Region One
Vegetation Classification, Mapping, Inventory and Analysis Report

$$\bar{x} = \frac{\sum x}{n}$$

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Region 1 Intensified Grid Field Procedures Using Inventory and Monitoring Protocols

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Table of Contents

REGION 1 INTENSIFIED GRID FIELD PROCEDURES 1

USING INVENTORY AND MONITORING PROTOCOLS 1

INTRODUCTION 1

SECTION 1: DATA COLLECTION OVERVIEW 1

1.A. GENERAL INFORMATION 1
1.A.1 Data Collection 1
1.A.2 Quality Control 3
1.A.3 Situation Prohibiting Data Collection 4
1.A.4 Order of Data Collection 4
1.B FINDING THE PLOT CENTER AND PLOT MONUMENTATION 5
1.B.1 Travel Description 5
1.B.2 Vehicle Coordinates 5
1.B.3 Reference Point 6
Remeasurement Finding Plot Center: 10
1.B.6 Monumentation of the Plot Center - *Installation* 11
Remeasurement: 11
1.C SELECTING WITNESS TREES AND WITNESS TREE/NAVIGATION FORM 12
1.C.1 Selecting Witness Trees 12
1.D PLOT LAYOUT 17
1.D.1 Correcting for Slope 21
1.E PHOTOGRAPHING THE PLOT 24
1.E.1 Photographing the Plot *(Required)* 24

SECTION 2: SETTING FORM 25

CSE 2.4 District (2-digit) *Default* 29
CSE 2.5 Location (2-digit) *Required* 29
CSE 2.6 Stand Number/PlotID (4-digit) *Required* 29
CSE 2.9 County (3-digit) Default 29
CSE 2.11 Date (8-digit) *Required* 29
CSE 2.13 Examination Level (4-character) Default 29
CSE 2.18 Potential Vegetation Reference (3-character) *Required* 30
CSE 2.23 Setting Elevation (5-digit) *Required* 30
CSE 2.28 Examiner (12-character) *Required* 30
CSE 2.34 Setting User Code (4-character) *Required if plot area contains a situation that prohibits data collection* 30
CSE 2.38 Setting Remarks (242-character) *Required if applicable* 31
CSE 2.39 Setting Damage Category (2-digit) *Required if applicable; separate form in Exams software* 31
CSE 2.40 Setting Damage Agent (3-digit) *Required if applicable* 31
CSE 2.41 Setting Damage Severity (2-character) *Required if applicable* 31

SECTION 3: SAMPLE DESIGN FORM 32

SECTION 4: PLOT DATA FORM 33

CSE 4.1 Plot Number (3-digit) *Default* 34
CSE 4.2 GPS Locations 34
CSE 4.2.1 Plot Latitude – *Required* 34
CSE 4.2.2 Plot Longitude – *Required* 34
CSE 4.4 Plot Aspect (3 digit) *Required* 34
CSE 4.5 Plot Slope (3-digit) *Required* 35
CSE 4.11 Plot Potential Vegetation (3-digit) *Required* 35
CSE 4.18 Plot Remarks (242-characters) 35

SECTION 5: TREE DATA FORM 36

5.A TALLY TREE DEFINITIONS 36
5.A.1 Live Trees 37
5.A.2 Standing Dead Trees (timber species) 38
5.B TREE DATA ITEMS 38
CSE 5.1 Plot Number (3-digit) *Default* 41
CSE 5.2 Tag ID Number (4-digit) *Default* 41
CSE 5.3 Tree Status (1-character) *Required* 43
CSE 5.4 Tree Class (2-characters) *Required for tally trees* 43
CSE 5.5 Growth Sample Tree *(1-character) Required for GST trees* 44
CSE 5.6 Tree Species (8-character) *Required* 45
CSE 5.7 Tree Count *(3-digit) Required for seedling groups; defaulted for tally trees* 45
CSE 5.8 Number of Stems *(3-digit) Required for woodland species ≥ 1.0-inch DRC* 46
CSE 5.9 DBH/DRC *(3,1-digit; xxx.y) Required for trees ≥ 1.0-inch DBH/DRC, timber species seedling groups if average height ≥ 4.5 ft, and woodland species seedling groups if height class ≥ 1 foot* 46
CSE 5.10 Height (3-digit) *Required for GST trees, trees with broken or missing tops, dead trees, and seedling groups* 49
CSE 5.12 Radial Growth (2-digit) *Required for GST trees with DBH > 3.0 inches* 49
CSE 5.14 Height Growth *(2,1-digit; xx.y) Required for GST trees 1.0-2.9 inches in diameter* 50
CSE 5.15 Tree Age *(4-digit) Required for GST trees do not record on junipers less than three inches DRC* 50
CSE 5.16 Crown Ratio *(3-digit) required for live trees including seedling groups* 50
CSE 5.17 Crown Class *(2-character) Required for all live trees including seedling groups.* 50
CSE 5.20 Snag Decay Class *(1-digit) Required for dead trees* 51
CSE 5.22 Tree Damage Category (*2-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable* . 51
CSE 5.23 Tree Damage Agent *(3-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable* 52
CSE 5.25 Tree Damage Severity *(2-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable* 52
CSE 5.26 Tree Remarks (*30-character)* 52
CSE 5.29 Tree Distance *(3 digit) Required for all trees ≥ 1.0 inch DBH/DRC* 53
CSE 5.30 Tree Azimuth (3-character) *Required for all trees ≥ 1.0-inch DBH/DRC* 53

SECTION 6: VEGETATION COMPOSITION AND GROUND SURFACE COVER TRANSECTS FORMS. 54

6.A VEGETATION COMPOSITION – COVER BY LIFEFORM AND COVER BY LAYER 54
6.A.1 Tree Lifeform – Cover and Cover by Layer 55
6.A.2 Shrub, Forb, Graminoid Lifeforms Cover 56
6.B VEGETATION COMPOSITION – COVER BY SPECIES FORM 57
6.B.1 Species List for species with ≥ 3% cover). 58
6.B.2 Noxious Species, Sensitive Species List, and aspen 59
6.B.3 Making Plant Species Available in the Exams Template. 59
6.C GROUND SURFACE COVER FORM 60

SECTION 7: DOWN-WOODY MATERIALS FORM 65

7.A DEFINITION OF DOWN-WOODY MATERIALS 65
7.A.1 Coarse Woody Debris (CWD). 65
7.A.2 Fine Woody Debris (FWD). 65
7.B DOWN-WOODY MATERIALS SAMPLING PROCEDURES 66
7.B.1 Down-Woody Materials Transect Layout 66
7.B.2 Down-Woody Materials Attributes to collect: 67
CSE 7.1 Plot Number (3-digit) *Default* 68
CSE 7.2 and 7.3 First Duff and Second Duff (2.1-digit; xx.y) *Required* 68
CSE 7.5 1-hr (0.01 to 0.24 inch) (3-digit) *Required* 70
CSE 7.6 10-hr (0.25 to 0.99 inch) (3-digit) *Required* 70
CSE 7.7 100-hr (1.00 to 2.99 inches) (3-digit) *Required* 70
CSE 7.8 CWD Transects Piece Count (3-digit) *Required* 73
CSE 7.9 Log Decay Class (1-character) *Required* 73

CSE 7.10 Diameter (at point of intersection) (3,1-digit; xxx.y) *Required* 74
CSE 7.11 Piece Length (3,1-digit; xxx.y) *Required* 76
CSE 7.12 Diameter Large End (3,1 digit; xxx.y) *Required* 76

LITERATURE CITED 77

APPENDICES: 78

APPENDIX A: DATA COLLECTION FORMS 79
Appendix A2: Photo Placard 82
Appendix A4: Microplot Seedling Data Collection Form 82
Appendix A4: Microplot Seedling Data Collection Form 84
Appendix A5: Vegetation Composition Form 85
Appendix A6: Ground Cover Sample Form 87
Appendix A7: Down-Woody Materials Form 88
APPENDIX B: GENERALIZED GPS OPERATING INSTRUCTIONS 90
APPENDIX C: FINDING THE PLOT CENTER USING BASELINE TECHNIQUES 93
APPENDIX D: TOLERANCES FOR THE R1 INTENSIFIED GRID INVENTORY 98
APPENDIX E: TALLY TREE SPECIES (TIMBER AND WOODLAND SPECIES) 105
APPENDIX F: INDIVIDUAL PLOT PACKET AND MULTIPLE PLOT PACKET BUNDLE CONTENTS 108
Plot Packet Contents: 108
Individual Plot Submission Requirements: 108
APPENDIX G: RECOMMENDED FIELD GEAR 110
APPENDIX H: EDITING AN INTENSIFICATION TEMPLATE FILE 112
APPENDIX I: NOXIOUS AND SENSITIVE PLANTS LISTS: 115
APPENDIX J: R1 HABITAT TYPE GROUPS 117

INDEX 121

FIGURES AND TABLES

Figure 1.1 – Witness Tree Configuration 12
Figure 1.2 – Example of a racetrack tag scribed with plot number, and whether it is an X or Y witness tree. 13
Table 1.3 – Witness Tree Reference Attributes 15
Table 1.4 – Alternative Witness Items 16
Figure 1.5 – Record the distance from plot center to the center of the face of the witness tree. 16
Figure 1.6 – Screen shot of Exams Software Witness Tree Information Form 17
Figure 1.7 – Plot layout for even numbered plots 18
Figure 1.8 – Plot layout for odd numbered plots 18
Table 1.9 – Plot Layout Sampling Description 19
Figure 1.10 – Crown Cover Transect and DWM Transect Layout 21
Table 1.11 – Slope Correction Factors 22
Figure 1.12 – Macroplot Option Information 23
Table 2.1 – Setting Data Form Required Attributes 25
Table 2.2 - Setting User Code 30
Figure 3.1 – Tree Sample Design 32
Figure 3.2 – Vegetation Composition Sample Design 32
Figure 3.3 – Surface Cover Sample Design 32
Figure 3.4 – Down-woody Material Sample Design 32
Figure 4.1 – Plot Form Required Fields 33
Figure 5.1– Sample Tree Specifications 36
Table 5.2 – Required fields for the R1 Intensified Grid Inventory Tree Data Form 39
Table 5.3 – Tree Class Definitions 43
Table 5.4 – GST Measurements by Diameter Class Range 44
Table 5.5 – Seedling Height Class Groups 45
Table 5.6 – CROWN CLASS Categories 50
Figure 5.7 – Slope Corrected Horizontal Tree Distance Example ..... **Error! Bookmark not defined.**
Table 6.1 – Vegetation Composition and Ground Surface Cover Exam Levels ..... **Error! Bookmark not defined.**

Table 6.3 – Reference Areas for 1/24th Acre Plot Percentages 56
Table 6.4 – Exams Cover by Lifeform Attributes 55
Figure 6.5 – Exams Cover by Lifeform Form Screenshot 57
Figure 6.6 – Exams Cover by Species Form Screenshot 58
Table 6.7 – Layer Code Definitions 58
Figure 6.8 – Adding Plant Species Code to Dropdown Menu Screenshot 1 59
Figure 6.9 – Adding Plant Species Code to Dropdown Menu Screenshot 2 60
Figure 6.10 – Adding Plant Species Code to Dropdown Menu Screenshot 3 60
Table 6.11 – Ground Surface Cover Type Codes and Category Definitions. 61
Figure 6.12 – Exams Ground Surface Cover Screenshot 63
Figure 6.13 – Ground Surface Cover Adjustment Guidelines 63
Figure 7.1 – Down Woody Materials Adjustment for Nonsampled Transect 66
Table 7.2 – Required Down Woody Material Fields 67
Table 7.3 – FWD Diameter Size Classes 69
Figure 7.4 – Tally rules for CWD 71
Figure 7.5 – CWD Tally Rules: Intersections 72
Figure 7.6 – CWD Tally Rules: Forked Trees 73
Table 7.7 – Log Decay Class Definitions 73
Figure 7.8 – Diameter Measurement 74
Figure 7.9 – Estimating Diameter (Pieces that are Not Round in Cross-Section) 75
Figure 7.10 – Example of Decayed End Intersecting the Transect 75

Introduction

This Region 1 (R1) manual supplement outlines the procedures for the field implementation of the Intensification of the FIA Grid inventory, referred to as the "R1 Intensified Grid Inventory". This inventory combines: (1) FSVeg Common Stand Exam/Inventory and Monitoring (CSE/IM) data collection protocols, and (2) Interior West Forest Inventory and Analysis (FIA) protocols.

Although this manual supplement is a combination of CSE and FIA variables and definitions, it is designed for use in conjunction with the *R1 Common Stand Exam and Inventory and Monitoring Field Guide,* referred to as R1 CSE/IM Field Guide. FIA definitions and procedures necessary for field implementation have been incorporated into this document.

Section 1, Data Collection Overview, has been divided into the following subsections: (A) General Information, (B) Finding Plot Center and Plot Monumentation, (C) Selecting Witness Trees, (D) Establishing the Plot, and (E) Photographing the Plot. The remaining sections in this manual (sections 2 through 7) directly correspond to the section chapters in the most current version of the R1 CSE/IM Field Guide (available for download at http://fsweb.r1.fs.fed.us/forest/inv). For example, section 2 in this document and in the R1 CSE/IM Field Guide relate to the Setting Form. The only exception to this is found in section 1.C.1.3 Witness Tree Data Items, which have been moved from section 4 to section 1 to reduce the need to flip between different sections of this manual during plot installation. Witness tree data items are found in section 4 in the R1 CSE/IM Field Guide.

To further assist the reader, all data items that pertain to the R1 CSE/IM Field Guide are preceded by a "CSE" in this document. For example, EXAMINATION LEVEL is referenced as item number "2.13" in the CSE manual, and it is referenced as item "CSE 2.13" in this document. Note: The only CSE/IM fields addressed in this manual are those that are required by Region 1. These fields are included in the default template for the Exams software program for grid intensification.

Unless an item is defined within this manual, the associated CSE/IM definition and appendices apply.

Section 1: Data Collection Overview

Remeasurement information has been highlighted throughout this document

1.A. General Information

1.A.1 Data Collection

1.A.1.1 Use of Portable Data Recorders and Exams Software

All data collected for the R1 Intensified Grid Inventory is recorded on a Juniper Systems Allegro (hereafter referred to as the PDR) using Exams software. Other makes and models of portable data recorders may be used for data collection, however the Region 1 Analysis Team only provides support for Juniper Systems Allegros. Paper data forms may be used to record field data in the event of PDR malfunction at the time of data collection, (refer to appendix A). If paper forms are utilized for data collection due to PDR malfunction, the data collected on the forms will be entered into the PDR when repaired, or may be directly entered into ExamsPC software on a computer. As an exception, *always* complete the **Plot Location Reference Form** (appendix A1; also refer to section 1.B) on paper; this form is labeled "Supplemental" in the upper right corner of the form.

The Forest may also specify additional attributes to collect.

Exams software: Prior to data collection, ensure that the most current version of Exams software, for the appropriate model of PDR and the PC, is downloaded. Each field crew will be provided with an intensification template file with intensified grid parameters set. This file includes the sample design and all valid lookup codes for discrete attributes. As an exception, refer to the R1 FSVeg Plant List for acceptable species codes (*available at website listed below*). The default values, referenced in this manual, require no additional keystrokes for data entry using the Exams software.

Websites:

Exams software is available at - • FS employees: http://fsweb.nris.fs.fed.us/products/PDR/CSE/installation.shtml • Contractors: http://www.fs.fed.us/nrm/fsveg/
R1 FSVeg Plant List (species codes) is available at – • FS employees at: http://fsweb.r1.fs.fed.us/forest/inv/fia_data/int_grid.htm • Contractors: electronic copies are available from your forest contact

Note: Only the CSE/IM fields addressed in this manual are required for Intensified Grid plots. These fields are included in the default intensification template for the Exams software program. The intensification template is for use with the Inventory and Monitoring option in Exams software and will have an .im file extension.

1.A.1.2 GPS Requirements

Use a GPS receiver that has the ability to be WAAS enabled and obtain the stated accuracy of ± 15 meters (49.2 feet) or less in the horizontal dimension. The easting and northing coordinates acquired by the GPS for the PC must be ± 10 meters (32.8 feet) of the stated plot location center. The GPS must be capable using waypoints and must have a route or distance function for navigation.

The required coordinate system for all GPS readings taken for intensified grid plot work is NAD 1983. Be certain the GPS is set to NAD 1983 prior to entering plot coordinates, or collecting GPS coordinates. See appendix B for additional GPS specifications and Information.

1.A.2 Quality Control

The goal of the quality assurance program is to ensure that all resource inventory data are scientifically sound, of known quality, and meet the specifications in this manual. Measurement quality objectives (MQO) are established as standards to define data quality. Part of the MQO is the allowable range of measurement or classification error, termed the **tolerance**. Examples of these data item tolerance limits are indicated throughout this manual within the text, generally directly below the corresponding data item. These examples are for quick reference only, and do not represent the entirety of acceptable ranges for all data collected on plot. Refer to appendix D for a complete list of tolerances. Both contractors and force account crews will be subject to periodic on-site inspections of plot locations to ensure fieldwork is being performed with the required accuracy and precision. Field checking is also conducted for the following reasons:

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

At least 10 percent of all field plots must be cold checked for quality assurance. The Forest must provide all QA/QC documentation to the Regional Office as required. These audits will be monitored by the Regional Office to ensure Intensified Grid data standards are maintained.

Remeasurement: If this inventory is part of a remeasurement effort, pay particular attention to the remeasurement box associated with each data item. Some items are updated, some are not.

The R1 Analysis Team has been seeing large numbers of plots turned in for uploading and processing that have missing data in required fields. In the event required data was not collected during initial plot installation, it is critical for remeasurement crews to identify attributes that should have been collected by prior crews and collect those attributes in order to avoid the perpetuation of these errors into the future.

In some cases the missing data items are fields that should be defaults in the re-measurement Exams template. Remeasurement crews need to scan the required fields on each form for blanks and collect this data if the fields are empty.

1.A.3 Situation Prohibiting Data Collection

If an entire plot or portion of a plot cannot be sampled because of a situation prohibiting data collection, such as a permanent physical condition/feature restricting access (e.g., cliffs, water, developed structure), collect as much data as can safely and accurately be collected. Take a photo as close to the plot as possible which documents the hazardous situation. Take GPS readings from the location where the photo is taken and enter the coordinates in the setting remarks field (CSE 2.38) in exams. Transient conditions such as snow or nightfall are not valid reasons for incomplete data collection, or for not completing the required measurements on a plot. Revisit the plot at another time when the plot will not be covered by snow or darkness.

Never sample private land. If a plot lands on private land (a very rare situation), and you are very close to Forest Service administered lands then you may be able to offset the plot center and install the plot there. At the point where you become aware that you are about to cross onto private land, use the GPS waypoint function to determine the distance and azimuth from your current location to the PC waypoint. Mark this location with a temporary marker. Add 90 degrees to the azimuth on the GPS. If traveling the distance on the GPS in the new direction will locate the plot entirely on Forest Service administered land, then use this as the new plot center. If not, go back to the location you marked when you were about to cross into private land. Add an additional 90 degrees (for a total of 180 degrees) to the azimuth you would travel along to get to the original plot location. If traveling the distance on the GPS in the new direction will put the plot entirely on Forest Service administered land, then use this as the new plot center. If not, repeat this procedure adding 270 degrees. If distance is the issue, then add 30 meters to the distance given by the GPS. If this doesn't locate the plot entirely on Forest Service land, add an additional 30 meters. If this doesn't locate the plot on Forest Service land, then contact the R1 Analysis Team and they will provide you with a new location center.

In the event a plot is inaccessible, complete the following items under **Setting Data**:

- SETTING USER CODE (CSE 2.34) – Record Setting User Code to indicate the following: (a) the reason why data could not be collected, and (b) the portion of the plot that has missing data. Refer to item 2.34 for further information.
- SETTING REMARKS (CSE 2.38) – Describe the situation/condition prohibiting data collection in the Setting Remarks.

On rare occasions an intensified grid plot location can be identified as inaccessible before going into the field based on aerial photography and topographic maps. In these rare cases, a plot can be considered inaccessible from the office. For example, the contracting officer's representative (COR) identifies that the plot center is on a cliff face based on the 7.5-minute quadrangle topographic map and cannot be accessed. In this case the Setting User Code (item 2.34) would be entered to indicate that 100% of the plot is inaccessible (Setting User Code = 5100).

1.A.4 Order of Data Collection

The suggested order of data collection is as follows:

- Plot Location Reference Form items
- Take photo (if required for the project) while collecting GPS point data

- Vegetation Composition
- Ground Surface Cover
- Down-woody Material data and Crown Cover information
- Tree data

1.B Finding the Plot Center and Plot Monumentation

1.B.1 Travel Description

As an aid in relocating the plot location in future inventories, it is necessary to provide a description of travel from a highway intersection, or other prominent landmark, to the vicinity of the Reference Point (RP), as described below.

