c. **Azimuth** (to nearest degree) from the LC stake to the center of tree at its base. **MQO**: ±2 degrees.

d. **Slope distance** (to the nearest 0.1 foot) from the top of the LC stake to the nailed tag (see below). If an alternative landmark is used as a witness, distance is from the top of LC stake to the face of the landmark. **MQO**: ±0.2 feet.

3. **Marking.**

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

For trees not scribed (tree within subplot radius), nail a witness tag (2.5” x 2.5” black, heavy aluminum, diamond shaped tag) approximately 6 feet above the ground facing the LC if appropriate.

If a small tree is used, or if the location is in close proximity to private residence, do not blaze or tag but record a note under the "Witness Trees" section of the Field Location Reference record. If a multistemmed woodland tree is used as an "X" Tree, scribe an "X" on the stem measured for DRC.

For all witness trees, scribe two aluminum tags, one labeled "X LOC #" (with the actual location number) and the other labeled "Y LOC #". Nail each tag to the appropriate witness tree, at ground level, with the tags facing the LC stake. On multistemmed woodland witness trees, nail the tag at ground level to the stem measured for DRC, or at ground level below the stem measured for DRC if the stem originates above ground level. **Note:** When driving nails into trees, leave at least 1 inch exposed to allow for tree growth.

Where the witness is not a tree (e.g., rock), tag the alternative landmarks in some manner if appropriate, with aluminum tags, to aid field crews in re-locating the LC in future remeasurement inventories.

Reserved locations: Witness trees will not be painted or scribed. 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.

E. Baseline Information

Record the appropriate baseline information as described in chapter 2.

F. Travel Description

Record road directions from the nearest post office, Forest Service office, major highway intersection, or other prominent landmark to the vicinity of the RP. This space can also be used to record other travel information that will assist in relocating the field location (e.g., hiking distance and direction from parking location to RP, specific information about obtaining keys for locked gates).

Road directions should contain (at a minimum):

- Road names and route numbers.
- Major landmarks.
- Mileages between roads/landmarks.
- Direction of turns at intersections/forks.
- Description of parking area.

Walking directions should contain (at a minimum):

- Trail name/number if applicable.
- Drain/creek/stream/ridge etc., name if applicable.
- Major landmarks.
- Approximate distances between trails, creeks, landmarks etc.

G. Owner Information

Record the name of the private landowner or the name of the managing agency. If a private landowner is listed, also record the address and telephone number, if known (this information is used for quality control crew access and remains confidential).

Below "Owner Information," record information about landowner contact, recommendations for 4-wheel drive and ATV use, and information about locked gates (in the boxes provided, check "yes" or "no").

H. Field Location Map

On the field location map diagram, draw any physical features that will assist in accurately relocating the field location (e.g., the location of the RP, roads or trails, drainages, ridgelines, fence lines, changes in vegetation type). In addition, **draw and label all condition class boundaries.**

I. Field Crew

Record the first initial and the full last names of the cruiser(s) and the recorder.

J. Photos

Record the aerial photography project, roll, and photo numbers. Place an asterisk (*) immediately before the photo number with the LC pinprick. Also, record the nominal photo scale (usually printed on the photo) and year of photography.

Remeasurement locations: Use the newest photos if possible; however, if the old photographs are at a better scale, and no significant change in the landscape has occurred (e.g., new roads), use the old photo pair.

K. Editing

1. Field Crew Edit.

After measuring the field location, but before leaving the site, the crew supervisor must review the field forms to make sure the required data are correctly and legibly recorded. Examine the following checklist, as a minimum, for completeness:

- All photo work complete, with RP pinpricked.
- Witness trees referenced and data recorded.
- Location and condition class maps drawn; photos taken.
- All data records are complete; no blank spaces.
- Necessary site trees selected and bored.
- Age and radial growth data complete.
- Unknowns collected and pressed.
- 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.

2. QC Review.

Leave blank; this item is only to be recorded by office or quality control staff.

L. Map Name and Scale

If using the field forms, record the name and scale of the USGS topographic map (provided in each field location packet) that displays the location of the LC (grid line intersection).

M. Legal Description

MQO: No errors.
Record the township, range, and section where the field location is located. Be careful when examining topographic, Forest, or BLM maps; changes in numbering often occur along State, baseline, or other boundaries.

N. Photographing the Field Location

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

Procedure: At each field location, stand over the LC stake and take four photographs in the cardinal directions (i.e., take pictures facing north, east, south, and west). Include a placard in each picture, placed in the lower right-hand corner of the view, indicating the State, county, location number, and direction faced (N, E, S, or W). Be sure the placard is legible, but do not allow the placard to obstruct the view of the site. **Note:** Field compass declination is set to 0°.

It is best to take the photographs in moderate light conditions; shade the lens from direct sunlight when necessary, and use the flash in dark conditions (dense stands, cloudy days, etc.). Also, avoid using the first or last frames of the film for photographing field locations.

In the case of an all-nonforest location, if the crew identifies the LC on the ground, Subplot 1 will be photographed in the 4 cardinal directions. If the crew does not identify the LC but determines the approximate location or conditions of the LC, the crew will photograph the LC area (e.g., crew determines LC is on a hill side, but the hill is covered with nonforest species). Crews are required to get as close as necessary to positively identify the nonforest condition. Photographs taken when crew does not occupy the LC should be representative of the sample area.

O. Global Positioning System (GPS) Reference Data

Refer to the Precision Lightweight GPS Receiver (PLGR) instruction manual for detailed information on using the PLGR.

Collect GPS data at 3 sites during data collection activities on all visited field locations. Collect and record UTM Zone (11, 12, or 13), UTM Easting, UTM Northing, and error (LC only). If no data are collected, record 0's for each and explain in the plot notes why no data were collected.

Important: Each day in the field, set up the PLGR in an open area for at least 15 minutes to load the satellite data.

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

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

1. **Truck** - 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.

2. **Reference Point** - collect and record the UTM coordinates at the reference point, regardless of how near or far from the LC. If the crew parked at the RP, repeat the truck GPS data.

3. **Location Center** - collect and record the UTM coordinates and the error value at the LC. If adequate GPS data cannot be collected at the LC due to terrain or dense tree canopy, collect the data on one of the other subplots and make GPS corrections for the azimuth and distance from the LC (if this is not possible, record in Plot Notes the azimuth and distance from the reading site to the LC).

CHAPTER 7 - FIELD LOCATION DESCRIPTION ITEMS

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

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

Refer to the Item Coding Guide (appendix E) for the items to record.

ITEM

101 **State.** (CORE)

When collected: All plots.
Field width: 2 digits.
Tolerance: No errors.
Record the code for the State where the field location is located.

Code	State	Code	State	Code	State
04	Arizona	30	Montana	49	Utah
08	Colorado	32	Nevada	56	Wyoming
16	Idaho	35	New Mexico		

104 **County**. (CORE)

When collected: All plots.
Field width: 3 digits.
Tolerance: No errors.
Record the code for the county where the field location is located.
This item is indicated on the field location packet. Refer to the appropriate State Supplement for a county code list.

ITEM

105 **P2 Location Number**. (CORE)

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

102 **USGS Map Number.** (RMRS)

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

103 **Consecutive Point Number (CPN)**. (RMRS)

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

121 **Current Date.** (CORE)

When collected: All plots.
Field width: 8 digits.
Tolerance: No errors.
Record in order the month, day, and year that the field location inventory is completed. August 12, 1995 would be recorded as 08,12,1995. Use the following codes for month:

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

ITEM

123 **Crew Type.** (CORE)

When collected: All plots.
Field width: 1 digit.
Tolerance: No errors.
Record one of the following codes:

Code	Type
1	**Standard field crew**
2	**QA crew** (any QA crew member present collecting data

122 **Crew Number(s).** (RMRS)

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

124 **QA Status.** (CORE)

When collected: All plots.
Field width: 1 digit.
Tolerance: No errors.
Record as appropriate: default is 1 for all valid production field plots:

Code	Type
1	**Standard production plot**
2	**Cold check**
3	**Reference plot (off grid)**
4	**Training/practice plot (off grid)**
5	**Botched plot**
6	**Blind check**
7	**Production plot (hot check)**

ITEM

131 **Sample Kind.** (CORE)

When collected: All plots.
Field width: 1 digit.
Tolerance: No errors.
Record the following code for the location:

Code	Sample kind
1	**Initial plot establishment** - field-visited or remotely classified.
2	**Remeasurement** of a previously established National design plot - field visited or remotely classified. Remeasurement of a previously established "Rocky Mtn 4-point center micro" or "National 4-point offset micro" (see chapter 5 for definitions). If the previously established plot is a design other than those mentioned above, the SAMPLE KIND will equal 1.
3	**Replacement plot** - a previously established National design plot that was replaced with a new plot because the original plot could not be relocated or because plot data were lost. Replacement of a previously established "Rocky Mtn 4-point center micro" or "National 4-point offset micro" (see chapter 5 for definitions). Includes a plot that was replaced with a new plot because the original plot was established in the wrong location (see chapter 4, field procedure overview).

128 **Manual Version.** (CORE)

When collected: All plots
Field width: 2 digits (x.y)
Tolerance: No errors.
Record the version number of the National Core Field Guide that was used to collect the data on this plot. This will be used to match collected data to the proper version of the field manual.

Default = 1.5.

ITEM

129 **Current Location Status.** (RMRS)

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

Code	Type
1	**At least one accessible forest land condition class** present on one or more of the subplots
2	Entire location is nonforest
3	Entire location is access denied
4	Entire location is too hazardous to visit

ITEM

130 **Condition Class Change.** (RMRS)

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

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

ITEM

134 **Range Data.** (RMRS)

When collected: All plots.
Field width: 1 digit.
Tolerance: No errors.
Record one of the following codes to indicate if the location falls in a range land pilot unit.

Code	Definition
0	Location **is not** in a range land pilot unit. Understory vegetation data will be collected on accessible forest land condition classes only.
1	Location **is** in a range land pilot unit. Understory vegetation data will be collected on all condition classes.

Note: default value for this variable = "0" for Arizona and Utah.

132 **Subplot Radius.** (RMRS)

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

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

133 **Microplot Radius.** (RMRS)

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

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

ITEM

135 **Microplot Location.** (RMRS)

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

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

143 **Trails or Roads**. (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record the trail or road **nearest, or on,** the field location. Consider only trails/roads for human access within 1 mile of the LC. If two or more trails/roads are equidistant, record the trail/road with the lowest number.

Code	Trails or Roads
0	None within 1 mile
1	Paved road or highway
2	Improved gravel road (has gravel, ditching, and/or other improvements)
3	Improved dirt road (has ditching, culverts, signs, reflectors, or other improvements)
4	Unimproved dirt road/four wheel drive road (has no signs of any improvements)
5	Human access trail - clearly noticeable and primarily for recreational use

ITEM

144 **Horizontal Distance to Improved Road**. (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Determine the distance from the LC to the **nearest improved road** and record the corresponding code. Consider only paved roads, improved gravel roads, or improved dirt roads regularly maintained for long-term continuing use (Trails or Roads codes 1-3). Measure the "**straight-line**" distance on the topographic map. If the nearest improved road is not on the topographic map, estimate the "straight-line" distance.

Code	Distance To Improved Road
1	100 ft or less
2	101 to 300 ft
3	301 to 500ft
4	501 to 1000ft
5	1001ft 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

ITEM

149 **Road Access.** (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record the first road access restrictions encountered while traveling to the plot. These restrictions limit car and truck access to the starting point for the walk to the plot, and may occur on ownerships encountered before reaching the plot area.

Code	Access
0	None – no road access restrictions
1	Road blocked by locked gate or cable across road
2	Road blocked by a human-made obstruction across road (ditch, mound, etc.)
3	Road blocked by natural occurrences (trees blown over onto road, road or bridge washed out)
4	Posted no motorized vehicle signs; road present, but restricted area such as Wilderness or National Park where vehicles are not allowed
9	Other – specify in plot-level notes

145 **Public Use Restrictions**. (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record, if any, the restriction posted near or on the plot area that limits public use of the plot area; if more than one restriction occurs for the plot area, record the lowest number restriction present (1-3, 9).

Code	Restriction
0	None – no public use restrictions
1	Keep out / no trespassing
2	No hunting or fishing
3	No dumping
9	Other - specify in plot-level notes

ITEM

146 **Recreation Use 1, 2, and 3.** (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record up to 3 signs of recreation use encountered **within the accessible forest land portion** of any of the four subplots, based on evidence such as campfire rings, compacted areas (from tents), hiking trails, bullet or shotgun casings, tree stands, etc. Record the recreation use that has had the most significant impact on the plot area first, then the second and third use. For example, in general numerous four-wheel drive or ATV trails would be coded before camping, and camping before hiking, and hiking before fishing.

Use the coding system provided as a hierarchy. Do not repeat codes, except codes 0 and 9. Physical recreation evidence must be present to code 1-9. Also, disregard dumping where no evidence of recreation is present. Examine the plot area for clues before spending an exorbitant amount of time trying to find evidence that normally would not be found in the area; look for the obvious signs first.

Code	Recreation Use
0	No evidence of recreation use
1	Motor vehicle (four wheel drive, ATV, motorcycle, snowmobile)
2	Horse riding, dog team trails, ski trails
3	Camping
4	Hiking
5	Hunting/shooting
6	Fishing
7	Boating - physical evidence such as launch sites or docks
9	Other – recreation use where evidence is present, such as human litter, but purpose is not clear or does not fit into above categories.

ITEM

150 **Water on Plot.** (CORE)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
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 may be used for recreation, wildlife, hydrology, and timber availability studies.

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

ITEM

147 **Water Proximity**. (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: ±1 class.
Record a code for the distance from the LC to the nearest permanent or reliable source of surface water for any use (e.g., for wildlife, livestock, recreation). Only examine water sources within 1 mile of the LC. For example, if the location is 250 feet from an ephemeral stream, but 1/4 mile from a catchment basin, reference the basin because it will likely hold water throughout a large portion of the year. Consider Regional climate when assessing this variable.

Code	Distance
0	**Adjacent (200 feet or less)**
1	**201-300 feet**
2	**301-500 feet**
3	**501-700 feet**
4	**701-900 feet**
5	**901-1100 feet**
6	**1101-1320 feet**
7	**1/4 - 1/2 mile (1321-2640 feet)**
8	**1/2 - 1 mile**
9	**None -- no water source within 1 mile**

ITEM

148 **Water Type.** (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: No errors.
Record a code for the type of water source used in determining Water Proximity (Item 147) above. If two or more water types are equidistant, record one type using the following hierarchical order: 1, 2, 5, 6, 7, 4, and 0.

Code	Type
0	**None**
1	**Perennial** -- permanent; a year-round water source
2	**Intermittent** -- seasonal; a water source that occurs throughout a large portion of the year, but is dry during certain months of the year
4	***Ephemeral*** -- a water source that only occurs in direct response to rainfall or surface runoff. Use only when no more reliable source is present within the mile.
5	**Catchment basin** -- a human-made structure to catch and store surface runoff for livestock/wildlife
6	**Irrigation** -- human-made ditches or other artificial channels used as a means of supplying water to the land
7	**Other** - specify in notes/comments

ITEM

141 **Size of Forested Area.** (RMRS)

When collected: All plots with at least one accessible forest land condition class.
Field width: 1 digit.
Tolerance: ±1 class.
Record the code that applies to the size of the entire **continuous** forest land area (all forest land condition classes combined) surrounding the LC. Include any forest condition in any ownership. Use the aerial photographs of the field location to aid in determining the size of the forest land area. Refer to appendix B.2 for map/photo scale ratios.

Code	Size
0	**No forest land on the location**
1	**1-5 acres**
2	**6-10 acres**
3	**11-20 acres**
4	**21-40 acres**
5	**41-160 acres**
6	**161-640 acres**
7	**1-5 square miles**
8	**>5 square miles**
9	**Forest Stringer** - forest land forming a linear cover, at least 120 feet wide, with the length at least 4 times the width.

ITEM

171 **GPS Unit (type).** (CORE)

When collected: All field visited plots.
Field width: 1 digit.
Tolerance: No errors.
Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0.

Code	GPS Type
0	GPS coordinates not collected
1	Rockwell Precision Lightweight GPS Receiver (PLGR)
2	Other brand capable of field averaging
3	Trimble GeoExplorer or Pathfinder Pro
4	Recreational GPS (Garmin, Magellan, etc.)

Codes 2-4 currently not used at RMRS.

172 **GPS Serial Number.** (CORE)

When collected: When GPS UNIT > 0.
Field width: 6 digits.
Tolerance: No errors.
Record the last six digits of the serial number on the GPS unit used.

173 **Coordinate System.** (CORE)

When collected: When GPS UNIT > 0.
Field width: 1 digit.
Tolerance: No errors.
Record a code indicating the type of coordinate system used to obtain readings.

Code	System
1	Geographic coordinate system
2	UTM coordinate system (All RMRS States)

ITEM

174 **GPS Elevation.** (CORE)

When collected: When GPS UNIT = 1, 2 or 4.
Field width: 6 digits.
Tolerance: No errors.
Record the elevation above mean sea level of the plot center, in feet, as determined by GPS.

175 **GPS Error.** (CORE)

When collected: When GPS UNIT = 1 or 2.
Field width: 3 digits.
Tolerance: No errors.
Record the error as shown on the GPS unit to the nearest foot. Make every effort to collect readings only when the error ≤ 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record reading with an error of up to 999 ft.

176 **Number of GPS Readings ("Hits").** (CORE)

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

177 **UTM Zone.** (CORE)

When collected: When Coordinate System = 2.
Field width: 3 digits: (##C)
Tolerance: No errors.
Record a 2-digit and 1 character field UTM ZONE as determined by GPS.
Values: 03-19Q and 03-19W.
RMRS values: 11-13, R-U.

178 **Easting (X) UTM.** (CORE)

When collected: When Coordinate System = 2.
Field width: 7 digits.

Tolerance: No errors.
Record Easting coordinate of the plot center as determined by GPS.

ITEM

179 **Northing (Y) UTM.** (CORE)

When collected: When Coordinate System = 2.
Field width: 7 digits.
Tolerance: No errors.
Record the Northing coordinate of the plot center as determined by GPS.

180 **Azimuth to Plot Center.** (CORE)

When collected: When GPS UNIT = 2, 3, or 4.
Field width: 3 digits
Tolerance: $\pm$ 3 degrees
Record the azimuth from the location where coordinates were collected to actual plot center. If coordinates are collected at plot center, record 000.

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

181 **Distance to Plot Center.** (CORE)

When collected: When GPS UNIT = 2, 3, or 4.
Field width: 3 digits.
Tolerance: $\pm$ 6 feet.
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 chapter 2, if a Laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 ft from the plot center. If a range finder is not used, the offset location must be within 200 ft.

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.

ITEM

107 **Future Forest Potential.** (RMRS)

When collected: When no accessible forest land condition class is present on the location.
Field width: 1 digit.
Tolerance: No errors.
Indicate if the location requires a prefield examination at the time of the next inventory (10-20 years).

Code	Definition
0	No, there is no chance this plot will meet the forest definition at the next cycle. It meets one or more of the following criteria: • Located more than ½ mile from the nearest forest land, and there are no trees present on or near the location. No disturbance evident (e.g. large fires, clearcut, etc.) • Located in a large reservoir. • Located in a developed urban area (on a house, building, parking lot), but the plot does not fall in a park, undeveloped yard, etc. that may revert to natural forest. • Located on barren rock, sand dunes, etc.
1	Yes, there is some chance that this plot could become forested in the next cycle; there are trees present, or forest land is present within ½ mile.
2	There are no forest tree species (tally tree species as defined in Item 416 pg 10-11 to 10-14) on the site, but other woody species not currently defined as forest species occupy the site (such as palo verde, ironwood, big sage). Where code 2 is selected, note the dominant tree or shrub species on the site in the Condition Notes.

CHAPTER 8 - CONDITION CLASS DESCRIPTION ITEMS

This chapter presents the Condition Class Description data (appendix A.3), the Condition Class Diagram and Boundary Record (appendix A.4). Carefully read all instructions for each item. Record leading zeros for each item, where appropriate. To determine a value for an item within a particular condition class, examine the condition class area, generally within 60 feet of the subplot centers.

Use the Plot Notes or the "Condition Class Comments" section to record any notes about the condition class or to record any specific notes that apply to one of the Condition Class Description items (e.g., "the condition class #1 habitat type was determined off-site due to severe burning in condition").

A. Condition Class Description

The attributes listed below are the critical variables for recognizing and defining a condition class (refer to chapter 3). Each time a distinct change occurs in one or more of the defining attributes, based on the minimum area size criteria and definitions in chapter 3, a new condition class is recognized. If any portion of a subplot is located within a new condition, the new condition class is to be described by the variables in this chapter.

The defining attributes are (in order of priority for mapping):

ITEM	
205	Reserved Status
207	Owner group
221	Forest Type (forest land)
222	Stand-size Class (forest land)
223	Regeneration Status (forest land)
224	Tree Density (forest land)

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

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

For each condition class recognized, record each of the following items unless otherwise noted (e.g., some are recorded only for forest land conditions classes). Refer to appendix E for the items to record based on condition classification.

ITEM

201 **Condition Class Number.** (CORE)

When collected: All condition classes.
Field width: 1 digit.
Tolerance: No errors.

For each condition class encountered on the subplots, record a condition class number. Record the condition class encompassing the LC as condition class 1. If additional condition classes occur, number and record them consecutively. For example, the first new contrasting condition is 2, the next is 3, etc.

Values: 1 to 9.

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

203 **Condition Class Status (DEFINING).** (CORE)

When collected: All condition classes.
Field width: 1 digit.
Tolerance: No errors.

Record the code that describes the status of the condition. Record for all condition classes sampled on a plot.

Code	Status
1	Accessible forest land (includes nonstocked forest - e.g. burned area or clearcut)
2	Nonforest land
3	Noncensus water
4	Census water
5	Denied access area
6	Area too hazardous to visit
7	Area that is not in the sample, e.g., in Canada or Mexico

ITEM

204 **Hazard Status**

When collected: When CONDITION STATUS = 6
Field width: 1 digit.
Tolerance: No errors.

Record the code that describes why the condition is coded as hazardous:

Code	Status
0	Physical Restrictions (cliffs, bears, bees, etc.)
1	Time Constraints. To use this code, ALL of the following criteria must be met: a. Camping out was not an efficient option due to terrain, etc. b. Crew worked a 10 hour plus day and was on plot at least 5 hours to conduct field work. c. Crew cannot complete all 4 subplots and safely return to the vehicle or base camp in one full day. d. Crew completed subplots 1, 2, and 3 in order. e. Plot is not a Phase 3 plot. These plots will be carefully examined by a Quality Control crew, and the number of missing subplots will be reported Nationally.

205 **Reserved Status (DEFINING).** (CORE)

When collected: All accessible forest land condition classes.
Field width: 1 digit.
Tolerance: No errors.

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. The phrase "withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products.

Code	Status
0	Not reserved
1	Reserved (refer to State supplement)

ITEM

207 **Owner Group (DEFINING).** (CORE)

When collected: All accessible forest land condition classes.
Field width: 2 digits.
Tolerance: No errors.

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.

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

209 **Owner Class.** (CORE)

When collected: All accessible forest land condition classes.
Field width: 2 digits.
Tolerance: No errors.

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.

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

Code	Owner
11	National Forest
12	National Grassland
13	Other Forest Service

Codes continued on next page.

ITEM

209 Owner Class **(contd)**

Owner Classes within Other Federal Lands (Owner Group 20)

Code	Owner
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)

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

Owner Classes within Private lands (Owner Group 40)

Code	Owner
41	Corporate
42	Non Governmental Conservation / Natural Resources Organiztion – 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

ITEM

210 **Private Owner Industrial Status.** (CORE)

When collected: All accessible forest land condition classes (CONDITION STATUS = 1) when the owner group is private (OWNER GROUP 40).
Field width: 1 digit.
Tolerance: No errors.

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 below.

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

ITEM
221

Forest Type (DEFINING). (CORE)

When collected: All accessible forest land condition classes (CONDITION STATUS = 1).
Field width: 3 digits.
Tolerance: No errors in group or type.

Record the code corresponding to the FOREST TYPE that best describes the species with plurality of stocking for all live trees in the condition class that are not overtopped.
Refer to Appendix I for stocking determination if available.
Refer to page 8-8 for instructions on determining FOREST TYPE.

Code	Species Type
	Eastern Spruce / Fir Group
122	White spruce
	Pinyon / Juniper Group
181	Eastern redcedar
182	Rocky Mountain juniper
183	Western juniper
184	Juniper woodland
185	Pinyon juniper woodland
	Douglas-fir Group
201	Douglas-fir
	Ponderosa Pine Group
221	Ponderosa pine
222	Incense cedar
223	Jeffrey pine / Coulter pine / bigcone Douglas-fir
224	Sugar pine
	Western White Pine Group
241	Western white pine

Code	Species Type
	Fir / Spruce / Mountain Hemlock Group
261	White fir
262	California red fir
263	Noble fir
265	Engelmann spruce
266	Engelmann spruce / subalpine fir
267	Grand fir
268	Subalpine fir
269	Blue spruce
270	Mountain hemlock
	Lodgepole Pine Group
281	Lodgepole pine
	Hemlock / Sitka Spruce Group
301	Western hemlock
304	Western redcedar
	Western Larch Group
321	Western larch
	Other Western Softwoods Group
362	Southwest white pine
365	Foxtail pine / bristlecone pine
366	Limber pine
367	Whitebark pine
368	Misc. western softwoods
	Exotic Softwoods Group
381	Scotch pine
383	Other exotic softwoods
	Oak / Hickory Group
503	Red oak / White oak / Hickory
509	Bur oak
512	Black walnut
520	Mixed upland hardwoods
	Elm / Ash / Cottonwood Group
703	Cottonwood
705	Sycamore / pecan / American elm
706	Sugarberry / hackberry / elm / green ash

Code	Species Type
	Maple / Beech / Birch
807	Elm / ash / locust
	Aspen / Birch Group
901	Aspen
902	Paper birch
904	Balsam poplar
	Alder / Maple Group
911	Red alder
	Western Oak Group
925	Deciduous oak woodland
926	Evergreen oak
	Other Western Hardwoods Group
951	Pacific madrone
952	Mesquite woodland
953	Cercocarpus woodland
954	Intermountain maple woodland
955	Misc. western hardwood woodlands
	Exotic Hardwoods Group
993	Eucalyptus
995	Other exotic hardwoods
999	**Nonstocked**

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;

Continued on next page

ITEM

221 **Forest Type** (contd)

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 nonstocked forest land, code 999.

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

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

ITEM

221 **Forest Type** (contd)

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.

The following list is a breakdown of the forest type stocking groups that will be used to arrive at a forest type.

SOFTWOODS:

TRUE FIRS AND SPRUCE -

White fir, grand fir, corkbark fir, subalpine fir, California red fir, Shasta red fir, noble fir, Engelmann spruce, blue spruce, Western white pine, Western hemlock, mountain hemlock.

Spruce – subalpine fir

265 Engelmann spruce
Geographic area – Entire Interior West.

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

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

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

Western Hemlocks

270 Mountain hemlock
Geographic area – Northern Idaho and Montana

301 Western hemlock
Geographic area - Northern Idaho and Montana

True Firs

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

262 Red fir
Geographic area – Extreme W. Nevada

263 Noble fir
Geographic area – Extreme W. Nevada

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

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

Western White Pine

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

EASTERN SPRUCE-FIR -
White spruce

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

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

Douglas-fir – Western larch

201 Douglas-fir
Geographic area – Entire Interior West.

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

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

Douglas-fir – Western pines

201 Douglas-fir
Geographic area – Entire Interior West.

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

281 Lodgepole pine
Geographic area – Entire Interior West.

224 Sugar pine
Geographic area – Primarily Western Nevada

222 Incense cedar
Geographic area – Primarily Western Nevada

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

Western larch - pine

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

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

281 Lodgepole pine
Geographic area – Entire Interior West.

SITKA SPRUCE - HEMLOCK
Western hemlock, Western redcedar

301 Western hemlock
Geographic area - Northern Idaho and Montana

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

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

362 Southwestern white pine
Apache pine, Chihuahua pine, Washoe pine
Geographic area - Primarily south of Interstate 40 in Arizona and New Mexico

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

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

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

368 Misc. Western softwoods
Arizona cypress, subalpine larch, Pacific yew

Geographic area - Arizona cypress in S. Arizona; subalpine larch and Pacific yew in N. Idaho – W. Montana.

PINYON – JUNIPER

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

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

182 Rocky Mountain Juniper
Geographic area – Entire Interior West.

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

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

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

EXOTIC SOFTWOODS

Austrian pine, Scotch pine

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

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

HARDWOODS:

OAK - HICKORY

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

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

509 Bur oak
Geographic area – Extreme NE Wyoming.

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

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

ELM – ASH - COTTONWOOD

Pecan, Eastern cottonwood, plains cottonwood, Rio Grande cottonwood, narrowleaf cottonwood, black cottonwood, boxelder

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

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

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

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

912 Bigleaf maple
Geographic area – Extreme W. Nevada.

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 alder, Arizona walnut, white alder, Pacific dogwood, Arizona sycamore.

951 Pacific madrone
Pacific madrone, Arizona madrone

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

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

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

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

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

EXOTIC HARDWOODS
Eucalyptus, Siberian elm

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

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

219 Nonstocked Forest Type (RMRS)

When collected: When Forest Type is coded 999.
Field width: 3 digits.
Tolerance: No errors group.

Record the FOREST TYPE code that best describes the past Forest Type. Use residual trees, stumps, or adjacent stands to help determine type.

ITEM

222 **Stand-size Class (DEFINING).** (CORE)

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

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

Within the sampled area on microplot, subplot, or annular plot, recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. 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 values 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% of the crown cover in STAND SIZE CLASSES of 1,2,3,4, and 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is either 0 or 6 depending on the characteristics of the stand. If at least 1/3 of crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), the accessible forested condition will be classified in one of these STAND SIZE CLASSES based on which of these STAND SIZE CLASSES has the most crown cover. If less than 1/3 of the crown cover is made up of STAND SIZE CLASSES = 2, 3, 4, and 5 (combined), classify the accessible forested condition as a STAND SIZE CLASS = 1, if adequate cover is present.

ITEM

222 **Stand-size Class** (contd).

If no other condition class defining variables are different between accessible forest conditions, delineate on differences in STAND SIZE CLASS only for the following combinations:

Between Nonstocked (Stand-size Class = 0) or cover trees (Stand-size Class = 6) and any stocked forest land (Stand-size Class = 1, 2, 3, 4, or 5);
Between Stand-size Class = 1 and Stand-size Class = 3, 4, and 5;
Between Stand-size Class = 2 and Stand-size Class = 4, and 5; or
Between Stand-size Class = 3 and Stand-size Class = 5.

Note: Differing stand size classes can be used to describe separate condition classes, while at the same time not be used to delineate separate condition classes. Example: Two adjacent forested stands of the same forest type, one with a STAND SIZE CLASS = 1 and the other with a STAND SIZE CLASS = 2 could be delineated as separated CONDITION CLASS if one of the other condition class delineation variables differs (based on the rules), i.e. OWNER GROUP differs between the two condition classes. In addition, the STAND SIZE CLASS variables for the two condition classes would be recorded and treated as an ANCILLARY variable.

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

Record one of the following one-digit codes for each condition:

ITEM

222 **Stand-size Class** (contd).

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

Code	Size Class
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, or (b) For forest types where stocking standards are not available, less than 5 percent **crown cover** of trees of any size. (areas was previously 5 percent cover, but now less than 5 percent cover due to burning, chaining, clearcut, etc.)
1	< 4.9 in (seedlings / saplings) At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 in DBH/DRC.
2	5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods) At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH, and/or western woodland trees 5.0 – 8.9 in DRC.
3	9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods) At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH, and for western woodland trees 9.0 – 19.9 in DRC.

ITEM

222 **Stand-size Class** (contd).

4	20.0 – 39.9 in At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.
5	40.0 + in At least 10 percent stocking (or 5 percent crown cover if stocking tables are not available) in trees of any size; and at least 1/3 of the crown cover is in trees greater than 5.0 in DBH/DRC **and** the plurality of the crown cover is in trees ≥ 40.0 in DBH.
6	Code not used in RMRS.

223 **Regeneration Status (DEFINING).** (CORE)

When collected: All accessible forest land condition classes (CONDITION STATUS = 1).
Field width: 1 digit.
Tolerance: No errors.
Record the code that best describes the degree of evidence of artificial regeneration which occurred in the condition.

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.

ITEM

223 **Regeneration Status** (contd).

0 Natural
Present stand shows no clear evidence of artificial regeneration.

1 Artificial
Present stand shows clear evidence of artificial regeneration.

225 **Artificial Regeneration Species.** (CORE)

When collected: All accessible forest land condition classes (CONDITION STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1).
Field width: 3 digits.
Tolerance: No errors.

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.
See Tree Species list pg. 10-11 to 10-14.

224 **Tree Density (DEFINING).** (CORE)

When collected: All accessible forest land condition classes.
Field width: 1 digit.
Tolerance: No errors.

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

Use code 1 for the first forest condition encountered.

Codes 2 and higher are used ONLY when all other defining 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 only as one forest condition. Otherwise, code 1 for all condition classes. Codes 2

ITEM

224 **Tree Density** (contd).

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% or less as dense as the denser condition.

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

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 forest land conditions with the same type, origin, stand size, ownership, and reserved status, but:

* the eastern half of an otherwise homogeneous, 20 ac stand has many trees killed by a bark beetle outbreak,

or

* one portion of a stand is partially cut over (with 40 sq. ft basal area per acre) while the other portion is undisturbed with 100 sq. ft basal area per acre.

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

ITEM

244 **Physiographic Class.** (CORE)

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

Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition; land form, topographic position, and soil generally determine physiographic class. As a rule of thumb, look over the annular plot area to determine physiographic class, but always use your best judgment when assessing any condition level variables.

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, percolatior 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 described above.

ITEM

244 **Physiographic Class** (contd).

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 described above.

ITEM

244 **Physiographic Class** (contd)

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.

ITEM

232 **Stand Age**. (CORE)

When collected: All accessible forest land condition classes (CONDITION STATUS = 1).
Field width: 3 digits.
Tolerance: +/- 10%.
RMRS: only record if no trees representing the stand size class are aged.

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, 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.

Years to add to DBH (RMRS States):

5	10	20
Western white pine	Ponderosa pine	Subapline larch
Western larch	Washoe pine	Whitebark pine
Cottonwood	Douglas-fir	Limber pine
Aspen	Lodgepole pine	
	Hemlock	

Add 15 years to all other species measured at DBH.

ITEM

232 **Stand Age** (contd).

Assign a weight to each core by visually estimating the percentage of total overstory trees it represents. Make sure the weights from all cores add up to 1.0, compute the weighted average age, and record. For example, if three trees aged 34, 62, and 59 years represent 25 percent, 60 percent, and 15 percent of the overstory, respectively, the weighted stand age should be:

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

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

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

If all of the trees in a condition class are of a species which, by regional standards, can not 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.

ITEM

220 **Size of Condition.** (RMRS)

When collected: All condition classes.
Field width: 1 digit.
Tolerance: ±1 class.
Record the code that applies to the continuous size of the condition class. Use the aerial photographs for the field location to aid in determining the size of the condition. Refer to appendix B.2 for map/photo scale ratios.

Code	Size
1	1-5 acres
2	6-10 acres
3	11-20 acres
4	21-40 acres
5	41-160 acres
6	161-640 acres (1 square mile)
7	1-5 square miles
8	>5 square miles
9	Linear feature (includes forest stringers at least 120- feet wide, riparian areas and streams at least 30-feet wide, improved roads, etc.)

237 **Width of Condition.** (RMRS)

When collected: All forest conditions (CONDITION STATUS = 1) where SIZE OF CONDITION = 9.
Field width: 1 digit.
Tolerance: no errors
Record the code that applies to the linear forest stringer. Code 1 can only be used for conditions associated with riparian areas within a forestland context. Refer to Chapter 3.

Code	Size
0	120 or more feet wide
1	30 to 120 feet wide

Item

234 **Condition Habitat Type.** (RMRS)

When collected: All accessible forest land condition classes.
Field width: 7 digits.
Tolerance: Series - no errors.
Type - no errors.
Record the 7-digit code for the primary and secondary Habitat Types that best represent the condition class. Examine the area surrounding each subplot within a condition class; if several types within a condition class are evident on the subplots, record the type that is most abundant as primary.

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

233 **Crown Cover**. (RMRS)

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

Record the percentage of crown cover, to the nearest 1 percent, of **all tally tree species** greater than 1.0" DBH/DRC (refer to the tally tree species list on pages 10-11 to 10-15). Crown cover is the percentage of ground surface area covered by a vertical projection of the live crowns. **Do not** include seedlings.

Use the following **line transect method** to determine the percentage of crown cover. Establish four 25-foot transects at each subplot, in the cardinal directions from subplot center (figure 17). Each transect begins 1 foot from the subplot stake; measure the length of live tally tree species crown intercepted (above or below) by the 4 transects at each subplot.

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

ITEM
233 **Crown Cover** (contd).

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

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

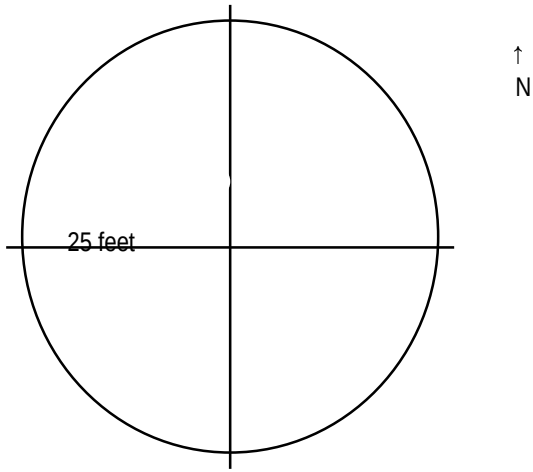
For example, the following crown length was intercepted for the 4 subplots:

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

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

If a condition contains less than 400 feet of transect (most multi-condition class plots), or if the transects do not represent the apparent crown cover of the condition class, record the calculated crown cover for Item 233 and record an estimate of cover in the condition class comments along with an explanation.

Figure 17. Crown cover transects.



ITEM

275 Ground Cover Transects. (RMRS)

When collected: All accessible forest land condition classes.
Field width: 3 digits.
Tolerance: ±10%.
On each subplot, use the transect layout shown below to sample ground cover. 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 record each point on the Ground Cover Supplemental Data form (appendix A.9) by the appropriate ground cover category (below).

At each transect point, if multiple cover categories (e.g., litter, moss/lichens, rocks) are vertically layered, record the most obvious cover item that is protecting the bare soil. For example, if litter is on top of a large boulder, record “rocks” as the most obvious cover. However, if it is not obvious which item is serving as the primary protection (for example, litter on top of pavement), record the first cover category that the stake touches (i.e., the item at the top of the layer).

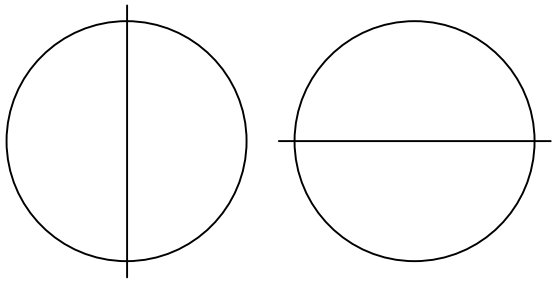
Where more than one condition class occurs on the location, separate and record the point samples by condition class.

After all 8 transects (2 per subplot) have been sampled, record the total number of "hits" by category sampled on the condition. Where transects are extremely difficult to sample (e.g., within a cholla cactus clump), provide a best estimate of ground cover. There is a total of 200 "hits" combining all categories over all condition classes.

- **Fine Soils** - exposed mineral soil with particles less than 1/8-inch diameter.
- **Pavement** - rocks and pebbles between 1/8 and 3/4-inch diameter (not asphalt).
- **Rocks** - greater than 3/4-inch diameter
- **Litter** - organic debris, freshly fallen or slightly decomposed; includes dead vegetation, animal feces, etc.
- **Cryptobiotic soil crust -** cyanobacteria/algae crust. In early stages of development, soil may appear bare but with a gray sheen covering. In more developed crusts, the soil is gray with pedicellation (bumpy) and may have a well developed algae covering (gray/green).
- **Moss/Lichens**
- **Basal Vegetation** - the area outline of a plant near the ground surface; in grass this comprises the shoot system at ground level, while in trees and shrubs it comprises the stem area.
- **Other** - water, ice, concrete, road asphalt, etc.
- **Not Sampled** - snow cover

Subplots 1 & 3 Subplots 2 & 4

•N



ITEM

263 **Disturbance 1.** (CORE)

When collected: All accessible forest land condition classes.
Field width: 2 digits.
Tolerance: No errors.

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 ac 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 disturbance codes below require "significant threshold" damage, which implies mortality and/or damage to 25 percent of individual trees in the condition class.

Code	Definition
00	None - no observable disturbance
10	Insects
20	Disease
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
53	flooding
54	drought

ITEM

263 **Disturbance 1.** (contd)

60	Vegetation (suppression, competition, vines)
70	Unknown / not sure / other (include in NOTES)
80	Human - Any significant threshold human-caused damage not described in the DISTURBANCE codes listed above or the TREATMENT codes listed below.

264 **Disturbance Year 1.** (CORE)

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.

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

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

263 **Disturbance 2.** (CORE)

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

264 **Disturbance Year 2.** (CORE)

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

263 **Disturbance 3.** (CORE)

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

264 **Disturbance Year 3.** (CORE)

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

ITEM

265 **Treatment 1.** (CORE)

When collected: All accessible forest land condition classes.
Field width: 2 digits.
Tolerance: No errors.

Record the code corresponding to the presence of one of the following treatments since the last inventory cycle or **within the past 5 years**. The area affected by any treatment must be at least 1.0 ac 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.

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 - Planting or direct seeding has resulted in a stand at least 50% stocked with live trees of any size.
40	Natural regeneration - Growth of existing trees and/or natural seeding has resulted in a stand at least 50% stocked with live trees of any size.
50	Other silvicultural treatment - The use of fertilizers, herbicides, girdling, pruning or other activities (not already listed above) designed to improve the commercial value of the residual stand.

ITEM

266 **Treatment Year 1.** (CORE)

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.

Record the year in which TREATMENT 1 occurred.

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

265 **Treatment 2.** (CORE)

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

266 **Treatment Year 2.** (CORE)

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

265 **Treatment 3.** (CORE)

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

266 **Treatment Year 3.** (CORE)

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

267 **Past Nonforest / Inaccessible Land Use.** (CORE)

Not used at measurement time 1.

When collected: Previous Condition Status not equal to 1, current Condition Status = 1.

Record only on remeasure of P2 plots.

Field Width: 2 digits.

Tolerance: No errors.

Record and delineate using this attribute ONLY when a condition classified at last inventory as nonforest is now accessible forest land. The area that has changed is a new, separate condition class. Instructions in Sections 2.1 and 2.3 apply. When classifying these cases, select the classification that, within the sampled area, indicates what the majority of this changed area was at the time of previous inventory.

Example: During the previous inventory, subplot 2 was classified as entirely nonforest land. The other subplots sampled accessible forest land. At that time, 55 percent of the area on subplot 2 was pasture, and 45 percent was cropland. (Note: these two nonforest classes were not actually delineated, but rather the entire subplot represented a condition class that was simply classified as nonforest land.)

At revisit, 60 percent of subplot 2, including all that was pasture within the subplot, is found planted to pines and is now forest land. The other subplots remained forest land. The portion of subplot 2 that changed from nonforest to forest is delineated and recorded as a new condition class if it meets the minimum size criteria. This "new" forest land should not be considered part of the original forest land condition class(es) sampled on the other subplots. Because it is a condition that changed from nonforest to forest, the attribute "Past nonforest land use" must be coded; the appropriate classification is pasture, the majority nonforest use -- at last inventory -- within the delineated portion of this new condition class.

Sampled area that shifts from access-denied, hazardous, outside-the-sample, or other uses to accessible forest land are treated in like manner. Codes 40, 91, 92, 93, and 94 apply.

ITEM

267 **Past Nonforest / Inaccessible Land Use** (contd).

10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 ac in size and 120.0 ft 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 ac in size and 120.0 ft 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 ac in size and greater than 120.0 ft 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.

ITEM

267 **Past Nonforest / Inaccessible Land Use** (contd).

90 Not sampled - Land areas that are not sampled. Use the 90 code only for land not better described by one of the following:

91 Census water: meets definition of Census water.

92 Denied access: access denied by the owner.

93 Hazardous: land could not be safely accessed by crews.

94 Not in the sample: area outside the population of interest, e.g., land in Mexico or Canada.

268 **Present Nonforest Land Use.** (CORE)
Not used at measurement time 1.
When collected: CORE: SAMPLE KIND = 2, Previous CONDITION STATUS = 1, current CONDITION STATUS not equal to 1
CORE OPTIONAL: current CONDITION STATUS = 2
Record only on remeasure of P2 plots.
Field width: 2 digits
Tolerance: No errors.

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. 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.

See Item 267 (Past nonforest/inaccessible land use) for codes. Note that the 90 codes will not apply.

ITEM

269 **Nonforest Year.** (CORE)
Not used at measurement time 1.
When collected: SAMPLE KIND = 2, Previous CONDITION STATUS = 1, current CONDITION STATUS not equal to 1
Field width: 4 digits.
Tolerance: +/- 1 year for measurement cycles of 5 years.
+/- 2 years for measurement cycles of > 5 years.
Record the estimated year that a previously accessible forest land condition class was converted to a nonforest condition. This variable will be used to apportion tree growth on any trees which were included in the condition when it was forest land. Record the year in which the conversion took place. In most cases, all trees in a given condition class will be assigned the same nonforest year. If it can be determined that a tree died before the land was converted to a nonforest use, mortality year is also required.

270 **Condition Status Change.** (RMRS)

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

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

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

B. Condition Class Diagram and Boundary Information

Refer to the boundary mapping instructions described in chapter 3. On the Condition Class Diagram illustrating the location area, sketch all condition class boundaries. In addition, on the individual subplot diagrams, carefully draw all condition class boundaries; be sure the boundary lines intersect the subplots at the same azimuth recorded for the boundary (below). Conditions must be labeled by Ground Cover Class, Land Use, Forest Type, or any other item used to differentiate condition classes. **This map is required even when data are entered on the data recorders.**

See figure 18 for a condition boundary examples.

ITEM

281 **Subplot Number.** (CORE)

When collected: All boundaries.
Field width: 1 digit.
Tolerance: No errors.

Record the subplot number being mapped. Codes = 1 to 4.

282 **Mapping Plot Type.** (CORE)

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors.

Code	Type
1	Subplot
2	Microplot

ITEM

283 **Boundary Change.** (CORE)

When collected: SAMPLE KIND = 2, All boundaries.
Field width: 1 digit.
MQO: No errors.
Remeasurement (SAMPLE KIND = 2) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

Code	Definition
0	No change - boundary is the same as indicated on plot map 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.

284 **Contrasting Condition Class Number**. (CORE)

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors.

Record the number for the condition class on the far or opposite side of the boundary from the subplot center (refer to Condition Class Description, page 8-1).

Codes = 1 to 9

285 **Azimuth Left and Right**. (CORE)

When collected: All boundaries
Field width: 3 digits
Tolerance: ±10 degrees.
Facing the contrasting condition from the subplot center, record the azimuth where the condition class boundary crosses the subplot or microplot circumference.

Codes = 001 to 360

ITEM

287 **Corner Azimuth.** (CORE)

When collected: All boundaries.
Field width: 3 digits.
Tolerance: Azimuth ±10 degrees.

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

Codes = 001 to 360

287 **Corner Distance.** (CORE)

When collected: All boundaries when CORNER AZIMUTH > 000.
Field width: 2 digits.
Tolerance: +/- 1 ft.

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

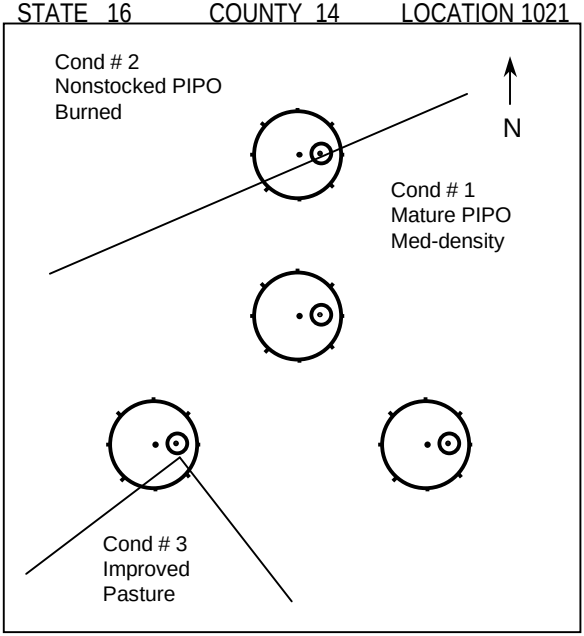
Codes

01 to 07	microplot
01 to 24	subplot

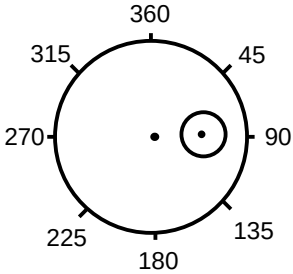
Figure 18. Example condition class diagram and condition boundary information.

CONDITION CLASS DIAGRAM

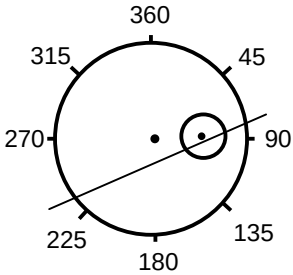
STATE 16 COUNTY 14 LOCATION 1021



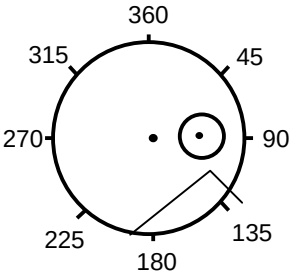
Subplot 1



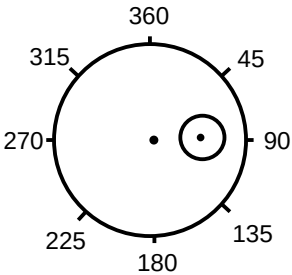
Subplot 2



Subplot 4



Subplot 3



Mapping? Y **N**
(circle one)

BOUNDARY INFORMATION

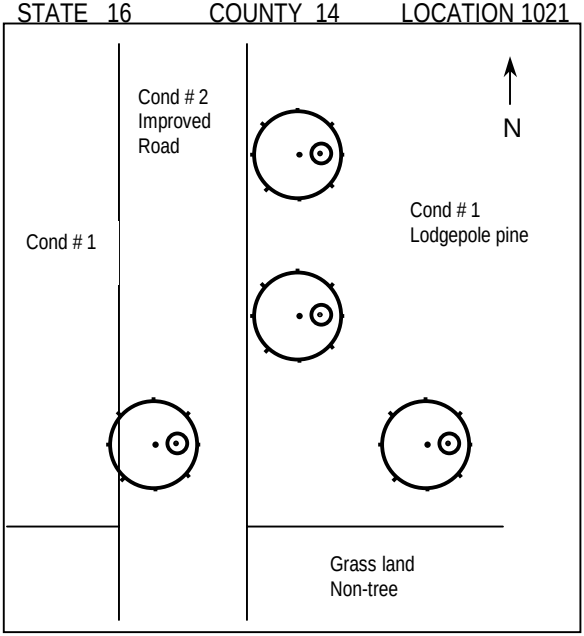
Mapping Plot Type:
1= Subplot
2= Microplot

281	Subplot Number	X	2	2	4		
282	Mapping Plot Type	X	1	2	1		
283	Boundary Change	X	---	---	---		
284	Contrasting Condition #	X	1	1	3		
285	Azimuth Left	XXX	088	091	133		
287	Corner Azimuth	XXX	---	---	120		
	Corner Distance	XX.X	---	---	17.1		
285	Azimuth Right	XXX	235	225	201		

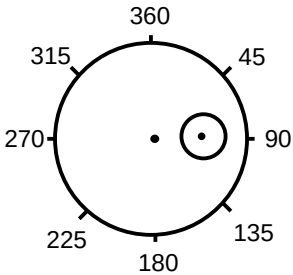
Figure 18. Example condition class diagram and condition boundary information.

CONDITION CLASS DIAGRAM

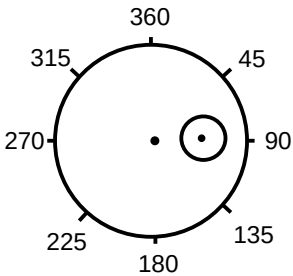
STATE 16 COUNTY 14 LOCATION 1021



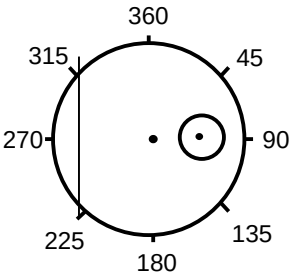
Subplot 1



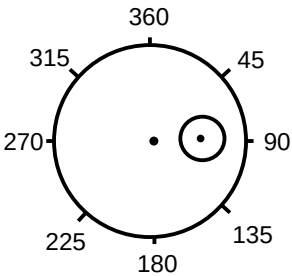
Subplot 2



Subplot 4



Subplot 3



Mapping? Y **N**
(circle one)

BOUNDARY INFORMATION

Mapping Plot Type:
1= Subplot
2= Microplot

281	Subplot Number	X	4				
282	Mapping Plot Type	X	1				
283	Boundary Change	X	---				
284	Contrasting Condition #	X	1				
285	Azimuth Left	XXX	226				
287	Corner Azimuth	XXX	---				
	Corner Distance	XX.X	---				
285	Azimuth Right	XXX	316				

CHAPTER 9 - SUBPLOT DESCRIPTION ITEMS

This chapter describes the data items that will be collected on each of the 4 subplots on a field location (Subplot Description record, appendix A.2). Complete the following items at each subplot:

If a previously established subplot was not established in the correct location, determine whether the subplot placement meets the following criteria:

- The old subplot was established in the correct condition class (refer to chapter 3).
- The old subplot was established within ± 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.

ITEM

Subplot Establishment. (RMRS)

Tolerance: ± 4 feet.

300 **Subplot Number.** (CORE)

When collected: All subplots.
Field width: 1 digit.
Tolerance: No errors.

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

ITEM

301 **Subplot Status**. (CORE)

When collected: All subplots.
Field width: 1 digit.
Tolerance: No errors.
Indicate whether or not this subplot currently has at least one accessible forested condition class.

Code	Status
0	No accessible forest land condition class
1	At least one accessible forest land condition class

304 **Subplot Condition List**. (CORE OPTIONAL)

When collected: All subplots.
Field width: 4 digits.
Tolerance: No errors.
This is a listing of all condition classes located within the 24.0-ft radius around the subplot center. A maximum of four conditions is permitted at any individual subplot. If a condition class has already been defined at a previously completed subplot, use the same condition class number whenever that condition is encountered. Define new condition classes as they are encountered. If more than one condition class is listed here, boundary data are required. If only one condition class is listed, this condition is automatically assigned to the subplot center and microplot center. If less than four condition classes occur on this subplot, complete the remainder of this field with zeros. For example, if condition 1 is the only condition class on a subplot, record 1000.

303 **Subplot Center Condition Number.** (CORE)

When collected: All subplots.
Field width: 1 digit.
Tolerance: No errors.
For each subplot, record the condition class number for the subplot center. Because the condition class at the location center (LC) is always designated as condition class 1, record 1 for subplot 1. If class 1 is also encountered at other subplot centers, record 1 for those subplots as well. Valid codes: 1 to 9.

ITEM

307 **Microplot Center Condition Number.** (CORE)

When collected: All microplots.
Field width: 1 digit.
Tolerance: No errors.
Record the condition class number of the condition class at the microplot center. Valid codes: 1 to 9.

315 **Subplot Slope.** (CORE)

When collected: All subplots with an accessible forest land condition class.
Field width: 3 digits.
Tolerance: +/- 10%.
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 predominately of one direction, code the predominate slope percentage rather than the average. If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the slope as follows:

- If the subplot falls directly between two side hills, code the average slope of the side hills.
- 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 that side hill.

Valid codes = 000 to 155.

ITEM

316 **Subplot Aspect..** (CORE)

When collected: All subplots with an accessible forest land condition class.
Field width: 3 digits.
Tolerance: +/- 10 degrees.
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 aspect as follows:

- 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.

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

318 **Snow/Water Depth.** (CORE)

When collected: All subplots with an accessible forest land condition class.
Field width: 2 digits (x.y).
Tolerance: +/- 0.5 ft.
Record to the nearest 0.1 ft 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 heights) may be measured with less certainty due to conditions at the time of measurement.

ITEM

322 **Root Disease Severity Rating**. (RMRS)

When collected: All subplots with an accessible forest land condition class.
Field width: 1 digit.
Tolerance: ±1 class.
For each subplot, record a root disease severity rating for the subplot area. Apply the severity rating on the basis of the percentage of the subplot area affected by root disease; use either canopy reduction or estimate ground area of the plot impacted. Consider the total impact, not just since the last inventory. The ground area impacted is estimated by projecting the drip line of the overstory crowns onto the ground and estimating the percentage of the area occupied by symptomatic or dead trees. A more direct method is to visualize the root system of infected trees, and then estimate the total root area of the subplot affected.

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

Code	Criteria
0	**No evidence of root disease visible within 50 feet of the subplot perimeter.**
1	**Root disease present within 50 feet of the subplot perimeter, but no evidence of root disease on subplot.**
2	**Minor evidence of root disease evident on the subplot** -- suppressed tree killed by root disease, or minor part of overstory showing symptoms of infection. Little or no reduction in canopy closure or volume.

ITEM
322 **Root Disease Severity Rating** (contd).

Code	Criteria
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.**

ITEM

254 **Litter Depth**. (RMRS)

When collected: All subplots with an accessible forest land condition class.
Field width: 3 digits.
Tolerance: ±1 inch.
Measure and record the average depth of litter at the subplot center stake to the nearest 0.1 inch, using a 3-digit code (e.g., record 3.2 inches as 032; record 0.3 inch as 003). Litter consists of undecomposed leaves and/or needles, together with twigs, bark, etc.

For areas dominated by woodland species, record an average litter depth based only on the areas within the condition that have litter; woodland sites often have litter directly beneath tree crowns, but none between tree crowns.

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CHAPTER 10 - TREE DATA

This chapter describes the tree data to be recorded on individual trees, saplings, and seedling counts, and covers instructions for measuring various tree attributes. These instructions apply to trees in accessible forest land condition classes. Refer to appendix A.5 for the Tree Data record. For specific items to record, refer to appendix E.

The number preceding each variable name below refers to the Item Number of the variable used on the Tree Data record. Some items reference only the individual tree tally, some items reference only the seedling counts, and other items reference both. Use the column at the right margin of the data form (comments column), the line immediately beneath a data record, or in the notes on the data recorder, to record any comments or changes pertaining to an individual tree. For example, if a tree diameter on a timber species is taken at a place other than DBH, include a note explaining at what height the diameter was taken and why.

ITEM

401 **Subplot Number.** (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.

When collected (RMRS): Record for every line of data, including new trees ≥ 1.0 in DBH/DRC on the center microplot.

Field width: 1 digit.

Tolerance: No errors.

Verify for previously tallied trees. Correct if an obvious error exists.

Record the SUBPLOT NUMBER where the tree occurs.

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

ITEM

402 **Tree Record Number**. (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the center microplot.
Field width: 3 digits.
Tolerance: No errors.
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 edge. On remeasured plots, use the tree number assigned at the previous visit. Saplings tallied on microplots will retain their initially assigned tree number if they grow to subplot tree size. Missed trees will be assigned the next available tree number. DO NOT renumber all plot trees in order to assign a more "correct" tree number to a missed tree. Numbers assigned to trees that are subsequently found to be extra will be dropped and not reused.

Repeat the numbering procedure, described below, for each subplot.

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 resampled 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.

a. **Subplot tally.** Standing over the subplot center stake, start at 1° azimuth and rotate clockwise numbering sequentially all tally trees 5.0-inches and greater, beginning with 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 microplot this inventory.

ITEM

402 **Tree Record Number**. (contd)

b. Microplot tally. Next, standing over the microplot center stake, begin at 1° azimuth and rotate clockwise to number the 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.

404 **Azimuth** and
405 **Horizontal Distance**. (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the center microplot.
Field width: 3 digits.
Tolerance: Azimuth ±10 degrees.
Horizontal distance ±1 foot for 0-22.9 feet,
±0.1 foot for >23 feet,
and ±0.2 foot for saplings on microplot.
Record an AZIMUTH, to the nearest degree, and a HORIZONTAL DISTANCE, to the nearest 0.1-foot, for all tally trees and all nontallied site trees. Set compass declination to 0. Do not record 0° (record 360° for due north).

Stand over the subplot center stake and take an azimuth and a horizontal distance from the top of the stake to the geographic center of the stem(s) or bole at the base of the tree:

a. **Standing tally trees -** geographic center at the base (pith of single stem/bole).

b. Downed tally trees - the point of tree origin (e.g., center of the base of tree stem or bole, root system depression).

c. Nontallied site trees - measure directly as in a. above, or if necessary, estimate an azimuth and distance from the nearest subplot center stake (i.e., if the tree is not within view of the stake). For distances greater than 99.9 feet, record 999.

ITEM

404 **Azimuth** and
405 **Horizontal Distance**. (contd)

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

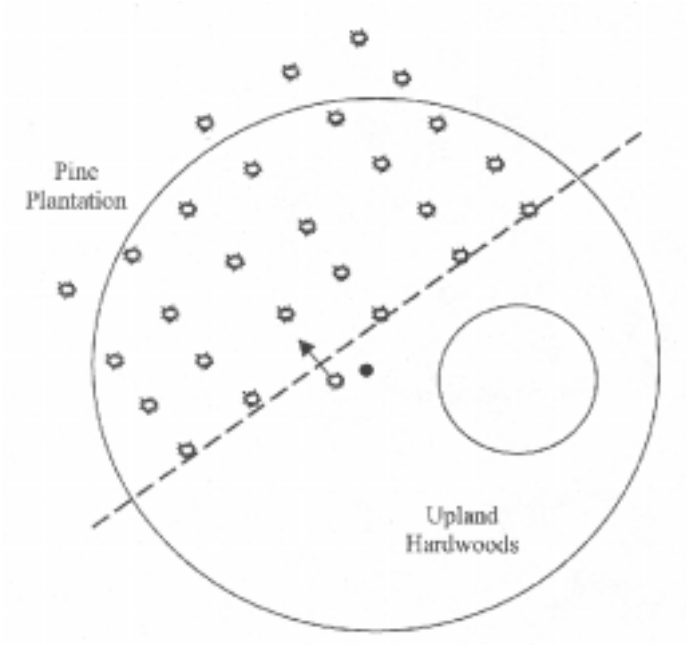
407 **Past Condition Class Number**. (RMRS)

When collected: Verify for previously tallied trees ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Verify for previously tallied trees. Correct if an obvious error exists and make a note in tree notes.

406 **Condition Class Number**. (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All tally trees, nontallied site trees, tree counts, and new tally trees ≥ 1.0 in DBH/DRC on the center microplot.
Field width: 1 digit.
Tolerance: No errors.
Record the appropriate CONDITION CLASS NUMBER for the condition class where the tree or tree count occurs. For locations with no condition class boundaries, record 1 for all tally trees and tree counts. Valid codes = 1 to 9.

Figure 19. Ragged Condition Class boundary and tree condition class designation



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410 **Past Tree Status**. (RMRS)

When collected: Verify for previously tallied trees ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.

Refer to CURRENT TREE STATUS for code definitions. If the past TREE STATUS appears to be incorrect (e.g., PAST TREE STATUS preprinted as "2", but tree is alive), record an estimated PAST TREE STATUS.

ITEM

411 **Current Tree Status.** (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.

When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the center microplot.

Field width: 1 digit.

Tolerance: No errors.

Record a CURRENT 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.

Code	Tree Status
0	No status –- tree is not presently in the sample (remeasurement plots only). Tree was incorrectly tallied at the previous survey or currently is not tallied due to definition or procedural change. Nontallied site tree – site tree selected from off the subplots.
1	Live tree - any live tree (new, remeasured or ingrowth).
2	Dead tree -- any dead tree (new, remeasured, or ingrowth), regardless of cause of death, which does not qualify as a removal. Any dead tree (standing or down).
3	Removal - tree was tallied in previous inventory but has been cut or killed by direct human activity related to harvesting, silviculture or land clearing (remeasurement trees only). The tree may, or may not, have been utilized. Only code trees killed by fire as removals if it was a prescribed burn. For remeasurement locations this includes "ingrowth cut" trees. Ingrowth cut trees are trees that were not tallied during the previous inventory, grew to 5.0 inches DBH/DRC since previous inventory and were removed. See stump diameter procedures.
4	Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc. (remeasurement trees only).

ITEM

413 **New Tree Reconcile.** (CORE)

When Collected (CORE): On SAMPLE KIND 2; all new live tally trees • 1.0 inch DBH/DRC (TREE STATUS=1), all new dead tally trees • 5.0 in (TREE STATUS=2).

When collected (RMRS): All new tally trees (trees not previously tallied) on SAMPLE KIND 2 locations, including new trees $\geq$ 1.0 in DBH/DRC on the center microplot.

Field width: 1 digit.

Tolerance: No errors.

For remeasurement locations only, record a NEW TREE RECONCILE for any new tally tree 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.

1	Ingrowth – new tally tree not qualifying as through growth (includes reversions). Includes "ingrowth cut" trees (see TREE STATUS =3).
2	Through growth – new tally trees $\geq$ 5.0 inches DBH/DRC, within the microplot (center microplot only).
3	Missed live – a live tree missed at previous inventory that is live or dead now. Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.
4	Missed dead – a dead tree missed at previous inventory that is dead now. Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

ITEM

412 **Tree Lean Angle.** (CORE)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.

When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the center microplot.

Field width: 1 digit.

Tolerance: No errors.

For each tally tree and nontally site tree, record the code that describes the angle of lean from vertical of the tree, from base to top of ACTUAL LENGTH.