Route from easily identifiable starting point to parking location should contain (as a minimum):

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

Hiking directions from vehicle to RP should contain (as a minimum):

- Trail name/number – if applicable
- Name of drainage/creek/ridge – if applicable
- Major landmarks
- Approximate distances between trails, creeks, landmarks, etc.

Under Travel Description on the **Plot Location Reference Form** (Appendix A1, item 1.B.1), record road and hiking directions from a highway intersection, or other prominent landmark to the vicinity of the RP.

The travel directions must be added to the ~~electronic~~ Exams datafile in **Plot Data<Witness Tree|Navigation Information** may be easier to use ExamsPC once the data has been loaded onto a computer.

- ❖ Tolerance (Travel Description): Both Road *and* Hiking directions must be present

1.B.2 Vehicle Coordinates

Record the following to indicate the location of the vehicle parking spot via GPS on the Universal Transverse Mercator (UTM) NAD 1983 grid system.

1.B.2.1 Easting – *Required*

Record the Easting for the vehicle parking location on the **Plot Location Reference Form**. Record as a 7-digit code using UTM coordinates.

1.B.2.2 Northing – *Required*

Record the Northing for the vehicle parking location on the **Plot Location Reference Form**. Record as a 7-digit code using UTM coordinates.

1.B.2.3 Zone – *Required*

Record the UTM Zone acquired by GPS.

1.B.3 Reference Point

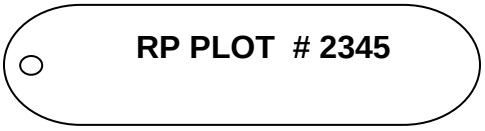
Prior to locating the plot center (PC), it is necessary to designate a plot reference point. A Reference Point (RP) is a landmark that is used in establishing the position of the PC. The RP is also used to relocate the PC in future inventories, especially if there has been a disturbance since the previous measurement.

Choose a RP that is readily identifiable on both the ground and the aerial photograph/DOQ (digital ortho-quad). Select a landmark such as a prominent tree or large boulder, a sharp bend in a road, a fence corner, etc. If a tree (preferred) is designated for the RP, select a tree that is not likely to die or be removed within the next 10-15 years. If possible, choose an RP with a view of the southern sky to allow for optimum satellite reception. Do not select an RP that is in close proximity to features that will interfere with compass readings (such as metal structures/objects, barbed-wire fences, high-power transmission lines). A unique and obviously identifiable RP (on both the aerial photograph and the ground) may be critical in relocating the PC for future inventories should significant change occur over time.

The RP should be at least 75 feet from the PC, if possible. It is more important for the RP to be easily identifiable so in certain circumstances, an RP can be less than 75' from the PC.

Monument the RP during plot installation. Attach aluminum racetrack tags scribed with "RP PLOT #" to the RP.

Tag the RP as follows:



Nail aluminum tags with aluminum nails 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 when following the travel directions and nail a second tag at 6 feet on the opposite side of the tree. Nail a third tag at ground level facing towards the plot. 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 (such as highly visible from a designated trail), only attach the tag at ground level and make a note on the paper Plot Location Reference Form in the RP box in the Remarks field (1.B.4.3) (appendix A1). If no tree is available, mark rocks or other objects with a paint pen or however possible and record in the notes section. However, do not tag aspen.

Avoid aspen, if possible; if an aspen tree is used, be sure it is only marked with a paint pen, no nails.

Remeasurement Reference Point:
Remonument when the RP tags cannot be found, when the old tags have been damaged, or if the RP has grown such that less than 1" of nail is exposed between the bark and tag. When replacing an RP tag, remove the old tag before nailing in the new tag.

Remeasure the Reference Point Diameter.

- Tolerance (RP):
  - RP Selection: at least 75' from the PC, unless extenuating circumstances apply
  - RP Selection: easily identifiable on the ground and in aerial photo

The following items are recorded on the **Plot Location Reference Form,** Appendix A1, Section 1.B.3**.**

1.B.3.1 Remarks

Record a detailed description of the RP and its location. For example, "large ponderosa pine with a fork in the southwest corner of the meadow." If the RP is not a tree, record a description clearly identifying the point such as, "northwest corner of old building at the south end of clearing."

1.B.3.2 Reference Point Species

If the reference point is a tree, record the Plants code

- Tolerance (RP): Species: No Errors

1.B.3.3 Reference Point Diameter

Record DBH to the nearest 0.1 inch

- Tolerance (RP): Diameter: ± 0.2 inch per 20 inches of diameter

1.B.3.4 Reference Point Coordinates

Record the following to indicate the location of the RP via GPS on the Universal Transverse Mercator (UTM) NAD 1983 grid system. See appendix B for requirements and additional information in using a GPS unit.

1.B.3.4.1 Easting – *Required*

Record the Easting for the RP on the **Plot Location Reference Form**. Record as a 7-digit code using UTM coordinates.

- Tolerance (RP): ± 10 meters (16.4 feet) of the stated plot location center

1.B.3.4.2 Northing – *Required*

Record the Northing for the RP on the **Plot Location Reference Form**. Record as a 7-digit code using UTM coordinates.

- ❖ Tolerance (RP): ± 10 meters (16.4 feet) of the stated plot location center

1.B.3.4.3 Zone

Record the UTM Zone as determined by GPS.

1.B.3.4.4 Error (to the nearest foot, as shown on the GPS unit)

Record the error as shown on the GPS unit to the nearest foot.

1.B.3.4.5 Number of Readings (Hits)

Record the number of readings that were averaged by the GPS unit to calculate the plot coordinates.

1.B.4 Traversing from the RP to the PC

It is the responsibility of the field crew to locate the plot location center (PC) on the ground as indicated by the theoretical plot coordinates provided. Wherever possible, use the following procedures as the primary method for locating the PC.

Using the GPS waypoint function, determine the distance and azimuth from the RP to the PC waypoint. Using a compass, tape and clinometer, traverse from the RP to PC along the GPS provided distance and azimuth.

*Note: GPS distances will be in horizontal distance; be sure to correct for slope when running tape and recording slope distance to PC.

In the event that it is not possible to obtain satellite coverage to navigate to the PC (e.g., malfunctioning GPS, heavy canopy cover, dead batteries, poor satellite reception) locate the PC using alternative baseline techniques described in appendix C. If necessary, plot the location of the PC on topographic maps and/or aerial photography prior to locating the PC on the ground.

Record RP to PC traverse information (azimuth and slope distance) on the **Plot Location Reference Form,** Appendix A1, during initial installation.

Remeasurement RP to PC Traverse:
Check azimuth and slope distance from RP to PC. If outside of tolerance, update values, otherwise transcribe information from previous measurement to the Plot Location Reference Form.

1.B.4.1 Azimuth (to the nearest degree; in 3 digits)

- ❖ Tolerance (RP to PC Traverse): Azimuth: ± 10 degrees

1.B.4.2 Slope Distance (record to the nearest foot)

- ❖ Tolerance (RP to PC Traverse): Distances: ± 6 feet per 100 feet of transect (30 feet maximum)

1.B.5 Plot Center (PC) Location Information

Record the following to indicate the location of the PC:

1.B.5.1 Easting – *Required*

Record the Easting for the PC on the Plot Location Reference Form. Record as a 7-digit code using UTM coordinates.

- Tolerance (RP): ± 10 meters (16.4 feet) of the stated plot location center

1.B.5.2 Northing – *Required*

Record the Northing for the PC on the Plot Location Reference Form. Record as a 7-digit code using UTM coordinates.

- Tolerance (RP): ± 10 meters (16.4 feet) of the stated plot location center

1.B.5.3 Zone

Record the UTM Zone as determined by GPS.

- Tolerance (RP): No errors

1.B.5.4 Error (to the nearest foot, as shown on the GPS unit)

Record the error as shown on the GPS unit to the nearest foot.

- Tolerance (RP): < 70 feet

1.B.5.5 Number of Readings (Hits)

Record the number of readings that were averaged by the GPS unit to calculate the plot coordinates.

- Tolerance (RP): ≥ 30 readings

Remeasurement Finding Plot Center:

Crews will be given electronic Exams data files (*.im) and a copy of the Plot Location Reference Form from the previous measurement. It is the responsibility of the field crew to re-locate the plot center (PC) on the ground with the provided information.

Review the Plot Location Reference Form included in the plot packet. Review the travel descriptions prior to traveling to the plot. Once the vehicle is parked, collect a GPS location for the truck and store it on the GPS unit and record on the Plot Location Reference Form for the current measurement.

Use the map, photos, crew notes and the PC/RP coordinates to help relocate the plot.

A reference point (RP) and witness trees were established in the first measurement to aid in relocating the plot. The RP is a landmark (usually a tree) that is identifiable on both the ground and the plot photo, and is described on the Plot Location Reference Form. Trees used as RPs were marked with aluminum tags: one tag nailed below stump height (1-foot) facing in the direction of the plot center, and two other silver tags nailed approximately 6 feet above the ground. One of the tags and faces the direction of approach to the plot and the other faces the location of the plot center.

Once the crew arrives in the vicinity of the plot, based on the GPS reading, they should look for the witness trees (X and Y) to help locate the plot center. The crew should also look for old flagging, plot stakes, and nails in trees at 4.5' (DBH).

The X tree will be marked with a silver tag with the letter "X" scribed on it above DBH facing the plot center. When possible, the X tree will be located on an extension of the course followed from the RP to the plot center. Both the X and Y trees have silver tags with "X" or "Y" scribed on them nailed less than 1 foot above the ground surface, facing the plot center. The Y tree should be located at a right angle to the line from the X tree to the plot center. The X and Y trees can be used to triangulate the center stake location. In general, the crews try to select an X tree between 25-30 feet from the PC and a Y tree that is as close to the PC as possible.

To triangulate the plot center location using the witness trees, measure the slope distance from the base of the X tree specified on the **Plot Location Reference Form** in the direction of the back azimuth to the azimuth specified for the X tree. Use the same procedure on the Y tree, measuring the Y slope distance in the direction of the back azimuth from the Y tree. The slope distances from the X and Y trees should intersect at the location of the center stake for the plot. Remove duff and soil, and search through vegetation for the plot stake (a thin, bent aluminum rod, or a short piece of rebar). Depending upon circumstances, a metal detector may be useful in finding the center stake. The previous measurement's Tree Data may also be useful in locating the plot.

If the plot lands outside of the currently administered National Forest System boundary, do not remeasure the plot. Inform the Contracting Officer/Contracting Officer's Representative.

Contractors:
If a plot cannot be re-located after one hour of searching, the plot can be declared 'unfound'. The Contracting Officer's Representative (COR)/inspectors will then attempt to locate the plot within that same timeframe. If the plot is located within that timeframe, it will be flagged by the COR/inspectors, and the field crew will be required to return to plot and remeasure with no monetary compensation adjustment or forfeit all compensation for that plot. If the COR/inspectors are unable to find the plot within an hour's time, the field crew will be compensated for their initial attempt at plot re-location at the full rate of plot remeasurement.

1.B.6 Monumentation of the Plot Center - *Installation*

Mark the plot location center (PC) by installing a metal stake in the ground. 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 PC cannot be established (e.g., in a river, rock, on a paved road), it is necessary to monument the plot center with an "offset stake" due to circumstances that prohibit the placement of a stake at the actual PC location. Record the **offset azimuth** (1.B.6.1) (to the nearest degree) and **slope distance** (1.B.6.2) (to the nearest 0.1 foot) from the offset stake to the PC on the **Plot Location Reference Form** under PC Coordinates (appendix A1), and in Exams Setting Remarks (item 2.38). Lay out the plot and take all measurements from the actual PC, not from the offset stake.

Remeasurement:
If plot center monumentation is damaged or the stake is missing, follow the instructions in this section to re-monument the plot.

1.B.6.1 Plot Location Map.

Draw a simple sketch of the plot location and hiking route from the vehicle to the PC on the paper **Plot Location Reference Form**. Include any helpful landmarks that may aid crews in relocating the PC in future inventories (e.g., location of RP, old jeep roads, hiking/game trails, drainages, cliffs, openings).

1.B.6.2 Plot Narrative/Remarks.

Use this section of the form to record general notes pertaining to the plot location such as the presence of hazardous conditions, description of alternative PC witness landmarks, general stand condition, etc.

1.C Selecting Witness Trees and Witness Tree/Navigation Form

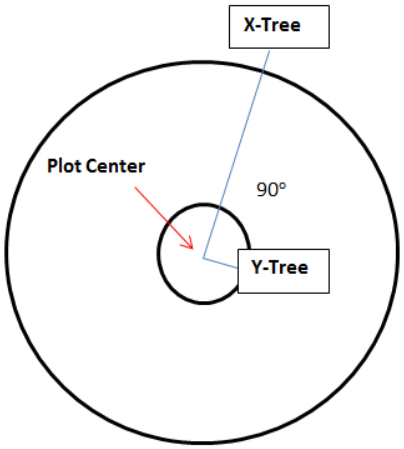
Remeasurement: if this is a re-measurement and the old witness trees are no longer suitable, then update with new trees. If old trees are still suitable, check distance, azimuth, slope distance, and diameter and update if not within stated tolerance.

Pull nails so that at least one inch of the nail is exposed. When pulling nails, it often helps to pound them in slightly prior to pulling to break the nail free of the tree's sap. Ensure that nails and tree tags are in good order, and replace if necessary.

1.C.1 Selecting Witness Trees

The X and Y witness trees (and/or other non-tree witness item) should be easily seen from the plot center and be roughly within the plot radius. Choose an X tree that is easily identifiable on the ground and in the aerial photo. Choose a Y witness trees with a trajectory to plot center which is as close to 90 degrees from the X tree to plot center trajectory as possible. The farther the two witness trees are from a right angle to each other, the less useful they will be for triangulating the plot center for relocation. Ideal witness trees are live, larger than five inches DBH, expected to live at least 10 more years, *are not* aspen, and are easily identifiable on the ground and in aerial photos.

Figure 1.1 – Witness Tree Configuration



Note on aspen: if aspen is the only species available, mark the tree(s) with paint pens only; do not break the bark with nails, scribes, etc. If no suitable witness tree(s) can be found within the plot vicinity, choose other obvious witness items, including trees that are less than five inches DBH and potentially dead trees, if they are expected to remain standing for 10 years. Other Witness Items that can be used in lieu of trees are listed in table 1.4. Attempt to mark non-tree witness items where possible via paint pen, tag, etc.

1.C.1.1 Witness Tree Specifications

Witness trees allow for plot center relocation via triangulation. For each plot that is monumented, two witness trees, or other items if trees are not available, will be established and referred to as X and Y.

Preferably, witness trees should meet the following criteria:

- Not likely to die within 10 years, generally healthy
- A species easily located on the site (e.g. an Engelmann spruce in lodgepole pine forest type). Avoid aspen, if possible; if an aspen tree is used, be sure it is off the subplot and only marked with a paint pen – no nails.
- At least 5.0-inches DBH (if possible).

"X" Tree:

- When possible, the X tree will be located on an extension of the course followed from the RP to the plot center.
- Ideally, a distance of 25-30 feet from the PC.
- If there are no suitable trees at 25-30 feet, use a tree closer to PC.

"Y" Tree:

- As close to PC as possible.
- At a right angle to the X tree to PC azimuth, if possible.

If no live trees are within the vicinity of the PC (e.g., clearcut, burn area) select alternative witness landmarks that are likely to be present in 10 years (e.g., a sound snag, prominent rock, rock cairn, road intersection, etc.), see table 1.4.

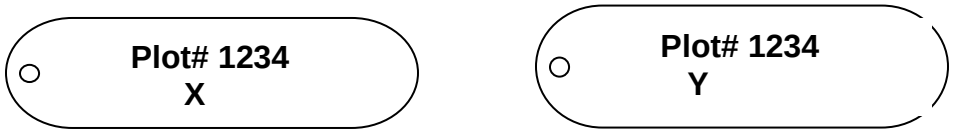
Record all **X/Y** information under **Plot Data>Witness Tree|Navigation** in Exams software as well as on the paper **Plot Location Reference Form**, appendix A1.

1.C.1.2 Tagging Witness Trees

For X trees: Scribe two aluminum racetrack tags, labeled with the plot ID number, and an "X". Nail one tag to the base of the tree (ground level) and the other tag approximately 6 feet above the ground, with both tags facing the PC stake. If a tree < 3.0" DBH is used, do not tag the tree at 6 feet, but record a comment in the **X Remarks** field (4.19.9) in the **Witness Tree/Navigation Information Form** in Exams and on the paper **Plot Location Reference Form**.

For Y trees: Scribe one aluminum racetrack tag, labeled with the plot ID number, and a "Y". Nail the tag to the base of the tree, with the tag facing the PC stake.

Figure 1.2 – Example of a racetrack tag scribed with plot number, and whether it is an X or Y witness tree.



Witness Tree tags are attached with three-inch aluminum nails, leaving at least two inches exposed to accommodate growth. Aluminum nails are used because they do not cause damage to saws, sawmills, harvesters, and because they do not rust. When using other items such as rocks, it will be necessary to improvise by marking objects with paint pens, attaching tags with aluminum wire, etc.

Record this information in Exams software in the **Witness Tree|Navigation Information Form** under **Y Remarks**. If no live trees are within the vicinity of the PC, and a landmark other than a tree is selected to witness the location, clearly describe the alternative landmark in the **X** and/or **Y Remarks** fields (4.19.9), as well as in the **Remarks** under the **PC Witness Trees** section on the paper **Plot Location Reference Form.**

If using witness trees and the tree is also tallied on the Tree Form then indicate the Tag Number, once the Tag Number is entered into the Exams software Witness Tree Form, DBH and Species will auto fill from the tree data entry form if the tree has already been tallied. ***Note: auto fill of tally tree distance will reflect horizontal distance from tally tree, so crew will need to ensure slope distance is entered after auto fill for witness trees.**

Plot Locations in Wilderness Areas: Nail only one tag at ground level, facing the PC. Use tags that have been spray painted brown or grey on both sides. Carefully select and adequately describe the RP to provide sufficient means for future relocation. Remove all flagging before leaving the vicinity, or utilize rapidly disintegrating biodegradable wood fiber flagging tape. The heads of all aluminum nails should be painted brown unless otherwise directed by Forest.

Remeasurement Witness Trees:
If previously selected trees are still suitable, check azimuth and slope distance, ~~and~~ update if outside of specified tolerances. Measure DBH and update.

Re-tag trees, if necessary. Pull nails so that at least one inch of the nail is exposed. When pulling nails, it often helps to pound them in slightly prior to pulling to break the nail free of the tree's sap.

If this is a remeasurement and the previous witness tree(s) is/are no longer suitable, then select new witness trees (1.C.1) and replace the previous Witness Tree information.

1.C.1.3 Witness Tree Data Items

It is preferable to use trees as witness items, all other options listed in table 1.4 should be used if there are no trees available. Table 1.3 below lists the witness tree information that needs to be recorded. Many of the following witness tree data items will be entered into Exams Software and also written on the paper Plot Location Reference Form.

Table 1.3 – Witness Tree Reference Attributes

Item number	Attribute	Description
1.C.1.3.1	Monument Type	Enter X or Y (Default in Exams)
1.C.1.3.2	Witness Type Code	Refer to table 1.4. Enter the code for the type of witness item that is being used.
1.C.1.3.3	Tag ID	If the witness tree is a tally tree, indicate the tally tree number. Note: this will need to be filled out after the tree data has been collected.
1.C.1.3.4	Species	This attribute is only available when Witness Type Code is TR. Enter the tree species (PLANTS code), if using a tree as a witness item.
1.C.1.3.5	DBH |DRC	This attribute is only available when Witness Type Code is TR. Indicate DBH or DRC, depending on species of tree. Note, if you enter a tally tree Tag ID, and the data has been entered on the Tree Form, this item will auto fill in Exams software.
1.C.1.3.6	Diameter	This attribute is only available when Witness Type Code is TR. Enter the diameter of the tree. Note, if you enter a tally tree Tag ID, and the data has been entered on the Tree Form, this item will auto fill in Exams software.
		Remeasure: Measure diameter and update.
1.C.1.3.7	Azimuth	Azimuth *from* plot center to the center of the bole of the witness tree or other witness object. Note: Declination is set at 0 degrees.
		Remeasure: Update if outside tolerance.
1.C.1.3.8	Slope Distance	Record **slope** distance *from* plot center to the center of the *face* of the witness tree or object, see figure 1.5. Record to the nearest 1/10th foot. *Note: Auto fill from tally tree Tag ID will populate horizontal distance.
		Remeasure: Update if outside tolerance.
1.C.1.3.9	Remarks	Make comments about witness items, if necessary. This is especially important when trees are not the witness item. Record remarks to aid in plot re-location, for example, give a specific description of a boulder used for

Item number	Attribute	Description
		a witness item ("X is a gray boulder roughly 2'X5'X4', measurement from the boulder was taken at an apex in the rock on the southwest side").
1.B.1	Travel Description to plot center	Describe how to locate the plot from a known location that will remain intact for the foreseeable future. See 1.B.1 Travel Descriptions. This is written on the Plot Location Reference Form, Appendix 1A.

❖ Tolerance (PC Witness Trees):

- Species: No Errors
- Diameter: ± 0.2 inch per 20 inches of diameter
- Azimuth: ± 10 degrees
- Slope Distance: ± 0.2 feet

Table 1.4 – Alternative Witness Items
Note: Trees are the preferred Witness Type;
***only use other witness options if no highly visible and identifiable trees are available*.**

Witness Type Code	Witness Item
BO	Boulder
CA	Cairn
FI	Fence Intersection
OT	Other
RB	Road Bend
RI	Road Intersection
TR	Tree (preferred)

Figure 1.5 – Record the distance from plot center to the center of the face of the witness tree.

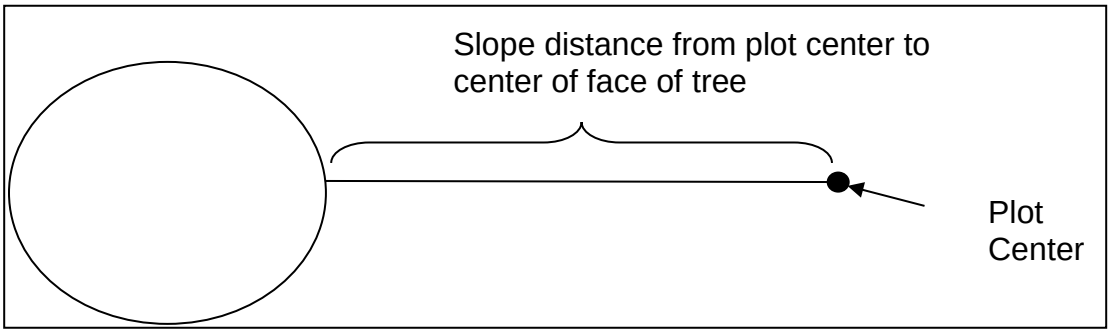
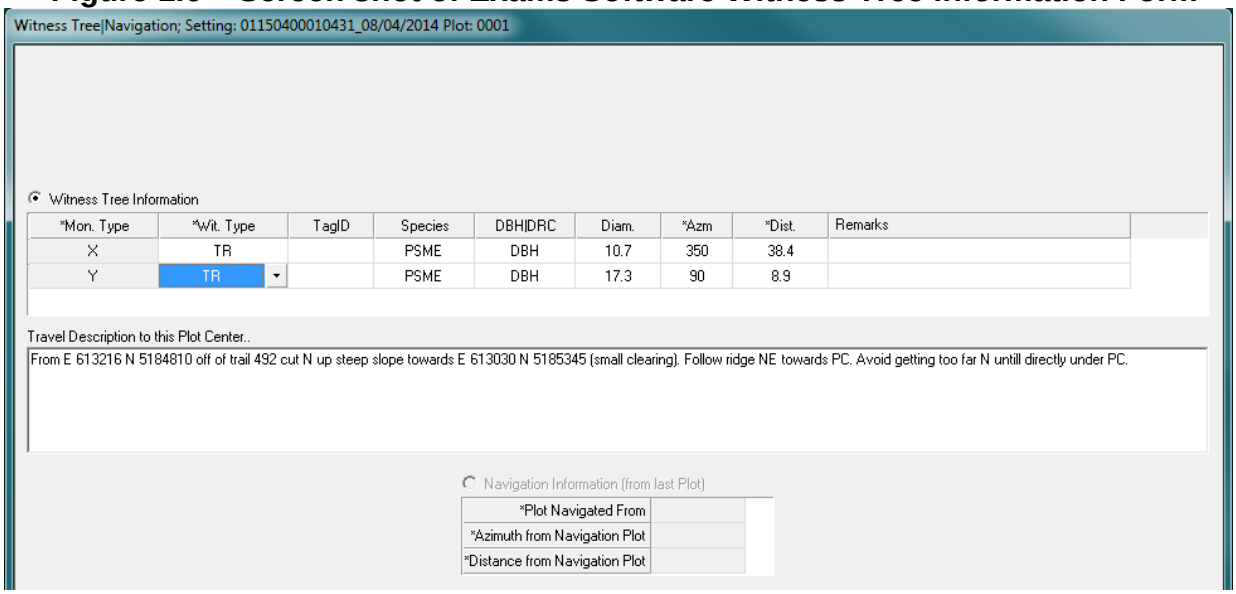


Figure 1.6 – Screen shot of Exams Software Witness Tree Information Form



1.D Plot Layout

The plot layout consists of a **subplot** (1/24th-acre fixed-radius plot) and a **microplot** (1/300th-acre fixed-radius plot). Each sample plot area is used to inventory **trees** of a specified range of heights and diameters, as indicated below. The subplot area is also used to sample **vegetation composition**.

Two 50-foot transects extend from plot center. The orientation depends upon whether the plot is odd or even. Tree canopy cover is sampled along both transects. Course-woody debris (3" and larger at point of intersection) is sampled along the first 30' of each of these transects. Along one of the transects, down-woody material <3" diameter is sampled on specified locations and lengths.

All sample plot areas are centered on the PC stake. All transects extend outward from the PC stake. Figures 1.7 and 1.8 demonstrate how a plot is laid out depending on whether it is an odd or even number. Table 1.9 describes which sample populations are selected using which methods.

Figure 1.7 – Plot layout for even numbered plots

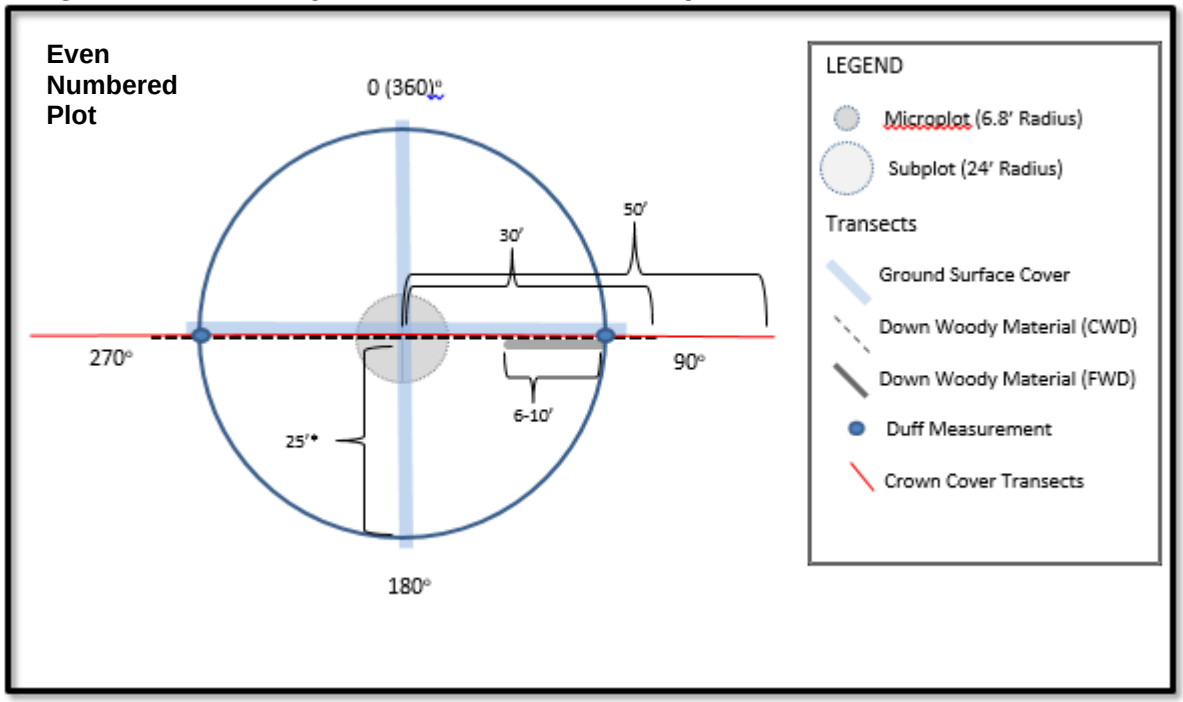
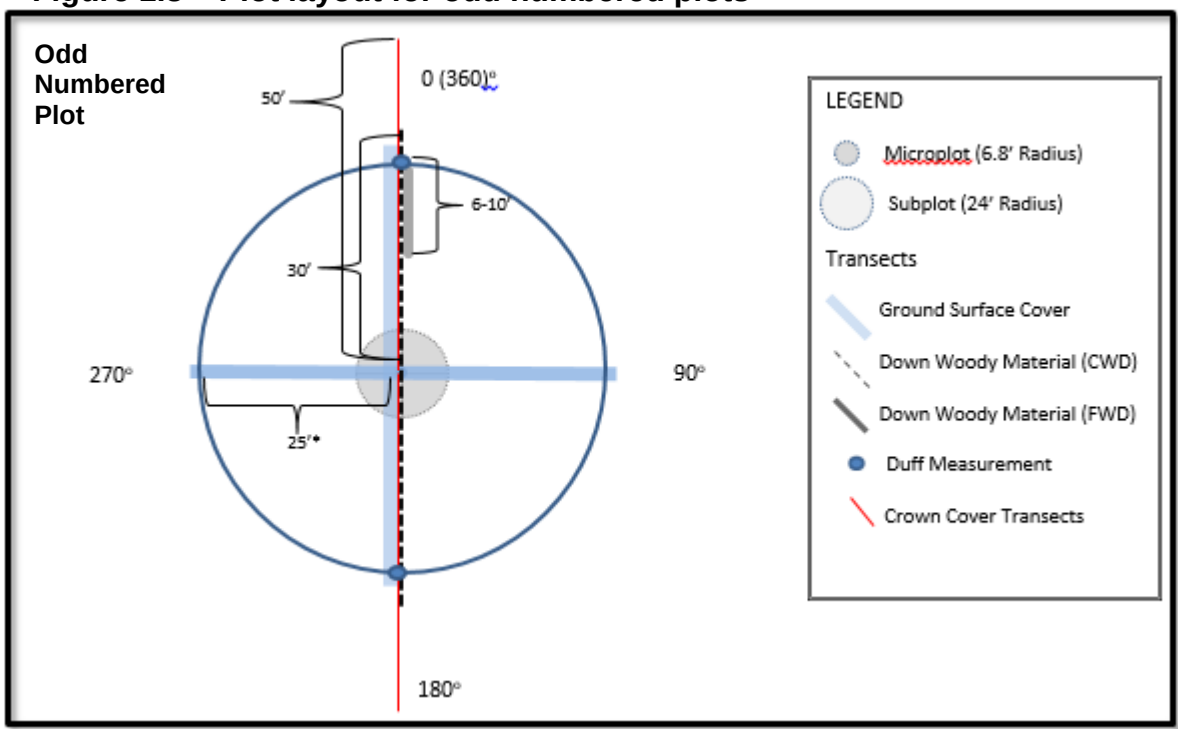


Figure 1.8 – Plot layout for odd numbered plots



* All transects are measured in *horizontal* distance except Ground Surface Cover, which is measured in *slope* distance.

Table 1.9 – Plot Layout Sampling Description

Population of Interest	Description	Type/Size of plot	Int Grid Manual Section
All Live/Dead Trees	≥ 5.0 inches DBH/DRC	**Subplot** Fixed Radius, 24' horizontal	5
Saplings	• Live and Standing Dead Trees 1.0"- to 4.9" DBH/DRC	**Microplot** Fixed Radius, 6.8' horizontal	5
Seedling Count	• Live Timber Seedlings < 1" DBH and > 0.5' tall • Live Woodland Seedlings <1" DRC and at least 1' tall	**Microplot** Fixed Radius, 6.8' horizontal	5
Tree Canopy Cover	Cover by Lifeform & Cover by Lifeform by Layer	**Transects** Two 50' Transects • 90º and 270º,even number plot • 0º and 180º, odd number plot	6
Shrub, Forb, Graminoid Canopy Cover	Cover by Lifeform & Cover by Lifeform by Layer	**Subplot** Fixed Radius, 24' horizontal	6
Cover by Species	Species with >3% Cover	**Subplot** Fixed Radius, 24' horizontal	6
Cover of Noxious species	Presence and cover of all Noxious Species as per state list	**Subplot** Fixed Radius, 24' horizontal	6
Cover of aspen	Presence and cover of aspen	**Subplot** Fixed Radius, 24' horizontal	6
1-hour Fuels (Twig1)	Down-woody material 0.01" to 0.24" diameter at intersection	**Transect** Count along 14'-20' of transect • 90º even number plot • 0º odd number plot	7
10-hour Fuels (Twig2)	Down-woody material 0.25" to 0.99" diameter at intersection	**Transect** Count along 14'-20' of transect • 90º even number plot • 0º odd number plot	7
100-hour Fuels (Twig3)	Down-woody material 1.00" to 2.99" diameter at intersection	**Transect** Count along 14-24' of transect • 90º even number plot • 0º odd number plot	7

Population of Interest	Description	Type/Size of plot	Int Grid Manual Section
1000-hour Fuels	Down-woody material 3.00"+ diameter at intersection	**Transect** Along 0-30' of transect • 90º and 270º,even number plot • 0º and 180º, odd number plot	7
Duff Depth	Depth of Duff and Litter	**Point Measurement** 24' horizontal distance from PC • At 90º and 270º for even number plot • At 0º and 180º for even number plot	7

Once the PC is established, the subplot, microplot, and transects can be established.

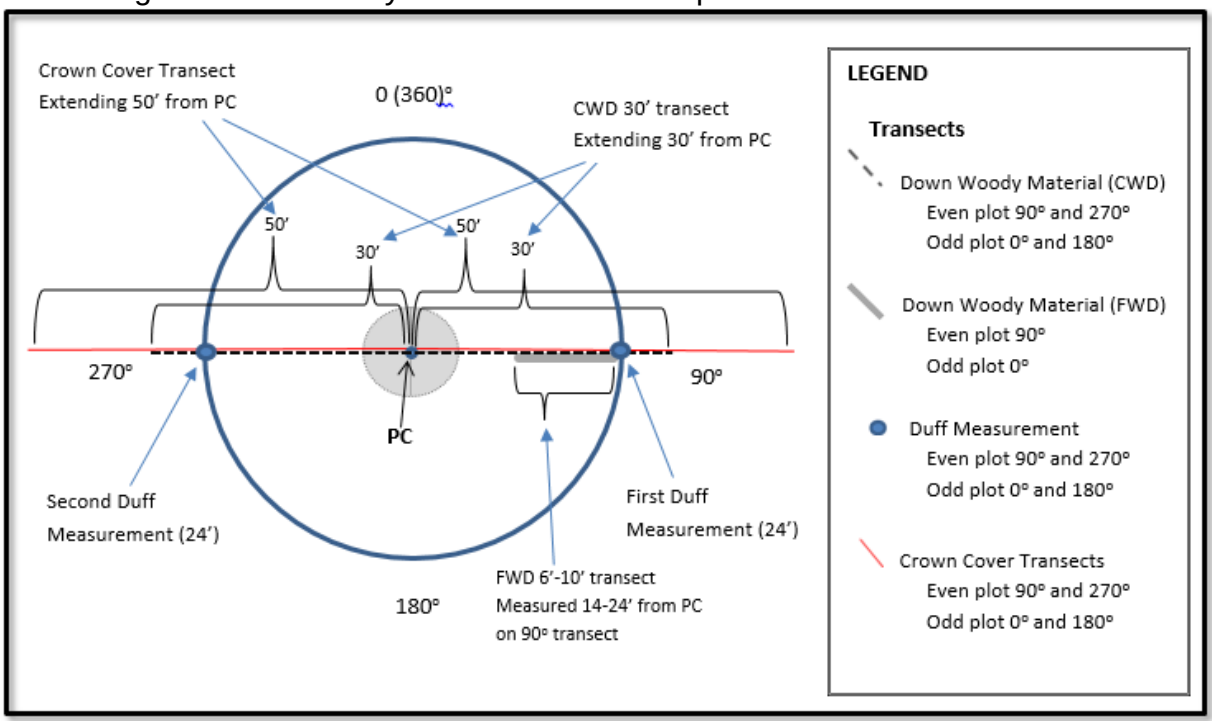
The **subplot** has a radius of 24.0' horizontal distance. If the slope distance is greater than 10% then follow the slope correction procedures, section 1.D.1, to determine the slope distance of the plot radius. Note: if the plot is on a slope, the slope distance changes. The plot is "shortest" when facing uphill and longest when extending downhill from plot center.

The **microplot** has a radius of 6.8' horizontal distance.

Lay out **two transects** that originate from plot center (PC stake) and extend outward **50.0 feet horizontal distance.** For even-numbered plots, orient transects at azimuths of 90 and 270 degrees. For odd-numbered plots, orient transects at azimuths of 0 (360) and 180 degrees. Mark the end of each transect with a pin or twig with flagging. See figure 1.10 for crown cover and DWM transect layout.

- ❖ Transect Tolerance: Azimuths: ± 10 degrees

Figure 1.10 – Crown Cover Transect and DWM Transect Layout further detail. This Figure shows the layout for even number plots.



Sample **CWD** along the first 30 foot horizontal distance of both transects. Sample **FWD** along a 6- to 10-foot subsection of transect located between 14- and 24-feet, horizontal distance. For even-numbered plots, sample FWD on the east transect (*oriented at 90 degrees*). For odd-numbered plots, sample FWD on the north transect (*oriented at 0 degrees*). Refer to section 7 for more detailed information on sampling down-woody material.

Lay out four transects that originate from plot center and extend out **25.0 feet slope distance** at 0(360), 90, 180, 270 degrees. These transects will be used to sample surface cover, sampling cover at each foot mark. The Ground Cover Sample Form will be used to collect hits and calculate totals that will be entered into Exams. See figure 1.7 for ground surface cover transect layout.

- Tolerance (Ground Surface Cover Transects): Azimuth: ± 10 degrees

1.D.1 Correcting for Slope

Sample plot area perimeters, tally tree distances on the microplot, all DWM transects, and tree canopy cover transects (not surface-cover) are based on **horizontal distance**.

Distance correction for slope is necessary when the slope exceeds 10 percent. Correcting for slope is necessary when determining the lengths of the DWM transects and associated sub-population transect lengths, tree canopy cover transects, determining if a noxious species or presence of aspen is within the plot perimeter, distances to tally trees, and the distance from plot center to base the fixed-area vegetation composition plot.

Note: the layout of fixed-radius plots, based on correcting for slope, will be oval.

The slope correction factor can be determined in two ways:

- Use a clinometer to measure the slope percent and then determining the correction factor from table 1.11 below
- Use a clinometer with the slope correction factor built in (% slope and slope correction factor are on the dial)

Table 1.11 – Slope Correction Factors

Percent of Slope	Slope Correction Factor (SCF)	Percent of Slope	Slope Correction Factor (SCF)
0 - 9	1.00	103 to 104	1.44
10 - 17	1.01	105	1.45
18 - 22	1.02	106 to 107	1.46
23 - 26	1.03	108	1.47
27 to 30	1.04	109	1.48
31 to 33	1.05	110 to 111	1.49
34 to 36	1.06	112	1.50
37 to 39	1.07	113	1.51
40 to 42	1.08	114 to 115	1.52
43 to 44	1.09	116	1.53
45 to 47	1.10	117	1.54
48 to 49	1.11	118 to 119	1.55
50 to 51	1.12	120	1.56
52 to 53	1.13	121	1.57
54 to 55	1.14	122	1.58
56 to 57	1.15	123 to 124	1.59
58 to 59	1.16	125	1.60
60 to 61	1.17	126	1.61
62 to 63	1.18	127 to 128	1.62
64 to 65	1.19	129	1.63
66 to 67	1.20	130	1.64
68 to 69	1.21	131	1.65
70	1.22	132 to 133	1.66
71 to 72	1.23	134	1.67
73 to 74	1.24	135	1.68
75	1.25	136	1.69
89	1.34	137 to 138	1.70
90 to 91	1.35	139	1.71
92	1.36	140	1.72
93 to 94	1.37	141	1.73
95	1.38	142 to 143	1.74
96 to 97	1.39	144	1.75

Percent of Slope	Slope Correction Factor (SCF)	Percent of Slope	Slope Correction Factor (SCF)
98	1.40	145	1.76
99 to 100	1.41	146	1.77
101	1.42	147	1.78
102	1.43	148 to 149	1.79

Slope Ground Distance = (Horizontal Ground Dist.) x SCF

Example:

If there is a 25% slope, then SCF = 1.03

A tree is in if it has a slope distance to the pith of the tree less than or equal to:

Slope Ground Dist. = 24.0 x 1.03

Slope Ground Dist. = 24.72 feet

Macroplot Option: Forests may install an optional **macroplot** (1/4th-acre fixed-radius plot) with approval of the Regional Office (*refer to comment box below*).