Note: For SAMPLE KIND 2 locations, if the previously tallied TREE LEAN ANGLE is equal to 1, it will be downloaded to the PDR to aid in tree re-location. Verify and correct if an obvious error exists.

Code	Tree Angle
0	Standing (less than 45 degrees of lean from vertical).
1	Down (more than 45 degrees of lean).

Note: **Trees supported by other trees or by their own branches are considered standing.**

415 **Mortality.** (CORE OPTIONAL)

When collected (CORE OPTIONAL): All dead trees (TREE STATUS 2) 5.0 in DBH/DRC and larger that were live at the previous inventory (TREE STATUS 1), or within the past 5 years if no previous inventory.

When collected (RMRS): All dead tally trees ≥ 1.0 in DBH/DRC that were live at the previous inventory or within the past 5 years if no previous inventory.

Field width: 1 digit.

Tolerance: No errors.

Record a MORTALITY code for any tree that was live within the past 5 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.

A mortality tree is a dead timber or woodland tally tree, standing or down, 1.0-inch DBH/DRC or larger, that was live at the time of previous inventory, or within the past 5 years on a new location, but has died.

ITEM

415 **Mortality** (contd).

Record one of the following one-digit codes for each dead tree. If code 1 is recorded, also record a CAUSE OF DEATH code (refer to Item 455, page 10-103) and a PAST TREE CLASS code (refer to Item 463, page 10-90).

Code	Mortality
0	**No - tree does not qualify as mortality**
1	**Yes - tree does qualify as mortality**

Refer to the following as a guide to 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).

ITEM

415 **Mortality** (contd).

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.

ITEM

417 **Mortality Year.** (CORE)

When collected (CORE): All TREE STATUS = 1 at time 1 and All TREE STATUS = 2 or 3

When collected (RMRS): All dead tally trees $\geq$ 1.0 in DBH/DRC that were live at the previous inventory or within the past 5 years if no previous inventory.

Field width: 4 digits.

Tolerance: $\pm$ 1 year for remeasurement cycles of 5 years.
$\pm$ 2 years for remeasurement cycles of > 5 years.

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.
Valid codes = 1995 or higher.

416 **Species**. (CORE)

When collected (CORE): All live and standing dead tally trees $\geq$1.0 in DBH/DRC.

When collected (RMRS): Record for all tally trees, nontallied site trees, seedling counts, and new trees $\geq$ 1.0 in DBH/DRC on the center microplot.

Field width: 3 digits.

Tolerance: No errors.

Record the appropriate SPECIES code from the list below. If you encounter a species not listed below 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 299 for unknown dead conifer and 999 for unknown dead hardwood when the genus or species codes cannot be used. The generic code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species~~ (Not used at RMRS). In this case use the sample collections procedures described earlier in this paragraph.

ITEM

416 **Species** (contd).

This following list is a subset of the FIA National Tree Species List. This list includes all tree species tallied in the Interior West States, and excludes those species found primarily in shrub form within the Interior West. "Woodland" designates species where DRC is measured instead of DBH. This list is based on the V1.5 National Manual list with RMRS additions (*) as recommended by the AB 11/2000.

Code	Common Name	Genus	Species	Woodland
15	white fir	Abies	concolor	
17	grand fir	Abies	grandis	
18	corkbark fir	Abies	lasiocarpa var. arizonica	
19	subalpine fir	Abies	lasiocarpa	
20	California red fir	Abies	magnifica	
21	Shasta red fir	Abies	shastensis	
22	noble fir	Abies	procera	
51	Arizona cypress	Cupressus	arizonica	
58	Pinchot juniper	Juniperus	pinchotii	w
59	redberry juniper	Juniperus	coahuilensis	w
62	California juniper	Juniperus	californica	w
63	alligator juniper	Juniperus	deppeana	w
64	western juniper	Juniperus	occidentalis	
65	Utah juniper	Juniperus	osteosperma	w
66	Rocky Mountain juniper	Juniperus	scopulorum	w
68	eastern redcedar	Juniperus	virginiana	
69	oneseed juniper	Juniperus	monosperma	w
72	subalpine larch	Larix	lyallii	
73	western larch	Larix	occidentalis	
81	incense-cedar	Calocedrus	decurrens	
93	Engelmann spruce	Picea	engelmannii	
94	white spruce	Picea	glauca	
96	blue spruce	Picea	pungens	
101	whitebark pine	Pinus	albicaulis	
102	Rocky Mountain	Pinus	aristata	

Code	Common Name	Genus	Species	Woodland
	bristlecone pine			
104	foxtail pine	Pinus	balfouriana	
106	common or twoneedle pinyon	Pinus	edulis	w
108	lodgepole pine	Pinus	contorta	
112	Apache pine	Pinus	engelmannii	
113	limber pine	Pinus	flexilis	
114	southwestern white pine	Pinus	strobiformus	
116	Jeffrey pine	Pinus	jeffreyi	
117	sugar pine	Pinus	lambertiana	
118	Chihuahua pine	Pinus	leiophylla var. chihuahuana	
119	western white pine	Pinus	monticola	
122	ponderosa pine	Pinus	ponderosa	
130	Scotch pine	Pinus	sylvestris	
133	singleleaf pinyon	Pinus	monophylla	w
134	border pinyon	Pinus	discolor	w
135	Arizona pine	Pinus	arizonica	
136	Austrian pine	Pinus	nigra	
137	Washoe pine	Pinus	washoensis	
140	Mexican pinyon pine	Pinus	cembroides	w
142	Great Basin bristlecone pine	Pinus	longaeva	
143	Arizona pinyon pine	Pinus	monophylla var. fallax	w
202	Douglas-fir	Pseudotsuga	menziesii	
231	Pacific yew	Taxus	brevifolia	
242	western redcedar	Thuja	plicata	
263	western hemlock	Tsuga	heterophylla	
264	mountain hemlock	Tsuga	mertensiana	
313	boxelder	Acer	negundo	
322	bigtooth maple	Acer	grandidentatum	w
351	red alder	Alnus	rubra	
352	white alder	Alnus	rhombifolia	
*354	Arizona alder	Alnus	oblongifolia	
361	Pacific madrone	Arbutus	menziesii	
*362	Arizona madrone	Arbutus	arizonica	
375	paper birch	Betula	papyrifera	
404	pecan	Carya	illinoensis	

Code	Common Name	Genus	Species	Woodland
475	curlleaf mountain-mahogany	Cercocarpus	ledifolius	w
492	Pacific dogwood	Cornus	nuttallii	
510	eucalyptus	Eucalyptus	spp.	
544	green ash	Fraxinus	pennsylvanica	
547	velvet ash	Fraxinus	velutina	
552	honeylocust	Gleditsia	triacanthos	
602	Black walnut	Juglans	nigra	
*606	Arizona walnut	Juglans	major	
660	apple spp.	Malus	spp.	
680	mulberry spp.	Morus	spp.	
*732	Arizona sycamore	Platanus	wrightii	
741	balsam poplar	Populus	balsamifera	
742	eastern cottonwood	Populus	deltoides	
745	plains cottonwood	Populus	deltoides ssp. monilifera	
746	quaking aspen	Populus	tremuloides	
747	black cottonwood	Populus	balsamifera spp. trichocarpa	
748	Rio Grande cottonwd, Fremont's Poplar	Populus	deltoides ssp. wislizeni	
749	narrowleaf cottonwood	Populus	angustifolia	
756	western honey mesquite	Prosopis	glandulosa var. torreyana	w
757	velvet mesquite	Prosopsis	velutina	w
758	screwbean mesquite	Prosopsis	pubescens	w
803	Arizona white oak, gray oak	Quercus	arizonica, grisea	w
810	Emory oak	Quercus	emoryi	w
814	Gambel oak	Quercus	gambelii	w
823	bur oak	Quercus	macrocarpa	
826	chinkapin oak	Quercus	muehlenbergii	
829	Mexican blue oak	Quercus	oblongifolia	w
843	silverleaf oak	Quercus	hypoleucoides	w
850	Oak – evergreen (for RMRS only netleaf oak)	Quercus	spp. (rugosa)	w
972	American elm	Ulmus	americana	
974	Siberian elm	Ulmus	pumila	

ITEM

420 **Past DBH/DRC**. (CORE)

When collected (CORE): Verify for remeasure trees ≥ 1.0 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.
Woodland species ± 0.2 inch per stem.
This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory. Any change made to this field signifies an error at the time of the previous inventory. "DIAMETER CHECK" should be set to 2 and an explanation is required in the notes if previous DBH is changed.
Change past DBH/DRC if it is obviously wrong. For example, previous crew recorded 31.0 instead of 13.0, or it appears that the crew read the tape wrong (a nice growing tree shrunk with no evidence of bark damage etc.).

421 **Current DBH/DRC**.

When collected (CORE): All live and dead tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All live and dead tally trees and nontallied site trees ≥ 1.0 in DBH/DRC, including new trees ≥ 1.0 in DBH/DRC on the center microplot.
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.
Woodland species ± 0.2 inch per stem.
Down dead trees ± 4.0 inches.
The following provides instructions for measuring and recording tree diameter for (a) timber species and (b) woodland species (page 10-11 to 15). Record diameter for all tally trees, 1.0-inch and larger in diameter, and nontallied site trees.

Diameter at Breast Height (DBH) -- timber species:

a. **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

421 **Current DBH/DRC (contd)**.

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 C.1.

Resampled 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), or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.
Change the PAST DBH/DRC if it is obviously incorrect (see PAST DBH/DRC).

For remeasure trees that are currently dead and have a smaller diameter than previously recorded, record the new smaller diameter unless the new diameter is < 5.0 inches for trees that were on the subplot or the new diameter is < 1.0 inch for trees that were on the microplot. Trees cannot shrink off the plot. If the tree has shrunk below the above-mentioned thresholds, record the previous diameter for the current diameter.

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

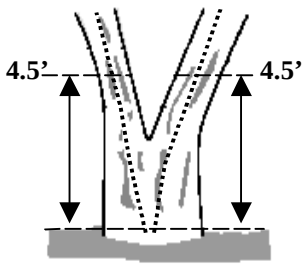
ITEM

421 **Current DBH/DRC (contd)**.

For trees requiring diameter at breast height, measure DBH at 4.5 feet above the ground line on the uphill side of the tree unless one of the special DBH situations listed below is present; figure 20 shows the proper diameter measurement methods for these cases:

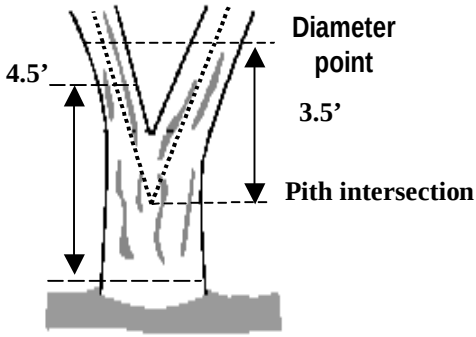
Figure 20. Points of diameter measurement for DBH trees.

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 ft, between 1.0 and 4.5 ft, or above 4.5 ft.



- Trees forked below 1.0 ft. Trees forked in this region are treated as distinctly separate trees (Figure 20, above). Distances and azimuths are measured individually to the center of each stem where it splits from the stump (Figure 20 A-C). DBH is measured for each stem at 4.5 ft above the ground. When stems originate from pith intersections below 1 ft, 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 ft fork again between 1.0 and 4.5 ft (Figure 20-E), the rules in the next paragraph apply.

Figure 20. Points of diameter measurement for DBH trees (contd).

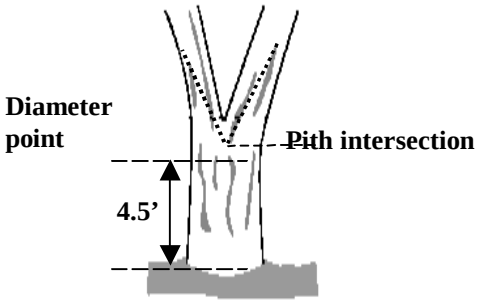


- Trees forked between 1.0 ft and 4.5 ft. Trees forked in this region are also counted as separate trees, but only one distance and azimuth (to the central stump) is used for all (Figure 20 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in 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 ft above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 ft, the limiting distance is the same for all forks--they are either all on, or all off the plot.

  Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 ft above the common pith intersection (Figure 20 F).

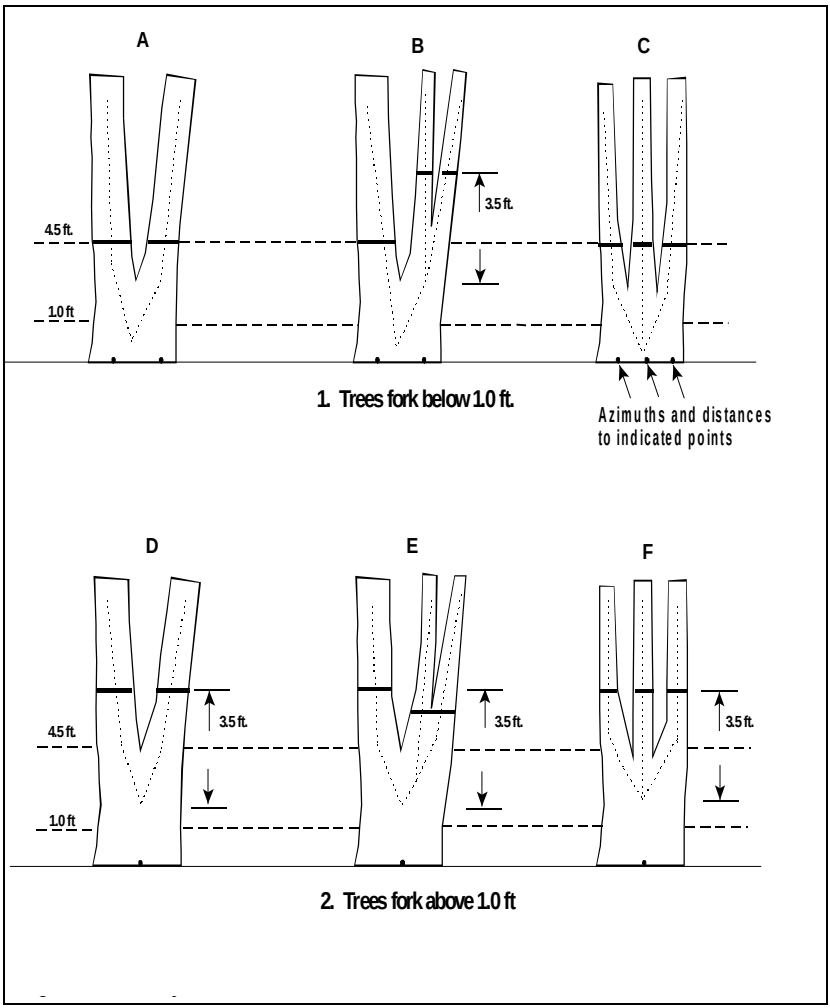
  Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 ft, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems at the base of the second fork as shown in Figure 20-E (i.e., do not move the point of diameter the entire 3.5 ft above the first fork).

Figure 20. Points of diameter measurement for DBH trees (contd).



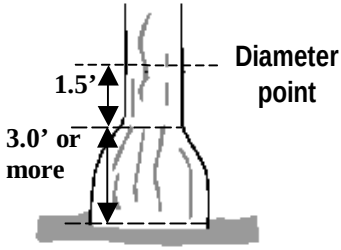
- <u>Trees forked at or above 4.5 ft.</u> Trees forked in this region count as one single tree. If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

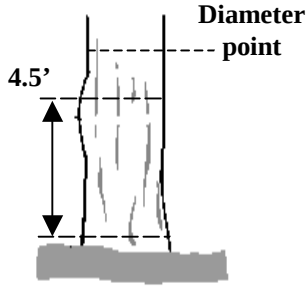
Figure 20 A-F. Summary of where to measure DBH, distance, and azimuth on forked trees.



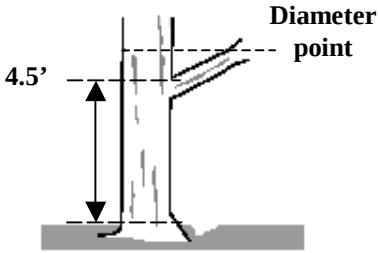
- Stump Sprouts. Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. Stump sprouts originating between 1.0 ft and 4.5 ft are measured at 3.5 ft 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 ft~~. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree~~ (moved to woodland section).

Figure 20. Points of diameter measurement for DBH trees (contd).



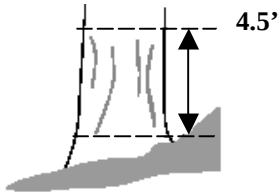


- Tree with butt-swell or bottleneck: Measure these trees 1.5 ft above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 ft or more above the ground.

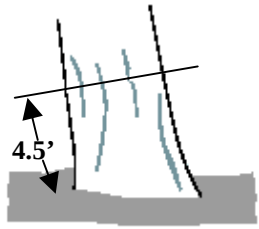


- Tree with irregularities at DBH: On trees with swellings, bumps, depressions, and branches at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

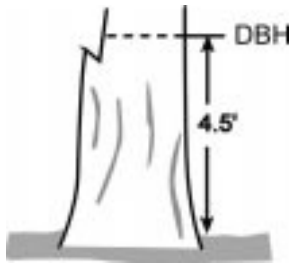
Figure 20. Points of diameter measurement for DBH trees (contd).



- Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree.

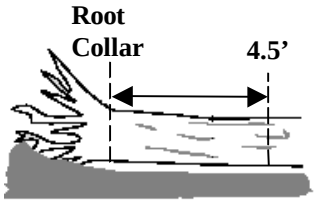


- Leaning tree: Measure diameter at 4.5 ft from the ground along the bole. The 4.5 ft distance is measured along the underside face of the bole.

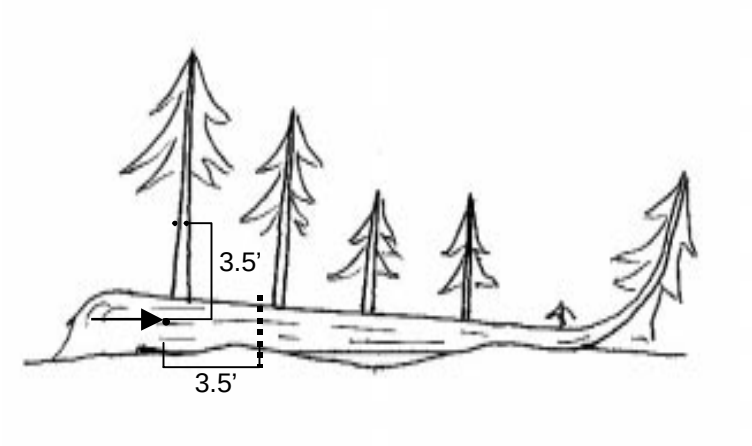


- Missing wood or bark. Do not reconstruct the DBH of a tree that is missing wood or bark or at the point of measurement. Record the diameter, to the nearest 0.1, of the wood and bark that is still attached to the tree (Figure 20). If a tree has a localized abnormality (gouge, depression, etc.) at the point of point of DBH, apply the procedure described for trees with irregularities at DBH.

Figure 20. Points of diameter measurement for DBH trees (contd).



- Live windthrown tree: Measure from the top of the root collar along the length to 4.5 ft (Figure 20).

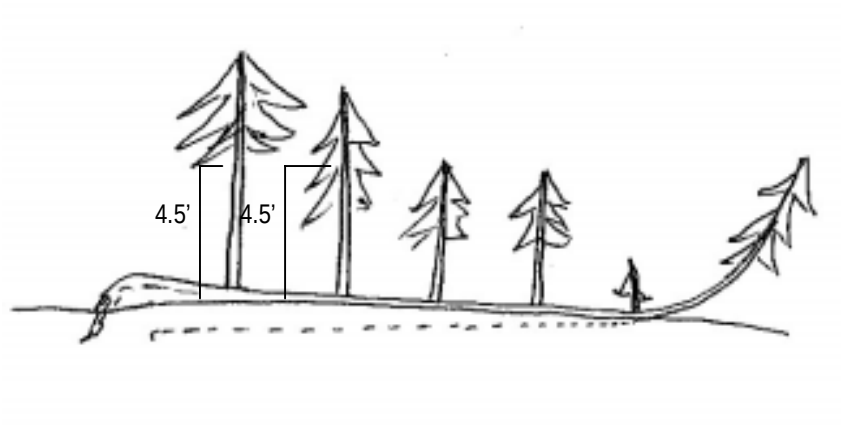


- Down live tree with tree-form branches growing vertical from main bole. When a down live tree, touching the ground, has vertical (<45° from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above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

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

Figure 20. Points of diameter measurement for DBH trees (contd).



If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5' 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 20 above). 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.

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

- 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.

b. Marking timber species.

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

(1) **Standing tally trees.** Mark trees 3.0-inches DBH and larger with an aluminum nail at 4.5 feet above the ground on the uphill side of the tree, except aspen or trees with a bole irregularity at breast height (BH). **Place the nail first, then measure DBH directly above** the nail. Place the nail perpendicular to the tree bole, and etch the tree number in pencil on the nail head. Leave at least 1 inch of the nail exposed to allow for tree growth.

Mark aspen and birch 3.0-inches DBH and larger with a paint pen. Put a horizontal line approximately 1 to 2 inches in length at BH. Do not nail.

Mark trees with bole irregularities at the point of diameter measurement.

(2) **Down tally trees.** Place a nail on top of the tree bole at the place of diameter measurement; etch the tree number on the head of the nail.

(3) **Resampled trees.** If the old nail is still protruding from the tree 3/4 - 1 inch or more, do not re-nail. If the old nail is protruding from the tree < 3/4 inch, re-nail next to the old nail.

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

ITEM

421 **Current DBH/DRC** (contd).

c. **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.

Diameter at root collar (DRC) -- Woodland species

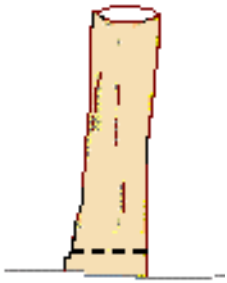
For species requiring diameter at the root collar (refer to tree species list), measure the diameter at the ground line or at the stem root collar, whichever is higher. For these trees, treat clumps of stems having a unified crown and common root stock as a single tree; examples include mesquite, juniper, 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 multi-stemmed trees, compute and record a cumulative DRC (see below); record individual stem diameters and a stem status (live or dead) on a separate form or menu as required.

a. **Measuring DRC.** Tree diameter, or DRC, for woodland species is measured at the ground line or at stem root collar, whichever is higher (figure 21).

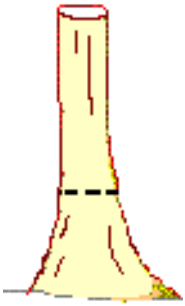
For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

Resample trees. If possible remeasure diameter at the same point as previous crew (look for old nail, paint pen mark, etc.).

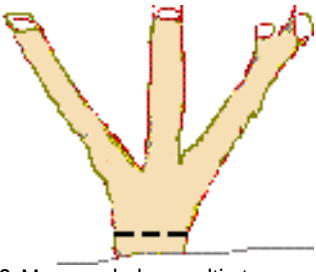
Figure 21. Points of diameter measurement on woodland species.



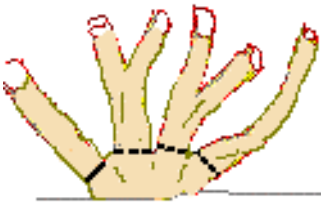
1. Measure at ground line when reasonable.



2. Measure above root collar.

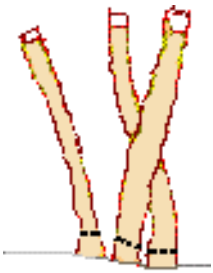


3. Measure below multi-stems at normal stem form.



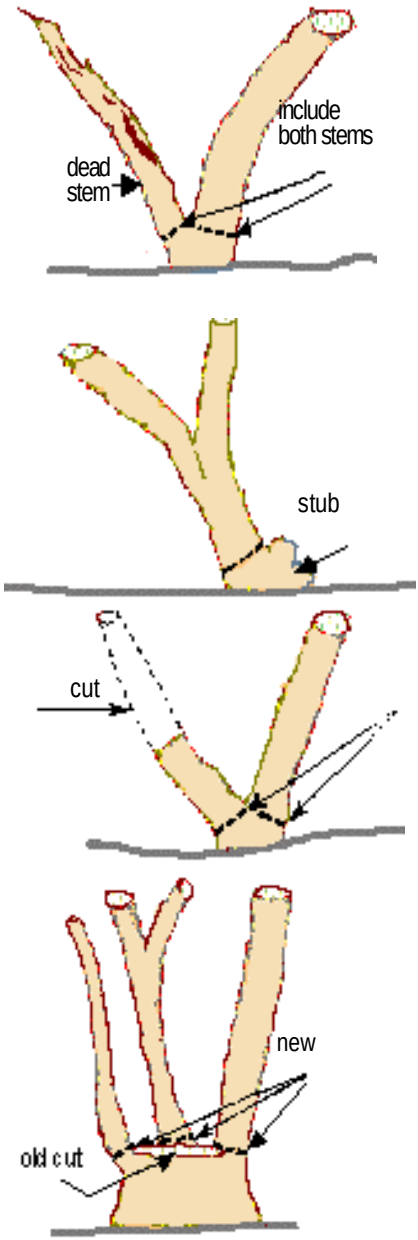
4. Excessive diameter below stems; measure individual stems and compute DRC.

5. Measure missing stem and compute DRC.



6. Forks are at or below ground line. Compute DRC. If tree is oak/maple, each stem is a tree.

Figure 21. Points of diameter measurement on woodland species (contd)



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.

ITEM

421 **Current DBH/DRC** (contd).

Record DRC for woodland tally trees, 1.0-inch and larger in diameter, as specified below. Before measuring the diameter on a stem, remove the loose material on the ground (e.g., litter), but not mineral soil. Measure just above any swells present, and in a location so that the diameter measurements are reflective of the volume above the stems (especially when trees are extremely deformed at the base). For example, when a single diameter measurement for a tree -- taken below several main stems originating near the root collar -- would grossly over estimate the volume for the tree, individually measure the stems qualifying for diameter measurement above the single diameter location.

Stems must be at least 1.0 foot in length to qualify for measurement; or stems missing due to cutting or damage must have previously been at least 1.0 foot in length. Refer to figure 21, page 10-29.

For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

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

Woodland species diameter groupings.

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

ITEM
421

Current DBH/DRC (contd).

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

b. **Marking woodland species.** For woodland species 1.0-inch DRC and larger, mark the exact location of stem diameter measurement with a lumber crayon or paint pen. Draw a small line (at least 1.0-inch long and parallel to the diameter tape placement on the stem) on each stem measured for DRC.

In addition, for all standing woodland trees, 5.0-inches DRC and larger, place a nail at the base of one stem, preferably the largest or main stem, facing subplot center. Etch the tree number in pencil on the nail head. For down woodland trees, place the nail on top of the largest or main stem. **Note:** The purpose of the nail is to aid in tree relocation and not to mark the exact location of a stem diameter measurement.

c. **Computing DRC.** For all woodland species tally trees with at least one stem 1.0 inch in diameter or larger at the root collar, DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed woodland tree, the computed DRC is equal to the single diameter measured.

The field data recorders calculate DRC using the individual stem diameters entered. Otherwise, use the following formula to compute DRC:

$$DRC = SQRT\left[\sum_{1}^{n} (\text{stem diameter}_i)^2\right]$$

Round the result to the nearest 0.1 inch. For example, a woodland tree with stems of 4.8, 5.2, 1.5, and 8.7 inches is calculated as:

$$DRC = \sqrt{(4.8^2 + 5.2^2 + 1.5^2 + 8.7^2)} = \sqrt{128.02} = 11.3''$$

ITEM

421 **Current DBH/DRC** (contd).

d. **Recording DRC.** Record the calculated DRC for item 421 as a three-digit code to the last whole 0.1 inch. **Note:** If a calculator is not available, use appendix C.2 to compute DRC. If using field forms, record individual stem diameters for multistemmed woodland trees on the "Multistemmed Woodland Species Tally" supplemental form (appendix A.8). **Note:** If a multistemmed woodland tree has dead stems, place a small "d" on the "Multistemmed Woodland Species Tally" form next to the individual diameter measurement of the dead stem.

Whenever DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme limbiness, packrat's nest, large down stem) the stem(s) may be measured or estimated to the nearest 1.0 inch class. Note which stems were estimated on the "Multistemmed Woodland Species Tally" supplemental form (appendix A.8).

422 **Seedling Count.** (CORE)

When collected (CORE): Each accessible forest land condition class on each microplot.
When collected (RMRS): Each accessible forest land condition class on each microplot, **not required** for center microplot.
Field width: 2 digits.
Tolerance: No errors.
The following procedures meet the National standards.
On the 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 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 in order to qualify for tallying. 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.

ITEM

422 **Seedling Count** (contd).

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

423 **DBH/DRC / Count Check.** (CORE/RMRS)

When collected (CORE): All live and standing dead tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All tally trees and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on the center microplot, and seedling counts.
Field width: 1 digit.
Tolerance: No errors.
Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses or for seedling counts that are estimated.

Code	Definition
0	Diameter measured accurately; seedlings counted accurately.
1	Diameter estimated; seedling count estimated.
2	Diameter measured at different location than previous measurement (remeasurement trees only).

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

425 **Stump Diameter.** (RMRS)

When collected (RMRS): Stump of a tree that was ≥ 5.0 inches DBH/DRC on a remeasure subplot, tree that was ≥ 1.0 inch DBH/DRC on a remeasure center microplot (includes center microplot on variable radius plots and remeasure offset microplots) with CURRENT TREE STATUS = 3 and no PAST TREE STATUS (removed ingrowth).
Field width: 4 digits.
Tolerance: ± 0.5 inch per 20 inches of diameter.
Measure STUMP DIAMETER at a point 1.0 foot above ground level on the uphill side of the stump or just below the cut, whichever is lower.

ITEM

426 **Past Number of Stems.** (RMRS)

When collected: Value is preprinted for SAMPLE KIND 2 locations.
Field width: 2 digits.
Tolerance: No errors.
If the PAST NUMBER OF STEMS does not equal THE CURRENT NUMBER OF STEMS, **do not** change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

424 **Current Number of Stems.** (RMRS)

When collected: For tallied **woodland** species with at least one stem 1.0 inches in diameter or larger; includes woodland species tallied on the center microplot.
Field width: 2 digits.
Tolerance: No errors.
Record the total number of stems that were measured for DRC. (e.g., record 1 stem as 01; record 12 stems as 12).

Count only the number of qualifying stems used to calculate DRC. Qualifying stems are those that are at least 1.0 foot in length and at least 1.0-inch in diameter.

440 **Past Total Tree Length**. (RMRS)

When collected: Verify for remeasure trees $\geq$ 1.0 inch DBH/DRC.
Field width: 3 digits.
Tolerance: No errors.
This is the TOTAL TREE LENGTH assigned at the previous inventory. It has been downloaded from the previous inventory. If the PAST TOTAL TREE LENGTH is obviously wrong (length recorded as 031 instead of 013), record a new PAST TOTAL LENGTH estimate.

ITEM

441 **Total Tree Length.** (CORE)

When collected (CORE): All live tally trees $\geq$ 5.0 in DBH/DRC.
When collected (RMRS): All tally trees and nontallied site trees, including new trees $\geq$ 1.0 in DBH/DRC on the center microplot.
Field width: 3 digits.
Tolerance: $\pm$ 10% of true length.
Record the TOTAL LENGTH of the tree, to the nearest 1.0 ft 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, estimate what the total length would be if there were no missing or broken top. Forked trees should be treated the same as unforked trees.

On multistemmed woodland trees, measure height along the main or largest stem. For measurement examples, refer to appendix C.4.

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

For all standing trees that **lean**, go out perpendicular to the lean to determine tree height. 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 height with a clinometer; also, in the comments column, note that tree height was estimated due to lean.

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

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

ITEM

448 **Past Actual Tree Length.** (RMRS)

When collected (RMRS): Verify for remeasure trees $\geq$ 1.0 inch DBH/DRC.
Field width: 3 digits.
Tolerance: $\pm$ 10% of true length.
This is the ACTUAL TREE LENGTH assigned at the previous inventory. It has been downloaded from the previous inventory. If the Past Actual Tree Length is obviously wrong (length recorded as 31 instead of 13), record a new PAST ACTUAL TREE LENGTH estimate.

446 **Actual Tree Length.** (CORE)

When collected (CORE): All live and standing dead tally trees (with broken or missing tops) $\geq$ 5.0 in DBH/DRC.
When collected (RMRS): All tally trees $\geq$ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: $\pm$ 10% of true length.
For trees with broken or missing tops. Record the ACTUAL LENGTH of the tree to the nearest 1.0 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. 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. Forked trees should be treated the same as unforked trees. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader 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).
If the top is intact, repeat total length.
For multistemmed woodland trees, use the tallest remaining stem to obtain actual length – only use the top of the broken stem if it is taller than the other remaining stems.

442 **Length Method (Tree Height Check).** (CORE)

When collected (CORE): All live tally trees ≥ 5.0 in DBH/DRC.
When collected (RMRS): All tally trees ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record the code that indicates the method used to determine tree lengths.

Code	Method
1	Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relascope, tape).
2	Total length is visually estimated (e.g., broken top, severe lean), actual length is measured with an instrument.
3	Total and actual lengths are visually estimated.

443 **Uncompacted Crown Ratio.** (CORE OPTIONAL)

When collected (CORE): All live tally trees ≥ 5.0 in DBH/DRC.
When collected (RMRS): All live tally trees ≥ 1.0 in DBH/DRC and nontallied timber species site trees.
Field width: 2 digits.
Tolerance: ±10%.
Record the UNCOMPACTED CROWN RATIO to the nearest 1%. UNCOMPACTED LIVE CROWN RATIO is the percentage of the total tree **height** supporting live foliage that is effectively contributing to tree growth.

UNCOMPACTED LIVE CROWN RATIO is determined by the ratio of live crown length to top of live crown (Figure 22). 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 in and are within 5 ft 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.

In this assessment, ignore epicormic branches (small branches well below the main crown, usually less than 1-inch in diameter).

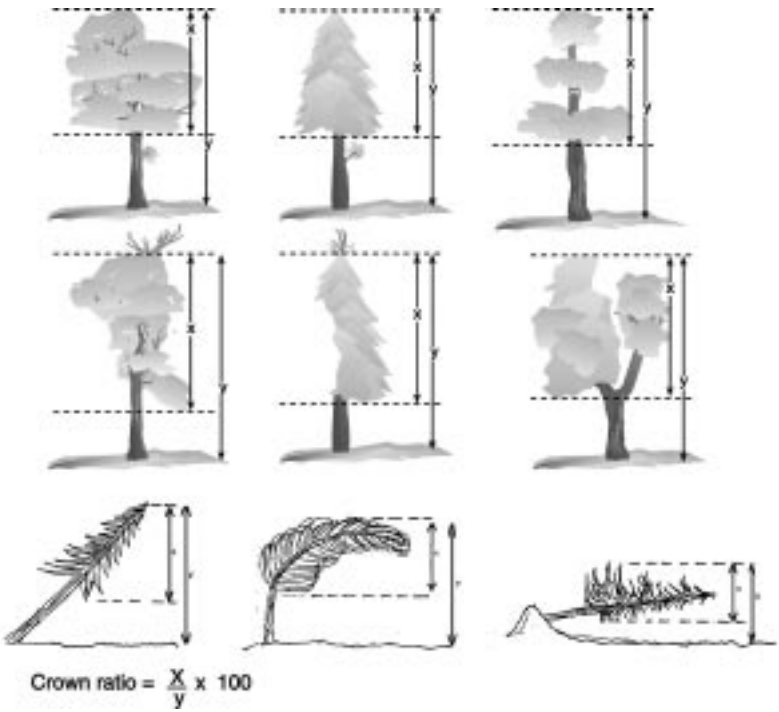
For trees with broken or missing tops, use the current length of live crown and the estimated total tree height.

Determine sapling LIVE CROWN RATIO by dividing the live crown length by total tree height to the live crown top. 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 in DBH/DRC and larger; the 1 in/ 5 ft rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (figure 23).

To determine UNCOMPACTED CROWN RATIO (UCR), stand away from the tree about 1 to 1.5 times the tree height and use the crown ratio scale or measure the percent of total tree height supporting live crown, making no adjustment for openings or lopsided crown (figure 22).

$$\text{Calculated UCR} = \frac{\text{(total height)-(height to the lowest live limb)}}{\text{Total height}}$$

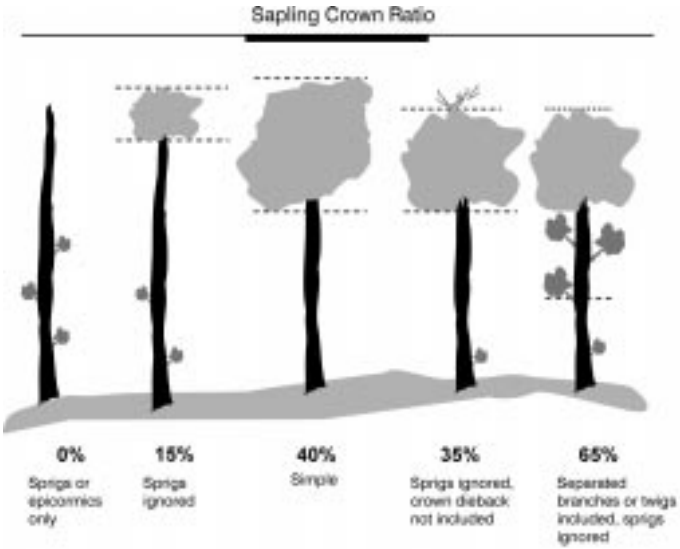
Figure 22. UNCOMPACTED CROWN RATIO examples.



ITEM

443 **Uncompacted Crown Ratio** (contd).

Figure 23. UNCOMPACTED CROWN RATIO examples for saplings.



444 **Compacted Crown Ratio.** (CORE)

When collected (CORE): All live tally trees ≥ 1.0 in DBH/DRC.
When collected (RMRS): All live tally trees ≥ 1.0 in DBH/DRC and nontallied timber-species site trees.
Field width: 2 digits.
Tolerance: ±10%.
Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 in and larger to the nearest 1%. COMPACTED CROWN RATIO is that portion of the tree 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.

ITEM

444 **Compacted Crown Ratio** (contd).

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 24).

Figure 24. Examples of COMPACTED CROWN RATIO of conifers.

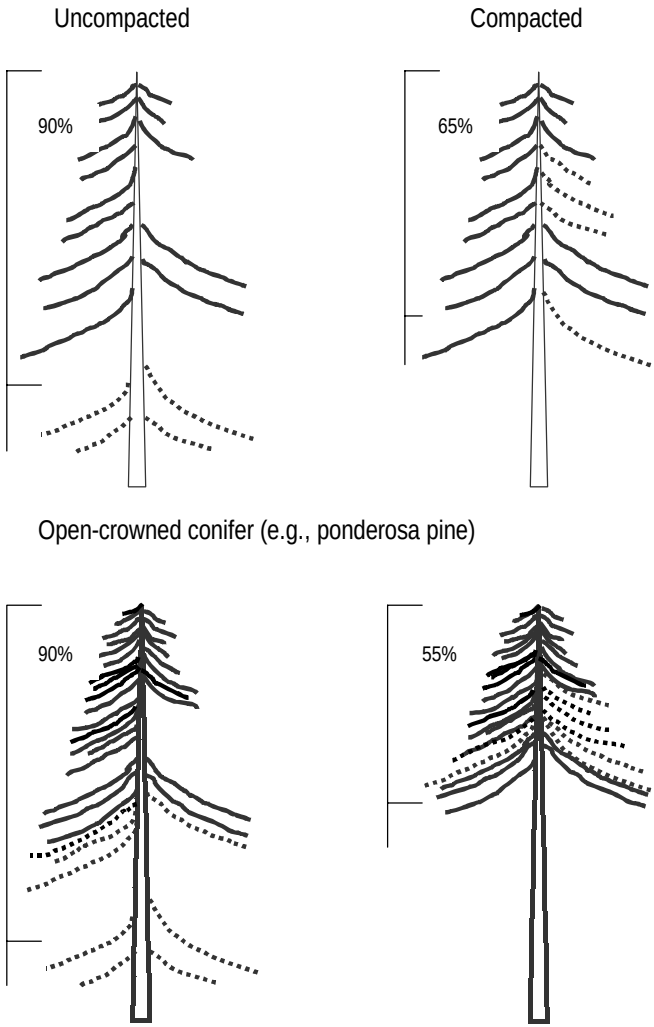
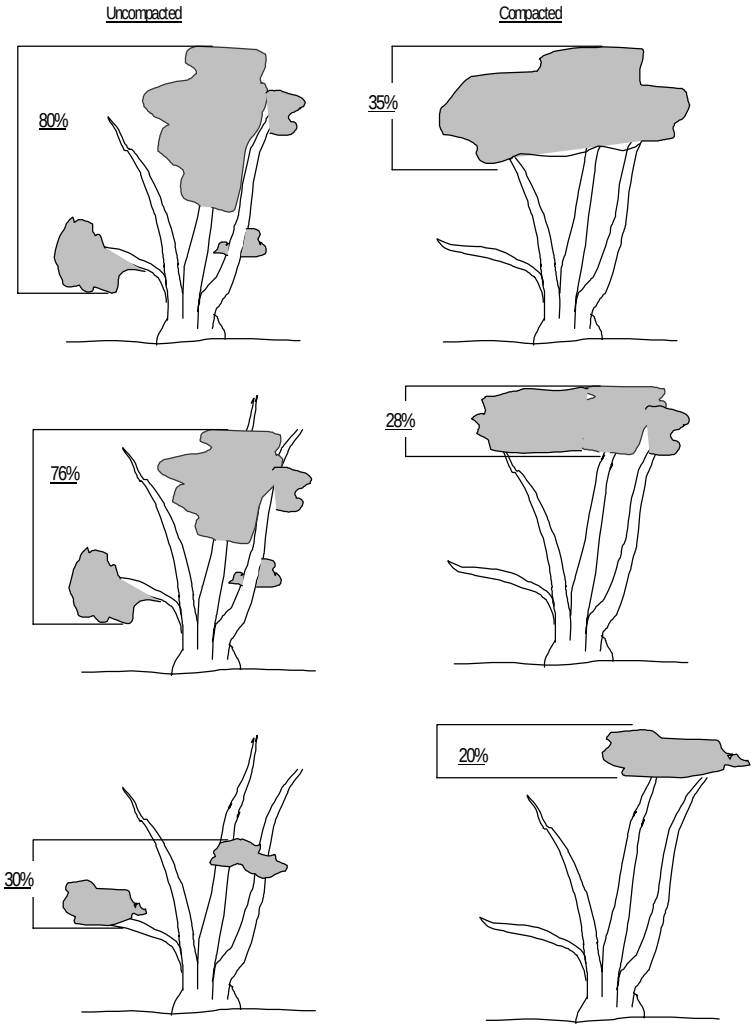


Figure 25. Examples of COMPACTED CROWN RATIO of western woodland species.



ITEM

445 **Crown Class.** (CORE)

When collected (CORE): All live tally trees ≥1.0-in DBH/DRC.
When collected (RMRS): All live tally trees ≥1.0-in DBH/DRC, and nontallied timber-species site trees.
Field width: 1 digit.
Tolerance: No errors.

CROWN CLASS is a categorization of a tree based on dominance in relation to adjacent trees in the stand. This dominance is indicated by crown development and amount of light received from above and the sides.

Each tree must be judged in the context of its immediate environment (that is, those trees affecting it or being affected by it in terms of crown competition).

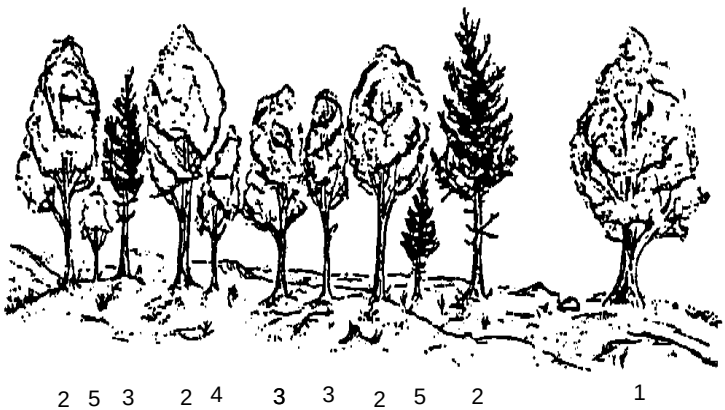
Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree which is now dominant due to tree removal is classified as dominant.

Code	Crown Class
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 crowns extending above the general level of the canopy and receiving full light from above and partial light from the sides. These trees are generally larger than the average trees in the stand, and have well-developed crowns that may 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	**Codominant** -- 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 generally shorter than those in the two preceding classes, with crowns either below or extending into the canopy formed by codominant and dominant trees. The crowns of these trees receive little direct light from above and none from the sides, are usually small, and are considerably crowded on the sides.
5	**Overtopped** -- trees with crowns entirely below the general canopy level and receiving no direct light from above or the sides.

CROWN CLASS definitions are most appropriate when considering a single-storied or clumpy/patchy canopy structure. However, in any type of canopy structure, classify each tree, as stated, in the context of its immediate environment. Therefore, a medium- or small-sized tree in a multistoried canopy structure that receives full light from above and partial light on the sides can be classified as a dominant tree.

Figure 27. Examples of CROWN CLASS definitions.



ITEM

447 **Cone Serotiny**. (RMRS)

When collected: All live lodgepole pine tally trees ≥ 5.0 in DBH.
Field width: 1 digit.
Tolerance: No errors.
Preprinted where previously recorded (SAMPLE KIND 2). Record the condition of the viable cones. Serotinous cones are those that mature but remain on the tree without opening for one or more years.

Code	Cone Serotiny
0	**No cones**
1	**Open cones** (less than 50% of the mature cones are closed)
2	**Closed cones** (more than 50% of the mature cones are closed)

456 **Dwarf Mistletoe Class.** (CORE OPTIONAL)

When collected (CORE): All live conifer (except juniper) tally trees ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: ±1 class.
Rate all live timber-species and pinyon tally trees, 1.0-inch DBH/DRC or larger, for **dwarf mistletoe** (Arceuthobium spp.) infection. Dwarf mistletoe occurs on larch, pines (including pinyon), and Douglas-fir (rarely true fir or spruce). Signs and symptoms include witches brooms (a massed dense clump of tree 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. Code mistletoe as damage (Item 450) for trees with a mistletoe class of 4 or more (unless more serious damages are present).

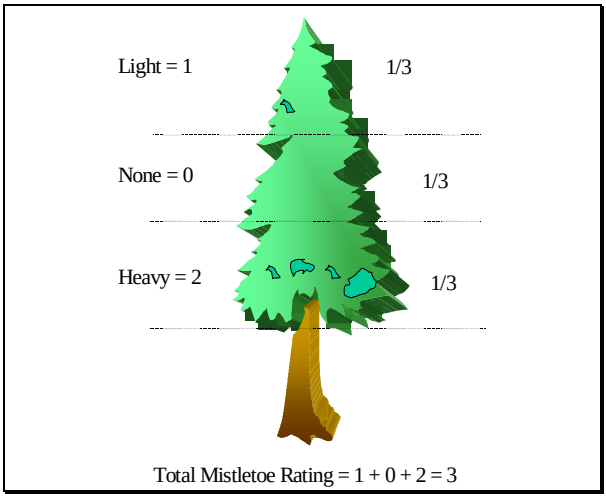
Use the following six-class mistletoe rating procedures:

- Divide live crown into thirds (figure 28);
- Rate each third separately for the amount of infection;

Rating	Amount of Infection (within the third)
0	**No visible infection**
1	**Light infection** -- one-half or fewer of the total branches infected
2	**Heavy infection** -- one-half or more of the total branches infected

- Add the three individual ratings of the thirds to obtain a total mistletoe rating for the tree; enter the total rating as the Mistletoe Class code.

Figure 28. Example six-class mistletoe rating.



CHAPTER 10 - PART II

450 Damage.

Record up to two different damages per tree. Damage is characterized according to three attributes: location of damage, type of damage, and severity of damage. Damages must meet severity thresholds (defined in ITEM 453 DAMAGE SEVERITY) in order to be recorded.

The tree is observed from all sides starting at the roots. Damage signs and symptoms are prioritized and recorded based on location in the following order: roots, roots and lower bole, lower bole, lower and upper bole, upper bole, crownstem, and branches recorded as location code 0 (for no damage), or DAMAGE LOCATION 1-9.

Within any given location, the hierarchy of damage follows the numeric order of DAMAGE TYPE possible for that location. The numeric order denotes decreasing significance as the code number goes up, i.e., DAMAGE TYPE 01 is more significant than DAMAGE TYPE 25. A maximum of two damages are recorded for each tree. If a tree has more than two damages that meet the threshold levels, the first two that are observed starting at the roots are recorded.

When multiple damages occur in the same place, the most damaging is recorded. For example, if a canker, DAMAGE TYPE 02, meets the threshold and has a conk growing in it, record only the canker. Another example: if an open wound meets threshold and also has resinosis, record only the open wound.

Multistemmed woodland trees: In the context of this damage protocol, each stem is considered a branch.

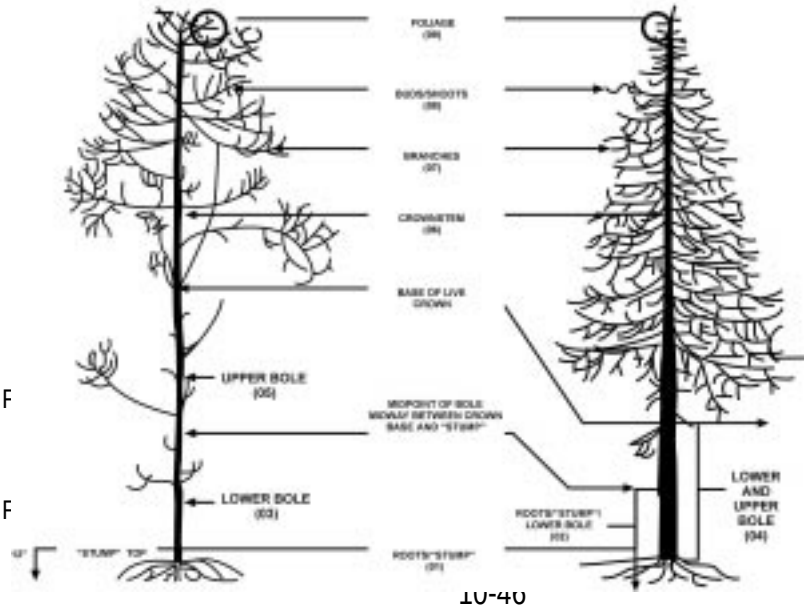
ITEM

451 **Damage Location 1.** (CORE)

When Collected (CORE): All live tally trees ≥ 5.0 in DBH/DRC.
When collected (RMRS): Record for all live tally trees ≥ 5.0 in DBH/DRC and all nontallied site trees.
Field Width: 1 digit.
Tolerance: ± 1 location class.
Record the location on the tree where DAMAGE TYPE 1 is found (Figure 29). If the same damage continues into two or more locations, record the appropriate code listed below, or if the combination of locations does not exist (damage extends from crownstem to roots), record the lowest location that best describes the damage (see Figure 30). Multiple damages may occur in the same location, but record the higher priority damage (lower code number) first. If the damages are coincident (a conk within a canker), record only the higher priority damage.

The "base of the live crown" is defined as the horizontal line which would touch the lowest part of the foliage, excluding branches towards the base of the tree which are less than 1.0 inch or more than 5 ft from the rest of the crown. See Item 443 (Uncompacted Crown Ratio) for more details.

Figure 29. Location codes for damage.



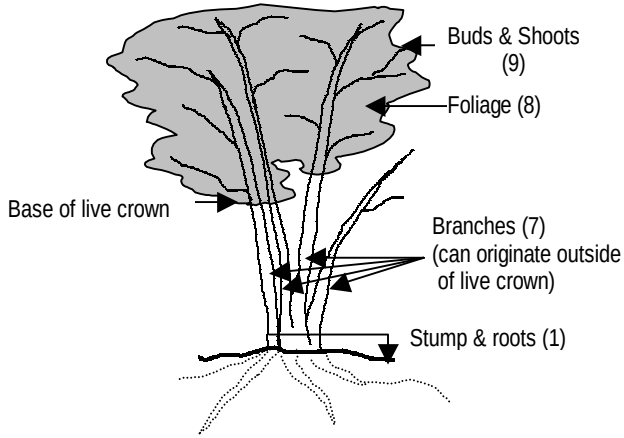
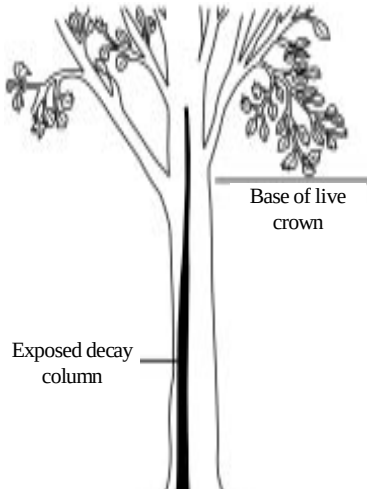


Figure 30. Damage location example.



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

ITEM

451 **Damage Location 1** (contd).

Code	Damage
0	No damage
1	Roots (exposed) and stump (12 inches in height from ground level)
2	Roots, stump, and lower bole
3	Lower bole (lower half of the trunk between the stump and base of the live crown)
4	Lower and upper bole
5	Upper bole (upper half of the trunk between stump and base of the live crown)
6	Crownstem (main stem within the live crown area, above the base of the live crown)
7	Branches (>1 in at the point of attachment to the main crown stem within the live crown area)
8	Buds and shoots (the most recent year's growth)
9	Foliage

452 **Damage Type 1.** (CORE)

When collected (CORE): All tally trees where DAMAGE LOCATION 1 > 0.
Field width: 2 digits.
Tolerance: No errors.

Record the first damage type observed that meets the damage threshold definition in the lowest location. Damage categories are recorded based on the numeric order that denotes decreasing significance from damage 01 - 31.

Code	Damage Type
01	Canker, gall: Cankers may be caused by various agents but are most often caused by fungi. The bark and cambium are killed, and this is followed by death of the underlying wood, although the causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider, or galling (including galls caused by rusts), on roots, bole, or branches. Due to the difficulty in distinguishing some abnormal swellings (e.g., burls) from classic galls and cankers, all are recorded as damage 01. A canker may be: **Annual** (enlarges only once and does so within an interval briefer than the growth cycle of the tree, usually less than one year), **Diffuse** (enlarges without characteristic shape or noticeable callus formation at margins), or **Perennial** (enlarges during more than one year - often has a target appearance).

ITEM

452	**Damage Type 1** (contd).	
	02	Conks, fruiting bodies, and signs of advanced decay: Fruiting bodies on the main bole, crownstem, and at the point of the branch attachment are signs of decay. "Punky wood" is a sign of decay and is evidenced by soft, often moist, and degraded tissue. Cavities into the main bole that are oriented in such a way that they act as catchment basins for water are signs of decay. Bird cavities are signs of decay. Rotten branches or branches with conks **are not indicators of decay unless** the threshold is met (.20% of branches are affected). Rotting stumps associated with coppice regeneration (e.g., northern pin oak, maple) are excluded from coding.
	03	Open wounds: An opening or series of openings where bark has been removed or the inner wood has been exposed and no signs of advanced decay are present. Improper pruning wounds that cut into the wood of the main stem are coded as open wounds, if they meet the threshold; those which leave the main stemwood intact are excluded.
	04	Resinosis or gummosis: The origin of areas of resin or gum (sap) exudation on branches and trunks.
	05	Cracks and seams (• 5 ft long): Cracks in trees are separations along the radial plane. When they break out to the surface they often are called frost cracks. These cracks are not caused by frost or freezing temperature, though frost can be a major factor in their continued development. Cracks are most often caused by basal wounds or sprout stubs, and expand when temperatures drop rapidly. Seams develop as the tree attempts to seal the crack, although trees have no mechanism to compartmentalize this injury. Lightning strikes are recorded as cracks when they do not meet the threshold for open wounds.

452 **Damage Type 1** (contd).

11	Broken bole or roots (less than 3 ft from bole): Broken and dead roots within 3 ft from bole either from excavation or rootsprung for any reason. For example, those which have been excavated in a road cut or by animals. Stem broken in the bole area (below the base of the live crown) and tree is still alive.
12	Brooms on roots or bole: Clustering of foliage about a common point on the trunk. Examples include ash yellows witches' brooms on white and green ash and eastern and western conifers infected with dwarf mistletoes
13	Broken or dead roots (beyond 3 ft): Roots beyond 3 ft from bole that are broken or dead.
20	Vines in the crown: Kudzu, grapevine, ivy, dodder, etc. smothers tree crowns. Vines are rated as a percentage of tree crown affected.
21	Loss of apical dominance, dead terminal: Mortality of the terminal of the crownstem caused by frost, insect, pathogen, or other causes.
22	Broken or dead: Branches that are broken or dead. Branches with no twigs are ignored and not coded as dead. Dead or broken branches attached to the bole or crownstem outside the live crown area are not coded. 20% of the main, first order portion of a branch must be broken for a branch to be coded as such.
23	Excessive branching or brooms within the live crown area: Brooms are a dense clustering of twigs or branches arising from a common point that occur within the live crown area. Includes abnormal clustering of vegetative structures and organs. This includes witches' brooms caused by ash yellows on green and white ash and those caused by dwarf mistletoes.
24	Damaged buds, foliage or shoots: Insect feeding, shredded or distorted foliage, buds or shoots >50% affected, on at least 30% of foliage, buds or shoots. Also includes herbicide or frost-damaged foliage, buds or shoots.
25	Discoloration of foliage: At least 30% of the foliage is more than 50% affected. Affected foliage must be more of some color other than green. If the observer is unsure if the color is green, it is considered green and not discolored.

ITEM

452 **Damage Type 1** (contd).

31	Other: Use when no other explanation is appropriate. Specify in "tree notes" section. Code 31 is used to maintain consistency with the Phase 3 crown damage protocols.

Legal Combinations of Damage Type by Damage Location:

For each of the following location codes, possible damage codes and damage definitions are presented. Minimum damage thresholds are described in Item 453 Damage Severity.

Location 1: Roots and stump	
01	Canker, gall -- exceeds 20% of circumference of stump
02	Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03	Open wounds -- exceeds 20% of circumference of stump
04	Resinosis or gummosis -- origin of flow width exceeds 20% of circumference of stump
05	Cracks and seams -- any occurrence
11	Broken bole or roots less than 3 ft from bole -- any occurrence
12	Brooms on roots or bole -- any occurrence.
13	Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead
31	Other
Location 2: Roots, stump, and lower bole	
01	Canker, gall -- exceeds 20% of circumference of stump
02	Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03	Open wounds – exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of the circumference of stump
04	Resinosis or gummosis -- origin of flow width exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of circumference of stump.
05	Cracks and seams - any occurrence
11	Broken bole or roots less than 3 ft from bole -- any occurrence
12	Brooms on roots or bole - -any occurrence.
13	Broken or dead roots -- exceeds 20% of roots, beyond 3 ft from bole, broken or dead
31	Other

Legal Combinations of Damage Type by Damage Location: (contd).

Location 3:	Lower bole
01	Canker, gall -- exceeds 20% of circumference at the point of occurrence
02	Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03	Open wounds -- exceeds 20% of circumference at the point of occurrence
04	Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05	Cracks and seams -- any occurrence
11	Broken bole or roots less than 3 ft from bole -- any occurrence
12	Brooms on roots or bole -- any occurrence
31	Other
Location 4:	Lower and upper bole -- same as lower bole.
Location 5:	Upper bole - same as lower bole.
Location 6:	Crownstem
01	Canker, gall -- exceeds 20% of circumference of crownstem at the point of occurrence
02	Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03	Open wounds - exceeds 20% of circumference at the point of occurrence -- any occurrence
04	Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05	Cracks and seams -- all woody locations -- any occurrence.
21	Loss of apical dominance, dead terminal -- any occurence
31	Other

Legal Combinations of Damage Type by Damage Location: (contd).

Location 7:	Branches >1 in at the point of attachment to the main or crown stem.
01	Canker, gall -- exceeds 20% of circumference on at least 20% of branches
02	Conks, fruiting bodies and signs of advanced decay -- more than 20% of branches affected
03	Open wounds -- exceeds 20% of circumference at the point of occurrence on at least 20% of branches
04	Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence on at least 20% of branches
05	Cracks and seams -- all occurrences, and on at least 20% of branches
20	Vines in the crown -- more than 20% of live crown affected
22	Broken or dead -- more than 20% of branches affected within the live crown area
23	Excessive branching or brooms -- more than 20% of branches affected
31	Other
Location 8:	Buds and shoots
24	Damaged buds, shoots or foliage - more than 30% of buds and shoots damaged more than 50%.
31	Other

Location 9:	Foliage
24	Damaged buds, shoots or foliage - more than 30% of foliage damaged more than 50%.
25	Discoloration of foliage - more than 30% of foliage discolored more than 50%.
31	Other

ITEM

453 **Damage Severity 1.** (CORE)

When Collected (CORE): All tally trees where DAMAGE LOCATION 1 > 0.
Field width: 2 digits.
Tolerance: No errors.
Record a code to indicate the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for TREE
DAMAGE 1. Severity codes vary depending on the type of damage recorded.

For multistemmed woodland trees, severity for branches is the percentage of basal area of the stems meeting threshold. For example, if a tree with 3 live stems (5.6", 8.2", 3.5" DRC) has 1 stem meeting a damage threshold (5.6"), severity is calculated as:

$$\frac{(5.6)^2}{(5.6)^2+(8.2)^2+(3.5)^2} = 28\%$$

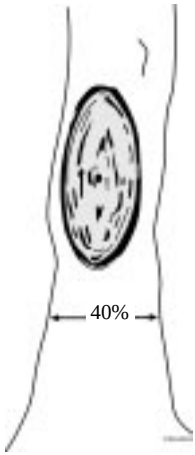
DAMAGE TYPE Code 01 -- Canker, gall

Measure the affected area from the margins (outer edges) of the canker or gall within any 3-ft vertical section in which at least 20% of circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 31.

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

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

Figure 31. Example of damage threshold



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

ITEM

453 **Damage Severity 1** (contd).

DAMAGE TYPE Code 02 -- Conks, fruiting bodies, and signs of advanced decay

Severity classes for code 02: None. Enter code 0 regardless of severity, except for roots > 3 ft from the bole, or number of branches affected - 20%

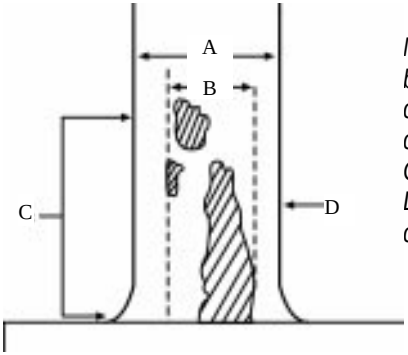
DAMAGE TYPE Code 03 -- Open wounds

The damaged area is measured at the widest point between the margins of the exposed wood within any 3-ft vertical section in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 32.

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

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

Figure 32. Example of multiple damages.



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

453 **Damage Severity 1** (contd).

DAMAGE TYPE Code 04 -- Resinosis or gummosis

Resinosis or gummosis is measured at the widest point of the origin of the flow width in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

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

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

DAMAGE TYPE Code 05 -- Cracks and seams

Severity class for code 05

Record "0" for the lowest location in which the crack occurs. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

453 **Damage Severity 1** (contd).

DAMAGE TYPE Code 11 -- Broken bole or roots less than 3 ft from bole

Severity classes for code 11: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 12 -- Brooms on roots or bole

Severity classes for code 12: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 13 -- Broken or dead roots

At least 20% of roots beyond 3 ft from bole that are broken or dead.

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

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

DAMAGE TYPE Code 20 -- Vines in crown

Severity classes for code 20 (percent of live crown affected):

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

ITEM
453

Damage Severity 1 (contd).

DAMAGE TYPE Code 21 -- Loss of apical dominance, dead terminal

Any occurrence (> 1%) is recorded in 10% classes as a percent of the crownstem affected. Use trees of the same species and general DBH/DRC class in the area or look for the detached portion of the crownstem on the ground to aid in estimating percent affected. If a lateral branch has assumed the leader and is above where the previous terminal was, then no damage is recorded.

Severity classes for code 21:

Classes	Code
01-09	0
10-19	1
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 22 -- Broken or dead branches (> 1in above the swelling at the point of attachment to the main or crown stem within the live crown area)

At least 20% of branches are broken or dead.

Severity classes for code 22 (percent of branches affected):

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

ITEM

453 **Damage Severity 1** (contd).

DAMAGE TYPE Code 23 -- Excessive branching or brooms

At least 20% of crownstem or branches affected with excessive branching or brooms.

Severity classes for code 23 (percent of area affected):

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

DAMAGE TYPE Code 24 - Damaged buds, shoots or foliage

At least 30% of the buds, shoots or foliage (i.e., chewed or distorted) are more than 50% affected.

Severity classes for code 24:

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

ITEM

453 **Damage Severity 1** (contd).

DAMAGE TYPE Code 25 - Discoloration of Foliage

At least 30% of the foliage is more than 50% affected.

Severity classes for code 25 (percent affected):

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

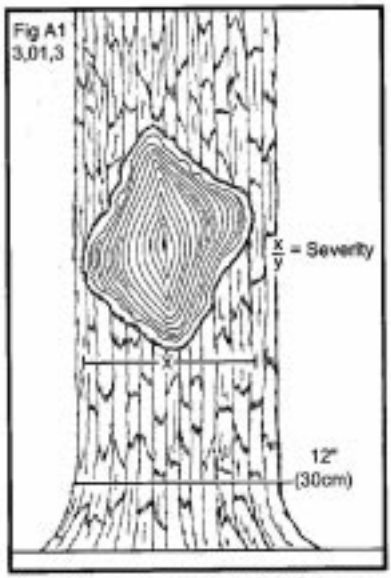
DAMAGE TYPE Code 31 -- Other

Severity classes for code 31:

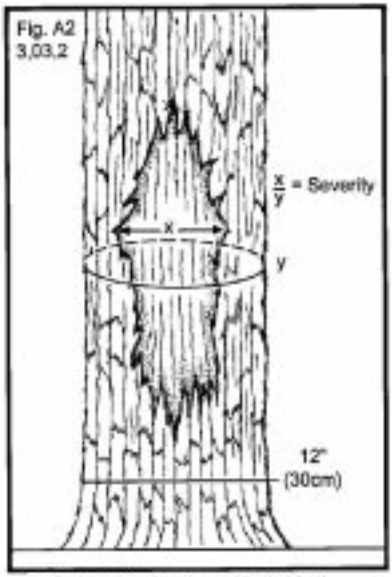
None. Enter code 0 regardless of severity. Describe condition in tree notes.