Figure 1.12 – Macroplot Option Information

Macroplot Option – An optional **macroplot** (1/4th-acre fixed-radius plot), centered on the PC stake, can be installed to measure tally trees ≥ 21.0 inches in diameter. With this option, tally trees are sampled as specified below:

Sample Plot Area	Sample Trees*	Tree Size (DBH/DRC)	Fixed-Plot Radius (horizontal distance)
Macroplot	Large Trees	≥ 21.0 inches	58.9 feet
Subplot	Large Trees	5.0- to 20.9 inches	24.0 feet
Microplot	Saplings	1.0- to 4.9-inches	6.8 feet
Microplot	Seedling Count		6.8 feet

NOTE: Prior to implementing this option, forests must first acquire approval from the Regional Office. * Tally Tree species (appendix E)

1.E Photographing the Plot

1.E.1 Photographing the Plot *(Required)*

As an additional aid in describing the plot and as a record of conditions at the time of the field inventory, take photographs of the plot using a digital camera. Photos can be used to appraise fuel and vegetation conditions on the plot and to compare those conditions over time. See R1 CSE/IM Supplementary Appendix R1-F for additional information and examples of good plot photos.

Procedure: At each plot location, stand over the PC stake and take four photographs in the cardinal directions). Include a Plot Photo Placard in each picture (appendix A2), placed in the lower right-hand corner of the view, indicating the State, County, Plot Number, and direction the photo is facing: N, E, S, W. Be sure the placard is legible and not obscured by light reflections, vegetation, or darkness; but do not allow the placard to obstruct the view of the site. Note: Compass declination is set to 0 degrees.

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.).

Remeasurement:
Take photos as specified above.

When back in the office, plot photos will be named County_Plotid_N.jpg, County_Plotid_S.jpg, etc.

Section 2: Setting Form

Record all attributes listed in table 2.1, unless indicated otherwise in the table. Follow the procedures indicated in Section 2 of the R1 CSE/IM Field Guide for the Setting Form unless directed otherwise below. If necessary, refer to the associated appendices located in the R1 CSE/IM Field Guide. Field number, name, and size (digit/character width) are as defined in the R1 CSE/IM Field Guide. Enter data items in Exams software.

Remeasurement:
Date (CSE 2.11) and Examiner (CSE 2.28) need to be updated.

- Check to make sure that all required fields have been collected.
- Check all attributes to make sure they are collected within specified tolerances. If value is not within tolerances, fix it, and note the changes in the Setting Remarks field. Notify the COR of the change. NOTE: it is important to note updates to attributes on the Setting Form if they were outside of tolerance because previous measurements may need to have these same modifications made to the data in FSVeg.

Table 2.1 – Setting Data Form Required Attributes

* indicate values set in the Exams Template File by Forest Intensified Grid Field Coordinator. The number in () following the attribute number indicates the subform in ExamsPDR that the attribute occurs on.

CSE Attrib #	Attribute Name	Value	Comments
2.1(1)*	Project Name	GRID INT XXXXX RMX	Select correct Project Name from Drop down list
			Remeasurement: Ensure that RM2, RM3, etc. is correct based on value in Measurement Number field.
2.2(1)	Proclaimed Region	01	Default in Exams software template file
2.3(1)*	Proclaimed National Forest	Default	Default in Exams software template file
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.4(1)*	District	Required	Choose from pick list
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.5(1)	Location	Required	Enter the LOCATION code as indicated.
			Remeasurement: Keep LOCATION code that is in Exams file.
2.6(1)		Required	Enter the Stand Number as indicated

CSE Attrib #	Attribute Name	Value	Comments
	Stand Number/ Plot ID		**Remeasurement:** Keep Stand Number that is in Exams file
2.7(1)*	Owner	USFS	Default in Exams software template file
2.8(2)*	State	Default	Default in Exams software template file
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.9(2)*	County	Required	Record the code identifying the county where the plot center is located. Some intensification projects may encompass more than one county. Refer to the "drop-down menu" in the Exams software for a list of all valid county codes.
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.10(2)*	Administrative Forest	Default	Default in Exams software template file.
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.11(2)	Date	Date of inventory	For new plots (data not previously entered into the Exams software), the date will be automatically inserted when the Setting Form is filled out.
			Remeasurement: Ensure that this field is updated to reflect the date of data collection by tabbing into the date field and recording the calendar month, day, and year that the plot is completed (MMDDYYYY).
2.12(2)	Photo ID	Null	Do not record
2.13(1)*	Exam Level	3421	Default in Exams software template file. Tree Form = 3, Intensive Exam Veg Comp Form = 4, indicates collecting Lifeform information, All species above minimum cover level, and species on lists to trace. DWM Form = 2, indicates using Brown's Protocols. Surface Cover Form = 1, collected

CSE Attrib #	Attribute Name	Value	Comments
2.14(2)*	Exam Purpose	FI	Default in Exams software template file. 'FI' indicates Forest Inventory
2.15(2)	Stratum	Null	Do not record.
2.16(2)	Existing Veg Reference	Null	Do not record.
2.17(2)	Existing Veg Composition Type	Null	Do no record.
2.18(2)*	Potential Vegetation Reference	Required	Record the code identifying the reference used to obtain PLOT POTENTIAL VEGETATION (refer to Appendix F, CSE Field Guide).
2.19(2)	Potential Vegetation	Null	Do not record on the Setting Form.
			Remeasurement: Delete if data has been imported into file.
2.20(3)	Structure	Null	Do not record.
2.21(3)	Setting Capable Growing Area	Null	Do not record.
2.22(3)	Setting Fuel Model	Null	Do not record.
2.23(3)	Setting Elevation	Required	Record the elevation (to the nearest foot) as determined from the GPS unit.
			Remeasurement: Check value in Exams file and ensure it is within specified tolerances. If it is modified, note in Setting Remarks (2.36)
2.24(3)	Setting Aspect	Null	Do not record in Exams on the Setting Form. Only record in Exams on the Plot Form.
			Remeasurement: Delete if data has been imported into file.
2.25(3)	Setting Slope	Null	Do not record in Exams on the Setting Form. Only record in Exams on the Plot Form.
			Remeasurement: Delete if data has been imported into file.
2.26(3)	Setting Slope Position	Null	Do not record.
2.27(3)	Acres	Null	Do not record
2.28(4)	Examiner	Required	Required for all measurements.

CSE Attrib #	Attribute Name	Value	Comments
2.29(4)*	Precision Protocol	CSE	Defaulted in Exams template file.
2.30(3)*	Radial Growth Interval	10	Defaulted in Exams template file.
2.31(3)	Radial Growth Interval 2	Null	Do not record. Not used
2.32(4)*	Height Growth Interval	5	Defaulted in Exams template file.
2.33(4)	Fuel Photo Reference	Null	Do not record.
2.34(4)	Setting User Code	Required if plot area contains a situation that prohibits data collection	See information, item 2.34, below.
2.35(4)*	Setting Lat Long Reference Datum	NAD83	Default in Exams software template file.
2.36(4)*	Magnetic Declination	0	Default in Exams software template file. **Note:** Compasses must be set to 0 degrees declination
2.37(1)	Measurement Number	Required	Installation: 1 will be default **Remeasurement:** Keep the Measurement Number in the Exams file. Should match RM# from Project Name.
2.38	Setting Remarks	Required if applicable	Use this section to record remarks about setting conditions not already described elsewhere. See item 2.38.
2.39	Setting Damage Category	Required if applicable;	See item 2.39 below

CSE Attrib #	Attribute Name	Value	Comments
2.40	Setting Damage Agent	Required if applicable	See item 2.40 below
2.41	Setting Damage Severity	Required if applicable	See item 2.41 below.
2.42	Species of Management Interest	Null	Do not use this form

CSE 2.4 District (2-digit) *Default*
Record the District where plot center is located. Some intensification projects may encompass more than one District. Refer to the "drop-down menu" in the Exams software for a list of all valid District codes.

CSE 2.5 Location (2-digit) *Required*
Use the LOCATION code as indicated.

CSE 2.6 Stand Number/PlotID (4-digit) *Required*
Use the Stand Number Code/PlotID as indicated.

CSE 2.9 County (3-digit) Default
Record the county code where the plot center is located. Some intensification projects may encompass more than one county. Refer to the "drop-down menu" in the Exams software for a list of all valid county codes.

CSE 2.11 Date (8-digit) *Required*
For new plots (data not previously entered into the Exams software), the date will be automatically inserted.

Remeasure:
Update the date by tabbing into the Date Field and entering the correct date of current measurement.

CSE 2.13 Examination Level (4-character) Default
The examination level for intensified grid plots should be defaulted at **3421**. This indicates intensive exam on trees (3); cover by lifeform and layer, cover by species for species with cover above minimum value, and cover by species regardless of cover % that are listed on a designated list (4); Brown's protocol for down woody material is used (2); and ground surface cover measurements are taken (1).

CSE 2.18 Potential Vegetation Reference (3-character) *Required*

Record the code identifying the reference used to obtain PLOT POTENTIAL VEGETATION (refer to section 4, item 4.11). Generally, this is defaulted in the Exams template file.

- Tolerance (PV Reference): No errors

CSE 2.23 Setting Elevation (5-digit) *Required*

Record the elevation (to the nearest foot) as determined from the GPS unit

- Tolerance (Elevation): ± 100 feet

CSE 2.28 Examiner (12-character) *Required*

Record the crew name for the individual(s) responsible for data collection. **Do not use reserved characters such as +, /, -, or * in this field.**

CSE 2.34 Setting User Code (4-character) *Required if plot area contains a situation that prohibits data collection*

If an entire plot, or portion of a plot, cannot be sampled, record SETTING USER CODE to indicate the following: (a) the reason why data could not be collected, and (b) the portion of the plot that has missing data.

Record Setting User Code as a four-digit code. Use the first digit to indicate the situation/condition that prohibits data collection; use the last three digits to indicate the percentage of the plot that is non-sampled. Zero fill leading digits as shown below.

If a plot lands on private land, see protocols in section 1.A.3 of this document for relocating the plot.

For the first digit, record one of the following codes.

Table 2.2 - Setting User Code

First digit of code	Situation prohibiting data collection:
1	Field inaccessible/hazardous
2	No longer used
3	Hazardous water: too deep or fast to sample in
4	Other: use this code if any other situation/condition prohibits data collection, such as an improved road, maintained rights-of-way, developed structure, etc.
5	Office inaccessible: See section 1.A.3 for specifications on using this code.

Example: If 80% of the plot is located in a lake, then record “3080” for Setting User Code (*first digit = 3, for water; last three digits = 080, for 80%*).

CSE 2.38 Setting Remarks (242-character) *Required if applicable*

Use this section to record remarks about setting conditions not already described elsewhere. For example, include comments concerning regeneration, occurrence of insect and disease, occurrence of blow-down events, etc.

- If the plot contains a **situation that prohibits data collection** on any part of the plot area, such as an inaccessible/hazardous condition or private land (i.e., part or the entire plot is nonsampled, and SETTING USER CODE is recorded). If plot is given a Setting User Code (CSE 2.34) then this field is required.

Do not record remarks already recorded in the STAND NARRATIVE/REMARKS on the Plot Location Reference Form, such as information about the reference point X and Y trees, and information that is pertinent to relocating the plot.

Remeasurement:
If Proclaimed Region (2.2), Proclaimed National Forest (2.3), District (2.4), State (2.8), County (2.9), Administrative Forest (2.10), Potential Veg Reference (2.18), or Setting Elevation (2.23) have been modified from the Exams file provided, make note of attribute that has changed and notify COR, if applicable.

CSE 2.39 Setting Damage Category (2-digit) *Required if applicable; separate form in Exams software*

Examine the **subplot** area (24.0-ft radius) for the occurrence of **damages and root disease not recorded as tree damages.** Refer to R1 CSE/IM Field Guide appendix R for a list of valid Damage Category Codes. If there is no evidence of further damages, leave the damage fields blank.

Macroplot option: If this option is used, examine the 1/4th-acre area (58.9-ft radius).

CSE 2.40 Setting Damage Agent (3-digit) *Required if applicable*

Record Agent if Setting Damage Category (2.39) is recorded

CSE 2.41 Setting Damage Severity (2-character) *Required if applicable*

Record Agent if Setting Damage Category (2.39) is recorded

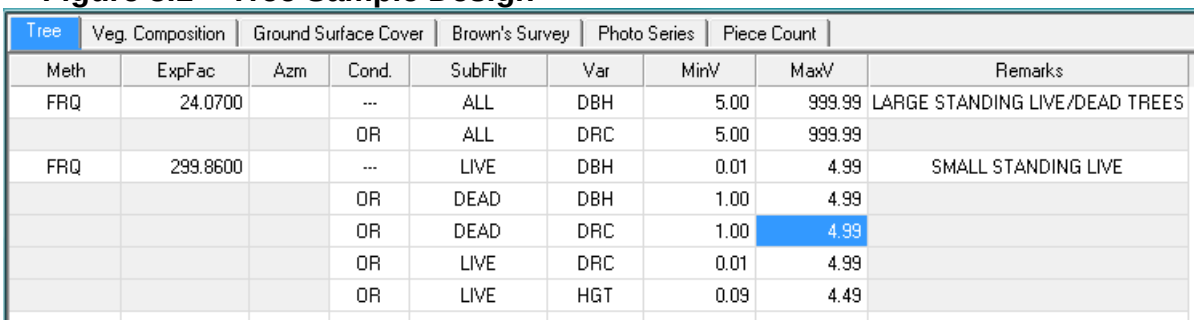
- ❖ Tolerance (Setting Damage Severity):
  - + 1 category

Section 3: Sample Design Form

Remeasurement:
Do not change the sample design form

The sample design is standard for all intensified plots unless the optional ¼ acre macroplot is being installed.

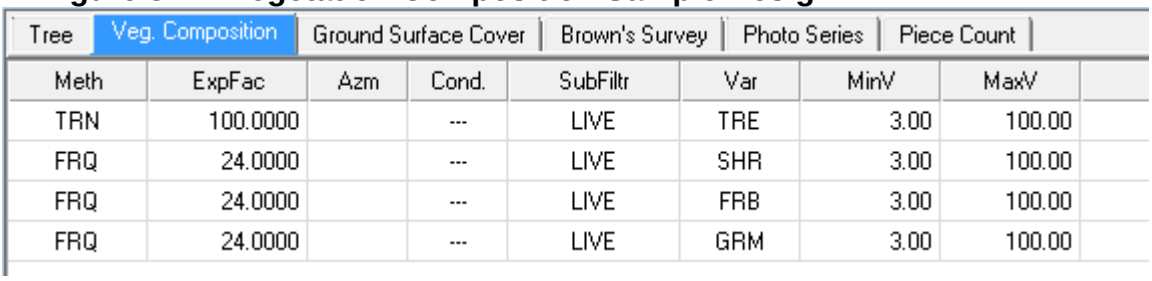
Figure 3.1 – Tree Sample Design



Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	24.0700		---	ALL	DBH	5.00	999.99	LARGE STANDING LIVE/DEAD TREES
			OR	ALL	DRC	5.00	999.99	
FRQ	299.8600		---	LIVE	DBH	0.01	4.99	SMALL STANDING LIVE
			OR	DEAD	DBH	1.00	4.99	
			OR	DEAD	DRC	1.00	4.99	
			OR	LIVE	DRC	0.01	4.99	
			OR	LIVE	HGT	0.09	4.49	

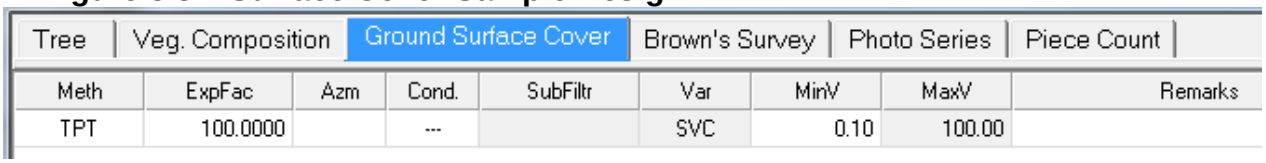
Figure 3.2 – Vegetation Composition Sample Design



Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV
TRN	100.0000		---	LIVE	TRE	3.00	100.00
FRQ	24.0000		---	LIVE	SHR	3.00	100.00
FRQ	24.0000		---	LIVE	FRB	3.00	100.00
FRQ	24.0000		---	LIVE	GRM	3.00	100.00

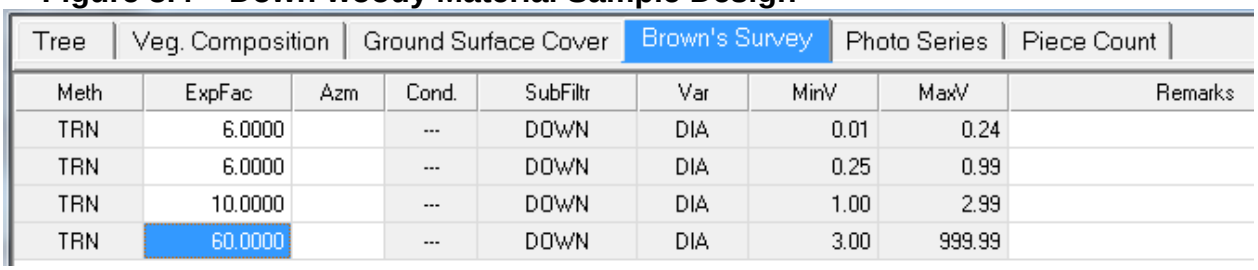
Figure 3.3 – Surface Cover Sample Design



Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TPT	100.0000		---		SVC	0.10	100.00	

Figure 3.4 – Down-woody Material Sample Design



Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	6.0000		---	DOWN	DIA	0.01	0.24	
TRN	6.0000		---	DOWN	DIA	0.25	0.99	
TRN	10.0000		---	DOWN	DIA	1.00	2.99	
TRN	60.0000		---	DOWN	DIA	3.00	999.99	

Section 4: Plot Data Form

Remeasurement:
Follow instructions under Remeasurement column, figure 4.1 below.

Follow the procedures indicated in section 4 of the R1 CSE/IM Field Guide for the Plot Data Form unless indicated otherwise below. Field number, name, and size (digit/character width) are as defined in the R1 CSE/IM Field Guide. Enter all plot data items into the Plot Form in Exams software.

Figure 4.1 – Plot Form Required Fields

CSE Attribute #	Attribute name	Comments	Remeasurement
4.1	Plot Number	This will always be 1.	Default
4.2.1	Plot Latitude	Required. See item 4.2 and 4.2.1 below.	Always acquire new longitude. Update if out of tolerance, make note in the Plot Remarks Field (Item 4.1.8), and bring to the attention of COR, if applicable.
4.2.2	Plot Longitude	Required. See item 4.2 and 4.2.2 below	Always acquire new longitude. Update if out of tolerance, make note in the Plot Remarks Field (Item 4.1.8), and bring to the attention of COR, if applicable.
4.4	Plot Aspect	Required. See item 4.4 below.	Update if outside tolerance, make note in the Plot Remarks Field (Item 4.1.8), and bring to the attention of COR, if applicable.
4.5	Plot Slope	Required. See item 4.5 below.	Update if outside tolerance, make note in the Plot Remarks Field (Item 4.1.8), and bring to the attention of COR, if applicable.
4.11	Plot Potential Veg.	Required. See item 4.11 below.	Update if outside tolerance, make note in the Plot Remarks Field (Item 4.1.8), and bring to the attention of COR, if applicable.

CSE Attribute #	Attribute name	Comments	Remeasurement
4.18	Plot Remarks	See below.	Record clarifying information. Enter notes when plot data fields are updated.

CSE 4.1 Plot Number (3-digit) *Default*

Plot Number will always be 1.

CSE 4.2 GPS Locations

See section 12.3.7 of R1 CSE/IM Field Guide for instructions on how to connect a Garmin GPS and Juniper Systems Allegro together and auto fill the lat/long fields in the Exams software.

Remeasurement:
Acquire latitude and longitude at each measurement. If latitude and longitude that is acquired is outside of tolerances, make note in Plot Remarks (item 4.18)

CSE 4.2.1 Plot Latitude – *Required*

Record the latitude for the plot as measured by GPS. Record as an 8-digit code comprised of the following values and in the following order: a 2-digit "degree" value, a 2-digit "minute" value, a 2-digit "seconds" value, and a 2-digit "hundredths of a second" value.

CSE 4.2.2 Plot Longitude – *Required*

Record the longitude for the plot as measured by a GPS. Record as a 9-digit code comprised of the following values and in the following order: a 3-digit "degree" value, a 2-digit "minute" value, a 2-digit "seconds" value, and a 2-digit "hundredths of a second" value.