Examples are shown in figure 33.

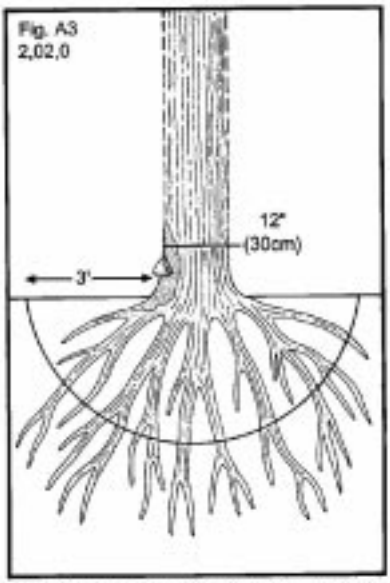
Figure 33. Examples of damage coding.



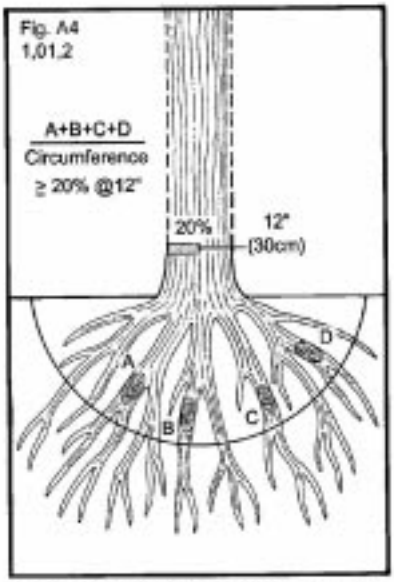
01 - Canker measured as widest distance between the outside of canker swelling (refer to Fig. 2 for y measurement)



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

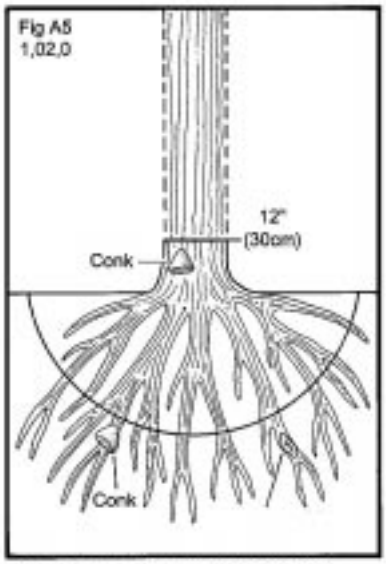


02 - Decay indicator on roots and lower bole

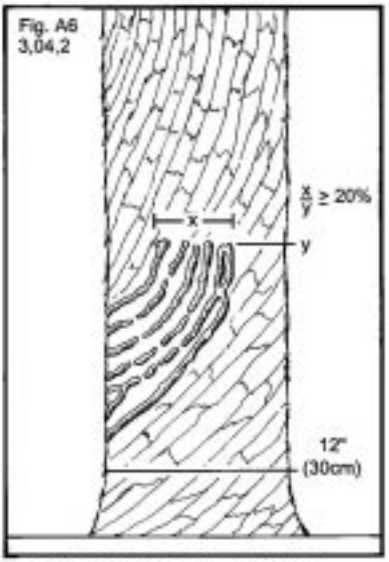


01 - Canker / gall on roots (within 3' of bole)

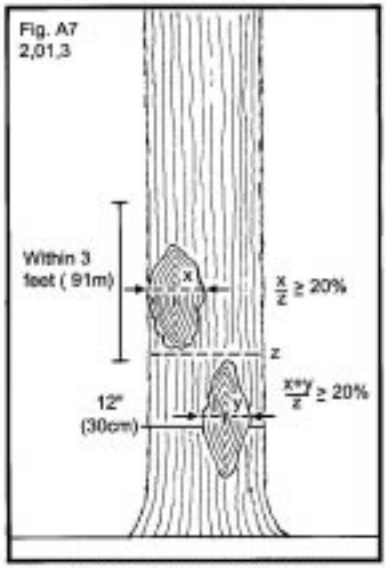
Figure 33. Examples of damage coding (contd).



02 - Indicator of decay within 3' of bole. Beyond 3" of bole, indicators must affect ≥ 20% of roots (see fig. 12)



04 - Origin of resinosis in lower bole

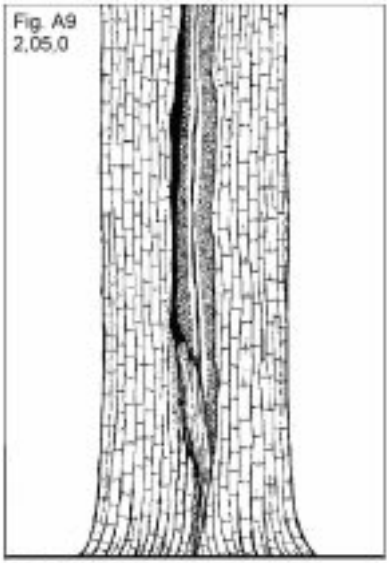


01 - Additive cankers within 3' in roots and lower bole

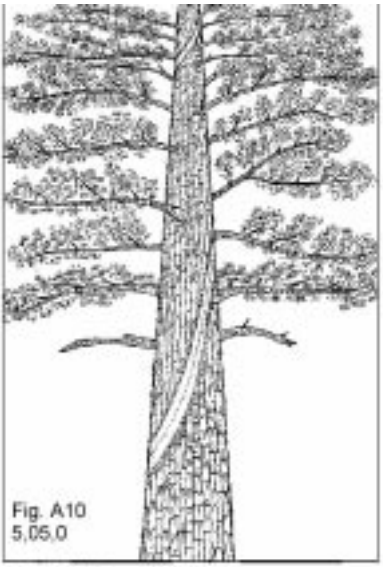
02 - Conks separated by >3'; 2 damages

.

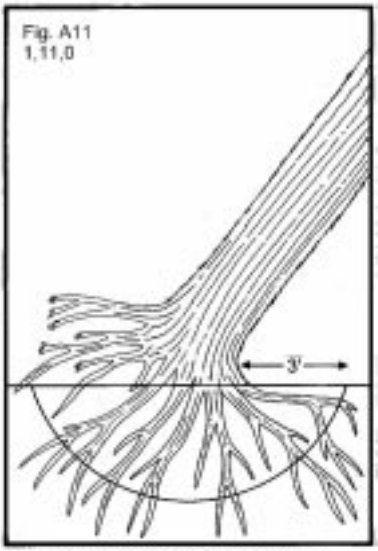
Figure 33. Examples of damage coding (contd).



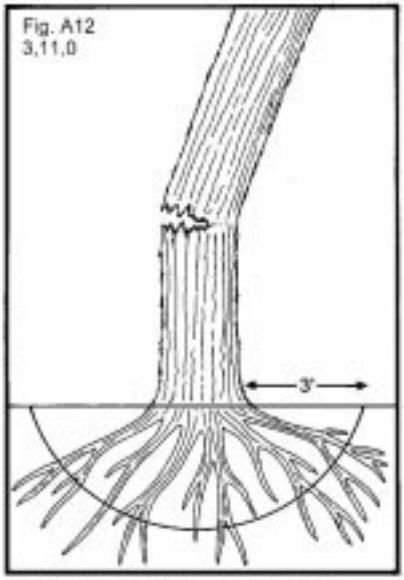
05- Cracks and seams



05 - Lightning strike

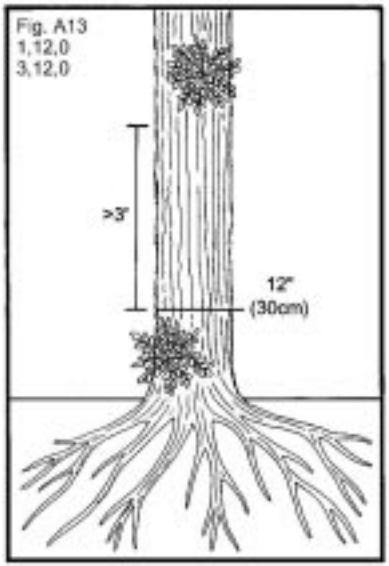


11 - Broken bole or roots <3' from bole, broken roots must be visible

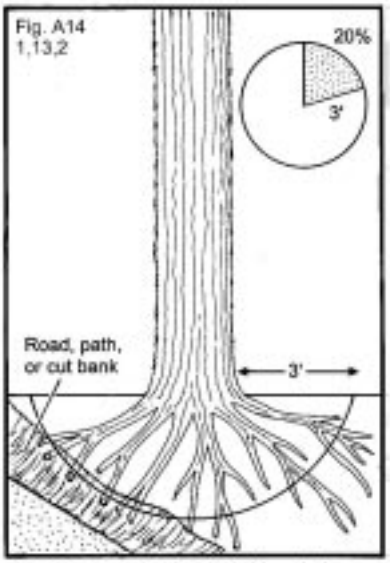


11 - Broken bole or roots <3' from bole

Figure 33. Examples of damage coding (contd).

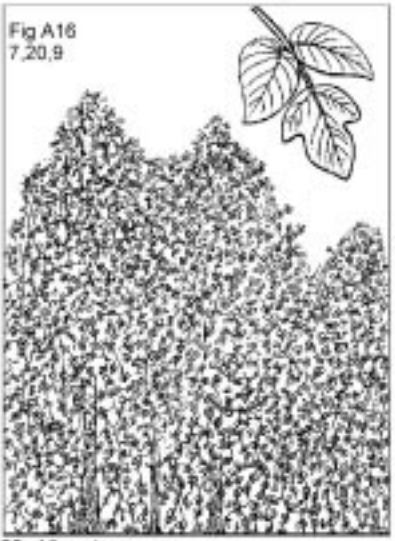


12 - Brooms on roots or bole



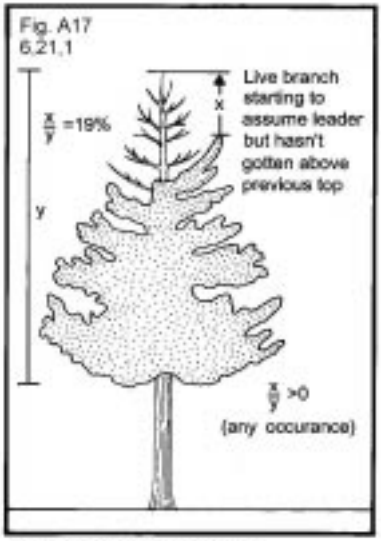
13 - Broken or dead roots >3' from bole

20 - Vines in crown

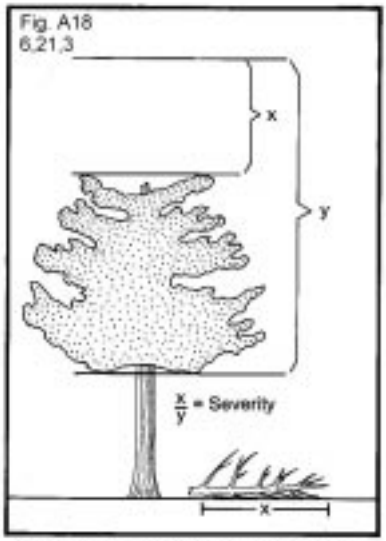


20 - Vines in crown

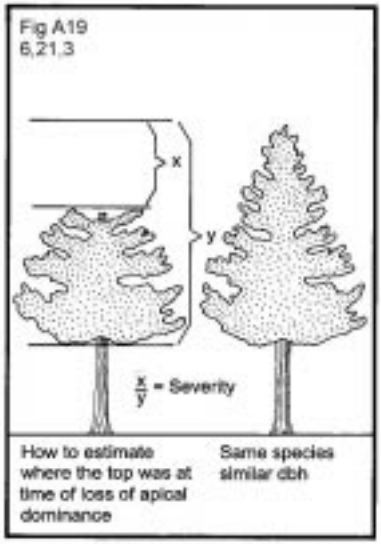
Figure 33. Examples of damage coding (contd).



21 - Loss of apical dominance



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

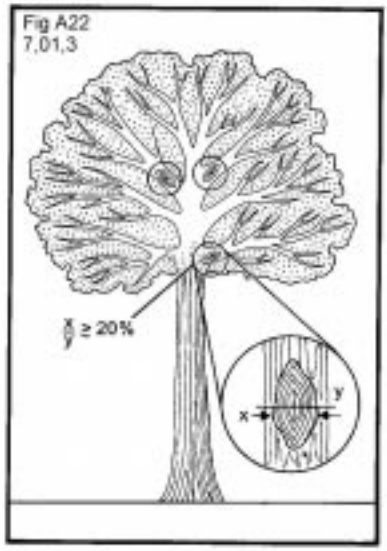


21 - Loss of apical dominance, look for same species of similar dbh

01 - Cankers above the threshold on ≥ 20% of branches

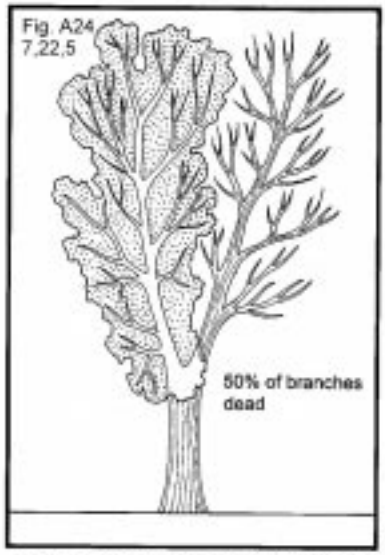
Figure 33. Examples of damage coding (contd).

02 - Conks on ≥ 20% of branches



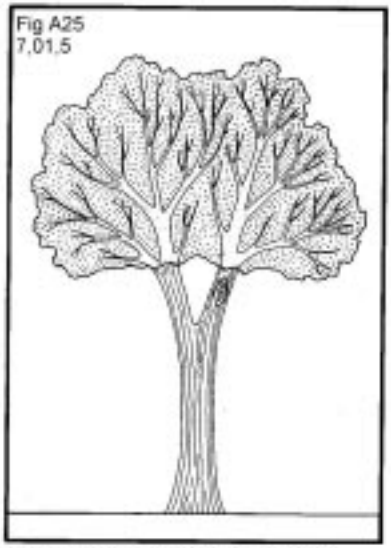
01 - Cankers above threshold on ≥ 20% of branches

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

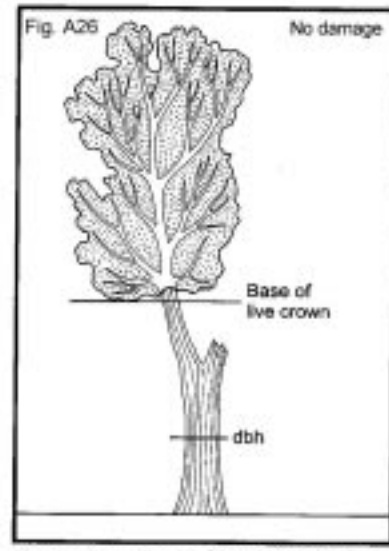


22 - Dead branches; only 2 branches present within live crown area, fines present and ≥20% of branch dead

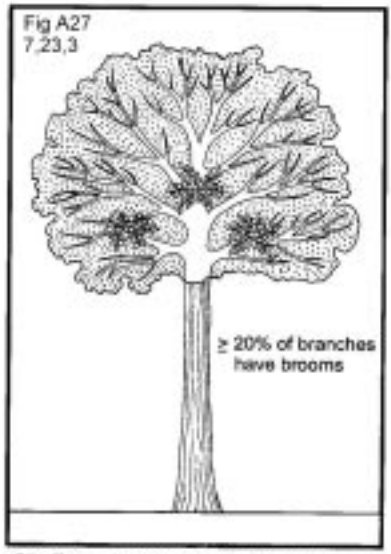
Figure 33. Examples of damage coding (contd).



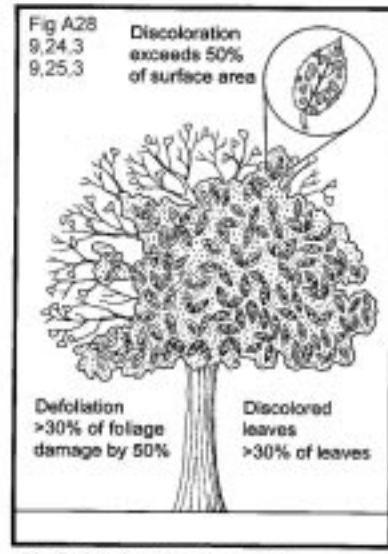
01 - Canker; no crown stem and only 2 branches present



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



23 - Excessive branching or brooms in crown



24 - Defoliation, 25 - Discoloration

Procedures to Record Multiple Occurrences of the Same Damage

Damage codes 01 (canker), 03 (open wounds), and 04 (resinosis/gummosis) must meet a threshold of 20 percent of the circumference at the point of occurrence, within any 3-ft section. Multiple cankers or open wounds which are directly above one another pose no more threat to long term tree survival than would a single damage incidence of the same width. However, should multiple damages be located horizontally within any 3-ft section, the translocation of water and nutrients would be significantly affected. The widths of each individual damage are added and compared as a percent, to the total circumference at the midpoint of the 3-ft section (Figure 32).

Procedures to Measure Circumference Affected

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40% of the circumference of a face can be observed at any one time. The damage is measured horizontally between the margins. If the cumulative area affected within a 3-ft section exceeds 1/2 of any face, then the 20% minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10% classes. If in doubt, measure the damage and circumference at the widest point of occurrence on the bole with a linear tape, and determine the percent affected.

ITEM
454 **Damage Agent 1.** (RMRS)

When Collected: All tally trees where DAMAGE TYPE 1 > 0 and for nontally site trees.
Field width: 2 digits.
Tolerance: No errors 80% of the time.
Record the damage that caused Damage Type 1.

	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

ITEM

454 **Damage Agent 1** (contd).

	Code	Damage
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.

Damage Definitions (contd).

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).

Damage Definitions (contd).

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 (Item 456, page 10-45).

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.

Damage Definitions (contd).

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.

Damage Definitions (contd).

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.

Damage Definitions (contd).

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.

Damage Definitions (contd).

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.

Damage Definitions (contd).

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.

ITEM

451 **Damage Location 2.** (CORE)

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

452 **Damage Type 2.** (CORE)

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

453 **Damage Severity 2.** (CORE)

Record the amount of affected area (above threshold) in DAMAGE LOCATION 2 recorded for DAMAGE TYPE 2. Follow the same procedures as for DAMAGE SEVERITY 1.

454 **Damage Agent 2.** (RMRS)

Record the damage that caused Damage Type 2. Follow the same procedures as for DAMAGE AGENT 1.

457 **Other Damage Agent.** (RMRS)

When Collected: All tally trees $\geq$ 5.0 inches diameter and nontally site trees.
Field width: 2 digits.
Tolerance: No errors.
Use the damages listed in DAMAGE AGENT 1.
Record other damage agent when a damage, not coded in damage agent 1 or 2, is severe enough to prevent tree from living to maturity (or surviving 10 or more years, if already mature), prevent tree from producing marketable products, or reduce the quality of the tree's products.

ITEM

458 **Decay Class.** (CORE)

When collected (CORE): All standing dead tally trees ≥ 5.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: ±1 class.
Record for each standing dead tally tree, 5.0 inches in diameter and larger, the code indicating the trees stage of decay.

Use the chart on the next page as a guide for decay class. Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

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

ITEM

465 **Percent Volume Missing Top.** (RMRS)

When Collected: All tally trees ≥ 5.0 inches in diameter, missing a portion of the merchantable top (i.e. missing a portion of the top with a DOB ≥ 4.0 inches).
Field width: 2 digits.
Tolerance: ±5% for total deductions ≤20%, 90% of the time, and ±10% for total deductions >20%, 90% of the time.
Record the percent volume of the missing merchantable top. Do not include any portion of the missing top that is < 4.0 inches DOB in the volume estimate. Many broken topped trees will have 0% volume missing top because no merchantable volume was lost. For multistemmed woodland trees, record 0.

460-462 **Percent Volume Loss - Rotten and Missing (460)** (CORE), **Sound Dead (461)** (CORE OPT), **and Form Defect (462)**(RMRS).

When Collected (RMRS): All tally trees ≥ 5.0 inches diameter (FORM DEFECT to be recorded on live timber species • 5.0 inches diameter only, FORM DEFECT not to be recorded for woodland species).
Field width: 2 digits.

Tolerance: ±5% for total deductions ≤20%, and ±10% for total deductions >20% for standing trees.
± 20% for down dead trees.

Using the general Seen Defect Guidelines provided (supplement), along with any other evidence, record the percentage of rotten and missing volume (less the PERCENT VOLUME MISSING TOP), sound dead volume, and form defect (live timber species only), to the nearest 1 percent, for all tally trees **5.0-inch** DBH/DRC and larger. When estimating volume loss (tree cull) only consider the cull on the merchantable bole/portion of the tree. **Do not include any cull estimate above ACTUAL LENGTH.**

ITEM

460-462 **Percent Volume Loss** (contd).

The **merchantable bole on a timber species** is defined as the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter.

The **merchantable portion of a woodland species** is defined as the portion of a tree, with at least 1 stem 3.0-inches DRC or larger, up to a minimum top diameter of 1.5-inches, and includes all qualifying segments above the place(s) of diameter measurement; do not include sections below the place(s) of diameter measurement. Qualifying segments are stems or branches that are a minimum of 1.0 foot in length and at least 1.5 inch in diameter (at the top). Branches and stems smaller than 1.5 inches in diameter (or portions of branches and stems smaller than 1.5 inches in diameter, such as tips of branches) are **not** included when determining volume loss.

Use the following guidelines to estimate tree cull:

a. **Timber species, 5.0-inches DBH and larger.** Refer to table 2 and supplemental guidelines to compute volume loss.

(1) **Rotten and missing volume (Item 460)** loss is often difficult to estimate. Use your best judgment and be alert to such defect indicators as the following:

- Cankers or fruiting bodies.
- Swollen or punky knots.
- Dull, hollow sound of bole when struck with an ax.
- Large dead limbs, esp. those with frayed ends.
- Sawdust around the base of the tree.

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

Refer to supplemental disease and insect pests field guides as an aid in identifying damaging agents and their impact on volume loss. Refer to appendix C.5 for a guide to estimating circular internal defect.

guide for estimating circular internal defect (defect deduction table).

(2) Sound dead volume (Item 461) loss can be detected by cutting into a tree with a hatchet and examining the soundness of the wood. Sound dead wood can be caused by insect or animal girdling, lightning or fire damage, etc.

(3) Form defect volume (Item 462). 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 section.

b. Woodland species tally trees ≥ 5.0-inches DRC and at least 1 stem 3.0-inches DRC and larger.

(1) **Rotten volume (Item 460)** may be identified by visual evidence of cubical rot, or indirectly detected by a dull hollow sound when the segment is struck by the flat side of a hatchet. Also, if a tree segment is suspected of containing rot, bore into the segment (but only far enough to detect rot), and check the core for punky wood.

(2) **Missing volume (Item 460)** includes the merchantable portion of the tree that has been cut (e.g., for posts or firewood) or is broken off. If cutting or other damage (fire scar) on a stem is so old that the tree stem or stub has deteriorated or has been replaced with new growth, do not deduct volume for the original loss.

(3) **Sound dead volume (Item 461)** 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.

Note: The above procedures meet and exceed core requirements for percent rotten/missing cull and percent rough cull.

ITEM

463 **Past Tree Class**. (RMRS)

When collected: Verify for remeasure trees ≥ 1.0 inch DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
This is the TREE CLASS assigned at the previous inventory. It has been downloaded from the previous inventory. If the PAST TREE CLASS is obviously wrong (past recorded as 6 and tree is still alive), record a new PAST TREE CLASS.

464 **Current Tree Class**. (RMRS)

When collected: All tally trees ≥ 1.0 inch and nontallied site trees, including new trees ≥ 1.0 in DBH/DRC on center microplot.
Field width: 1 digit.
Tolerance: No errors 90% of the time.
Base the Tree Class code on the information collected in Items 460, 461, and 462.

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.

ITEM

464 **Current Tree Class** (contd).

- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound dead wood volume loss or severe form-defect volume loss.
- a live tree, 5.0-inches DBH or larger, that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

Code	Tree Class
4	**Rotten (live) - timber species**

- a live tree, 5.0-inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.

5 **Hard dead**

- a standing or down dead tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).

6 **Soft dead**

- a standing or down dead tree, 1.0-inch DBH/DRC or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

ITEM

430 **Radial Growth** and
431 **Tree Age.** (RMRS)

When collected: see below.
Field width: RADIAL GROWTH = 2 digits, TREE AGE = 3 digits.
Tolerance: RADIAL GROWTH ±1/20-inch.
Age ±5%.
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. Refer to appendix C.3 for instructions on boring trees for radial growth and age.

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:

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

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 1 for "RADIAL GROWTH AND TREE AGE CHECK". **Note:** For QA/QC purposes, be sure to make note of which previously inventoried tree is used (tree number) to determine RADIAL GROWTH or Tree Age.

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

ITEM

430/431 **Radial Growth and Tree Age** (contd).

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

(1) **Timber species**

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

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

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

Diam. Class	Class Range (DBH, inches)
Seedling	0.0 - 0.9 (count whorls/scars): age only
2"	1.0 - 2.9 (age at base): age only
4"	3.0 - 4.9 (age at BH): age and radial
6"	5.0 - 6.9 |
etc.	(2-inch classes)

Note: Do not bore aspen or birch tally trees on the subplot area; these trees are highly susceptible to rot and damage. Instead, locate an aspen or birch tree of the same diameter class to bore for AGE and RADIAL GROWTH measurements within 60 feet of the subplot, if possible. Record this age and radial in the tally tree data.

Select age and radial-growth trees as they are tallied across the subplots, regardless of what order the subplots are sampled:

ITEM

430/431 **Radial Growth and Tree Age** (contd).

(a) Select the first timber species tallied by diameter class and species type across the subplots. Obtain age for all trees selected, and radial growth for trees in the 4-inch diameter class and larger. For the seedling class, select the first seedling group counted in each species on the location and obtain AGE only.

(b) For trees in the 4-inch diameter class and larger, also select the second timber species tallied across the subplots, by diameter class and species type, and obtain RADIAL GROWTH only. To help distribute trees, always select the radial growth tree from a different subplot than the age/growth tree selected in (a) above. **Note:** If a second tree is not tallied on a different subplot, the second RADIAL GROWTH measurement is not required.

For example (subplot 1 measured first, and subplot 2 measured second):

	DBH	Species	Diameter Class	Bore for Age	Bore for Radial Growth
Subplot 1:	8.1	Douglas-fir	8"	X	X
	7.2	Douglas-fir	8"		
	5.1	Douglas-fir	6"	X	X
	5.2	White pine	6"	X	X
	6.9	White pine	6"		
	4.1	White pine	4"	X	X
	3.2	White pine	4"		
		White pine	seedling	X	
Subplot 2:	9.3	Douglas-fir	10"	X	X
	8.6	Douglas-fir	8"		X
	7.2	Douglas-fir	8"		
	6.1	White pine	6"		X
	3.8	White pine	4"		X
	2.2	White pine	2"	X	
		White pine	seedling		

ITEM

430/431 **Radial Growth and Tree Age** (contd).

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 8-inch Douglas-fir class and the 6-inch, 4-inch, and seedling white pine classes. In addition, the age requirements are met for the 10-inch and 6-inch Douglas-fir classes, and the 2-inch pine class. However, given the types of species and diameter classes tallied so far, one more live sound Douglas-fir in the 10-inch class, and one in the 6-inch class, if tallied on subplots 3 or 4, need to be bored for RADIAL GROWTH.

(2) **Woodland species.** For each woodland genus group tallied across the subplots, select one representative live tally tree within each size class tallied (refer to STAND-SIZE CLASS). If the age cannot be determined in the field, leave age/growth blank (record 000 for age and 00 for radial growth on paper forms).

For each of the selected trees, bore one total age core. Count whorls or estimate age if seedlings represent the seedling/sapling size class. **Important:** Do not bore dead trees, and do not bore cercocarpus species or desert ironwood.

If the total age and growth cannot be determined in the field, send the cores to the office for measurement. Glue cores into a core holder; for pinyon cores, glue with the resin ducts up. On the side of the core holder, place arrows indicating the outside end (bark end) of the cores, and record the appropriate codes for items listed below.

(a) **Species groups.** Woodland genus groups for boring are as follows:

- oak (codes 800-850)
- maple (code 322)
- juniper (codes 058-069)
- pinyon (codes 106, 133, 134, 140, 143)
- mesquite (codes 755-758)

ITEM

430/431 **Radial Growth and Tree Age** (contd).

(2) **Woodland species** (contd).

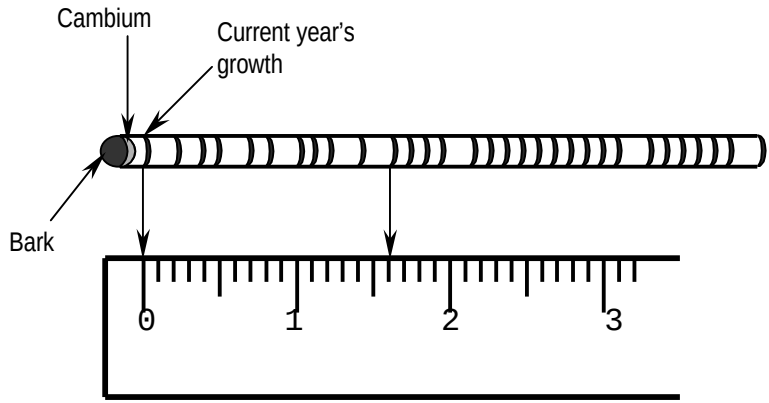
(b) **Saving cores.** Glue the cores into a core holder and label the core holder with the following:

- State
- County
- Location Number
- Subplot Number
- Tree Number
- Species
- Total DBH/DRC of tree
- DRC of stem

Note: Do not place age cores from more than one State or county on a single core holder. After the cores are glued, wrap the core holder in flagging to protect the cores, and record the State, County number, Location number(s) on the flagging.

b. **Radial-growth measurement** (timber species, 4-inch diameter class and larger). Measure the last 10 years of RADIAL GROWTH from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. To reduce bias, bore on the side of the tree facing the subplot center, where reasonable. Using a ruler with a 1/20-inch scale, measure the length of the core from the inner edge of the last (most recent) complete summer wood ring to the inner edge of the summer wood ring 10 years previous (figure 34).

Figure 34. Radial growth measurement.



ITEM

430/431 **Radial Growth and Tree Age** (contd).

c. **Age tree measurement (**timber species).

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

- **2-inch diameter class (1.0- to 2.9-inches DBH) age trees:** Measure and record **total tree age**. Use the following methods:

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

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

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

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

- **4-inch diameter class and larger age trees:** Measure and record breast height **(BH)** age. Count the growth rings from an increment core taken immediately below the point of diameter measurement and at a right angle to the bole. Bore on the side of the tree facing the subplot center, where reasonable. Count every growth ring from the bark end to the pith (center of the tree). If the age is difficult to determine (e.g., due to indistinct rings, presence of rot), or if the pith was not reached (e.g., diameter too big to bore to center) estimate the age and note in the comments column.

d. Radial-growth and age tree coding.

(1) Radial growth. Record the radial-growth measurement as a two-digit code; for example, record 6/20 as 06, and record 23/20 as 23.

(2) Age tree coding. Record Tree Age as a three-digit number. For example, record 29 years as 029, and record 195 years as 195.

ITEM

432 **Radial Growth and Tree Age Check**. (RMRS)

When collected (RMRS): All tally trees where RADIAL GROWTH and/or TREE AGE is collected.
Field width: 1 digit.
Tolerance: No errors.

Code	Description
0	• Age/radial growth measured directly from core. • Age/radial growth calculated from remeasurement data (same tree).
1	• Age/radial growth was estimated due to rot. • Age/radial growth was estimated because rings were difficult to count (old suppressed trees). • Age was estimated because the increment bore could not reach to tree center.
2	• Age/radial growth was calculated from a similar remeasure tree (same spp. and diam. class). • Age/radial growth was based on a similar tree off the subplot. If 1 is coded, explain in the notes.

414 **Site Tree.** (CORE)

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.

When collected (RMRS): All timber species site trees.
Field width: 1 digit.
Tolerance: Selected as required by the condition class tally.

ITEM

414 **Site Tree** (contd).
Collect and record site tree data only for those species listed as **timber species trees** (refer to species list page 10-11 to 14. Also refer to Appendix 5, preferred site tree species by region).
Site trees are selected as indicators of site productivity.