Remember that one second latitude or longitude is equal to approximately 120 feet on the ground, 1/10" ≈ 12 feet, and 1/100" ≈ 1.2 feet

Note: If it is unlikely that tolerances can be met using the GPS Method to locate the PC (as described in section 1.B.4), then use alternative baseline techniques to locate the PC (refer to appendix C).

CSE 4.4 Plot Aspect (3 digit) *Required*

Record the direction toward which the plot faces (to the nearest degree, 0° to 360°). PLOT ASPECT may be determined by taking compass readings directly down slope from the plot center.

- Tolerance (Plot Aspect): ± 45 degrees

Remeasurement:
If Aspect is outside of tolerance, record the correct aspect. Make note of change in Plot Remarks Field (Item 4.18) and report to COR, if applicable.

CSE 4.5 Plot Slope (3-digit) *Required*

Record the average slope for the plot area (to the nearest 1 percent). Average the down slope and upslope measurements from plot center. Slope is defined as the ratio of vertical rise divided by the horizontal distance.

- Tolerance (Plot Slope): ± 10 percent

Remeasurement:
If Slope is outside of tolerance, record the correct slope. Make note of change in Plot Remarks Field (Item 4.18) and report to COR, if applicable.

CSE 4.11 Plot Potential Vegetation (3-digit) *Required*

Record the potential vegetation (habitat type) code for the plot. To classify, examine a 1/10th-acre plot area (37.2-ft radius, horizontal distance) centered on plot center. If several types occur within the plot area, record the type that is best represented at the plot center. For example, if the plot area is in: a transition zone or a micro-site where some indicators do not represent the general area immediately adjacent to the plot, record the type that is best represented at the plot center. For areas that have had a severe or recent disturbance (e.g., burn or cut), estimate the type from a nearby similar site.

Refer to appendix F and G in the R1 CSE/IM Field Guide for a complete list of Habitat Type Manuals (references) and associated codes. The *reference* used to obtain PLOT POTENTIAL VEGETATION is to be recorded under POTENTIAL VEGETATION REFERENCE (CSE 2.18). **Note:** Contract specifications may require a habitat type field form to be completed.

- Tolerance (Plot Potential Vegetation):

- Accurate to R1 Habitat Type Group (see table 2 in *R1 Forested Potential Vegetation Group Crosswalk, Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. Milburn et al. 2015*) unless specified otherwise by Forest.

Remeasurement:
Review Habitat Type from previous measurement to ensure it is within tolerances. If it is not, update and make note in Plot Remarks (CSE 4.18) and report to COR, if applicable.

CSE 4.18 Plot Remarks (242-characters)

Record specific information if any of the following attributes are out of tolerance: Plot Latitude, Plot Longitude, Plot Aspect, Plot Slope, or Plot Potential Veg. Record clarifying information for any unusual data recorded on the plot form, such as explanations for unusual habitat types.

Section 5: Tree Data Form

This section contains the following subsections: (A) Tally Tree Definitions, and (B) Tree Data items.

Follow the protocols indicated in section 5 of the R1 CSE/IM Field Guide for the Tree Data form unless indicated otherwise below. Field number, name, and size (digit/character width) are as defined in the R1 CSE/IM Field Guide. Enter all tree data items into Exams software Tree Data form.

Remeasurement:
For re-measurement, follow instructions in tabl 5.2 Tree Data Items under re-measurement. There may also be additional information under each tree data item narrative.

5.A Tally Tree Definitions

Each of the sample plot areas on the plot location (subplot, microplot, *and macroplot, if applicable*) is used to inventory trees of a specified sizes, as indicated below. Refer to section 1.D. Plot Layout, for a diagram of the plot layout.

Figure 5.1– Sample Tree Specifications

Sample Plot Area	Plot Radius (horizontal distance)	Tally Tree Diameter Size:
Subplot	24.0 feet	▪ Live and Dead trees ≥ 5.0-inches DBH/DRC
Microplot	6.8 feet	▪ Live Saplings (trees 1.0- to 4.9 inches DBH/DRC) ▪ Dead Saplings (trees 1.0- to 4.9-inches DBH/DRC) ▪ Live Seedling counts(trees < 1.0 inches DBH)

Tally Tree: This term is used to refer to all of the "qualifying trees" that are sampled on the subplot and microplot areas (*and macroplot,* if collected). This includes all live and standing dead trees that are tallied on the subplot (*and macroplot*), and all live and standing dead trees that are tallied on the microplot, the first time the plots are established. Tally tree also refers to qualifying trees that grow into a plot thereafter (future inventories). Refer to appendix E for a list of species that are considered trees for the R1 Intensified Grid Inventory.

Tally Tree Definitions:

5.A.1 Live Trees

Trees are defined as being "alive" if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement, either diameter at breast height (DBH) for timber species or diameter at root collar (DRC) for woodland species. Trees that have been defoliated may still be alive.

Live trees do not have to be self-supported (standing independently). Other trees, branches, or their crown may support them.

Live timber species trees are further classified as **growing-stock** (sound), **rough**, or **rotten** based on the presence and level of defect**.**

5.A.1.1: Timber and Woodland Species (Tally Tree Species)

Only certain species are considered for tree tally and seedling counts. These species are referred to as "timber" or "woodland" species. Refer to appendix E for a list of tally tree species for the R1 Intensified Grid Inventory. Timber species are measured for diameter at breast height, 4.5 feet above the ground (Diameter at Breast Height, DBH); exceptions apply to trees with bole irregularities. Woodland species are measured for diameter at ground level or the stem-root collar, whichever is higher (Diameter at Root Collar, DRC); a cumulative DRC is computed for multi-stemmed woodland species. Refer to CSE 5.9 DBH/DRC. Tally trees are recorded individually in the Exams Tree Data form.

For multi-stemmed woodland trees to qualify for tally, at least one measured stem must be 1.0-inch DRC or larger, and the cumulative (calculated) DRC must be 5.0 inches DRC or larger.

5.A.1.2: Saplings

This term is applied to live trees with a diameter at least 1.0 inch but less than 5.0 inches and all dead trees with a diameter of at least 1.0 inches but less than 5.0 inches; these trees are sampled on the microplot. "Tally saplings" are defined as all live saplings and dead saplings encountered the first time a microplot is established, and all saplings that grow into each microplot thereafter (until they grow to 5.0-inches DBH/DRC or larger, at which time they are tallied on the subplot). Saplings are tallied individually.

For a multi-stemmed woodland species sapling to qualify for tally, at least one measured stem must be 1.0-inch DRC or larger and 1 foot in length, and the cumulative (calculated) DRC must be between 1.0 and 4.9 inches DRC.

Treat all woodland species that have several stems clumped together, with a unified crown, and appearing to be from the same root origin, as a single tree.

5.A.1.3 Seedlings

Conifer seedlings must be at least 0.5 ft in length and less than 1.0 inch at DBH in order to qualify for counting. Hardwood seedlings must be at least 1.0 ft in length and less than 1.0 inch at DBH to qualify for counting. For woodland species, each stem on a single tree must be less than 1.0 inch at DRC. Seedlings are grouped.

Multiple “suckers” of aspen that originate from the same location and stump sprouts are considered one seedling. Do not count fir “layers” (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Once a stem within a fir layer meets sapling tree qualifications, then tally the stem as a sapling.

5.A.2 Standing Dead Trees (timber species)

To qualify as a standing dead timber species tally tree, dead trees must be at least 1.0 inches in diameter on the microplot or at least 5.0 inches in diameter on the subplot, have a bole that has an “unbroken actual length” of at least 4.5 feet, and lean less than 45 degrees from vertical. Trees supported by other trees or by their own branches are considered standing if lean is < 45 degrees.

For trees with broken or missing tops, **unbroken actual length** is defined as the standing portion of the tree up to the point where at least 50 percent of the original bole is still attached (from ground level to this point). The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the base of the tree to the top of the unbroken actual length.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Debris (DWD) if they otherwise meet DWD tally criteria (refer to section 7).

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement. Once tallied, dead trees 1.0 inches and larger, in diameter are tracked until they no longer qualify as standing dead.

Standing dead timber species trees are further classified as either **salvable** (hard) or **non-salvable** (soft) based on the level of rotten and/or missing material (refer to section 5.B, subsection 5.4, Tree Class).

Working around dead trees is a safety hazard - crews should exercise extreme caution and wear hard hats! Trees that are deemed unsafe to measure should be estimated.

5.B Tree Data Items

Remeasurement:
Follow instructions under Remeasurement column in table 5.2 below.

Follow procedures indicated in Section 5 of the R1 CSE/IM Field Guide for the Tree Data Form unless indicated otherwise below. Field number, name, and size (digit/character width) are as indicated in the field guide. Enter all tree data into Exams software Tree Data Form.

Figure 5.2 – Required fields for the R1 Intensified Grid Inventory Tree Data Form

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.2	Tag ID Number	Defaulted by software	Do not change, if trees are added, use the *next* available number, if trees disappear/no longer standing, delete the tree record and retire the Tag ID. See specification in 5.2 below.
5.3	Tree Status	Required for all trees	Update as needed
5.4	Tree Class	Required for all trees	Update as needed
5.5	Growth Sample Tree (GST)	See item 5.5, below.	Only add GST trees due to ingrowth or that were missed during installation of the plot.
5.6	Tree Species	Required for all trees	Update if error was made on previous inventory. If updated, make note in Tree Remarks (Item 5.26)
5.7	Tree Count	Required for seedling groups, defaulted for tally trees (non-woodland species)	Redo seedling counts
5.8	Number of Stems	Woodland species ≥ 1.0" DRC	Update as needed
5.9	DBH / DRC	• Timber species ≥ 4.5' tall and ≥ 1.0" DBH • Woodland species ≥ 1' tall and ≥ 1.0" DRC • Dead trees ≥ 4.5' tall and ≥ 1.0" DBH • Seedling groups (timber species if ≥ 0.5' tall and < 1.0" DBH; hardwood species if ≥ 1' tall and < 1" DBH; woodland species if the cumulative DRC <1.0" and height is at least 1')	Remeasure
5.10	Height	• All GST trees • Trees with broken tops • Seedling groups • Dead trees	Remeasure

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.12	Radial Growth	GST trees ≥ 3.0” DBH	Only measure radial growth on newly designated GST trees ≥3.0” DBH.
5.14	Height Growth	GST trees 1.0”-2.9” DBH	Only measure on newly designated GST trees in 1.0-2.9” diameter class.
5.15	Tree Age	All GST trees	Only measure on newly designated GST trees.
5.16	Crown Ratio	All live trees	Remeasure
5.17	Crown Class	Live tally trees	Remeasure
5.20	Snag Decay Class	Dead trees only	Remeasure
5.22	Tree Damage Category	Live tally trees. For dead trees (died <5 yrs ago) record damage category that is cause of death.	Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement.
5.23	Tree Damage Agent	Live tally trees. For dead trees (died <5 yrs ago) record damage agent that is cause of death.	Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement.
5.25	Tree Damage Severity	All live trees with Damage Agent and Category collected when damage meets severity definition. For recent mortality trees, code highest severity.	Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement.
5.26	Tree Remarks	See 5.26 for information on what to record in tree remarks.	Update if necessary. Delete Remarks that are no longer pertinent to the tree.
5.29	Tree Distance	All tally trees and saplings.	If horizontal distance recorded is outside of tolerance, then update.

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.30	Tree Azimuth	All tally trees and saplings. Distance is not recorded for seedlings.	If azimuth recorded is outside of tolerance, then update.

CSE 5.1 Plot Number (3-digit) *Default*

CSE 5.2 Tag ID Number (4-digit) *Default*

Tally qualifying trees that fall within the **horizontal distance** of the sample plot perimeter.

Work clockwise from 1 to 360 degrees azimuth (declination set at 0), and outwards from the PC stake to the sample plot perimeter. Refer to appendix E for the list of tally tree species.

Tally Tree Procedures:

1) Subplot Tally (*and macroplot, if applicable*). Starting at 1 degree azimuth rotate clockwise and tally all qualifying trees with a diameter ≥ 5.0 inches that fall within the perimeter of the subplot (24.0-ft horizontal distance). **For a qualifying tree to be tallied, the horizontal distance from the PC stake to the geographic center of the bole (pith) at the base of the tree, or stem(s) must be 24.0 feet horizontal distance or less**. Refer to section 5.29 Tree Distance, and section 1.D.1 for directions on correcting for slope to determine whether a tree is in or out.

Qualifying Trees. Trees qualifying for tally are defined in section 5.A.

If two or more "in" trees are along the starting azimuth line, where the bole of the nearest tree completely obscures the bole of the farthest tree (at breast height, 4.5 feet), then record the tree nearest to PC first.

2) Sapling Tally (Microplot). Stand directly over the PC stake. Starting at 1 degree azimuth rotate clockwise and tally all qualifying trees (Live and dead trees 1.0-4.9" DBH/DRC) that fall within the perimeter of the microplot (6.8-ft horizontal distance). For a qualifying tree to be tallied, the horizontal distance from the PC stake to the geographic center of the bole (pith) or stem(s) at the base of the sapling must be 6.8 feet or less horizontal distance. Trees are tallied and numbered clockwise starting with the last number recorded on the subplot (*and macroplot, if established*).

Qualifying Trees. Trees qualifying for tally are defined in section 5.A.

Remeasure Subplot Tally Trees and Microplot Sapling Tally Trees:
In order to track trees over time, use the assigned Tag ID in Exams software. Retain the Tag ID for saplings, formerly tallied on microplots, that have grown onto the subplot (i.e. DBH for timber species is 5.0" or larger). Any missed trees will be assigned the next Tag ID available regardless of where they are located on the subplot. For example, if the last tree tallied on the last measurement was 11, the next

available tree number is 12. **NEVER** renumber the trees on the plot after installation in order to assign a more "correct" tree number to a missed tree.

Numbers assigned to trees that have been removed from the plot (i.e. due to harvest), that are no longer standing due to mortality, or were mistakenly recorded (horizontal distance is not ≤ 24.0 feet) will be deleted and not reused.

Assign new GST designations for ingrowth saplings and collect appropriate data. Assign new Tag ID Numbers to all saplings, live or dead, added since previous measurement, and collect appropriate data. **Disregard Tag IDs assigned to prior *seedling* counts, as they will be fully remeasured after sapling remeasurement**

Make note of any tree tag numbers that are removed due to due to harvest, falling down, etc in the Plot Remarks Field (Item 4.18) as well as on the Plot Location Reference Form, Appendix A1, Plot Narrative (1.B.6.2).

3) Seedling Counts (Microplot). Within the perimeter of the microplot area (6.8 feet horizontal distance), record the number of live tree seedlings by species and height classes. Only include species listed as tally tree species (refer to appendix E). Although seedling groups are assigned a unique number by the software program, seedlings are not permanently identified until they meet sapling definitions.

Remeasure Microplot Seedlings:
Disregard Tag IDs assigned to prior seedling counts, as they will be fully remeasured after sapling remeasurement, and utilize next available Tag ID after Subplot trees/Sapling trees from prior measurement if assigning new tally trees.

Collect and record seedling counts last. Assign the next highest Tag IDs to the seedling groups after all other tally trees have been recorded.

Macroplot Option – use the following procedures:

Procedures. Stand directly over the PC stake. Starting at 1 degree azimuth (declination set at zero), rotate clockwise and tally all qualifying trees that fall within the perimeter of the macroplot (58.9-ft horizontal distance) that have DBH ≥ 21.0" DBH.

Tally all qualifying trees 21.0-inches in diameter or larger. For a qualifying tree to be tallied, the horizontal distance from the PC stake to the geographic center of the stem(s), or the center of the bole (pith) at the base of the tree, must be 58.9 feet or less.

CSE 5.3 Tree Status (1-character) *Required*

Record a TREE STATUS code to identify each sample tree as live or dead.

Remeasure Tree Status:
Update, if needed. If a tree goes from live to dead between measurement cycles, in addition to updating the tree status, enter a cause of death in the damage category and agent fields if damages can be reasonably determined.

CSE 5.4 Tree Class (2-characters) *Required for tally trees*

Record for all tally trees. Assign a code to each tree individually without regards to the status of other trees on the plot (refer to table 5.3 below). Note: 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.

- **Tolerance (Tree Class):** ±1 Tree Class with No Errors 90% of the time

Table 5.3 – Tree Class Definitions

Code	Tree Class	Status	Must have the following characteristics:
GS	Growing Stock	L	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 growing-stock (sound) tree 5.0 inches DBH or larger with good form or vigor. • A live tree, 5.0 inches DBH or larger, that has less than 67 percent of the merchantable voulume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber-sized trees), reasonable free of form defect, on the merchantable bole. Woodland Species (all live)
RF	Rough	L	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 growing-stock (sound) tree of good form, 5.0 inches DBH or larger. • A live tree, 5.0 inches DBH or larger with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound-dead wood volume loss or severe form-defect volume loss. • A live tree, 5.0 inches DBH or larger, that does not now, nor prospectively, have at least one solid 8 foot section, reasonably free of form defect, on the merchantable bole.

Code	Tree Class	Status	Must have the following characteristics:
RN	Rotten	L	A live **timber species** 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.
SV	Salvable dead (Hard)	D	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
US	Non-salvable dead (Soft)	D	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

Remeasure Tree Class:
Update, if needed.

CSE 5.5 Growth Sample Tree *(1-character) Required for GST trees*
Record this item only for Growth Sample Trees (GST). Leave blank for all other trees. GST are defined as all trees meeting the "GST Selection Guidelines" below.

GST Code	Description
G	Growth Sample Tree

GST Selection Guidelines: Select the first tally tree of each species by the following diameter classes.

Table 5.4 – GST Measurements by Diameter Class Range

Diameter Class (inches)	Radial or Height-Growth Measurement	Age Measurement	Total Height Measurement
1 – 2.9	Height growth	Total age	Required
3 – 4.9	Radial growth	Age at DBH/DRC	Required
5 – 8.9	Radial growth	Age at DBH/DRC	Required
9 – 12.9	Radial growth	Age at DBH/DRC	Required
13 – 16.9	Radial growth	Age at DBH/DRC	Required
17 – 20.9	Radial growth	Age at DBH/DRC	Required
21 – 24.9	Radial growth	Age at DBH/DRC	Required
25 – 28.9	Radial growth	Age at DBH/DRC	Required
etc.	Radial growth	Age at DBH/DRC	Required

Remeasure GST Trees:
If, due to ingrowth or being missed on installation, a tree is within a specified diameter class and is a species that has not been designated as GST, generally trees in the 1-2.9" and 3-4.9" diameter classes, then designate and record all GST values.

CSE 5.6 Tree Species (8-character) *Required*

Remeasure:
If species recorded in previous measurement is incorrect, update Tree Species code. Make note of change in the Tree Remarks field (item 5.26).

CSE 5.7 Tree Count *(3-digit) Required for seedling groups; defaulted for tally trees*
Record the number of trees represented by each line of tree data.

Seedlings (trees with a diameter < 1.0 inch): Seedlings, grouped by species and height classes, are called **seedling groups**. Use a single data line for each seedling group, and record the actual number of trees within the group for TREE COUNT. Record the average DBH/DRC (CSE 5.9) *when applicable*, HEIGHT (CSE 5.10), and CROWN RATIO (CSE 5.16) for each seedling group. Seedling groups are listed in table 5.5 below. Appendix A4, Microplot Seedling Data Collection Form, can be utilized for collecting seedling information when microplots have multiple seedlings.

Table 5.5 – Seedling Height Class Groups

Seedling Height Class	Recorded Height	Actual Diameter	Recorded Diameter
0.5 – 4.4 feet	Average of seedlings in the group	< 1.0 inch(1)	Average of seedlings in the group (1)
4.5 + feet	Average of seedlings in the group	< 1.0 inch	Average of seedlings in the group

(1) For woodland species seedling groups.

Conifer seedlings must be at least 0.5 ft in height and less than 1.0 inch at DBH to qualify for the seedling counts. Hardwood seedlings must be at least 1 foot in length and less than 1.0 inch at DBH in order to qualify for counting. Woodland seedlings must be less than 1.0 inch DRC and at least 1 foot in length.

Multiple "suckers" of aspen that originate from the same location and stump sprouts are considered one seedling. Do not count fir "layers" (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Once a stem within a fir layer meets sapling tree qualifications, then tally the stem as a sapling.

Remeasure Seedling Counts:
Complete a new seedling count during remeasurement as seedling numbers are not included in the permanent record until they have reached at least 1.0" DBH.