If a site tree is selected from one condition class, and can be used for additional condition classes, list these additional classes in the Site Tree Condition List on the data recorder or in the tree notes on the field form.

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

Code	Site Tree
0	**Not selected as a site tree**
1	**Suitable site tree**
2	**Unsuitable site tree**

a. **Site tree requirements**.

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

(2) Unsuitable site trees:
- relicts;
- intermediate crown class; code 4
- over rotation age but less than 200 years (DBH age);
- rough trees.
- damage 61, 73, 74; suppression; broken top, dead top respectively. Broken top and dead top must be less than 10% of TOTAL LENGTH.

ITEM

414 **Site Tree** (contd).

b. **Site tree selection.** Select a minimum of **two** site trees that represent the species of the condition class Forest Type. Also, select at least **two** site trees for each additional timber species representing **20 percent or more** of the live timber trees tallied or counted, and select at least **one** site tree for each species representing **less than 20 percent**. Select no more than 6 site trees per condition class. If more than three timber species are tallied (each representing 20 percent or more tally) within a condition class, select site trees from the three most dominant tallied species.

Note: If only dead trees of a particular species are tallied, and no seedlings of that species were counted, and that species does not represent the Forest Type, it is not necessary to obtain site trees for that species.

If not enough suitable trees can be selected from the subplot tally, then select nontallied suitable site trees (Tree History 00) off the subplots from a nearby site of similar slope, aspect, elevation, and soils. Assign each nontallied site tree selected to the nearest subplot. Obtain only suitable site trees where possible; however, if no suitable site trees are present within 60 feet of the subplots, select an unsuitable site tree. If no site trees are available within 60 feet, do not obtain the site trees **except** for those species representing the Forest Type. 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.

The above guidelines meet “core” standards for site tree selection. Additional site tree data is collected as a “regional add-on”.

ITEM

455 **Cause of Death.** (CORE)

When collected (CORE): All TREE STATUS = 1 at time 1 and TREE STATUS = 2 or 3 at time 2.
When collected (RMRS): Record the primary CAUSE OF DEATH (C.O.D.) for all dead tally trees that qualify as MORTALITY (refer to page 10-8).
Field width: 2 digits.
Tolerance: No errors.
Record a CAUSE OF DEATH for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

Code	Cause of Death
10	Insect
20	Disease
30	Fire
40	Animal
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other (include notes)
80	Human-caused damage (cultural, logging, accidental, etc.)
90	Physical (hit by falling tree)

Note: If multiple possibilities for cause of death exist, record the lowest numbered code.

466 **Utilization Class.** (CORE)

When collected (CORE): All TREE STATUS = 3.
Field width: 1 digit.
Tolerance: No errors.
Record the code to identify cut trees that have been removed from the site.

Code	Class
0	Not utilized - can still be found on the site
1	Utilized – some portion of the tree cannot be found on site, assumed to have been removed

ITEM

470 **Posts - Lines (470) and Corners (471).** (RMRS)

471

When collected: Woodland juniper and woodland oaks ≥ 5.0 inches DRC.
Field width: 2 digits.
Tolerance: No errors.
Examine all **woodland juniper and woodland oak** tally trees (live or dead) for fence post products. Line posts are placed along a straight length of fence line to keep the fence strands separated. A corner post is a larger segment used to anchor the fence at a selected location along the fence line, such as a bend or corner. The criteria for posts are as follows:

a. **Corner posts**:

- 8.0 feet minimum length.
- 7.0 - 9.0 inches diameter at butt (large) end.
- 2.5 inches minimum diameter at small end.
- Reasonably straight and solid.

b. **Line posts**:

- 7.0 feet minimum length.
- 5.0 - 7.0 inches diameter at butt (large) end.
- 2.5 inches minimum diameter at small end.
- Reasonably straight and solid.

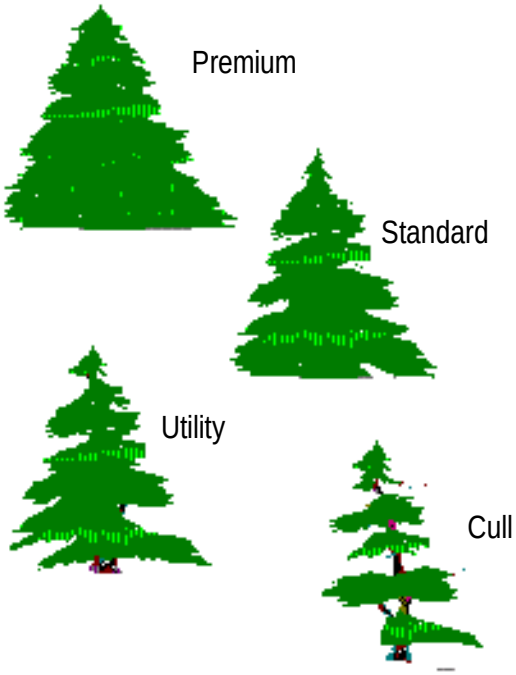
Record the number of corner and line posts per tally tree. Include qualifying stems and large branches. Ignore portions of butt segments larger than 9.0 inches in diameter; however, count any posts that occur above a large butt segment. Include down stem segments, from stems that have been measured for DRC, if the downed segment meets the post criteria. Consider corner posts first. Do not double record the same segment as a corner and line post. Record 0 if there are none.

472 **Christmas Tree Grade**. (RMRS)

When collected: For all live pinyon tally trees ≤ 12 feet in height.
Field width: 1 digit.
Tolerance: ±1 class.
Record one of the following one-digit codes for live **pinyon** tally trees, **12 feet or shorter in height**. Refer to figure 35 for illustrations of the following grades:

Code	Grade
1	**Premium** -- excellent conical form with no gaps in branches; trees have a straight stem/bole.
2	**Standard** -- good conical form with small gaps in branches; trees are bent or slightly malformed.
3	**Utility** -- conical in form with branches missing; trees are bent or malformed.
4	**Cull --** not meeting one of the above classifications. Poor conical form; large gaps in branches; may have more than one stem.

Figure 35. Christmas tree grades for pinyon.



CHAPTER 11 - 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.6 for the Understory Vegetation Description record.

No understory vegetation data will be collected if the subplot center is located in nonforest land, non-census water, or census water.

When all or part of the vegetation sample cannot be determined due to snow cover, write "snow" in the General Comments and in the notes area on the vegetation description record. For any cover in Part II (below) that cannot be determined due to deep snow, record 999; do not record 0, which means "no cover".

Tolerance: Plant identification - genus no errors.
- species no errors.

Layer - no errors.
Cover ±10%.

A. Sample Subplot Size

For each of the subplots, estimate and record understory vegetation data for the 1/24-acre subplot (24.0-foot radius). If a portion of one of the 1/24-acre subplots is not in the condition class of the subplot center (i.e., in a contrasting condition class), determine understory cover percentages based only on the portion of the subplot within the subplot center condition class.

B. Sample Identification

On the Understory Vegetation Description, record the appropriate codes for the header items listed below:

1. State
2. Map Number
3. Consecutive Point Number (CPN)
4. County
5. Field Location Number
6. Subplot Number
7. Subplot Center Condition Class Number

C. Vegetation Description

Part I is an assessment of the major species that have at least 5 percent cover. List the predominant species (a maximum of four per plant group) within each plant group heading (e.g., tree, shrub) by the appropriate plant alphanumeric code and record a percent cover and a code for vegetation layer (as described below).

Part II is an assessment of the plant groups by layer: 0-1.5 feet, 1.6-6.0 feet, and $\geq$ 6.1 feet. Assign a percent cover to each plant group that occurs within each layer.

1. General Definitions.

a. Plant groups. The vegetation is divided into four growth forms or plant groups; these groups are trees, shrubs, forbs, and graminoids, and are defined as follows (classify each species into one category):

- **Trees:** This category includes

  (1) seedlings and saplings of both timber and woodland tally species (refer to page 10-11 to 10-14),
  (2) tree species defined as "other tree species" (those defined by Little, 1979, as trees but not listed as tally species on pages 10-11 to 10-14, such as ash, willow, etc.); refer to appendix D for the tree species list.

- **Shrubs:** Woody, multiple-stemmed plants, of any size, except species designated as trees above. Most cacti are included in this category.

- **Forbs:** Herbaceous, broad-leaved plants; includes vines, ferns (does not include mosses and cryptobiotic crusts).
- **Graminoids:** Grasses and grass-like plants (includes rushes and sedges).

b. Percent cover. Crown canopy cover is defined as the area of ground surface covered by a vertical projection of the canopy of a plant. Estimate cover to the nearest 1 percent of crown canopy by species in Part I and for entire plant groups in Part II.

To record an individual species in Part I, it must have at least 5 percent cover; a circle 5.4 feet in radius or a square 9.5 feet on a side would represent 5 percent of the total 1/24-acre subplot (24.0-foot radius).

Note regarding dead vegetation: Do not include cover by a dead shrub, or portion of a dead shrub (that will not recover) in cover estimates. However, cover should be estimated for the current season's annual forbs and grass species that have already died. Perennial forbs and grasses may also appear dead, but are actually in an inactive or dormant stage -- these plants should also be included in the cover estimates.

c. Layer codes. One of the following Layer codes will be assigned to individual plant species in Part I and to plant groups in Part II.

Layer Code	Item	
1	**Layer 1**	(0-1.5 feet)
2	**Layer 2**	(1.6-6.0 feet)
3	**Layer 3**	($\geq$ 6.1 feet)

The 1.5- and 6.0-foot boundaries should be considered approximate. For example, visualize layer 1 as graminoids, forbs, and low shrubs that occur (general height) below your knee. Layer 2 includes plants that occur between knee and eye level, possibly grasses or forbs, but usually medium shrubs. Layer 3 includes plants occurring above eye level and would usually consist of seedlings, saplings, and tall shrubs only.

Note: For unusual circumstances that may occur (e.g., an entry for a forb or graminoid in Layer 3), include a note at the bottom of the vegetation form to verify the entry.

2. **Entries to be Recorded.**

a. **Understory Vegetation Description record -- Part I (Species List by Cover and Layer).** For recording purposes on the Understory Vegetation Description record, start with the first space (or block) under each plant group heading. Do not leave blank spaces above or between individual species listed.

(1) **Species.** In the appropriate plant group column, record up to four plant species (the most dominant) that have 5 percent cover or greater, occurring on the 1/24-acre subplot. Record the alphanumeric code for the plant, as listed in the PLANTS[a] data base. Record all alphanumeric codes in **capital letters** to avoid possible misinterpretation of a small letter. Also, record the entire alphanumeric code listed in the PLANTS handbook.

For field use, many of the plants and associated codes for a particular State or region are summarized on a "common plant" code list(s). These codes have been taken directly from the PLANTS handbook. If a plant is not listed on the "common plant" code list, first check to see if it is listed in the PLANTS handbook. If the alphanumeric code for a certain plant species is not listed in the PLANTS handbook, record an abbreviation for that plant species using the first two letters of both the genus and species followed by an asterisk (*), and write out the abbreviation and the scientific name at the bottom of the vegetation form. For example, the hypothetical plant "Plantus exampleis" would be coded as "PLEX*".

Use the "?" symbol for species that can be identified in the field, but the scientific name or code must be identified at camp; for example "?RedBrome."

[a] USDA, Natural Resources Conservation Service. 1994. The PLANTS data base. Ecological Sciences Division, Washington D.C.

Some plants require identification only to the genus level. When multiple species in one genus occur together on a subplot, but the actual species name is not known, and the genus is either a graminoid or other genus where species identification is not required, the multiple species can be lumped in one genus record.

For example, a crew encounters multiple species of the genus Poa but cannot confidently identify the different species. All of the species' crown canopy cover would be combined and listed under the genus Poa. There will be no way to determine how many individual species made up the genus during data processing.

However, field crew supervisors are responsible for identifying **indicator plants**, used for habitat typing, to the species level (even if some of the indicators are in one of the genera listed below).

Plants coded to the genus level are as follows:

Grasses

All Grasses – except habitat type indicators (these must be identified to the species level).

Forbs

Allium spp. (ALLIU) -- onion
Aster spp. (ASTER) -- aster
Astragalus spp. (ASTRA) -- locoweed, milkvetch, poisonweed
Castilleja spp. (CASTI2) -- paintbrush
Cirsium spp. (CIRSI) -- thistle
Erigeron spp. (ERIGE2) -- fleabane, daisy
Lupinus spp. (LUPIN) -- lupine
Trifolium spp. (TRIFO) -- clover
Viola spp. (VIOLA) -- violet

Shrubs

Rosa spp. (ROSA5) -- wild rose

In the event a qualifying plant species cannot be identified to the species level:

- Record "UNKN1" in the species column for the first unknown, "UNKN2" for the second unknown, and so forth. Each unknown on a field location will have a different unknown number, even if unknowns are from various species groups.

- Collect a sample of the unknown to be sent to the office (refer to page 11-10).

When multiple species exist for plants requiring identification to the genus level only, but the actual species is not known, the multiple species will be lumped and considered one at the genus level.

For example, a crew encounters multiple species of the genus Poa but cannot confidently identify the different species. All the species' crown canopy cover would be combined and listed under the genus Poa. However, there will be no way to determine how many individual species make up the genus.

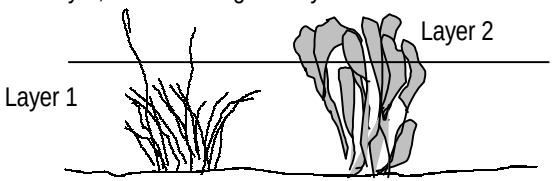
Note: When the vegetation cannot be determined due to snow cover, describe the situation in notes/comments, but **do not record snow as a species in Part I**.

(2) **Species canopy cover.** For each individual plant species that makes up at least 5 percent cover, estimate and record crown canopy coverage to the nearest 1 percent. Crown canopy cover is identified as the area of ground surface covered by, in this case, the canopy of each plant species.

(3) **Species vegetation layer.** For each individual plant species recorded, assign one of the vegetation layers (page 11-3). These layers illustrate the vertical diversity of the 1/24-acre subplot.

In this part (Part I), a plant species can be assigned only one vegetation layer; if a plant species is found in more than one layer, assign the layer where the bulk of the species height

occurs. If a plant species occurs equally in more than one layer, record the highest layer where it occurs.



b. Understory Vegetation Description record -- Part II (Plant Group Cover by Layer). In this part (Part II), determine a total crown canopy coverage by layer for each plant group, and record to the nearest 1 percent.

Crown canopy cover is identified as the area of ground surface area covered by, in this case, the canopy of each plant group occurring in each of the three layers. Plant groups recorded in each layer will include plants whose heights end in that layer. If a plant group does not end (top out) within a layer, record 0 for the Cover code. Record 1 for plant groups occupying a trace to 1 percent cover.

One plant species may be represented on the 1/24-acre subplot by plants growing in two layers. In Part I, because each plant species could be assigned only one layer, the layer where the bulk of the species occurs 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.

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 36 for an example of a completed Understory Vegetation Description record.

D. Noxious Weeds

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

Figure 36. Example of a completed understory vegetation description record.

UNDERSTORY VEGETATION DESCRIPTION

Feb-00

STATE 04 MAP 811 CPN 147

COUNTY 15 LOC# 21

SUBPT	COND #	PART I TREES SPECIES (XXXXX)	COVER (XXX)	LAYER (X)	SHRUBS SPECIES (XXXXX)	COVER (XXX)	LAYER (X)	FORBS SPECIES (XXXXX)	COVER (XXX)	LAYER (X)	GRASS SPECIES (XXXXX)	COVER (XXX)	LAYER (X)
1	1	PIFL2	45	3	MARE11	12	1	DESC	25	1			
		JUSC2	10	2	ROSA5	6	2	UNKN1	8	1			
2	2	JUSC2	6	2	MARE11	6	1	DESC	7	1	UNKN2	20	1
					AMUT	5	2				MUEM	15	1
3	1	PIFL2	11	3							BOGR2	11	1
											MUEM	8	1
4	1	PIFL2	5	3	ROSA5	8	1	UNKN3	5	1			

PART II GROUP	COVER LAYER 1 (0-1.5 feet) (XXX)	COVER LAYER 2 (1.5-6 feet) (XXX)	COVER LAYER 3 (> 6 feet) (XXX)	TOTAL COVER (AERIAL VIEW) (XXX)
TREES	2	12	40	48
SHRUBS	15	7	0	18
FORBS	35	1	0	36
GRASS	2	0	0	2
TREES	0	5	3	7
SHRUBS	8	6	0	12
FORBS	5	3	0	7
GRASS	42	1	0	42
TREES	1	1	12	12
SHRUBS	6	1	0	7
FORBS	5	3	0	8
GRASS	21	0	0	21
TREES	0	1	5	6
SHRUBS	9	2	0	11
FORBS	3	2	0	5
GRASS	4	0	0	4

PART I - Do not include species with < 5% cover

5% of a 1/24-acre subplot entails a circle with radius 5.4 ft.

Part II - code 999 for snow

NOTES:

UNKN1 GOLDENROD?

UNKN2 POSSIBLY BOER4

UNKN3 LARGE HEARTSHAPED LEAVES, BASAL

NOXIOUS WEEDS

SPECIES (XXXXXXX)	PRESENT ON SUBPLOT? (Y OR N) 1	2	3	4
EXTC	N	Y	N	N

E. Instructions for Collecting Plant Sample "Unknowns"

If a qualifying plant species cannot be identified in the field, do the following:

1. **Collect Sample.** Collect as good a sample as possible -- include roots, leaves, flowers, more than one leaf blade and inflorescence for graminoids, etc. Also, collect more than one specimen of the plant to be identified. Place the unknown in a plastic cover, with a piece of paper for absorbency, and place the cover in a tatum or book so that the sample remains pressed. Do not place the sample in a field vest pocket or lunch bag for it is likely to be crumpled or ruined and may no longer be suitable for identification.

2. **Fill Out an Unknown Identification Document** (ID slip)**.** These forms are located in the notebook included with the plant press. Fill out a form with the following information:

   - State code.
   - County code.
   - Field location number.
   - The subplot number(s) where the unknown was found.
   - The unknown number (e.g., UNKN1, UNKN2); each unknown on a field location must have a unique unknown number.

3. **Place Sample in Camp Plant Press.** It is important that the unknown samples be dried and pressed. After arriving back at camp, carefully take the unknown sample out of the plastic cover (do not leave the unknown samples in the plastic cover overnight). Place the unknown sample in a standard size sheet of newspaper, attach the unknown identification slip, and place the newspaper in the camp plant press.

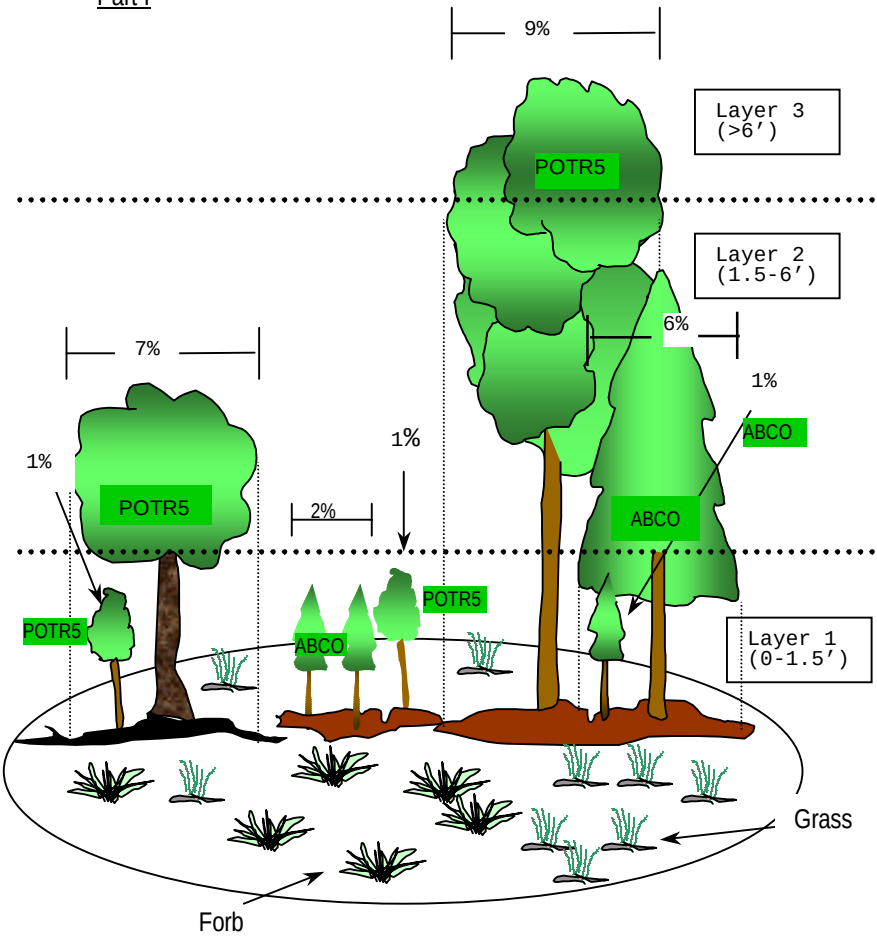
   Note: Do not put tape directly on plant samples, and do not store plant presses outdoors or in an unprotected location.

After the camp plant press is full, the field supervisor will collect the samples and return them to the office.

Reserved locations: No personal flora or fauna collection is permitted on Wilderness lands. Collections are for scientific or educational purposes only, dedicated to public benefit, and may not be used for personal or commercial profit. All collections for scientific purposes must be approved by the RHWR Wilderness Manager. No archeological or vertebrate paleontological materials may be collected.

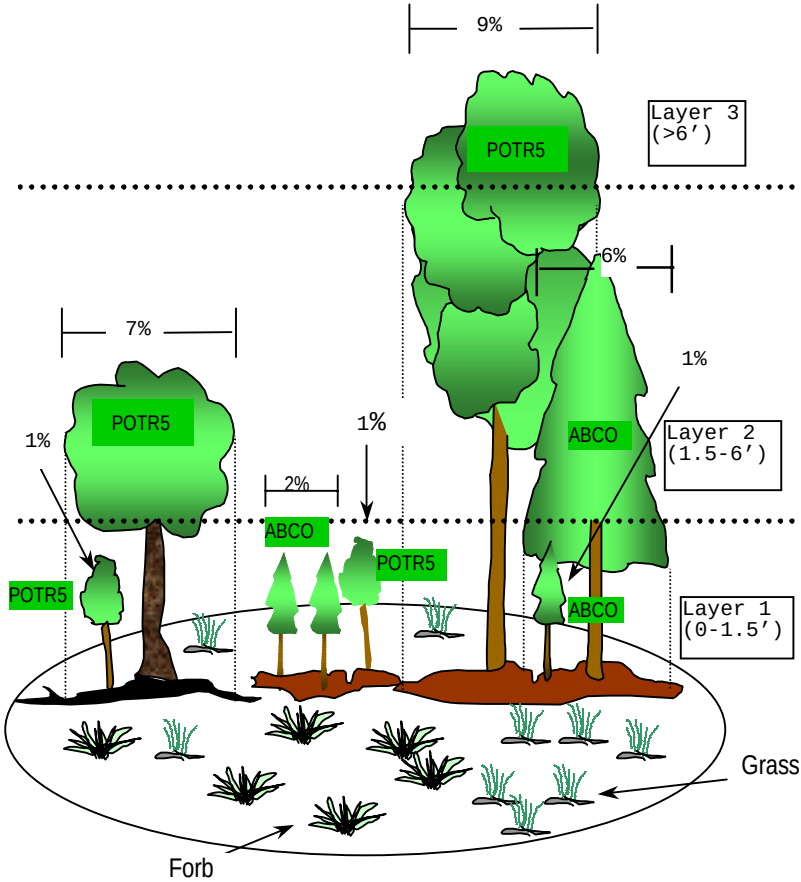
UNDERSTORY VEG EXAMPLES

Part I



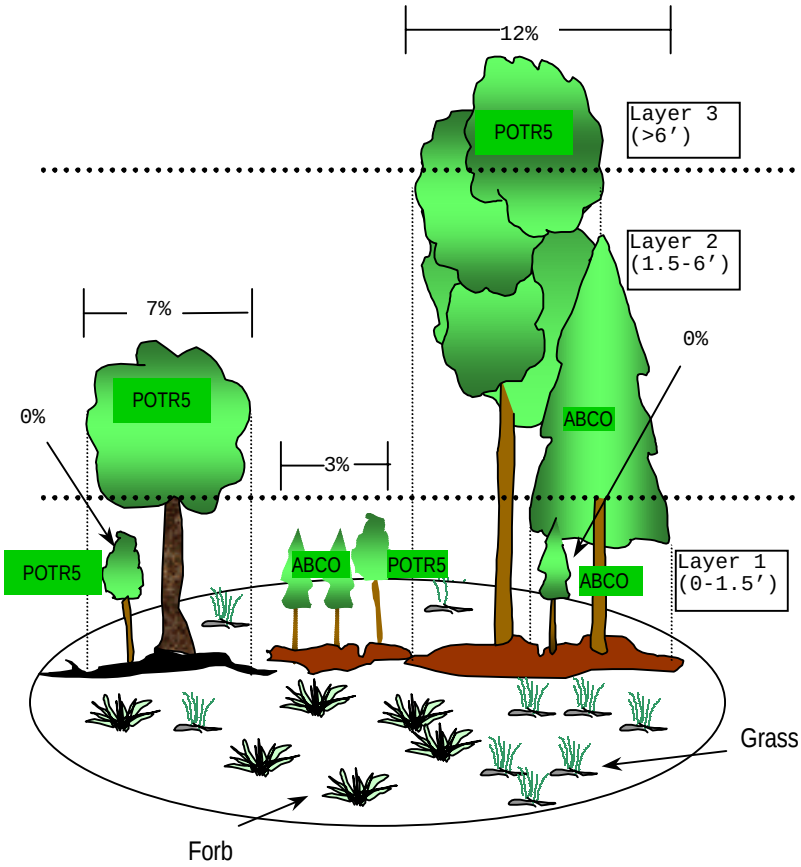
TREES			SHRUBS			FORBS			GRASS		
SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER	SPECIES	COVER	LAYER
POTR5	18	2				ARCO9	5	1	POPR	5	1
ABCO	9	2									

Part II



Group	Layer 1 (0-1.5')	Layer 2 (1.5 – 6')	Layer 3 (>6')
Trees	5	13	9
Shrubs	0	0	0
Forbs	5	0	0
Grass	5	0	0

Part II (Total Cover / Aerial View)



Group	Total Cover (Aerial View)
Trees	22
Shrubs	0
Forbs	5
Grass	5

CHAPTER 12 - ACCOUNTING PROCEDURES

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

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

- The old plot was established in the correct condition class (refer to chapter 3).
- The old plot was established within 500 feet of the correct map point.
- The plot was not a “shifted” woodland plot.

If the old location meets all of the criteria; **account** for the trees and saplings on the old location, remove the tags and nails from old plot design trees not re-tallied in the current inventory, and establish the new plot layout at the old location center.

If the old location does not meet all of the criteria, **account** for the trees and saplings on the old plot as instructed in this chapter, but establish the current plot layout in the correct location. Remove the old tags and nails in the trees, but note this re-location in the notes/comments for the current inventory. **Note:** In the first inventory, some fixed-radius plots were "shifted" away from nonforest land, moving the entire sample plot into accessible forest land. For these locations establish the current design in the correct (grid) location.

A. Plot Layout

In the previous inventory, the Sampling Factor designated the plot layout and sampling system used. For field locations with the Sampling Factor coded as a 20 or 40, a 5-point or 10-point cluster was established, and variable-plot sampling techniques were employed. On locations with the Sampling Factor coded as 01, 02, 05, 91, 92, or 95, a fixed-radius woodland plot was established. For these fixed-radius woodland plots **DO NOT ACCOUNT FOR TREES OR SAPLINGS**. However, the new plot layout will be established at the old location center (provided the old location was established in the correct condition class, was established within 500 feet of the correct map point, and was not a “shifted” woodland plot).

1. **Variable-Radius Plots.**

The LC was designated as point 1 of 5 or 10 points on the field location. Points 2 through 5 or 10 were distributed around the LC, and within the condition of the LC, using a triangular grid pattern with 100-foot or 70-foot intervals (figure 37). The spacing and orientation of the primary point positions was as follows:

5-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from LC (1) to	2	60		100
	3	120		100
	4	300		100
	5	240		100

10-point layout	Primary Point	Azimuth (degrees)	and	Distance (feet)
from LC (1) to	2	360		70
2 to	3	360		70
3 to	4	120		70
4 to	5	180		70
5 to	6	180		70
6 to	7	240		70
7 to	8	300		70
8 to	9	360		70
9 to	10	360		70

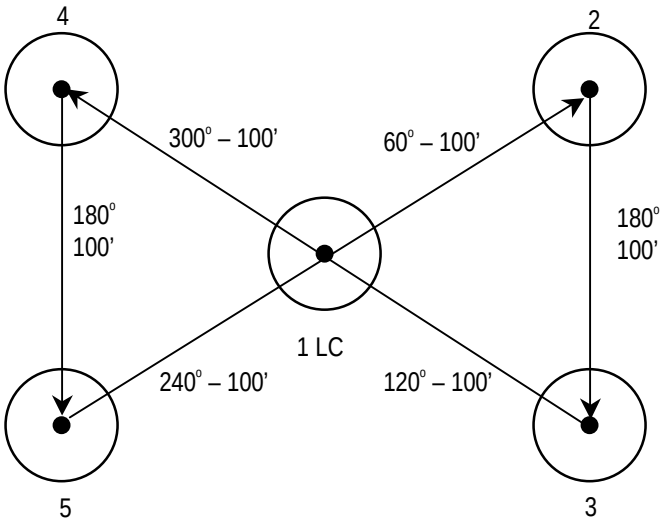
In the previous inventory, when points 2 through 5 or 10 fell into vegetation conditions different than the condition at the LC, those points were redistributed back into the LC condition. Refer to the previous field location map to determine the actual point placement established.

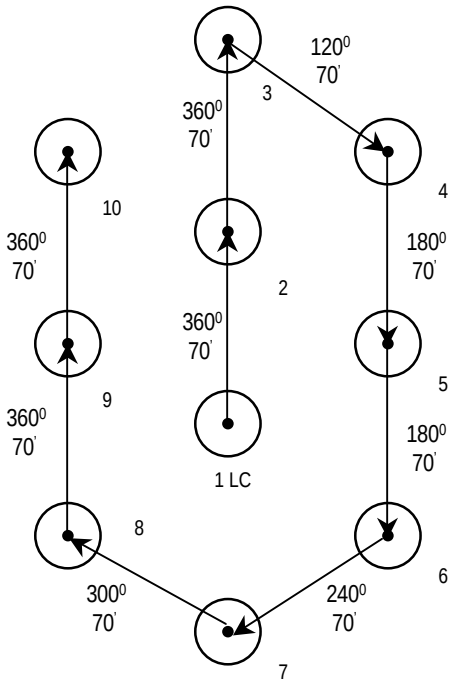
At each of the points, timber species trees 5.0-inches DBH and larger, and woodland species trees 3.0-inches DRC and larger, were tallied on a variable-radius main plot; a 20 or 40 basal area factor (BAF) angle gauge, depending on forest type, was used to select tally trees:

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 37. Previous variable-radius plot layouts.





2. **Fixed-radius plots.**

Woodland fixed-radius plots will be relocated, but no tree accounting information will be collected.

B. Sampling Methods

Locate and account for all trees preprinted on the Accounting Tree Data record (appendix A.10) using the preprinted Sampling Factor code and the plot diagram on the old field form as a reference for the plot layout. 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. In addition measure all trees $\geq$ 1.0 inches DBH/DRC that were not tallied during the previous inventory (live or dead, standing or down).

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 distance of 6.8 feet.

Locate individual trees by referencing the preprinted azimuth and distance, or by locating the numbered tree tag. Use the sampling procedures described on pages 12-1 to 5 to help relocate trees.

The following trees were sampled in the previous inventory:

1. **Main Plot.**

   a. **Live timber species** 5.0-inches DBH and larger.

   b. **Live woodland trees** 3.0-inches DRC and larger. For multistemmed trees, at least one stem was 3.0-inches DRC or larger.

   c. **Standing dead timber species** 5.0-inches DBH and larger.

   d. **Standing dead woodland trees** that had at least one standing qualifying stem (3.0-inches DRC or larger, 8.0 feet in length to a 1.5-inches branch diameter).

2. **Seedling/Sapling Microplot.**

After trees were tallied on the main plot, the following microplot trees were tallied:

a. **Timber species saplings** (1.0 - 4.9 inches DBH).

b. **Woodland species saplings** (1.0 - 2.9 inches DRC).

c. **Established seedlings** (less than 1.0-inches DRC/DBH) to bring the total tally of main plot and microplot live trees to 4.

C. Tree Data

ITEM

601 **Point Number**.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists. For new trees, record the point number where the tree occurs.
Valid codes = 1 to 5 or 1 to 10.

602 **Point History.**

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 1.0 in DBH/DRC.
Field width: 2 digits.
Tolerance: No errors.
Record the appropriate point history for each preprinted and new tally tree.

Code	History
01	Forest land before, forest land now
02	Forest land before, nonforest now
04	Forest land condition different from point 1 (condition of point has changed since the previous inventory)

ITEM

603 Tree Record Number.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists.
Record next available tree number for new tally trees.

604 Azimuth.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: $\pm$ 10 degrees.
For preprinted trees, verify/correct if an obvious error exists.
Record azimuth to the nearest degree for new tally trees. Record 360^0 for due north.

605 Distance.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: $\pm$ 1 foot for 0-5.8 feet.
$\pm$ 0.1 foot for 5.8-6.8 feet.
For preprinted trees, verify/correct if an obvious error exists. This value is the **horizontal** distance from the center stake or microplot stake to the center of single-stemmed trees or to the geographic center of multistemmed trees. Record the distance to the nearest 0.1-foot for new tally trees. **Note**: Previous inventory collected slope distance from center stake to face of single-stemmed trees or to the geographic center of multistemmed trees. It is important to keep this difference in mind when accounting for previously inventoried trees. Do not consider the difference between horizontal distance and slope distances an error.

ITEM

610 **Past Tree Status**.

When collected: Value is preprinted.
Field width: 1 digit.
Tolerance: No errors.
Refer to CURRENT TREE STATUS for code definitions. For preprinted trees, verify/correct if an obvious error exists. For example, if the PAST TREE STATUS preprinted as "2", but tree is alive, record an estimated PAST TREE STATUS.

611 **Current Tree Status (Current Tree History).**

When collected: Record for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record a current TREE STATUS for each preprinted tree and new microplot 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.

Code	Tree Status
0	No status –- tree is not presently in the sample (preprinted trees only). Tree was incorrectly tallied at the previous survey or currently is not tallied due to definition or procedural change.
1	Live tree - any live tree (preprinted or new microplot tree).
2	Dead tree -- any dead tree (standing or down, preprinted, or new microplot tree), regardless of cause of death, which does not qualify as a removal.
3	Removal - tree was tallied in previous inventory but has been cut or killed by direct human activity related to harvesting, silviculture or land clearing (preprinted trees only). The tree may, or may not, have been utilized. Only code trees killed by fire as removals if it was a prescribed burn.
4	Missing – tree was tallied in previous inventory but now is missing due to natural causes such as landslide, fire, etc. (preprinted trees only).

ITEM

613 **New Tree Reconcile**

When Collected: New tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record a NEW TREE RECONCILE for any new tally tree on the microplot that was not tallied in the previous inventory; this code is used to identify the reason a new tree appeared in the inventory. This information is needed to correctly assign volume information to the proper component of volume change.

1 Ingrowth – new tally tree not qualifying as through growth (includes reversions).

2 Through growth - new tally tree 5 inches DBH/DRC and larger, within the microplot.

3 Missed live – a live tree missed at previous inventory that is live or dead now.
Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

4 Missed dead – a dead tree missed at previous inventory that is dead now. Includes trees not measured at previous inventory because tree is located in an area or condition that was access denied, too hazardous, not considered forested, or not considered a tree due to different procedures/definitions during previous inventory.

ITEM

612 Tree Lean Angle.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists. For each new tally tree record the code that describes the angle of lean from vertical of the tree, from base to top of ACTUAL LENGTH.

Code	Tree Angle
0	Standing (less than 45 degrees of lean from vertical).
1	Down (more than 45 degrees of lean).

Note: **Trees supported by other trees or by their own branches are considered standing.**

616 Species.

When collected: Preprinted for previously tallied trees; record for new tally trees on microplot ≥ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists. Record for new tally trees. Refer to Item 416, page 10-11 to 10-14 for species list; delete tree records for preprinted species not listed. If preprinted species is incorrect, delete the preprinted code and record the correct species code.

620 Past DBH/DRC.

When collected: Value is preprinted.
Field width: 4 digits (xxx.y).
Tolerance: No errors.
If the preprinted past diameter appears to be incorrect (e.g., past DBH larger than current DBH, and the tree is still alive and growing) delete the preprinted value and record a past DBH/DRC estimate.

ITEM

621 **Current DBH/DRC**.

When collected: Record for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 4 digits (xxx.y).
Tolerance: Standing trees ±0.1 inch per 20 inches of diameter, down trees ±1 inch per 20 inches of diameter. Multi-stemmed Woodland species ± 0.2 inch per stem.
Record as directed in Item 421, starting on page 10-16, for each preprinted and new tally tree. If individual stems are nailed, measure the stems at (above) the nail. For preprinted trees that were dead during the previous inventory and currently have a smaller diameter than last time, record the new smaller diameter unless the new diameter is < 5.0 inches (<3.0 inches for woodland species) for trees that were on the variable plot or the new diameter is < 1.0 inch for trees that were on the microplot. Trees cannot shrink off the plot. If the tree has shrunk below the above-mentioned thresholds, record the previous diameter for the current diameter.

623 **DBH/DRC Check.**

When collected: All tally trees $\geq$ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

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

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

ITEM

625 **Stump Diameter.** (RMRS)

When collected: Stump of a tree that was $\geq$ 5.0 inches DBH/DRC on a remeasure subplot, tree that was $\geq$ 1.0 inch DBH/DRC on a remeasure center microplot (includes center microplot on variable radius plots and remeasure offset microplots) with CURRENT TREE STATUS = 3 and no PAST TREE STATUS (removed ingrowth).
Field width: 4 digits.
Tolerance: $\pm$ 0.5 inch per 20 inches of diameter.
Measure STUMP DIAMETER at a point 1.0 foot above ground level on the uphill side of the stump or just below the cut, whichever is lower.

626 **Past Number of Stems.**

When collected: Value is preprinted.
Field width: 2 digits.
Tolerance: No errors.
If the past number of stems does not equal the current number of stems, do not change the preprinted value, but make a note in comments suggesting the possible reason for the difference.

624 **Current Number of Stems.**

When collected: Record for previously tallied trees; record for new tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 2 digits.
Tolerance: No errors.
Record for each preprinted and new tally **woodland** species with at least one stem 1.0 inch in diameter or larger.

640 **Past Total Tree Length**.

When collected: Value is preprinted.
Field width: 3 digits.
Tolerance: No errors.
For preprinted trees, verify/correct if an obvious error exists.

ITEM

641 **Current Total Tree Length**.

When collected: New tally trees on microplot $\geq$ 1.0 in DBH/DRC.
Field width: 3 digits.
Tolerance: $\pm$ 10% of true length.
Determine Total Tree Length for new tally trees as directed in Item 441 (Total Tree Length), page 10-34.

655 **Cause of Death.**

When collected: Record for previously tallied trees that have died since the previous inventory and new tally trees $\geq$ 1.0 in DBH/DRC that grew onto a microplot and died since the previous inventory.
Field width: 2 digits.
Tolerance: No errors.
Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure.

Code	Cause of Death
10	Insect
20	Disease
30	Fire
40	Animal
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other (include notes)
80	Human-caused damage (cultural, logging, accidental, etc.)
90	Physical (hit by falling tree)

Note: If multiple possibilities for cause of death exist, record the lowest numbered code.

ITEM

663 **Past Tree Class.**

When collected: Preprinted for previously tallied trees. Record for new tally trees ≥ 1.0 in DBH/DRC that grew onto a microplot and died since the previous inventory.
Field width: 1 digit.
Tolerance: No errors.
Refer to CURRENT TREE CLASS for codes. For preprinted tees, if the PAST TREE CLASS appears to be incorrect (e.g., tree was coded as rotten in first inventory, but is sound), delete the preprinted code and record an estimate of the correct PAST TREE CLASS. For new tally trees, estimate the live tree class immediately prior to death (see sound, rough, and rotten, Item 464).

664 **Current Tree Class**.

When collected: Record for previously tallied trees; record for new tally trees on microplot ≥ 1.0 in DBH/DRC.
Field width: 1 digit.
Tolerance: No errors.
Record the CURRENT TREE CLASS for each previously tallied and new tree.

Code	Tree Class
1	**Sound (live) - timber species** • a live sapling (1.0- to 4.9-inches DBH), with minor or no evidence of form defects, insects, or disease, that is expected to become a sound tree 5.0-inches DBH or larger with good form and vigor. • a live tree, 5.0-inches DBH or larger, that has less than 67 percent of the merchantable volume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber sized trees), reasonably free of form defect, on the merchantable bole.
2	**All live woodland species**

ITEM

664 **Current Tree Class**. (contd)

Code	Tree Class
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 or down dead tree, 1.0-inch DBH/DRC or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
6	**Soft dead** • a standing or down dead tree, 1.0-inch DBH/DRC or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

CHAPTER 13 - 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 of any size (appendix 3) 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 prevents 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 ft from ground level to the highest remaining portion of the tree still present and attached to the bole. If the top is intact, actual length equals total length. 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 ac in size and 120.0 ft. wide at the point of occurrence.

ALLUVIAL FAN: 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.

ANNULAR PLOT*: A circular, fixed area plot, centered on the subplot center, with a radius of 59.0 feet. Annular plots may be used for sample intensification or for sampling relatively rare events.

ALPINE: The zone of low arctic-type vegetation above tree line.

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

AZIMUTH: 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: 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): 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): 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: A reference line of sight, located and measured on both the aerial photo and the ground.

BENCH: 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: 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 timber species tree. For estimating tree cull, use the merchantable bole -- the section of the tree between a 1-foot stump and a 4-inch top diameter outside bark (DOB).
Note: Small trees (e.g., seedlings, saplings) are often characterized as having stems; for field use, a tree stem is equivalent to a tree bole.

BOUNDARY*: The distinct intersection of two or more conditions. Each boundary occurring on a subplot or microplot 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. Boundaries occurring between subplots are not mapped.

BUREAU OF LAND MANAGEMENT LANDS: Public lands administered by the Bureau of Land Management (BLM), U.S. Department of the Interior.

CENSUS WATER: Rivers, streams, sloughs, estuaries, and canals, more than 200 feet wide and 4.5 acres and larger in size; only portions of rivers and streams meeting the definition criteria are considered census water. Other census water includes lakes, reservoirs, and ponds 4.5 acres and larger in size. Portions of braided streams meeting the census water definition criteria and more than 50 percent water at normal high-water level are considered census water. Ephemeral and intermittent streams are classified as land.

CHAINING (woodland treatment method): 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: 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: 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. Data errors are corrected. Cold checks are done on production plots only.

CONDITION: 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. Condition defining attributes include condition status, reserved status, owner group, forest type, stand size, regeneration status, and density.

CONTRASTING CONDITION CLASS: Any qualifying condition class that is different than a previously assigned class based on the defining attributes.

CONK: 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.

CORD: 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: 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 in the stand as indicated by crown development and amount of light received from above and the sides.

CROWN COVER: 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: 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: 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 wood products due to cubic-foot volume loss (e.g., rotten/missing bole sections, dead material bole sections) or severe form-defect volume loss (e.g., severe crook, sweep, forking).

CULL TREE: A live timber species that fails to meet the specifications for a sound tree now or prospectively (see Rotten Tree and Rough Tree).

DBH (DIAMETER AT BREAST HEIGHT): The diameter for timber species, located at 4.5 feet above the ground (breast height) on the uphill side of a tree. The point of diameter measurement may vary on abnormally formed trees.

DEAD VOLUME: That part of a tree's merchantable portion, consisting of sound dead wood (expressed as a percent).

DIAMETER CLASS: 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: Diameter inside bark.

DOB: Diameter outside bark.

DOWNED TREE: 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.

DRC (DIAMETER AT ROOT COLLAR): The diameter for woodland trees, taken at the root collar or at the point nearest the natural ground line (whichever is higher) that represents the basal area of the tree stem or stems. The place of diameter measurement may vary for woodland trees with stems that are abnormally formed.

EPHEMERAL STREAM: See "Stream, Ephemeral."

ESTABLISHED SEEDLING: 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: 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: 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: 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
Annular Plot:	1/4 acre	= 58.9-foot radius

FLAT PLAIN: A level or nearly level area of land marked by little or no relief.

FLOOD PLAIN: The nearly level plain that borders a stream and is subject to inundation under flood stage conditions.

FOREST INDUSTRY LAND: Land owned by a company or an individual(s) operating a primary wood-processing plant.

FOREST LAND: 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 TYPE: A classification of forest land based upon and named for the tree species that forms the majority of live-tree stocking.
A Forest type classification for a field location indicates the predominant live-tree species cover for the field location; hardwoods and softwoods are first grouped to determine predominant group, and Forest Type is selected from the predominant group. For nonstocked forest land, forest type is based on an estimate of the predominant tree species of the previous stand.

GEOGRAPHIC TREE CENTER: 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: 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 UTM coordinates and elevation latitude of each plot.

HARD DEAD TREE: 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: Trees that are usually broad-leaved and deciduous (leaves that fall off or shed at specific seasons).

HERBACEOUS: 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 (or 5% crown cover where stocking cannot be determined).

IMPROVED PASTURE: Land currently improved for grazing use as a result of cultivation, seeding, irrigation, clearing of trees or brush. These areas are generally extensively managed or maintained, unlike natural herbaceous/grass cover. Small areas are often fenced.

IMPROVED ROAD: 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 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.

INHIBITING VEGETATION: Includes all vegetation considered to repress the natural establishment of tree seedlings.

INTERMITTENT STREAM: See "Stream, Intermittent."

LAND: 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. Noncensus water is included in Land Area.

LAND USE: The classification of a land condition class by use or type.

LIMBS: 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: 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: 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): 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: The felling and extraction of timber.

MAIN PLOT (OLD PLOT DESIGN): 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: 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: 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): 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.

MESA: A broad, nearly flat-topped, and usually isolated land formation with steep sides.

MICROPLOT: The 1/300 acre fixed-radius plot (6.8-foot radius), located at an azimuth of 90 degrees and distance of 12 feet from subplot center, used to sample seedling and sapling trees.

MORTALITY TREE: 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 LANDS: Public lands administered by the Forest Service, U.S. Department of Agriculture, such as National Forests, National Grasslands, and some National Recreation Areas.

NATIONAL PARK LANDS: 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: Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

NFS: An abbreviation for "National Forest System."

NONCENSUS 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 non-tree 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: Inclusions within forest land not capable of supporting trees because of the presence of rock, water, roads, and so forth.

NONSTOCKED FOREST LAND: 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: Surface exposure of a significant geologic strata.

OVERGROWN KNOT: 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 DEFINING 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 condition classification.

PATHOGEN: An organism capable of causing disease.

PERENNIAL STREAM: 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. Includes prefield classifications.

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 feet from the center of subplot 1 at azimuths of 360, 120, and 240 degrees, respectively. Each subplot has an associated microplot and annular plot.

POLETIMBER TREES: See "Tree Size Class."

POST (FENCE): Juniper and oak species are evaluated for fence post potential using the following criteria:

Line Post: 7-foot minimum length, 5.0 to 7.0 inches diameter at the butt (large end), 2.5-inches minimum small-end diameter, and reasonably straight and solid.

Corner Post: 8-foot minimum length, 7.0 to 9.0 inches diameter at the butt (large end), 2.5-inches minimum small-end diameter, and reasonably straight and solid.

PRIMARY WOOD-PROCESSING PLANT: 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.

REFERENCE POINT (RP): 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 FIELD LOCATION: 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 (refer to State Supplement).

RESERVED STATUS: An indication of whether the land in a condition has been reserved.

ROTATION: 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: 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: 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: 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: A live timber species, 5.0-inch DBH and larger, with 2/3 (67 percent) or more of the merchantable volume cull, and more than half of this cull due to sound dead wood cubic-foot volume loss or severe form-defect volume loss (e.g., severe sweep and crook, forks, extreme form reduction). Also, a live timber species sapling (1.0- to 4.9-inches DBH) that is not expected to become a sound tree with good form and vigor due to defect, or a timber species (5.0-inches DBH and larger) that does not now, nor prospectively, have at least one solid 8-foot section, reasonably free of form defect, on the merchantable bole.

ROUNDWOOD PRODUCTS – Logs, bolts or other round sections cut from trees for industrial or consumer uses. (Note: includes sawlogs veneer logs and bolts; cooperage logs and bolts; pulpwood, fuelwood; pilings; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

SAPLING: Live trees 1.0 to 4.9 inches DBH/DRC.

SEEDLING: Live trees less than 1.0 DBH/DRC that are at least 6-inches tall for softwoods and 12-inches tall for hardwoods.

SITE TREE: A tree used to provide an index of site quality.

SLASH: 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: A continuous cover of grass and/or herbaceous plants.

SOFT DEAD TREE: 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 that are usually evergreen (retain leaves year-round), and having needle- or scale-like leaves.

SOUND TREE: 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.

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 (DEFINING): 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 (DEFINING): 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 administered by States, counties, and local public agencies or municipalities, or lands leased to these governmental units for 50 years or more.

STOCKING: An expression of the extent to which growing space is effectively utilized by trees. 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: 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: A gently sloping stream pathway subject to frequent flooding.

STREAM TERRACE: 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: 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 – 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: The 1/24-acre fixed-radius area (24-foot horizontal radius) used to sample trees 5.0-inches DBH/DRC and larger and understory vegetation.

SUPPRESSION: 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: A curve in a tree bole, not an abrupt bend (crook).

TALLY TREE: Tree species listed in this manual (chapter 10) as timber or woodland trees and measured for volume, growth, and mortality.

TALUS: The accumulated mass of loose, broken rock fragment derived from and lying at the base of a cliff or steep rock slope.

TIMBERLAND: 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: 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.), and boxelder. Western juniper is measured as a timber species, though measured for age and radial growth using woodland species rules.

TIMBER STAND IMPROVEMENT: 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: 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 ft 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: A pathway consistently used by wildlife, domestic animals, or humans.

<u>improved trail:</u> 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.

<u>unimproved trail:</u> used for human recreation/travel, sometimes documented on a forest/recreation map, but rarely cleared or posted.

<u>wildlife/animal trail:</u> not cleared, maintained, posted, or documented for human use.

TRANSITION ZONE: An area where a distinct boundary between two or more different conditions cannot be determined.

TREE CLASS: 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.

UNIMPROVED ROAD: 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: 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: 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: 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: 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: 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: 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: 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.

CHAPTER 14 - APPENDICES

APPENDIX A

FIELD FORMS

BLANK

APPENDIX A.1

FIELD LOCATION REFERENCE

Revision 5/00

STATE _____ MAP _____ CPN _____ COUNTY _____ LOCATION _____

REFERENCE POINT:

SPECIES _____

DBH/DRC _____

RP UTM Zone: _____ EAST _____ NORTH _____

R.P. DESCRIPTION: _____

COURSE FROM RP TO LOCATION CENTER:

AZIMUTH _____

HORIZONTAL DISTANCE _____

SLOPE DISTANCE _____

LC UTM Zone: _____ EAST _____ NORTH _____

ERROR _____

L.C. WITNESS TREES:

X SPP _____ DBH/DRC _____ AZ _____ DIST _____

Y SPP _____ DBH/DRC _____ AZ _____ DIST _____

*FIELD LOCATION MAP

(NORTH)

BASELINE INFORMATION:

From	to	Azimuth	Horz Grd Dist	/ Photo Dist	PSR	PSR Adjustment

From	to	Azimuth	Photo Dist	X PSR	Horz Grd Dist	Adjustment

TRAVEL DESCRIPTION: (Include both road directions and hiking directions to RP)

TRUCK UTM Zone: EAST NORTH

OWNER INFO _____

OWNER CONTACTED? Y N 4 X 4 RECOMMENDED? Y N

LOCKED GATE? Y N ATV RECOMMENDED? Y N

FIELD CREW:

CRUISER _____

RECORDER _____

PHOTOS:

PROJECT _____

ROLL _____

PHOTO Nos. _____

NOM. SCALE _____

YEAR _____

DECLINATION 0°

TOPOGRAPHIC MAP:

NAME _____

SCALE _____

_____ _____ _____

Township Range Section

***FIELD CREW EDIT:**

NAME _____

DATE _____

***QC REVIEW:**

NAME _____

DATE _____

* must complete even if data are entered on PDR

FIELD LOCATION DESCRIPTION

3/00

101	State	xx		129	Current Status	x		147	Water Proximity	x	
102	Map Number	8x		131	Sample Kind	x	1	148	Water Type	x	
103	CPN	3x		132	Subplot Radius	3x	240				
104	County	3x		133	Microplot Radius	3x	068	171	GPS Type	x	1
105	Location	4x		135	Microplot Location	x	1	172	GPS Serial Number	6x	
128	Manual Version	xx	1.5	130	Cond Class Change	x		173	Coordinate System	x	
								174	GPS Elevation	5x	
121	Date - Month	xx		141	Size of Forest Area	x		175	GPS Error	3x	
	- Day	xx						176	# GPS Readings	3x	
	- Year	4x		143	Trails or Roads	x		177	UTM Zone	3x	
				144	Distance to Road	xx		178	UTM Easting	6x	
122	Crew Spvsr	3x		149	Road Access	x		179	UTM Northing	6x	
	Crew Number	3x						180	Az to Plot Center	3x	
	Crew Number	3x		145	Use Restriction 1	xx		181	Dist to Plot Center	3x	
	Crew Number	3x		146	Recreation Use 1	x					
	Crew Number	3x			Recreation Use 2	x		107	Future Forest Potent	3x	
123	Crew Type	x			Recreation Use 3	x					
124	QA Status	x									
				150	Water on Plot	x					

LOCATION COMMENTS: _____

SUBPLOT DESCRIPTION

SUBPLOT 1				SUBPLOT 3			
301	Subplot Status	x		301	Subplot Status	x	
304	Condition List	4x		304	Condition List	4x	
303	Subplot Center Cond #	x		303	Subplot Center Cond #	x	
307	Microplot Center Cond #	x		307	Microplot Center Cond #	x	
315	Slope	3x		315	Slope	3x	
316	Aspect	3x		316	Aspect	3x	
318	Snow/Water Depth	xx		318	Snow/Water Depth	xx	
322	Root Disease	x		322	Root Disease	x	
254	Litter Depth	3x		254	Litter Depth	3x	
SUBPLOT 2				**SUBPLOT 4**			
301	Subplot Status	x		301	Subplot Status	x	
304	Condition List	4x		304	Condition List	4x	
303	Subplot Center Cond #	x		303	Subplot Center Cond #	x	
307	Microplot Center Cond #	x		307	Microplot Center Cond #	x	
315	Slope	3x		315	Slope	3x	
316	Aspect	3x		316	Aspect	3x	
318	Snow/Water Depth	xx		318	Snow/Water Depth	xx	
322	Root Disease	x		322	Root Disease	x	
254	Litter Depth	3x		254	Litter Depth	3x	

SUBPLOT COMMENTS: _____

APPENDIX A.3 Condition Class Description Record

CONDITION CLASS DESCRIPTION

Revision 4/98

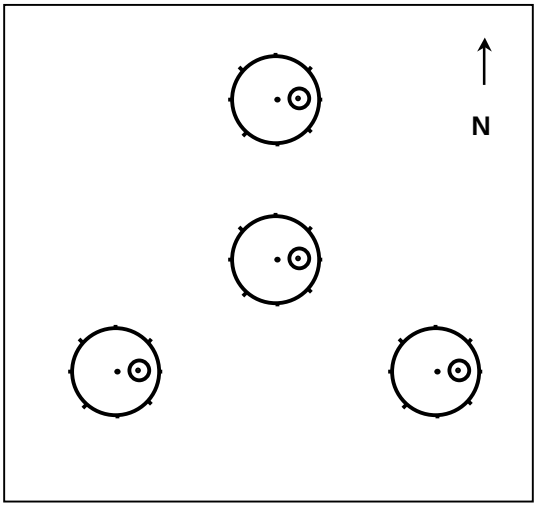
101	State	xx		275	Litter	xxx	
102	County	xxx			Cryptobiotic Soil Crust	xxx	
103	Location	xxxx			Moss/Lichens	xxx	
201	Condition Class Number	x			Basal Vegetation	xxx	
203	Condition Status	x			Other	xxx	
205	Reserved Status	x			Not Sampled	xxx	
207	Owner Group	xx					
209	Owner Class	xx		263	Disturbance 1	xx	
210	Industry Status	xx			Disturbance 2	xx	
					Disturbance 3	xx	
221	Forest Type	xxx		264	Disturbance Year 1	xxxx	
222	Stand-Size Class	x			Disturbance Year 2	xxxx	
223	Regeneration Status	x			Disturbance Year 3	xxxx	
225	Regeneration Species	xxx					
224	Tree Density	x		265	Treatment 1	xx	
					Treatment 2	xx	
243	Physiographic Class	xx			Treatment 3	xx	
				266	Treatment Year 1	xxxx	
232	Stand Age	xxx			Treatment Year 2	xxxx	
					Treatment Year 3	xxxx	
220	Size of Condition	x					
234	Primary Habitat Type	7x		267	Past Nonforest/Innac Land Use	xx	
	Secondary Habitat Type	7x		268	Present Nonforest Land Use	xx	
233	Crown Cover	xxx		269	Nonforest Year	xxxx	
				270	Condition Status Change	x	
275	Fine Soils (< 1/8")	xxx					
	Pavement (1/8 - 3/4")	xxx					
	Rock (>3/4)	xxx					

CONDITION CLASS COMMENTS:

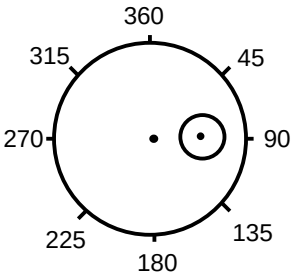
APPENDIX A.4 Condition Class Diagram and Boundary Record

CONDITION CLASS DIAGRAM

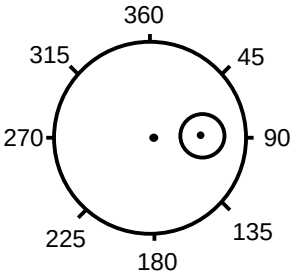
STATE _____ COUNTY_____ LOCATION_____



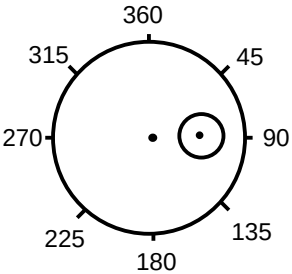
Subplot 1



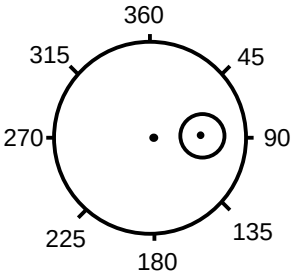
Subplot 2



Subplot 4



Subplot 3



Mapping? Y N
(circle one)

BOUNDARY INFORMATION

Mapping Plot Type:
1= Subplot
2= Microplot

281	Subplot Number	X					
282	Mapping Plot Type	X					
283	Boundary Change	X					
284	Contrasting Condition #	X					
285	Azimuth Left	XXX					
287	Corner Azimuth	XXX					
	Corner Distance	XX.X					
285	Azimuth Right	XXX					

APPENDIX A.5 Tree Data Record

SEE APPENDIX E

APPENDIX A.6 Understory Vegetation Description Record

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

APPENDIX A.7 Tree-Check Form

TREE CHECK FORM

Fixed radius plot

STATE _____
COUNTY _____
LOCATION _____

Subplot = 24.0 feet

4-98

Subplot	Azimuth	Measured Distance (slope)	/	Slope Correction	=	Horizontal Distance	Tree Number		Subplot	Azimuth	Measured Distance (slope)	/	Slope Correction	=	Horizontal Distance	Tree Number

APPENDIX A.8 Multistemmed Woodland Species Tally

MULTISTEMMED WOODLAND SPECIES TALLY

STATE _____
COUNTY _____
LOCATION _____

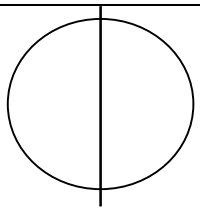
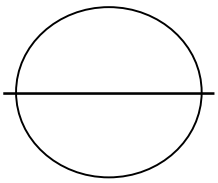
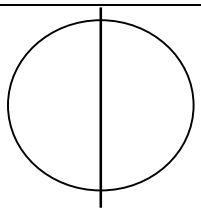
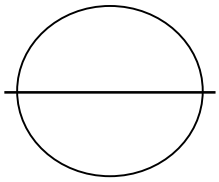
4-93

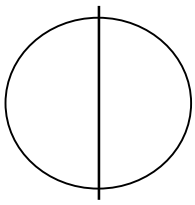
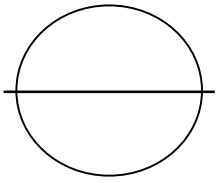
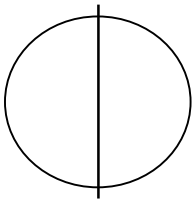
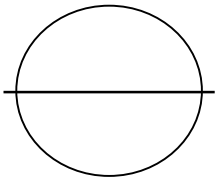
Subplot Number	Tree Number	INDIVIDUAL STEM DIAMETERS Place a small "d" by the DRC of each stem	Number of Stems	Computed DRC*

APPENDIX A.9 GROUND COVER SUPPLEMENTAL DATA

(NOTE: Save this record. Transfer totals to Condition Description record)

STATE_____ COUNTY_____ LOCATION_____

DIRECTION OF TRANSCECT (50 feet of transect per subplot)	 **N-S**	 **E-W**	 **N-S**	 **E-W**	
COND# _____	**SUBPLOT**				**TOTAL "HITS"**
	1	2	3	4	
Ground Cover:					
bare ground (≤3/4")					
rock (>3/4")					
litter (incl. Branches)					
Biotic (cryptobiotic crust, moss/lichen, basal veg)					
other (water, ice, asphalt)					
not sampled (snow)					
Crown Cover					%
Litter Depth					. "

APPENDIX A.10 ACCOUNTING TREE DATA RECORD

State _____ County _____ Inv. Date

Map _____ Location _____

Cpn _____ Samp. Factor _____

Point Number	Point History	Tree Number	Azimuth	Distance	Past 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 Clas	Comments

CHAPTER 14 - APPENDIX B

MAP, PHOTO, AND TRAVERSING TABLES

APPENDIX B.1 Slope Correction Table

Horizontal Distance = Slope Distance / Slope Correction Factor

Slope (%)	Corr. Factor	Slope (%)	Corr. Factor
0-9	1.00	99-100	1.41
10-17	1.01	101	1.42
18-22	1.02	102	1.43
23-26	1.03	103-104	1.44
27-30	1.04	105	1.45
31-33	1.05	106-107	1.46
34-36	1.06	108	1.47
37-39	1.07	109	1.48
40-42	1.08	110-111	1.49
43-44	1.09	112	1.50
45-47	1.10	113	1.51
48-49	1.11	114-115	1.52
50-51	1.12	116	1.53
52-53	1.13	117	1.54
54-55	1.14	118-119	1.55
56-57	1.15	120	1.56
58-59	1.16	121	1.57
60-61	1.17	122	1.58
62-63	1.18	123-124	1.59
64-65	1.19	125	1.60
66-67	1.20	126	1.61
68-69	1.21	127-128	1.62
70	1.22	129	1.63
71-72	1.23	130	1.64
73-74	1.24	131	1.65
75	1.25	132-133	1.66
76-77	1.26	134	1.67
78-79	1.27	135	1.68
80	1.28	136	1.69
81-82	1.29	137-138	1.70
83	1.30	139	1.71
84-85	1.31	140	1.72
86	1.32	141	1.73
87-88	1.33	142-143	1.74
89	1.34	144	1.75
90-91	1.35	145	1.76
92	1.36	146	1.77
93-94	1.37	147	1.78
95	1.38	148-149	1.79
96-97	1.39	150	1.80
98	1.40		

APPENDIX B.2 Map/Photo Scale Ratios

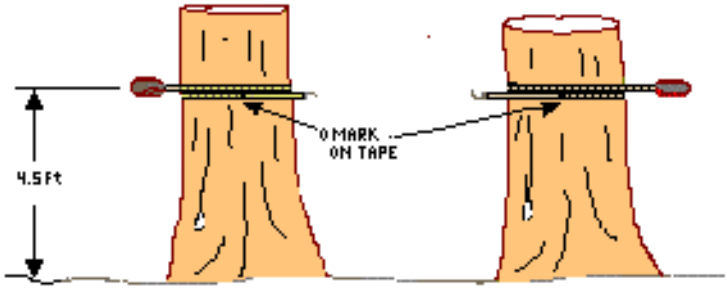
Fractional Scale	Feet Per Inch	Miles Per Inch	Inches Per Mile	Acres Per Square Inch
1:10,000	833	.158	6.34	14.69
1:11,000	917	.174	5.76	19.29
1:12,000	**1,000**	**.189**	**5.28**	**22.96**
1:13,000	1,083	.205	4.87	26.94
1:14,000	1,168	.221	4.53	31.25
1:15,000	1,250	.237	4.22	35.87
1:15,840	**1,320**	**.250**	**4.00**	**40.00**
1:16,000	**1,333**	**.253**	**3.96**	**40.81**
1:17,000	1,417	.268	3.73	46.07
1:18,000	1,500	.284	3.52	51.65
1:19,000	1,583	.300	3.33	57.55
1:20,000	1,667	.316	3.17	63.77
1:24,000	**2,000**	**.379**	**2.64**	**91.83**
1:30,000	2,500	.474	2.11	143.48
1:40,000 (NAPP)	3,334	.632	1.59	255.08
1:50,000	4,167	.789	1.27	398.56
1:60,000 (NHAP)	5,000	.948	1.06	573.99

APPENDIX C

TREE DATA

APPENDIX C.1 Diameter Measurement Techniques for Timber Species

Correct method: Alternate left-handed method:

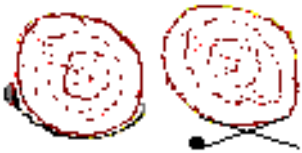


End of tape (with 0 mark) or hook crossed under

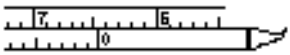
End of tape crossed under (Careful! Readings will be from an upside down d-tape)

Press tape firmly against the tree; Do not pull it out at a tangent to the tree at the point of measurement.