❖ **Missed/Extra Tree Tolerance:**

Number of Trees on Plot (subplot/saplings)	Diameter (DBH/DRC)	Height or Height Class	Missed/Extra Tree Tolerance
0	NA	NA	No Errors
1+	1.0-inch and larger	NA	No Errors
Number of Trees on Plot (seedling groups)	Diameter (DBH/DRC)	Height or Height Class	Missed/Extra Tree Tolerance
1 – 5	0.1- to 0.9-inch *	0.5 - 4.4 feet	± 1 tree
6+	0.1- to 0.9-inch *	0.5 - 4.4 feet	± 20%
1 – 5	0.1- to 0.9-inch	≥ 4.5 feet	± 1 tree
6+	0.1- to 0.9-inch	≥ 4.5 feet	± 10%

* Only applicable to woodland species seedling group 1 foot – 4.4-foot tall

CSE 5.8 Number of Stems ***(3-digit) Required for woodland species ≥ 1.0-inch DRC***
For each woodland species with at least one stem 1.0-inch in diameter or larger, record the number of stems measured for DRC. 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.

Remeasure Number of Stems:
Update as necessary

CSE 5.9 DBH/DRC ***(3,1-digit; xxx.y) Required for trees ≥ 1.0-inch DBH/DRC, timber species seedling groups if average height ≥ 4.5 ft, and woodland species seedling groups if height class ≥ 1 foot***
Tree diameters are measured at either breast height or ground level (root-collar) depending on the species type (timber or woodland species). Refer to appendix E for a list of timber and woodland tally tree species.

Diameter Measurement.

a. Timber Species. Record the **Diameter at Breast Height (DBH)** for all timber species, 1.0-inch in diameter and larger. Record DBH to the nearest 0.1 inch;

always round down. Record an average DBH for timber species **seedling groups** if the average height is 4.5 feet or more.

DBH is measured outside bark at a point 4.5 feet above the forest floor on the uphill side of the tree. As specified in the R1 CSE/IM Field Guide, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line. If a standing dead tree is missing bark, measure DBH without the bark and record that measurement.

For trees that fork below 4.5 feet, consider each fork to be a separate tree. Trees forked at or above 4.5 feet count as one tree. Measure DBH at 4.5 feet above the forest floor.

For trees with bole irregularities at breast height, such as branches, swellings, or depressions, measure DBH as close as possible to breast height (4.5 feet), but above or below the deformity. Additionally, record '**DBHxx**' under **TREE REMARKS** (CSE 5.26) where xx indicates the height of the diameter measurement to the nearest tenth of foot.

Refer to Appendices L and M, R1 CSE/IM Field Guide, for instructions on measuring DBH and examples of measuring trees with bole irregularities.

b. Woodland Species. Record the **Diameter at Root Collar (DRC)** for all woodland species, 1.0-inch in diameter and larger (and at least 1-foot tall). Record DRC to the nearest 0.1 inch; always round down. DRC is measured outside bark at ground level, or at the stem-root collar, whichever is higher. A cumulative DRC is computed for multi-stemmed woodland species (specified below). Record an average DRC for woodland species **seedling groups** (for height classes ≥ 1-foot).

For woodland species, treat clumps of stems having a unified crown and common rootstock, such as juniper, as a single tree.

1) **Measuring DRC –** Before measuring DRC, remove the loose material on the ground (e.g. litter) but not the mineral soil. Measure the stem(s) just above any swells that may be present, and in a location that is reflective of the volume above the stem(s). This is especially important when trees are extremely deformed at the base.

   Qualifying Stems: Woodland tree stems must be at least 1.0 foot in length and 1.0 inch in diameter to qualify for measurement (excluding seedlings); stems that are missing due to cutting or damage must have previously been at least 1.0 foot in length and 1.0 inch in diameter.

2) **Computing and Recording DRC –** Woodland tree DRC is computed as the square root of the sum of the squared stem diameters. For single-stemmed trees, the computed DRC is equal to the single diameter measured. For multi-

stemmed woodland trees (with at least one qualifying stem) use the formula below to compute DRC. Record DRC to the nearest tenth inch; always round down.

Multi-stemmed Woodland Species DRC Computation:
DRC = SQRT [SUM (stem diameter^2)]

Round to the nearest 0.1 inch. For example, a multi-stemmed woodland tree with stems of 12.2, 13.2, 3.8, and 22.1 inches would be calculated as:

DRC = $\sqrt{[12.2^2 + 13.2^2 + 3.8^2 + 22.1^2]}$
= $\sqrt{[825.93]}$
= 28.74
= 28.7

- Tolerance (DBH/DRC):
  - Live Timber Species: ± 0.1 inch per 20.0-inch increment of measured diameter
  - Standing Dead Timber Species, with Snag Decay Class of 1 or 2: ± 0.1 inch per 20.0-inch increment of measured diameter
  - Standing Dead Timber Species, with Snag Decay Class of 3, 4, or 5: ± 1.0 inch per 20.0-inch increment of measured diameter
  - Live Woodland Species: ± 0.2 inch per stem

Marking Diameter Measurement Position
In order for the diameter of a tally tree to be inspected and remeasured at the same point on the tree bole or tree stem at successive visits, the exact point of diameter measurement must be marked (as specified below).

a. Timber Species. For standing tally trees, 3.0-inches DBH and larger, place an **aluminum nail** at 4.5 feet above the ground on the uphill side of the tree (excluding aspen trees or trees with a bole irregularity at breast height). **Place the nail perpendicular to the tree bole, then measure DBH directly above the nail and write the TAG ID NUMBER (CSE 5.2) on head of nail with a pencil.** Leave at least 1 inch of the nail exposed to allow for tree growth.

Note: Do not mark non-tally trees with a nail. Trees close to being in (4.9" DBH on subplot or 2.9" DBH on microplot) can be marked with a lumber crayon or paint pen so quality control crews will know where the diameter was measured.

For trees with bole irregularities at breast height, place the nail at the point of diameter measurement (and record 'DBHxx' under TREE REMARKS, CSE 5.26.2, where xx indicates the height of the diameter measurement to the nearest tenth of foot).

For aspen trees, and trees less than 3.0-inches DBH, use a **paint pen** to mark a small line (at least 1.0-inch long and parallel to the ground) at the point of diameter measurement on the uphill side of the tree. Place the paint pen mark first, and then measure DBH directly above the line. Write the tag number under the DBH mark.

b. Woodland Species. For tally trees, 1.0-inch DRC and larger (and at least 1-foot tall), 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, 3.0-inches DRC and larger, place a **nail** at the base of one stem, preferably the largest or main stem, on the uphill side of the tree. Write the TAG ID NUMBER (CSE 5.2) on the head of the nail (or below the paint mark on a main stem for trees 1.0- to 2.9-inches DRC).

Remeasure DBH/DRC:
Update DBH/DRC by determining if stems have died/been removed or grown into inclusion since last inventory and re-calculate DRC. Update DBH/DRC for all tally trees live and dead. Collect DBH/DRC for any new tally trees added to plot during remeasure. Place tape directly above nail, measure diameter.

Pull nails so that at least one inch of the nail is exposed. When pulling nails, it often helps to pound them in slightly prior to pulling to break the nail free of the tree's sap. Remark aspen and woodland species with paint pen if old marks are faint or unreadable.

If it is not physically possible to remeasure the tree in exactly the same location (e.g. tree was buried by mudslide) estimate DBH/DRC and note in Tree Remarks that DBH estimated. If an action has caused major disturbance and tree has new terminal leader (e.g. tree harvested below DBH and new leader has emerged) retire Tag ID# and assign new Tag ID#. Treat as a new ingrown tree.

CSE 5.10 Height (3-digit) *Required for GST trees, trees with broken or missing tops, dead trees, and seedling groups*

Remeasure Height:
Measure heights on all GST trees, trees that have broken or missing tops, and dead trees. Determine the average height for each seedling group recorded.

CSE 5.12 Radial Growth (2-digit) *Required for GST trees with DBH > 3.0 inches*

Measure radial growth for all GST trees the first time they are tallied.

Remeasure Radial Growth:
Only collect radial growth on GST trees that have not been previously recorded. These are GST trees that are growing onto one of the plots, due to change in diameter, or were missed in the installation. Radial growth does not need to be measured in subsequent measurements, because it can be calculated from measured diameters.

CSE 5.14 Height Growth *(2,1-digit; xx.y) Required for GST trees 1.0-2.9 inches in diameter*

Remeasure Height Growth:
Collect height-growth for newly established GST trees that have grown into the 1.0-2.9" DBH category.

CSE 5.15 Tree Age *(4-digit) Required for GST trees do not record on junipers less than three inches DRC*
Measure age for all GST trees the first time they are tallied.

Remeasure:
Only collect age on GST trees that have not previously been tallied. These are GST trees that are growing onto one of the plots, due to change in diameter, or were missed in the installation. Age does not need to be measured in subsequent measurements because it can be calculated from measured ages.

CSE 5.16 Crown Ratio *(3-digit) required for live trees including seedling groups*

Remeasure Crown Ratio:
Collect crown ratio on all live trees.

CSE 5.17 Crown Class *(2-character) Required for all live trees including seedling groups.*
Record CROWN CLASS for all live trees. CROWN CLASS is a categorization of a tree based on dominance in relation to adjacent trees in the stand (categories listed below). This dominance is indicated by crown development and amount of light received from above and the sides. Evaluate each tree in the context of its immediate environment (that is, how is the subject tree competing for sunlight or moisture with adjacent trees/shrubs).

- Tolerance (Crown Class): ± 1 class

Table 5.6 – CROWN CLASS Categories

Code	Name	Description
OP	Open-grown or Isolated	Trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.
DO	Dominant	Trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.

Code	Name	Description
CO	Co-dominant	Trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.
IN	Intermediate	Trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediate trees usually have small crowns and are very crowded from the sides.
OV	Overtopped	Trees with crowns entirely below the general level of the canopy that receive no direct sunlight either from above or the sides.

Remeasure Crown Class:
Assess tree class for all live trees.

CSE 5.20 Snag Decay Class *(1-digit) Required for dead trees*

For standing dead trees (snags), record a SNAG DECAY CLASS code to indicate the condition of the tree. If SNAG DECAY CLASS code 1 is used indicating recent mortality (within 5 years) then record the cause of death in the Tree Damage Category field (see CSE 5.22). All other snag decay codes indicate the tree died more than 5 years ago.

Remeasure Snag Decay Class:
Evaluate Snag Decay Class for all dead tally trees.

- Tolerance (Snag Decay): ± 1 class

CSE 5.22 Tree Damage Category (*2-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable*

For live tally trees and saplings with serious damage (see rule below), record up to three damages. For recently dead trees (those that died within the last 5 years with Snag Decay Class =1), record damage category as cause of death. For an unknown cause of death on mortality trees code category 90 "Unknown" with a severity of 9.
Code broken top on all trees including non-recent mortality (died more than five years ago with Snag Decay Class >1).

If TREE DAMAGE CATEGORY is recorded, also record TREE DAMAGE AGENT (CSE 5.23) and TREE DAMAGE SEVERITY (CSE 5.25).

Examine physical evidence carefully; general symptoms may be indicative of several damaging agents. Refer to appendix R in the R1 CSE/IM Field Guide for a complete listing of TREE CATEGORY, AGENT, and SEVERITY codes. Codes are provided for general categories of damaging agents as well as for specific agents. The general category code should be used if there is any question as to the identity of the specific damaging agent. It is very important to record only accurate pest information for intensified grid plots. See the CSE/IM General Descriptions of Insects and Diseases for more specific identification information.

Remeasure Tree Damage:
Evaluate each tally tree for damages. If a recorded damage is no longer applicable, delete that damage. Add additional damages, if needed.

If a tree has died since previous measurement, retain or record *only* the damage agent and category that caused the tree mortality.

If a tree was dead in the previous measurement, delete the mortality agent recorded in the previous measurement.

CSE 5.23 Tree Damage Agent *(3-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable*
Record if TREE DAMAGE CATEGORY is recorded (see CSE 5.22 above). Refer to appendix R in the R1 CSE/IM Field Guide for a complete listing of TREE CATEGORY, AGENT, and SEVERITY codes.

CSE 5.25 Tree Damage Severity *(2-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable*
Record if TREE DAMAGE CATEGORY is recorded (see CSE 5.22 above). Refer to appendix R in the R1 CSE/IM Field Guide for a complete listing of TREE CATEGORY, AGENT, and SEVERITY codes.

CSE 5.26 Tree Remarks (*30-character)*
Use this field to record any notes pertaining to a specific tree that may explain or describe another variable.

Additionally, use TREE REMARKS to record the following information:
5.26.1 Estimated Age Flag *Required for GST trees as specified*
If TREE AGE (CSE 5.15) is estimated for a GST tree, due to heartrot, record '**AE1**' in this field.

5.26.2 DBH Height ('DBH' + 2 digit) *Required for timber species as specified*
For timber species with bole irregularities at breast height, record the height of the diameter measurement on the tree bole. Record '**DBHxx'** where xx indicates the height of the diameter measurement (to the nearest tenth of foot), from the ground surface to the nail, paint line, or other mark placed at DBH (refer to CSE 5.9 DBH/DRC, Marking Tally Trees).

Remeasure Tree Remarks:
Record Tree Remarks as indicated above. Additionally, record information if Species was incorrectly recorded on the previous measurement.

CSE 5.29 Tree Distance *(3 digit) Required for all trees ≥ 1.0 inch DBH/DRC*

For each tally tree, 1.0-inch in diameter or greater, record HORIZONTAL DISTANCE (to the nearest 0.1 foot) from the PC stake to the geographical center of the tree. For a multi-stemmed woodland tree, the geographic center is a point of equal distance between all tallied stems. Distance correction for slope is necessary when the slope exceeds 10 percent. See Section 1.D.1, Correction for Slope, to determine if the tree is in or out and what the horizontal distance from the plot center to the tree center is.

Remeasurement Horizontal Distance:
Do not change the distance unless it is not within the specified tolerances

- Tolerance (Tree Horizontal Distance):
  - Microplot: ± 0.2 foot
  - Subplot: ± 1.0 foot from 0-22.9 feet, and ± 0.1 foot for > 23.0 feet
  - Macroplot: ± 3.0 feet

CSE 5.30 Tree Azimuth (3-character) *Required for all trees ≥ 1.0-inch DBH/DRC*

For each tally tree, 1.0-inch in diameter or greater, record AZIMUTH (to the nearest degree) from the PC stake to the geographical center of the tree. Sight the center of the base of each tree with a compass (declination set at zero; use 360 degrees for north). For a multi-stemmed woodland tree, the geographic center is a point of equal distance between all tallied stems.

Remeasurement Tree Azimuth:
Do not change the azimuth unless it is outside of specified tolerances.

- Tolerance (Tree Azimuth): ± 10 degrees

Section 6: Vegetation Composition and Ground Surface Cover Transects Forms

This section contains the following subsections: (A) Vegetation Composition – Cover by Lifeform Form, (B) Vegetation Composition – Cover by Species Form, and (C) Ground Surface Cover Form.

Follow the procedures indicated below in this manual. Section 6 in the R1 CSE/IM Field Guide is not applicable to R1 Intensified Grid Inventory. Enter Vegetation Composition data items into **Plot Data/Veg Composition|Ground Surface Cover Data**.

Remeasurement Vegetation Composition, Surface Cover:
Completely remeasure the Vegetation Composition and Surface Cover as per the following instructions.

Complete the following Vegetation Composition and Surface Cover Forms. Sampling Methods are described in the following sections. Transect and plot layouts are described in Section 1D, Plot Layout.

A. **Cover by Lifeform and Cover by Lifeform by Layer**
   - **Line-intercept method on 100' transect** for Cover by Lifeform of Trees, Cover by Lifeform by Layers for Trees
   - **Ocular estimates on 1/24th-acre subplot area** for Cover by Lifeform of Shrubs, Cover by Lifeform of Forbs, Cover by Lifeform of Graminoids, Cover by Lifeform by Layer for Shrubs.

B. **Cover by Species**
   - **Ocular estimates on 1/24th-acre subplot area** for all species with at least 3 percent cover; additionally, record the presence of any noxious species (see list in Appendix I) **and** aspen regardless of percent cover.

C. **Ground Surface Cover**
   - **Four 25' transects for a combined total of 100'**: Collect ground surface cover data on four transects that originate from plot center (PC stake) and extend outward for 25.0 feet slope distance at azimuths of 0, 90, 180, and 270 degrees. Begin measurements at the 1 foot mark.

NOTE: the Cover by Species and Layer form is not used in Exams.

6.A Vegetation Composition – Cover by Lifeform and Cover by Layer

See section 1.D for information on laying out the Vegetation Composition 1/24th acre plot and 50' transect (**horizontal distance**).

The following Attributes will be measured:

Table 6.1 – Exams Cover by Lifeform and Cover by Lifeform by Layer Attributes

Lifeform	Code	Attribute
Trees:	TOT	Total Tree Canopy Cover
	TOV	Trees Canopy Cover (layer > 6.0 feet)
	TSA	Trees Canopy Cover (layer ≤ 6.0 feet)
Shrubs:	TOS	Total Shrub
	ST	Shrubs (layer > 6.0 feet)
	SM	Shrubs (layer 1.6 – 6.0 feet)
	SL	**Shrubs (layer ≤ 1.5 feet)**
Forbs:	TOF	Total Forbs
Graminoids:	TOG	Total Graminoids

6.A.1 Tree Lifeform – Cover and Cover by Layer

Measure the Cover of Trees using the following Method.

Method: Section 1.D describes the layout of the canopy cover transects. Figure 1.7 and 1.8 show the layout for odd and even number plots. Use Appendix A5, Vegetation Compostion:Cover by Lifeform – Tree Canopy Cover Form.
Count and record the linear feet of the transect that intersect tree canopy in a plane extending vertically above the transect. Do not remove gaps between branches or needles, imagine a tarp is covering the tree and the projection of the tree crown is solid along the transect.

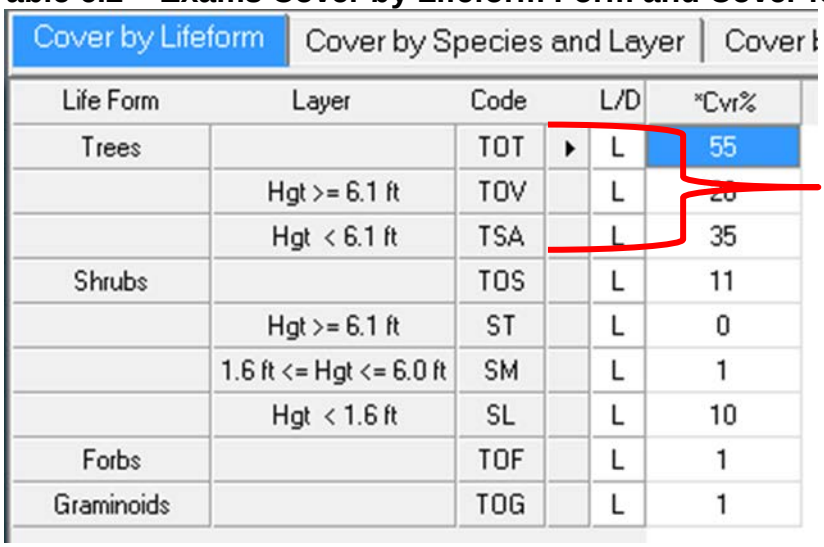
Every tree, regardless of height or diameter, should be included when assessing total tree canopy cover (TOT).

- Sum up the total linear feet of covered transect on the form and total. Record in the Exams Cover by Lifeform form next to TOT.
- Sum up the total linear feet of covered transect on the form for trees > 6' tall and trees ≤ 6' tall. Record in the Exams Cover by Lifeform form next to TOV (trees ≥ 6.1 ft) and TSA (trees ≤ 6 ft). TOV and TSA are independent of one another and should reflect the total value for both size classes.

  Note that these two fields can add to a total greater than TOT because TOV and TSA can be overlapping.

If the slope exceeds 10 percent correct both the transect length and feet of canopy cover for slope prior to entering a percent, see section 1.D.1 for slope correction information.

Table 6.2 – Exams Cover by Lifeform Form and Cover for Tree Lifeform fields.



Cover by Lifeform | Cover by Species and Layer | Cover

Life Form	Layer	Code	L/D	*Cvr%
Trees		TOT	L	55
	Hgt >= 6.1 ft	TOV	L	20
	Hgt < 6.1 ft	TSA	L	35
Shrubs		TOS	L	11
	Hgt >= 6.1 ft	ST	L	0
	1.6 ft <= Hgt <= 6.0 ft	SM	L	1
	Hgt < 1.6 ft	SL	L	10
Forbs		TOF	L	1
Graminoids		TOG	L	1

Enter total tree cover (TOT), tree cover of trees taller than 6' (TOV), and tree cover of trees 6' and shorter in the Cover by Lifeform Form

6.A.2 Shrub, Forb, Graminoid Lifeforms Cover

Determine the total canopy cover by Lifeform for shrubs, forbs, and graminoids and the cover by height class for shrubs. Examine each Lifeform individually as if the other Lifeforms do not exist. Do not double count overlapping layers within a Lifeform. Use Appendix A4, Vegetation Composition Form, Cover by Lifeform section to record data prior to entering in Exams software

Method: Section 1.D, Plot Layout, shows how to layout the 1/24th acre macroplot. The plot radius is based on Horizontal Distance and must be adjusted for slopes greater than 10%, see Section 1.D.1, Slope Correction, for detailed instructions.

Remember the formula for the area of a circle = πr^2 so the area of a 24 ft radius circle = 3.14 (24^2) = 1808 ft^2. Five percent of this = 1808 ft^2 (.05) ≈ 90 ft^2 and the radius of a 90 ft^2 circle = $\sqrt{(90/3.14)}$ ≈ 5.4 ft which is approximately the arm span of a 5.5 ft tall person. This same process can be used to determine the area of any percentage of any fixed radius plot. See Figure 6.3 for square and circle dimensions associated with commonly encountered percentages of a 1/24th acre plot.

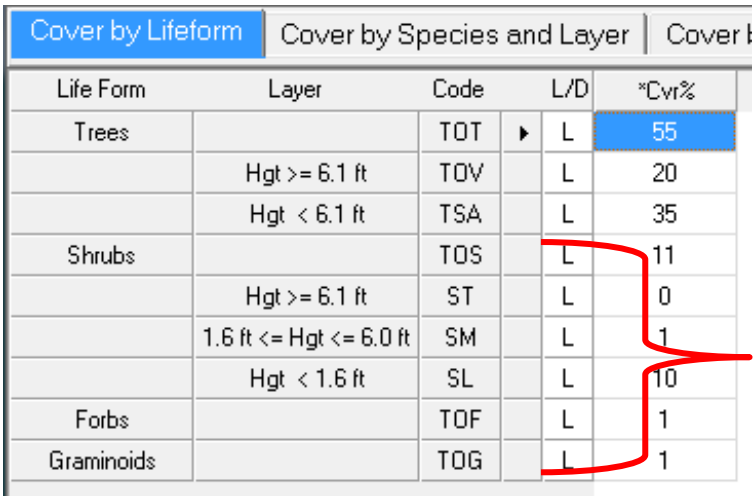
Table 6.3 – Reference areas for 1/24th acre plot percentages

Cover (%)	Area (ft^2)	Square Side Length (ft)	Circle Radius (ft)
1	18	4.3	2.4
3	54	7.4	4.2
5	90	9.5	5.4
10	181	13.4	7.6

Estimate the percent of 1/24th acre subplot covered by the vertical projection of the canopy for the particular Lifeform: shrubs (TOS), forbs (TOF), graminoids (TOG). Only include

vegetation and plant parts within the 1/24th-acre subplot perimeter (horizontal distance), that are alive (or were alive) during the current growing season. Record to the nearest 1 percent. Estimate the cover of shrubs by height classes: shrubs > 6' (ST), shrubs from 1.5 to 6' tall (SM), and shrubs ≤ 1.5' tall (TOG). Enter into the Cover by Lifeform form, see Figure 6.4.

Figure 6.4: Exams Cover by Lifeform Form, Cover of Shrubs, Forbs, and Graminoids fields.



Enter total shrub cover (TOS), shrub cover for shrubs taller than 6' (ST), shrub cover for shrubs from 1.5 to 6' tall (SM), and shrub cover for shrubs 1.5' and shorter (SL), forb cover (TOF), and graminoid cover (TOG) in the Cover by Lifeform Form

- Tolerance (Canopy Cover): ± 10 percent

Note: For any given Lifeform, different plants of the same Lifeform can be divided into more than one layer. However, parts of an individual plant (e.g., upper half, lower half) cannot be assigned into different layers. See "Agave Rule" below.

Agave Rule – If a plant has a seed head that grows much taller than the rest of the plant, assign the entire plant to the layer where most of the cover occurs (not the layer where the seed head tops out).

6.B Vegetation Composition – Cover by Species Form

For the 1/24th-acre subplot area, complete the following (procedures specified below):

- **Species List** – a listing of all species, with a canopy cover of 3 percent or greater
- **Noxious Species List** a listing of the occurrence of any noxious or sensitive species with *any* canopy cover percent (see Appendix I for complete list).
- **Aspen** -the presence, and cover, of aspen

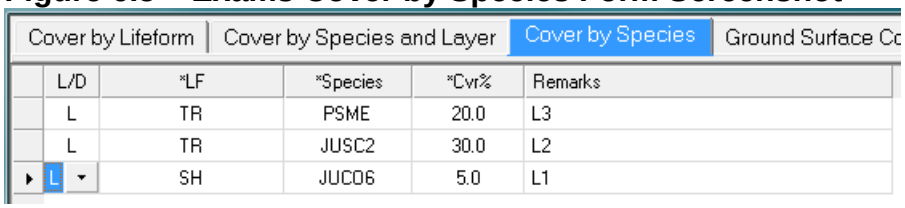
Method: Section 1.D, Plot Layout, shows how to layout the 1/24th acre macroplot. The plot radius is based on Horizontal Distance and must be adjusted for slopes greater than 10%, see Section 1.D.1, Slope Correction, for detailed instructions.

Remember the formula for the area of a circle = πr^2 so the area of a 24 ft radius circle = 3.14 (24^2) = 1808 ft^2. Five percent of this = 1808 ft^2 (.05) ≈ 90 ft^2 and the radius of a 90 ft^2 circle = $\sqrt{(90/3.14)}$ ≈ 5.4 ft which is approximately the arm span of a 5.5 ft tall person. This same process can be used to determine the area of any percentage of any fixed radius plot. See Figure 6.3 for square and circle dimensions associated with commonly encountered percentages of a 1/24th acre plot.

Base all estimates on the cover of vegetation and plant parts that are (or were) alive during the current growing season, and are located within the subplot perimeter (24.0-ft radius, horizontal distance, see section 1.D.1 for information on correcting for slope). Only record a species once on this form.

See the method for calculating the area of various percentages of a 1/24th acre plot and the associated table of reference areas in table 6.2.

Figure 6.5 – Exams Cover by Species Form Screenshot



6.B.1 Species List for species with ≥ 3% cover).

For **each** species in the subplot area that has a canopy cover of 3 percent or greater, record the following:

- **Lifeform** (LF) – select the Lifeform (tree, shrub, forb, or graminoid) from the drop-down list.
- **Species** – record the species PLANTS code; refer to R1 Intensification Plant List for acceptable species codes.
- **Cover** (Cvr%) – record canopy cover to the nearest 1 percent. To determine, estimate the area of ground surface area covered by a vertical projection of the canopy for the species. Do not count overlap of crowns within a species.
- **Remarks –** in the Remarks column, record the code for the layer (listed below) that best represents where most of the cover tops out (note: this layer is not necessarily where most of plant biomass occurs). **If a plant species occurs equally in more than one layer, record the highest layer where it occurs.**

Table 6.6 – Layer Code Definitions

Layer code	Height Class
1	0.0 –1.5 feet
2	1.6 – 6.0 feet
3	> 6.0 feet

6.B.2 Noxious Species, Sensitive Species List, and aspen

For species on the noxious list (Appendix I), sensitive species, **and aspen,** examine the subplot area (24.0-ft radius), and record all species that occur, regardless of canopy cover, record the following for **each** species:

- **Lifeform** (LF) – record Lifeform.
- **Species** – record the species PLANTS code; refer to R1 Intensification Plant List for acceptable species codes
- **Cover** (Cvr%) – record '**.1**' for canopy cover (use this code for all invasive species less than 3 percent cover).
- **Remarks** – in the Remarks column, record the code for the layer that best represents where most of the cover tops out (see table 6.6, above, for layer codes). If an invasive species occurs equally in more than one layer, record the highest layer where it occurs.

❖ Tolerance (Vegetation Composition): Plant Identification :

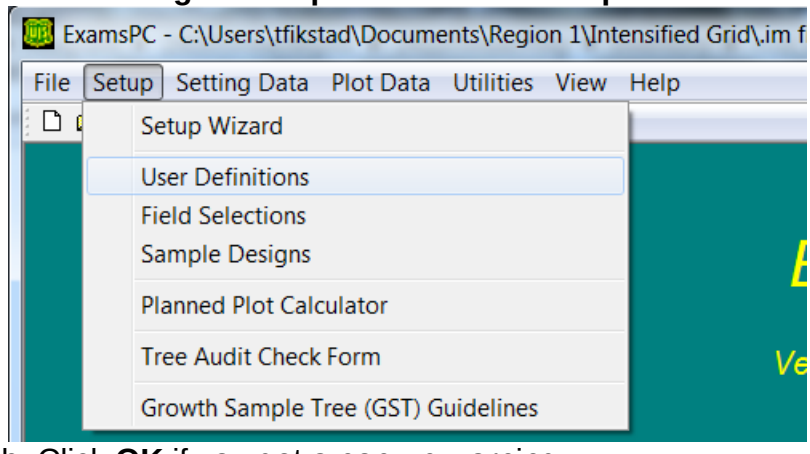
- Genus: No Errors
- Species: No Errors
- Layer: No Errors
- Cover: ± 10 percent
- Lifeform: No Errors

6.B.3 Making Plant Species Available in the Exams Template.

Crews may encounter plant species that have not been added to the template. The most commonly encountered species should already be available, however, if an unusual species is encountered crews may add species to the template in ExamsPC. Please notify the Analysis Team Protocol Specialist in the event that commonly encountered species are not turned on in the template, so the template can be updated for the next season.

a. Select **User Definitions** from the **Setup** dropdown menu.

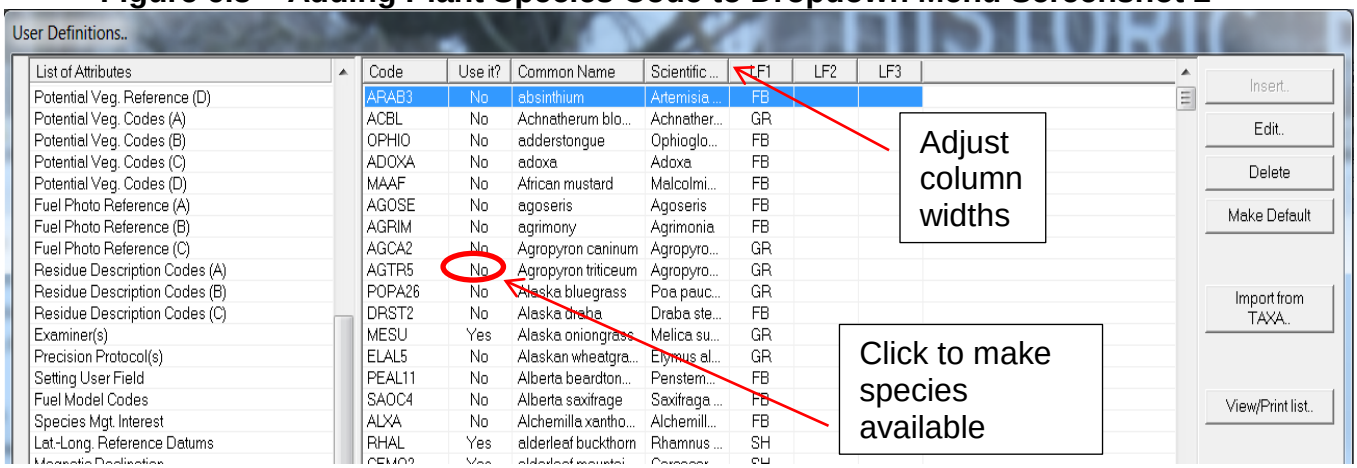
Figure 6.7 – Adding Plant Species Code to Dropdown Menu Screenshot 1



b. Click **OK** if you get a pop-up warning.

c. Scroll down through the **List of Attributes** and click on **Veg. Species**. The Veg. codes will populate in the **User Definitions** window.

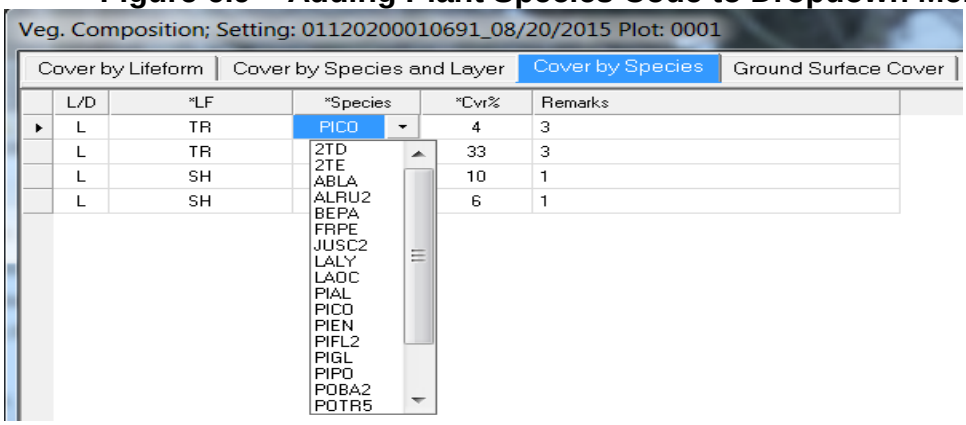
Figure 6.8 – Adding Plant Species Code to Dropdown Menu Screenshot 2



d. The column widths can be adjusted by clicking the column header divider lines and dragging them to where you want them.

e. Find the species name you are looking for and simply click **No** in the **Use it?** Column once. This will toggle the **No** to **Yes**, and the species will now be available in the dropdown list available under **Plot Data<Veg Composition|Ground Surface Cover Data<Cover by Species**.

Figure 6.9 – Adding Plant Species Code to Dropdown Menu Screenshot 3



6.C Ground Surface Cover Form

Ground surface cover data (by cover type category) are collected along transects radiating from plot center. Data are then converted to cover percent estimates.

Sampling Method: Refer to Section 1D, Plot Layout.
Lay out **four transects** that originate from plot center (PC stake) and extend outward 25.0 feet **slope distance** at azimuths of 0, 90, 180, and 270 degrees. Lay a cloth tape along the slope of the ground; do not correct the slope distance to obtain horizontal distance. Mark

the end of the transect lines with a pin or small twig with a piece of flagging attached. See figure 1.7 for a diagram of the layout of the ground surface cover transects.

Beginning at the 1-foot mark from PC (*along each transect direction*), place the tip of a plot stake or sharply pointed staff on the ground along the transect line at each 1-foot mark (against the right side of the tape with your back to plot center). Record each point, referred to as a "hit," on the Ground Cover Sample Form (appendix A6) by the appropriate ground surface cover type category (see table 6.10) for cover type categories). If more than one category occurs at a point (e.g., litter on top of a rock), always record the ground cover category that is on top (i.e., the category that the pointed staff touches first). Note: Foliar canopy cover above the soil surface plane is not considered to be ground surface cover.

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

Remeasurement:
Ground surface cover transects are completely remeasured.

Table 6.10 – Ground Surface Cover Type Codes and Category Definitions.
Valid Ground Surface Cover Type categories and codes (4-character; *Required)* for the R1 Intensified Grid Inventory are as follows:

Code	Description	Definition
ASH	Ash (Organic from fire)	Remaining residue after all combustible material has been burned off.
BARE	Bare soil (soil particles < 2 mm)	Bare soil, not covered by rock, cryptogams or organic material. Does not include any part of a road (see definition for road).
BAVE	Basal vegetation	Basal vegetation not differentiated by Lifeform. For use when basal vegetation is not separated into more detailed codes (BAFO, etc.)
CRYP	Cryptogamic crust	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria).
DEVP	Developed Land	Surface area occupied or covered by any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure, sod/lawn.
LICH	Lichen	Lichens: an organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in a symbiotic

Code	Description	Definition
LITT	Litter and duff	Leaf and needle litter, any material < ¼ inch, and duff not yet incorporated into the decomposed top humus layer. Non-continuous litter is not included (for example, scattered needles over soil is classified as Bare)
MOSS	Moss	Nonvascular, terrestrial green plants including mosses, hornworts and liverworts - always herbaceous. This code does not apply to moss growing on bare soils in dry rangeland conditions. For rangeland conditions, see cryptogamic crusts.
PEIS	Permanent ice and snow	Surface area covered with ice & snow at time of plot measurement, considered permanent.
ROAD	Road/Trails	Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained or in long-term continuing use. May be constructed using machinery. Includes cutbanks and fills.
ROCK	Rock	Relatively hard, naturally formed mineral or petrified matter > 1/8 inch in diameter appearing on soil surface as small to large fragments or as relative large bodies, cliffs, outcrops, or peaks. Includes bedrock.
TRIS	Transient ice and snow	Surface area covered by ice and snow at the time of plot measurement, considered transient.
UNKN	Unknown	Other covers not defined elsewhere including trash and garbage.
WATE	Water	Where remaining above the ground surface during the growing season, such as streams, bogs, swamps, marshes and ponds (FIA definition).
WOOD	Wood	Woody material, slash and debris; any woody material, small and large woody debris, regardless of depth. Litter and non-continuous litter are not included (for example, scattered needles over soil is classified as BARE).

After all of the “hits’ for the ground surface cover transects sample have been recorded on the Ground Surface Cover Form, Appendix A6, determine a GROUND SURFACE COVER PERCENT for each cover type category sampled. On the Ground Surface Cover Form in Exams software, record the category and the GROUND SURFACE COVER PERCENT for each cover type sampled. *The surface cover percentages for all categories sampled on a plot MUST total 100 percent.*

Determining GROUND SURFACE COVER PERCENT for the plot:

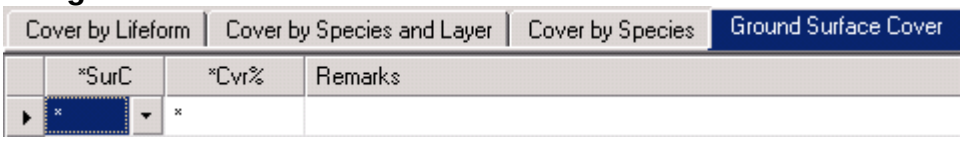
Add the Surface Cover Type totals from each transect to determine the surface cover type totals for the plot. Enter these numbers into the plot total column.

Cover Type GROUND SURFACE COVER PERCENT – By cover type, determine the cover percent value associated with the total number of hits sampled:

Category Cover Percent = Total # hits for each category

"Cover %" Entry – On the Ground Surface Cover Form in Exams software, record the cover percent value (GROUND SURFACE COVER PERCENT) in the "Cover %" column, by category.

Figure 6.11 – Exams Ground Surface Cover Screenshot



NOTE: Prior to entering the GROUND SURFACE COVER PERCENT for each cover type category in Exams software, verify that all of the individual category percent values sum to 100 percent.

Table 6.12 – Ground Surface Cover Adjustment Guidelines

GROUND SURFACE COVER PERCENT – adjustment for partially sampled transects.
Adjustment for nonsampled transect: The individual category percentages that are entered in the Exams software sum to 100 percent. If any portion of a transect cannot be sampled (e.g., due to a hazardous situation), use the following procedures to determine individual category percentages. This procedure adjusts percentages to the area sampled, thus allowing the grand total to equal 100 percent. Adjustment Procedure: 1) Determine the "total number of hits sampled for the plot." 2) Divide each cover type category total by the "total number of hits sampled for the plot." 3) Verify that the sum of all categories is equal to 100 percent. If the grand total is slightly off (e.g., 98% or 102%), due to categorical rounding, then further adjust one or more of the individual category percentages so that the grand total will equal 100 percent. Use one of the following steps: • If the cover type category with the highest percent cover is at least 5% higher than any other category percent, then make the adjustment to that category (e.g., add or subtract 1% or 2%).

GROUND SURFACE COVER PERCENT – adjustment for partially sampled transects.
• If two (or more) cover type categories have the highest cover percents (they are less than 5% apart), then make adjustments (equal if possible) to each of the top categories.

Example – GROUND SURFACE COVER PERCENT adjustment for nonsampled transect:

- Categories and number of hits sampled for entire plot:

BAVE: 21 hits
BARE: 10 hits
LITT: 31 hits
ROCK: 15 hits

Total hits for Plot = 77 hits (*23 hits could not be sampled*)

- GROUND SURFACE COVER PERCENT adjustment:

BAVE: 21/77 = 27%
BARE: 10/77 = 13%
LITT: 31/77 = 40%
ROCK: 15/77 = 19%

Total Percent for Plot = 99%

- Because the grand total is only 99% (and not 100%), further adjust an individual category (or categories) to allow the grand total to equal 100%. Because LITT is the category with the highest cover percent, and it is at least 5% higher than any other category percent, make the adjustment to that category:

BAVE: 27%
BARE: 13%
LITT: ~~40%~~ adjust to 41%
ROCK: 19%

Total Percent for Plot: 100%

❖ **Tolerance Ground Surface Cover Percent:** ± 10 percent

Section 7: Down-Woody Materials Form

This section contains the following subsections: (A) Definition of Down-Woody Materials, and (B) Down-Woody Materials Items.

Follow the procedures indicated below in this manual. Section 7 in the R1 CSE/IM Field Guide is not applicable to R1 Intensified Grid Inventory. Enter Down-Woody Materials data items in the Exams software Plot/Down Woody Material Data.