Correct Incorrect



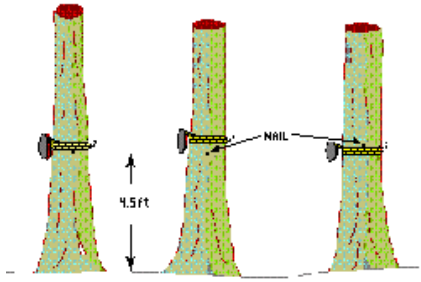
The diameter must be read at the exact point marked -- above the 0 mark.
Always round down to the nearest 0.1 inch:



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.

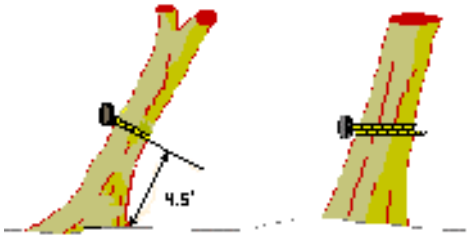
APPENDIX C.1 Diameter Measurement Techniques (contd).

Place the diameter tape directly above the nail:



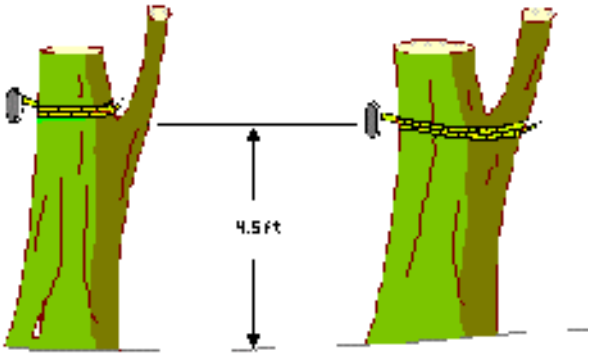
Correct Incorrect Incorrect

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

APPENDIX C.2 Square-Foot Basal Area Values for Certain Diameters (to be used in calculating DRC for woodland trees that have multiple stems)

	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
1	0.0055	0.0066	0.0079	0.0092	0.0107	0.0123	0.0140	0.0158	0.0177	0.0197
2	.0218	.0241	.0264	.0289	.0314	.0341	.0369	.0398	.0428	.0459
3	.0491	.0524	.0559	.0594	.0631	.0668	.0707	.0747	.0788	.0830
4	.0873	.0917	.0962	.1008	.1056	.1104	.1154	.1205	.1257	.1310
5	.1364	.1419	.1475	.1532	.1590	.1650	.1710	.1772	.1835	.1899
6	.1963	.2029	.2097	.2165	.2234	.2304	.2376	.2448	.2522	.2597
7	.2673	.2749	.2827	.2907	.2987	.3068	.3150	.3234	.3318	.3404
8	.3491	.3578	.3667	.3757	.3848	.3941	.4034	.4128	.4224	.4320
9	.4418	.4517	.4616	.4717	.4819	.4922	.5027	.5132	.5238	.5346
10	.5454	.5564	.5675	.5786	.5899	.6013	.6128	.6244	.6362	.6480
11	.6600	.6720	.6842	.6964	.7088	.7213	.7339	.7466	.7594	.7724
12	.7854	.7985	.8118	.8252	.8386	.8522	.8659	.8797	.8936	.9076
13	.9218	.9360	.9503	.9648	.9793	.9940	1.0088	1.0237	1.0387	1.0538
14	1.0690	1.0843	1.0998	1.1153	1.1310	1.1467	1.1626	1.1786	1.1947	1.2109
15	1.2272	1.2436	1.2601	1.2768	1.2935	1.3104	1.3273	1.3444	1.3616	1.3789
16	1.3963	1.4138	1.4314	1.4491	1.4669	1.4849	1.5029	1.5211	1.5394	1.5578
17	1.5763	1.5948	1.6136	1.6324	1.6513	1.6703	1.6895	1.7087	1.7281	1.7476
18	1.7671	1.7868	1.8066	1.8265	1.8466	1.8667	1.8869	1.9073	1.9277	1.9483
19	1.9689	1.9897	2.0106	2.0316	2.0527	2.0739	2.0953	2.1167	2.1382	2.1599
20	2.1817	2.2035	2.2255	2.2476	2.2698	2.2921	2.3145	2.3371	2.3597	2.3824
21	2.4053	2.4282	2.4513	2.4745	2.4978	2.5212	2.5447	2.5683	2.5920	2.6159
22	2.6398	2.6639	2.6880	2.7123	2.7367	2.7612	2.7858	2.8105	2.8353	2.8602
23	2.8852	2.9104	2.9356	2.9610	2.9865	3.0121	3.0377	3.0635	3.0895	3.1155
24	3.1416	3.1678	3.1942	3.2206	3.2472	3.2739	3.3006	3.3275	3.3545	3.3816
25	3.4088	3.4362	3.4636	3.4911	3.5188	3.5466	3.5744	3.6024	3.6305	3.6587

Example: On subplot 1, a four-stemmed juniper is tallied. The diameter at root collar (DRC) for these four stems is calculated as follows:

1. Measure individual stem diameters for four stems and use table to get basal area:

   Stem No. 1 - 3.3" 0.0594 basal area
   Stem No. 2 - 4.3" 0.1008 basal area
   Stem No. 3 - 6.1" 0.2029 basal area
   Stem No. 4 - 7.9" 0.3404 basal area

2. Sum the basal area: 0.0594 + 0.1008 + 0.2029 + 0.3404 = 0.7035

3. Go back to the table and obtain the diameter which corresponds to a basal area of 0.7035. This value is closest to 0.7088 which is the basal area for 11.4 inches DRC.

APPENDIX C.3 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).

APPENDIX C.4 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:

$$\text{Tree Height} = \frac{[\mathbf{T} + \mathbf{B}(-1)] \times (\mathbf{D}/100)}{\mathbf{SC}}$$

where:

T = percent scale reading for the **top** of the tree.

B = percent scale reading for the **base** of the tree at ground level.

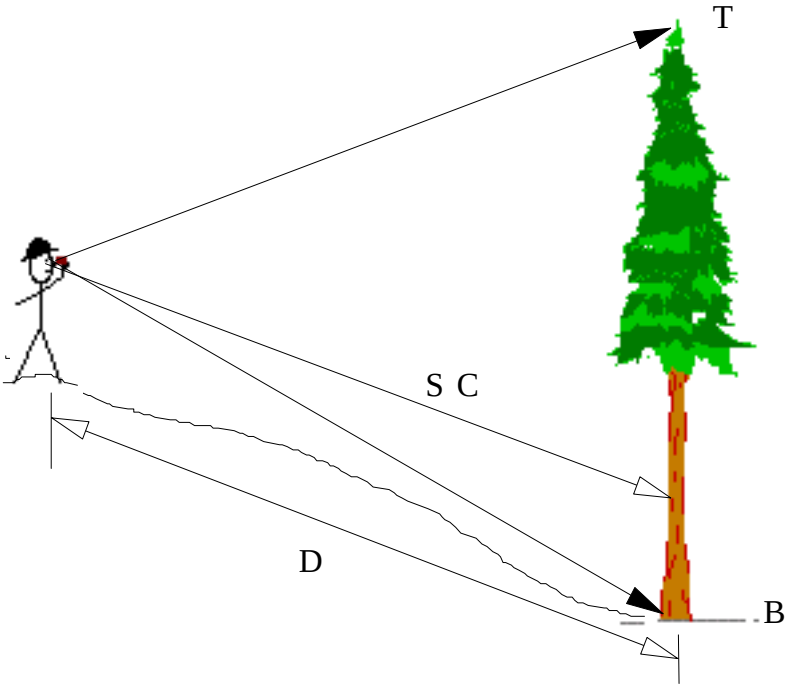
D = slope ground distance (between cruiser and tree, to the nearest foot).

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)

$$\text{Tree Height} = \frac{[T + B(-1)] \times (D/100)}{SC}$$

$$\text{Tree Height} = \frac{[28 + 30] \times (120/100)}{1.03}$$

Tree Height = 67 feet

APPENDIX C.5 Circular Defect Deduction Table

This table presents the defect percentage for circular interior defect (for use where diameter of defect column can be determined).

DIB of 4-foot section (inches)	Diameter of defect column -- inches											
	2	4	6	8	10	12	14	16	18	20	22	24
	Percent defect (cubic-foot basis)											
6	100											
8	100	100										
10	10	25	100	100								
12	5	20	35	100	100							
14	5	15	25	40	100	100						
16	5	10	20	30	45	100						
18	5	10	15	25	35	50	100					
20	5	5	15	20	30	40	100	100				
22	5	5	10	15	25	35	45	100	100			
24		5	10	15	20	30	40	50	100	100		
26		5	5	10	20	25	35	45	100	100	100	
28		5	5	10	15	20	30	35	45	100	100	
30		5	5	10	15	20	25	30	40	50	100	
32			5	10	10	15	20	30	35	45	50	
34			5	5	10	15	20	25	30	40	45	100
36			5	5	10	15	15	20	30	35	40	50

For example, a 13-inch DBH tree (12" DIB) is bored, and it is determined that a column of rot, 6 inches in diameter, occurs within the bole. It is then estimated, based on the type of rot identified, that the column of rot extends from the ground level to 8 feet up the tree bole. Reading from the table, a 6-inch defect column within a 12-inch DIB section yields 35 percent defect for each section. Therefore, approximately 35 percent of the first 8-foot log is cull.

APPENDIX D

TREE SPECIES LIST

APPENDIX D Tree Species List

For UTAH 2000 Annual Inventory, consider as trees only those species listed on the tree species list, pages 10-11 through 10-15.
Do not use Little's Tree Species List, formerly pages 14-30 to 14-36.

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: 7/98.

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX D Tree Species List (contd.)

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

APPENDIX E.1 Item Coding Guide: Location Reference Data

FIELD LOCATION REFERENCE

Revision 5/00

STATE__X___ MAP__X___ CPN __X___ COUNTY___X_____ LOCATION _____X_

REFERENCE POINT:
SPECIES V
DBH/DRC V
RP UTM Zone V EAST V NORTH V

R.P. DESCRIPTION: V

COURSE FROM RP TO LOCATION CENTER:
AZIMUTH V
HORIZONTAL DISTANCE
SLOPE DISTANCE
LC UTM Zone: V EAST V NORTH V
ERROR V

L.C. WITNESS TREES:
X SPP __V___ DBH/DRC __V___ AZ __V__ DIST ____V____
Y SPP __V___ DBH/DRC __V___ AZ __V__ DIST ___V_____

*FIELD LOCATION MAP
(NORTH)

V

BASELINE INFORMATION: **V (if used)**

From	to	Azimuth	Horz Grd Dist	/ Photo Dist	PSR	PSR Adjustment

From	to	Azimuth	Photo Dist	X PSR	Horz Grd Dist	Adjustment

TRAVEL DESCRIPTION: (Include both road directions and hiking directions to RP)
TRUCK UTM Zone V EAST V NORTH V

OWNER INFO X

OWNER CONTACTED? Y N 4 X 4 RECOMMENDED? Y N
LOCKED GATE? Y N ATV RECOMMENDED? Y N

FIELD CREW:
CRUISER ____X_____
RECORDER ____X_____

PHOTOS:
PROJECT ____X_____
ROLL _____X_____
PHOTO Nos. ____X_____
NOM. SCALE ____X_____
YEAR ____X_____

DECLINATION 0°

TOPOGRAPHIC MAP:
NAME _____X_____
SCALE ____X_____

__X___ ___X___ __X___
Township Range Section

***FIELD CREW EDIT:**
NAME _____X_____
DATE ____X_____

***QC REVIEW:**
NAME ____QC____
DATE ___QC_____

* must complete even if data are entered on PDR

X = Always record **V = Record for all visited plots**

APPENDIX E.2 Item Coding Guide

National Core
National Optional
RMRS

PLOT (Location) LEVEL DATA

STATUS =	Accessible Forest Land Present	NO Accessible Forest Land
State	DX	DX
County	DX	DX
P2 Location #	DX	DX
P3 Hexegon Number	P3	P3
P3 Plot Number	P3	P3
Map Number	DX	DX
CPN	DX	DX
Date - Month	X	X
- Day	X	X
- Year	X	X
Crew Type	X	X
Crew Spvsr	X	X
Crew Number	X	X
Crew Number	X	X
Crew Number	X	X
Crew Number	X	X
QA Status	X	X
Sample Kind	X	X
Current Status (Hook)	1	X
Range Data (Hook)	0	X
Subplot Radius	240	
Microplot Radius	68	
Microplot Location	1	
Trails or Roads	DX	
Hz Distance to Road	X	
Road Access	X	
Public Use Restriction	X	
Recreation Use 1	DX	
Recreation Use 2	DX	
Recreation Use 3	DX	
Water on Plot	X	
Water Proximity	DX	
Water Type	DX	
Size of Forest Area	X	
GPS Unit	DX	
GPS Serial Number	DX	
Coord System	2	
GPS Elevation	DX	
GPS Error	DX	
# GPS Readings (hits)	DX	
UTM Zone	DX	
UTM Easting	DX	
UTM Northing	DX	
Condition Change	R	
Future Forest Potential		X

SUBPLOT LEVEL DATA

	Accessible Forest Land Present	No Accessible Forest Present
Subplot Number	DX	DX
Subplot Status	X	X
Condition List	X	X
Subplot Center Cond #	X	X
Microplot Center Cond#	X	X
Subplot Slope	X	X
Subplot Aspect	X	X
Snow/Water Depth	X	X
Root Disease Severity	CX	
Litter Depth	X	

CX = On remeas. Locs, previous data may be printed on sheet; copy old data if valid, otherwise record new.
DX = Downloaded for verification OR record if blank
R = Remeasurement Locations
X = Always record

APPENDIX E.3 Item Coding Guide

National Core
National Optional
RMRS

CONDITION LEVEL DATA

CONDITION STATUS=	Accessible Forest Land	Nonforest Land	Noncensus/Census Water	Denied Access or Hazardous	Not Sampled (see rules)
Condition Class Number	X	X	X	X	X
Condition Status**	1	2	3,4	5,6	8
Reserved Status **	CX	CX	CX	CX	CX
Owner Group **	CX	CX	CX	CX	CX
Owner Class	CX	CX	CX	CX	CX
Industry Status	X				
Forest Type **	CX				
Stand-Size Class **	CX				
Regeneration Status **	CX				
Regeneration Species	X				
Tree Density **	X				
Physiographic Class	X				
Stand Age	X				
Size of Condition	CX	CX	CX		
Primary Habitat Type	CX				
Secondary Habitat Type	X				
Crown Cover	X				
GROUND COVER TRANSECTS (#hits)					
Fine Soil Cover (<1/4")	X				
Pavement(rocks 1/4-3/4")	X				
Rock (>3/4")	X				
Litter Cover	X				
Moss/ichens	X				
Cryptobiotic crusts	X				
Basal vegetation	X				
Other Cover (water, etc.)	X				
Not Sampled	X				
Disturbance 1	X				
Disturbance 1 Year	X				
Disturbance 2	X				
Disturbance 2 Year	X				
Disturbance 3	X				
Disturbance 3 Year	X				
Treatment 1	X				
Treatment 1 Year	X				
Treatment 2	X				
Treatment 2 Year	X				
Treatment 3	X				
Treatment 3 Year	X				
Condition Status Change	R(a)	R(a)			
Past Nonfor/Haz. LU	R(b)				
Present Nonfor LU		R(c)			
Nonforest Year		R(c)			

R(a) Remeasurement location ** Defining (mapping) attribute
R(b) Remeasurement location where past Condition Status = 2 or 6, current =1
R(c) Remeasurement location where past Condition Status = 1, current = 2
DX = Downloaded for verification OR record if blank
CX = On remeas. locations, previous data may be printed on sheet; Copy old data if valid, otherwise record new.
X = Always record

APPENDIX E.4 Item Coding Guide: Tree Data

Black = National Core Red = National Core Optional Blue = RMRS Add-on

TREE TYPE	(Tree Status past/present)	Subplot Number	Tree Record Number	Horizontal Distance	Azimuth	PAST Condition Class Number	CURRENT Condition Class Numb.	PAST Tree Status	CURRENT Tree Status	New Tree Reconcile	Utilization Class	CURRENT Lean-Angle	Species	PAST DBH/DRC	Current DBH/DRC	Diameter Check	Stump Diameter	PAST Number fo Stems	CURRENT Number of Stems	PAST Total Tree Length	CURRENT Total Tree Length	PAST Actual Tree Length	CURRENT Actual Tree Length	Length Method (Ht Check)	Uncompacted Crown	Compacted Crown	Crown Class	Cone Serotiny	Dwarf Mistletoe Class	Damage 1 LOCATION	Damage 1 TYPE	Damage 1 SEVERITY	Damage 1 AGENT	Damage 2 LOCATION	Damage 2 TYPE	Damage 2 SEVERITY	Damage 2 AGENT	Other Damage AGENT	Decay Class	% Rotten & Missing	% Vol Missing Top	% Sound Dead	% Form Defect	PAST Tree Class	CURRENT Tree Class	Line Posts	Corner Posts	Christmas Tree	Age/ Radial Growth	Growth/Age Check	Site Tree	Mortality	Mortality Year	Cause of Death
New Trees --																																																						
Live tally 5.0"+ DBH/DRC (-/1)	- / 1	X	X	X	X	0	X	-	1	R	-	X	X	-	X*	X	-	-	W	-	X	-	X	X	X	X	X	L	X	X	X	X	X	X	X	X	X	-	X	X	X	T	-	X	J	J	P	A	A	X	-	-	-
Dead tally 5.0"+ DBH/DRC	- / 2	X	X	X	X	0	X	-	2	R	-	X	X	-	X*	X	-	-	W	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	-	-	M	X	J	J	-	-	-	X	M	M
Live sap 1.0-4.9" DBH/DRC	- / 1	X	X	X	X	0	X	-	1	R	-	X	X	-	X*	X	-	-	W	-	X	-	X	X	X	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	P	A	A	-	-	-	-
Dead sap 1.0-4.9" DBH/DRC	- / 2	X	X	X	X	0	X	-	2	R	-	X	X	-	X*	X	-	-	W	-	X	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	M	X	-	-	-	-	-	-	X	M	M
Removal (Sample Kind 2 ONLY)	- / 3	X	X	X	X	0	X	-	3	R	X	-	X	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X
Remeasurement Trees (includes center micro) --																																																						
Live 5.0"+ DBH/DRC	1 / 1	D	D	D	D	D	X	D	1	-	-	X	D	D	X*	X	-	D	W	D	X	DX	X	X	X	X	X	D,L	X	X	X	X	X	X	X	X	X	-	X	X	X	T	D	X	J	J	P	DX	DX	X	-	-	-
Live before, Dead now 5.0"+ DBH/DRC	1 / 2	D	D	D	D	D	X	D	2	-	-	X	D	D	X*	X	-	D	W	D	X	DX	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	-	-	D	X	J	J	-	-	-	-	X	X
Dead before, Dead now 5.0"+ DBH/DRC	2 / 2	D	D	D	D	D	X	D	2	-	-	X	D	D	X*	X	-	D	W	D	-	DX	DX	X	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	-	-	D	X	J	J	-	-	-	-	-	-
Live sap 1.0-4.9" DBH/DRC	1 / 1	D	D	D	D	D	X	D	1	-	-	X	D	D	X*	X	-	D	W	D	X	DX	X	X	X	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	P	A	A	-	-	-	-
Live sap before, Dead sap now 1.0-4.9" DBH/DRC	1 / 2	D	D	D	D	D	X	D	2	-	-	X	D	D	X*	X	-	D	W	D	D	DX	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	X	X
Dead sap before, Dead sap now 1.0-4.9" DBH/DRC	2 / 2	D	D	D	D	D	X	D	2	-	-	X	D	D	X*	X	-	D	W	D	-	DX	DX	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-
Live before, 1.0"+, Removal	1 / 3	D	D	D	D	D	X	D	3	-	X	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	X	X
dead before, 1.0"+, Removal	2 / 3	D	D	D	D	D	X	D	3	-	X	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	-
Live before, 1.0"+, Missing	1 / 4	D	D	D	D	D	X	D	4	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	X	X
Dead before, 1.0"+, Missing	2 / 4	D	D	D	D	D	X	D	4	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	-
Accounting Trees (Old variable-radius plots) --																																																						
New Live tally 1.0" +	- / 1	X	X	X	X	-	-	-	1	AC	-	X	X	-	X	X	-	-	W	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
New Dead tally 1.0" +	- / 2	X	X	X	X	-	-	-	2	AC	-	X	X	-	X	X	-	-	W	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	X
Live befor, Live now tally 5.0"+ DBH/DRC	1 / 1	D	D	D	D	-	-	D	1	-	-	X	D	D	X*	X	-	D	W	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	-
Live before, Dead now 5.0"+ DBH/DRC	1 / 2	D	D	D	D	-	-	D	2	-	-	X	D	D	X*	X	-	D	W	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	M
Dead before, Dead now 5.0"+ DBH/DRC	2 / 2	D	D	D	D	-	-	D	2	-	-	X	D	D	X*	X	-	D	W	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	-
Live sap 1.0-4.9" DBH/DRC	1 / 1	D	D	D	D	-	-	D	1	-	-	X	D	D	X*	X	-	D	W	D	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	-
Live sap before, Dead sap now 1.0-4.9" DBH/DRC	1 / 2	D	D	D	D	-	-	D	2	-	-	X	D	D	X*	X	-	D	W	D	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	M
Dead sap before, Dead sap now 1.0-4.9" DBH/DRC	2 / 2	D	D	D	D	-	-	D	2	-	-	X	D	D	X*	X	-	D	W	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	X	-	-	-	-	-	-	-	-	-
Live before, 1.0"+, Removal	1or 2 / 3	D	D	D	D	-	-	D	3	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	X
dead before, 1.0"+, Removal	1or 2 / 3	D	D	D	D	-	-	D	3	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	-
Live before, 1.0"+, Missing	1or 2 / 4	D	D	D	D	-	-	D	4	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	X
Dead before, 1.0"+, Missing	1or 2 / 4	D	D	D	D	-	-	D	4	-	-	-	D	D	-	-	-	D	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D	-	-	-	-	-	-	-	-	-
Nontallied site trees --																																																						
Live tree 5.0"+ DBH/DRC (timber spp. only)		D,X	D,X	D,X	D,X	D,-	X**	-	0	-	-	X	D,X	-	X	X	-	-	-	-	X	-	-	X	X	X	-	-	-	-	-	-	X	-	-	-	X	X	-	-	-	-	-	X	-	-	-	DX	DX	X	-	-	-

TREE TYPE		Subplot Number	CURRENT Condition Class	Species	Seedling Count	Count Check	Tree Age
Seedling group tally		X	X	X	X	X	X

A = Age and Radial trees as directed
AC = New tree on accounting location microplot
D = Downloaded for remeasurement trees; change only if previous in error
DX = May be downloaded, or may have to fill in from old tree comments
J = Juniper and oak species only
L = Lodgepole pine only

M=New tree mortality code 01, or any tree that has died since the last inventory
P = Pinyon trees 12' and shorter
R = New trees on a remeasurement location
T = Timber (DBH) species only
W = Woodland species (plus w. juniper)
X = Always record

* Record individual stems and live/dead for woodland trees on the data recorder or on the multistem woodland supplemental form.

** If a site tree is used for other condition classes, record those on the data recorder or in tree comments.

APPENDIX F

VARIABLE NAME ABBREVIATIONS

N/A PAGES 14-43 to 50

CHAPTER 14 - APPENDIX G

PLGR Operating Instructions

Use the instructions below for setting up and operating the Precision Lightweight GPS Receiver. Each section below corresponds to its counterpart in Chapter 2.c.2, "**Finding the Field Location Center – New Field Locations.**"

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

***PLGR:* Setup.** To enter the **Setup Menu**, insert the PLGR batteries and turn the unit on. Push the **Menu** button, then use the right arrow key to highlight **Setup**. Use the down arrow key to select **Setup**.

Position	Line Heading	Setting
SCREEN 1		
Line 1, Field 1	Setup Mode	: **Cont**
Line 2 and 3		: na
Line 4, Field 1	SV-Type	: **Mixed**
SCREEN 2		
Line 1	Setup Units	: na
Line 2, Field 1		: **UTM/UPS**
Line 2, Field 2		: **English**
Line 3, Field 1	Elev.	: **Feet**
Line 3, Field 2	Elev**.**	: **MSL (Mean Sea Level)**
Line 4, Field 1	ANG.	: **DEG**
Line 4, Field 2	ANG**.**	: **Mag**
SCREEN 3		
Line 1	Setup MAGVAR	: na
Line 2, Field 1	Type	: **Calc**
Line 2, Field 2	Type	: **deg**
Line 3	WM 1995	: na
SCREEN 4		
Line 1, Field 1	Setup Wage	: **ON**
Line 2, Field 1	ELHold	: **automatic**
Line 3, Field 1	TIME	: **Z-600 (Mountain Standard)** **Z-700 (Daylight Savings)**
Line 4, Field 1	ERR	: **EHE**
SCREEN 5		
Line 1, Field 1	Setup DTM	: **NAS-C**
Line 2	NA27CONUS/CLK66 (see note below)	
Line 3	Automatic Off	: na
Line 4, Field 1	Timer	: **Off**

Note: Examine each topographic map to identify the UTM datum, located in the bottom left hand corner of the map. Most USGS maps in the West use the 1927 (NAS-C) datum. Notify the field

supervisor if maps with the 1983 (NAR) datum are encountered because the UTM plot grid system used for the Program is based on the 1927 system.

b. **Verify that your PLGR has a Current Cryptographic Key.** Press the menu button twice. The word **CRYPTO** displays in the lower left corner of the screen if you have a current key. If this field is blank you do not have a cryptographic key installed. Inform your supervisor and obtain another PLGR or use baseline procedures to locate the LC.

c. **Verify WAGE Activation.** WAGE stands for Wide Area GPS Enhancements. WAGE allows the PLGR to use enhanced clock signals from the Precise Positioning Service Satellites. Approximately 15 minutes after the initial start up of the PLGR, a "**W"** will appear to the right of the Elevation Hold (**Elh**) field on the first page of the Positioning menu. A "W" indicates that the PLGR has an updated WAGE. If possible, do not record UTM coordinates at the RP or LC until the PLGR has an updated WAGE.

d. **Enter the LC coordinates into the PLGR.** All potential LC coordinates for a given work area should be uploaded to the PLGR prior to moving to a new work area. LC coordinates for a given work area will begin at waypoint number 101 in the PLGR leaving the first 100 waypoints empty for user waypoint entry. If the LC coordinates are not preloaded or are missing, obtain the coordinates from the location packet label or from the topographic map inside the packet and enter them manually.

***PLGR:* Way Points.** A Way Point is a specific location marked in the PLGR for future reference. Examples of a potential Way Points include the location of the truck, a trailhead, a critical junction on a travel route to the plot, the reference tree, or the plot center location. There are three methods of setting Way Points in the PLGR: by uploading waypoints from a PC, by using the **Mark** Key, or by a manual input of the coordinates using the **WP** Key.

- **PC to PLGR Upload.** All potential LC coordinates for a given work area should be preloaded into the PLGR before moving to a new work area using this method. LC waypoints will be named using the following naming convention. State letter – County number – Location Number (e.g., A-029-0123.)

  Refer to the **Waypoint Number– Location Center Cross Referencing List** to determine the waypoint number of the location you wish to visit. Use the **NAV** key to enter the navigation menu. Scroll to the first field on the second line and press the **NUMLOCK key**. Enter the desired waypoint number. Press the **NUMLOCK** key again to display the page turn icon (**P**). Verify that the waypoint name and coordinates match those listed on the packet label.

- **Marking a Way Point.** Use the **Mark** key when currently at the desired Way Point position. After determining position coordinates at a given location (e.g., the trailhead), the crew may decide to use this location as a reference or Way Point to return to on their way out of the plot.

  Once the coordinates for the location (e.g., trailhead) are on the screen --using the Positioning feature described above -- simply push the **Mark** button twice. This action automatically sets the current screen coordinates as the last Way Point in the list.

- **Setting a Way Point.** Use the manual Way Point (WP) when it is necessary to navigate to a location that has not been marked. To get into the Way Point menu, push the **WP** key. Now the **ENTER** field should be flashing; use the down arrow key to select the **ENTER** field. The WP### in the upper left hand corner indicates the Way Point number to be saved (note this number for future reference). Scroll to the 1st field on the 3rd line using the right or left arrow key, and enter the desired Easting coordinates. Then highlight the northing field and enter the desired northing coordinates. The Easting information is usually located along the top or bottom margin of the topographic map, and the northing is located along the left or right margins. Entering the elevation information is useful but not necessary. Scroll to the end of the page and exit. The Way Point is stored, and the PLGR is prepared to navigate to that point.

- **Naming a Way Point.** To name a Way Point as something other than a number, push the WP key and select edit. Highlight the WP in the upper left hand corner and scroll to the Way Point number to name. Push the right arrow twice to highlight the field to the right (entire field should be flashing), then use the down arrow to highlight the first letter (1st character should be flashing). Depress the down/up arrow until the desired number or letter appears. Use the right arrow to select the next character. Up to 10 characters can be used to name a Way Point.

e. **Find the Position of the RP.** The Position (POS) feature of the PLGR provides coordinates for the present position on either the Universal Transverse Mercator (UTM) or on the Latitude/Longitude (Lat/Long) grid system.

PLGR: **Positioning**

Push the **POS** button for approximately 5 seconds until the field in the upper left hand corner reads **AVG**. At this point the PLGR begins to acquire satellites. After sufficient satellites are acquired, the PLGR begins to average the satellite hits, indicated by numbers just to the right of the **AVG** symbol. Allow the PLGR to average at least 180 hits. In areas receiving poor satellite reception, it may be necessary to let the PLGR average more hits.

Record the UTM coordinates from the 3rd line on the screen. Do not move the PLGR while it is in the averaging mode.

In a situation where the RP itself blocks signal reception, measure from the RP into an open area and place a stake. Use this as your base-point (RP stake) for collecting the RP's coordinates and locating the LC. Record azimuth and distance from the RP to the RP stake in plot notes, and explain why you chose not to take the GPS coordinates at the RP tree (e.g., heavy crown cover at RP center). Record the RP coordinates in the PDR.

Note: The continuous mode can also be used for positioning; however, the reading is not as accurate. The continuous mode provides an instantaneous or continuous reading of position when a quick position fix is needed, but should not be used to collect GPS data for the RP.

f. **Chaining from the RP to LC.** Employ the PLGR's Navigate function to determine a distance and azimuth to LC from the RP. Use a chaining tape and compass for chaining from RP to LC.

***PLGR:* Navigation.** To enter into the navigation menu, push the **NAV** key. There are several modes of operation for navigating; for the purposes of this inventory work, use either the **Custom, Slow**, or **2d Fast** mode; these fields are located on the first screen after pushing the **NAV** key.

Slow direct mode. Leave the PLGR in the **Averaging** mode and set **NAV** to **slow direct** for determining the course to location center.

Screen 1 procedure:

1. Using the right arrow key, highlight the first field on the first line of the navigation menu. Select **Custom, Slow,** or **2D Fast** using the down arrow**.**
2. Using the right arrow key, select the 2nd field on line one. Select **direct** by pushing the down arrow**.**
3. Using the right arrow key, highlight the **WP** field. Select the Way Point number desired using the down arrow key.
4. Using the right arrow, scroll to the **P** at the bottom of the page. Use the down arrow key to change the page.

Screen 2 in **Custom** mode displays the azimuth (**AZ**) in degrees, range (**RNG**) or horizontal distance, and navigational steering arrows to the selected Waypoint. In **Slow** mode, "**RNG**" and "**AZ**" are displayed. **2dFast** mode displays track (**TRK**), azimuth, and steering arrows (**STR**).

Screen 3 in **Custom** mode is blank. In **Slow mode**, elevation difference (**ELD**), slant range (**SR**), "**AZ**", and elevation angle (**ELA**) are displayed. **2dFast** mode displays the "**RNG**", Time To Go (**TTG2**), "**ELD**", and minimum miss distance (**MMD2**). Make slope corrections as necessary when chaining to the LC.

Use the up or down arrow while the page icon is highlighted to select the desired navigation screens.

APPENDIX H

LASER 200 INSTRUCTIONS

TABLE OF CONTENTS

A. Overview…… 3
B. Basic operation…… 3
C. Settings…… 4
D. Filters and Reflectors…… 5
E. Distances and % slope…… 5
F. Tree heights…… 6
G. Gates…… 6
H. Cumulative distances…….... 7

LASER 200 INSTRUCTIONS

A. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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 Husky.

G. 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.

H. 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.