Remeasurement:
Completely remeasure all down woody material variables as per the instructions below.

7.A Definition of Down-Woody Materials

7.A.1 Coarse Woody Debris (CWD).

In this inventory, CWD includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth, on the ground, and are 3.0 inches in diameter and greater for three feet of length. CWD also includes dead trees (either self-supported by roots, severed from roots, or uprooted) that are leaning > 45 degrees from vertical.

CWD does not include:

1) Woody pieces less than 3.0 inches in diameter at the point of intersection with the transect.
2) Dead trees leaning 0 to 45 degrees from vertical.
3) Dead shrubs, self-supported by their roots.
4) Trees showing any sign of life.
5) Stumps that are rooted in the ground (i.e., not uprooted).
6) Dead foliage, bark or other non-woody pieces that are not an integral part of a bole or limb (bark attached to a portion of a piece is an integral part).
7) Roots or main bole below the root collar.
8) Pieces less than 3.0 inches in diameter for 3 feet of length
9) Decay class 5 pieces less than 5.0 inches in diameter for 3 feet of length and less than 5 inches from the ground.

Note: In this inventory, the decay stage of a piece ≥ 3.0 inches (and intersect diameter) will first determine whether the piece qualifies for tally. Refer to **LOG DECAY CLASS** (item 7.9).

7.A.2 Fine Woody Debris (FWD).

In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD

can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

1) Woody pieces greater than 3.0 inches in diameter at the point of intersection with the transect.
2) Dead branches connected to a live tree or shrub; or to a standing dead tree or dead shrub.
3) Dead foliage (i.e., pine or fir needles, or leaf petioles).
4) Bark fragments or other non-woody pieces that are not an integral part of a branch, twig, or small bole.
5) Small pieces of decomposed wood (i.e., chunks of cubical rot).

7.B Down-Woody Materials Sampling Procedures

7.B.1 Down-Woody Materials Transect Layout

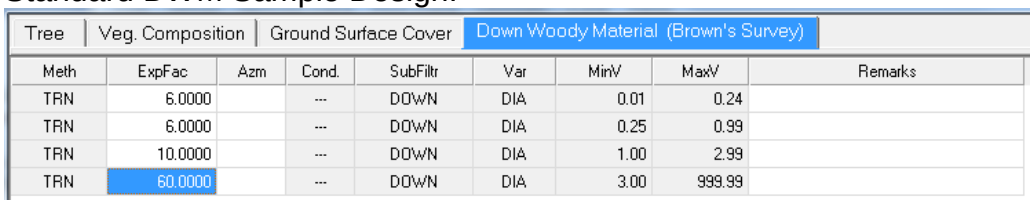
Lay out **two transects** that originate from plot center (PC stake) and extend outward **30.0 feet horizontal distance** in two cardinal directions**.** For even-numbered plots, orient transects at azimuths of 90 and 270 degrees. For odd-numbered plots, orient transects at azimuths of 0(360) and 180 degrees. Mark the end of each transect with a pin or twig with a piece of flagging attached.

Sample coarse-woody debris (CWD) along the entire length of both transects. Sample fine-woody debris (FWD) along a 6- to 10-foot subsection of transect between 14- and 24-feet, **horizontal distance**. For even-numbered plots, sample FWD on the east transect (*oriented at 90 degrees*). For odd-numbered plots, sample FWD on the north transect (*oriented at 0 degrees*). See section 1.D Plot Layout for additional diagrams of down woody materials transects.

See section 1.D.1 for correcting transect lengths and the associated sampling length if slope exceeds 10%.

Figure 7.1 – Down Woody Materials Adjustment for Nonsampled Transect

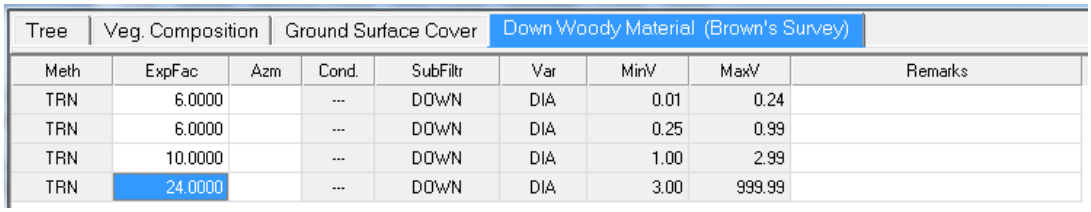
Standard DWM Sample Design:



Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	6.0000		---	DOWN	DIA	0.01	0.24	
TRN	6.0000		---	DOWN	DIA	0.25	0.99	
TRN	10.0000		---	DOWN	DIA	1.00	2.99	
TRN	60.0000		---	DOWN	DIA	3.00	999.99	

Adjustment for nonsampled transect:
If any portion of a DWM transect cannot be sampled (e.g., due to a hazardous situation), go into Exams software, Setting Data, Sample Designs for the affected plot, Down-Woody Material tab. Enter the actual length sampled (truncate the length for the appropriate transect and plot). The

example below shows a plot with a truncated transect length of 24 feet to the north and 0 feet to the south for the piece count of logs 3" and larger.



Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	6.0000		---	DOWN	DIA	0.01	0.24	
TRN	6.0000		---	DOWN	DIA	0.25	0.99	
TRN	10.0000		---	DOWN	DIA	1.00	2.99	
TRN	24.0000		---	DOWN	DIA	3.00	999.99	

Notify the COR if transect lengths need to be truncated, such as hazardous conditions. Put Remark in Plot Remarks, item 4.18, in Exams Plot form.

7.B.2 Down-Woody Materials Attributes to collect:

The required fields for the R1 Intensified Grid Inventory are listed below. These fields yield data that allow the ability to assess down-woody material for wildlife needs and fuels assessments. Refer to individual items for additional definitions and field procedures.

Remeasurement:
Re-collect all down woody material data.

Table 7.2 – Required Down Woody Material Fields

Item No.	Field	Recorded
7.1	Plot Number	X
7.2	First Duff	X
7.3	Second Duff	X
FWD:		
7.5	Twig1 (1-hour; 0.01" to 0.24")	X
7.6	Twig2 (10-hour; 0.25" to 0.99")	X
7.7	Twig3 (100-hour; 1.00" to 2.99")	X
CWD:		
7.8	Piece Count	3.0" diameter and larger
7.9	Log Decay Class	3.0" diameter and larger
7.10	Diameter (at point of intersection)	3.0" diameter and larger
7.11	Piece Length	3.0" diameter and larger
7.12	Diameter Large end	3.0" diameter and larger

Note: If there is no down wood or duff present on the plot, enter "0" for the two duff measurements, Exams will not allow any entries into the other fields. Following this procedure ensures that the plot was established, but that there was nothing to measure.

CSE 7.1 Plot Number (3-digit) *Default*

CSE 7.2 and 7.3 First Duff and Second Duff (2.1-digit; xx.y) *Required*
Take FIRST DUFF and SECOND DUFF measurements as specified below. Although titled "duff," these measurements include both total duff and litter depth at the locations indicated (24-ft, horizontal distance). Record the duff/litter values to the nearest 0.1 inch.

Duff/Litter Sampling Methods
Litter is the layer of freshly fallen leaves, needles, twigs (<.25 inch in diameter), cones, detached bark chunks, dead moss, dead lichens, detached small chunks of rotted wood, dead herbaceous stems, and flower parts (detached and not upright). Litter is the loose plant material found on the top surface of the forest floor. Little decomposition has begun in this layer. Litter does not include bark that is still attached to a down log, or rotten chunks of wood that are still inside a decaying log or log end (i.e. if a decayed log end has a lot of rotten cubes or pieces laying on a log surface and exposed to air, they are considered part of the log and not litter). If these rotten chunks have spilled out to the ground and are actually on the ground surface, then they would be included in the litter layer. Litter does not include animal manure.

Duff is the layer just below litter. It consists of decomposing leaves and other organic material. The duff layer is usually dark decomposed organic matter; plant parts are not recognizable. It does not include the freshly cast material in the litter layer. When moss is present, the top of the duff is just below the green portion of the moss.

Procedure: Carefully expose a profile of the forest floor for the measurement. A knife or hatchet helps, but is not essential. Avoid compacting or loosening the duff /litter profile where the depth is measured. Use a plastic ruler to measure total depth of the duff/litter profile to the nearest 0.1 inch. Place the zero end of the ruler at the point where the mineral soil meets the duff layer then move either your index finger or thumb down the ruler until it is level or touches the top of the litter. While keeping your finger in the same position on the ruler, lift the ruler out of the profile and record the duff/litter depth indicated by your finger. Collect duff/litter measurements at the subplot perimeter as specified below:

- **For even-numbered plots –** Take the first duff/litter measurement on the east transect (*oriented at 90 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**First Duff**" column. Take the second duff/litter measurement on the west transect (*oriented at 270 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**Second Duff**" column.

- **For odd-numbered plots –** Take the first duff/litter measurement on the north transect (*oriented at 0 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**First Duff**" column. Take the second duff/litter measurement on

the south transect (*oriented at 180 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**Second Duff**" column.

When stumps, logs, and trees occur at the point of measurement, offset 1 foot perpendicular to the right of the sampling plane (with your back to plot center). Include portions of rotten logs in the depth measurement if the central axis of the rotten log is in the duff layer.

- **Tolerance** (First Duff; Second Duff): ± 1/2 inch duff/litter

7.B.3 Fine Woody Debris Sampling Method (Items 7.5, 7.6, and 7.7)

FWD is sampled along a 6-10 foot subsection of transect, and is tallied in three size classes (Twig1, Twig2, and Twig3) depending on the cross-section diameter size of each piece. Collect FWD data as indicted in the plot layout section, 1.B.1. Beginning at 14 feet (horizontal distance) from the PC and extending either 6 or 10 feet (horizontal distance) depending on the FWD diameter-size class, as follows:

Table 7.3 – FWD Diameter Size Classes

Field	Diameter Size Range (cross section)	Transect Length	Transect Location (**horizontal distance**)*
7.5 Twig1 (1-hour)	0.01 to 0.24 in	6 feet	14 to 20 feet
7.6 Twig2 (10-hour)	0.25 to 0.99 in	6 feet	14 to 20 feet
7.7 Twig3 (100-hour)	1.00 to 2.99 in	10 feet	14 to 24 feet

* Transect lengths and location of measurements need to be modified if slope ≥10%. See section 2.B for specific information.

FWD Tally Rules:

1. The length of FWD transects are measured in **horizontal distance** -- correction for slope is required. The FWD transects start at 14.0 feet horizontal distance, and extends for 6.0 or 10.0 feet horizontal distance (depending on FWD size class).

2. Only sample FWD that intersects a plane from the ground to a height of 6 feet.

   FWD is sampled in three size classes. FWD 0.01 to 0.24 inches, and FWD 0.25 to 0.99 inch, are counted on a 6-foot transect, from 14 to 20 feet along the tape. FWD 1.00 to 2.99 inches are counted on a 10-foot transect, from 14 to 24 feet. These transects overlap.

3. Count a piece of FWD if it intersects the transect. Only count a piece if the twig, branch, wood fragment, or shrub/tree bole are woody. Do not count pine or fir needles or non-woody parts of a tree or shrub.

4. Count the number of pieces within each FWD size class (Twig1, Twig2, Twig3), and enter the total count by size class. If there is no tally for a size class on a transect, enter zeros for the count.

5. Transects that fall on very dense FWD (where counting is nearly impossible), can be subsampled and calculated. For example, an accurate count can be conducted on a 2.0-foot section of the transect and then multiplied by 3 to provide an estimate for the 6 foot transect (as long as the remaining transect has a similar density of FWD pieces).

6. If a transect intersects a large pile of material such as a wood rat's nest or a recently fallen tree (with many attached fine branches), estimate a count based on #5 above.

7. If rocks, logs, or other obstructions are present along the transect include any FWD that is present on top of these obstructions in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.

CSE 7.5 1-hr (0.01 to 0.24 inch) (3-digit) *Required*
Record the number of small twig intersections for each transect. Small twigs are defined as pieces that have a cross section diameter of less than ¼ inch (0.01 to 0.24 inch) at the point of intersection with the sampling plane.

- **Tolerance** (Twig1): ± 40 percent

CSE 7.6 10-hr (0.25 to 0.99 inch) (3-digit) *Required*
Record the number of large twig intersections for each transect. Large twigs are defined as pieces that have a cross section diameter of between 0.25 and 0.99 inch inclusive at the point of intersection with the sampling plane.

- **Tolerance** (Twig2): ± 30 percent

CSE 7.7 100-hr (1.00 to 2.99 inches) (3-digit) *Required*
Record the number of branch intersections for each sampling plot. Branches are defined as pieces with a cross section diameter of between 1.0 and 2.99 inches inclusive at the point of intersection with the sampling plane.

- **Tolerance** (Twig3): ± 20 percent

7.B.4 Coarse Woody Debris Sampling Methods (Items 7.8, 7.9, 7.10, 7.11, and 7.12):
CWD is sampled along two 30 foot transects (see figure 1.7, section 1.A.5 Plot Layout; *transects oriented east-west for even-numbered plots; transects oriented north-south for odd-numbered plots*). Collect CWD data along the entire length of both transects.

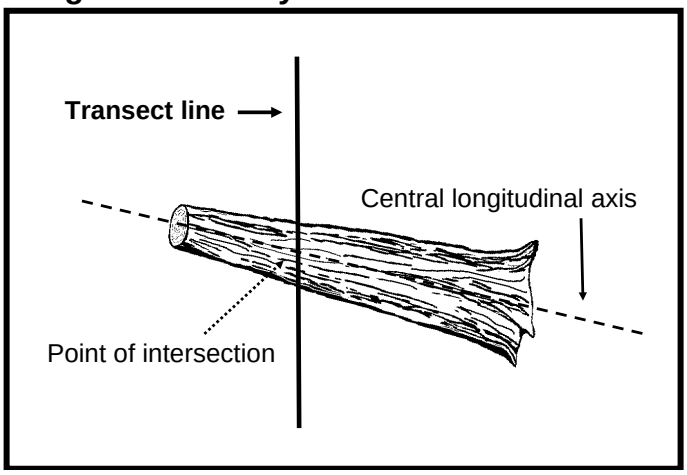
Note: Please record CWD systematically starting at plot center for each transect in the order as follows for quality control purposes: measure the north transect followed by the south transect for odd plots, and measure the east transect followed by the west transect for even plots.

CWD Tally Rules:

Note: In this inventory, the decay stage of a piece ≥ 3.0 inches for 3 feet of length (and intersect diameter) will first determine whether the piece qualifies for tally. Refer to **LOG DECAY CLASS** (item 7.9).

1. Tally a CWD piece if its central longitudinal axis intersects the transect line (see figure 7.4).

Figure 7.4 – Tally rules for CWD



2. Tally dead trees that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees that are still upright and leaning ≤ 45 degrees from vertical. Most CWD will be lying on the ground.

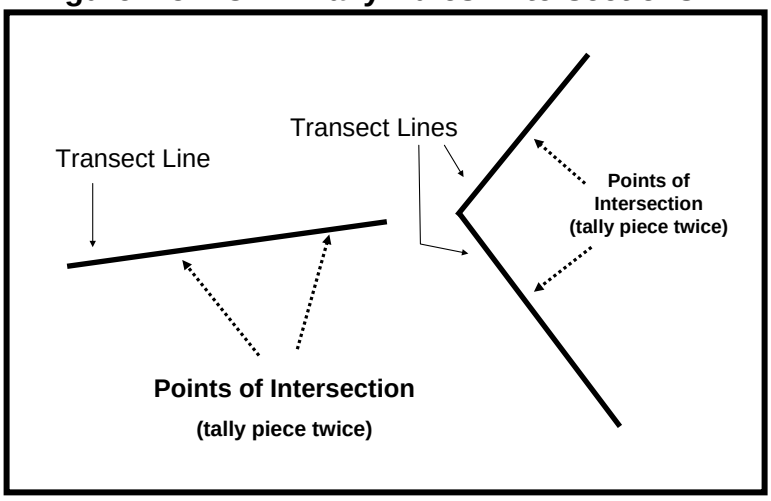
3. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3.0 feet, measure the length to the nearest 0.1 ft to determine if it is ≥ 3.0 feet.

4. Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine-piled. Do not record pieces that are part of machine-piled slash piles or windrows, or pieces that are part of a log "jumble" at the bottom of a steep-sided ravine (where individual pieces are impractical to tally separately).

5. Tally a CWD piece only if the point of intersection occurs above the ground (at least part of the top surface is still visible). If one end of a CWD piece is buried in the litter, duff, or mineral soil, ignore the part that is buried (consider the piece to end at the point where it is no longer visible), and take diameter and length measurements only on the part that is above the ground.

6. If the central longitudinal axis of a CWD piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see figure 7.5).

Figure 7.5 – CWD Tally Rules: Intersections



7. Tally a piece only once if the subplot center falls directly on the central longitudinal axis of the piece.

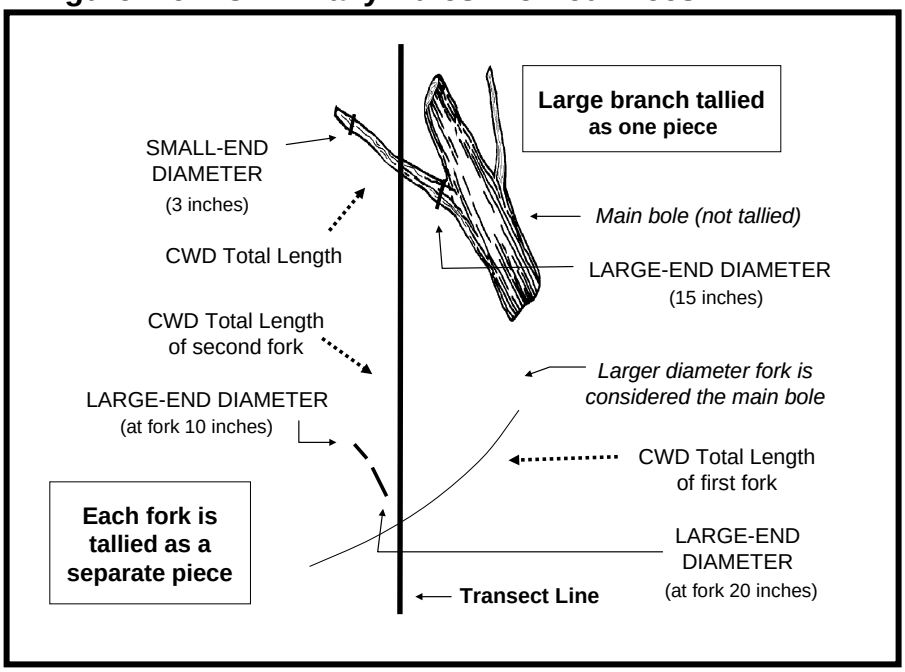
8. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

9. Do not tally a piece if it intersects the transect on the root side of the root collar. Do not tally roots.

10. When the transect crosses a forked down tree bole or large branch connected to a down tree, tally each qualifying piece separately. To be tallied, each individual piece must meet the minimum diameter and length requirements.

11. In the case of forked trees, consider the "main bole" to be the piece with the largest diameter at the fork. Variables for this fork such as PIECE LENGTH and LOG DECAY CLASS should pertain to the entire main bole. For smaller forks or branches connected to a main bole (even if the main bole is not a tally piece), variables pertain only to that portion of the piece up to the point where it attaches to the main bole (see figure 7.6).

Figure 7.6 – CWD Tally Rules: Forked Trees



CSE 7.8 CWD Transects Piece Count (3-digit) *Required*

Tally individual CWD pieces according to the CWD tally rules stated below. Generally, CWD piece count is "1."

- **Tolerance** (CWD Piece Count): No Errors

CSE 7.9 Log Decay Class (1-character) *Required*

In this inventory, the decay stage of a piece ≥ 3.0 inches (and intersect diameter) will first determine whether the piece qualifies for tally. See tally qualifications below.

For pieces that qualify for tally, record LOG DECAY CLASS according to the class code. See table 7.7 for Log Decay Classes and their definitions.

Table 7.7 – Log Decay Class Definitions

Class Code	Bark	Texture	Twigs	Shape	Wood Color	Portion of log on ground
1	Intact	Intact	Present	Round	Original	None, elevated on supporting points
2	Intact	Intact to soft	Absent	Round	Original	Parts touch, still elevated, sagging slightly
3	Trace	Hard large pieces	Absent	Round	Original to faded	Bole on ground

Class Code	Bark	Texture	Twigs	Shape	Wood Color	Portion of log on ground
4	Absent	Soft blocky pieces	Absent	Round to oval	Light brown to faded brown	Partially below ground
5	Absent	Soft, powdery	Absent	Oval	Faded light yellow or gray	Mostly below ground

Tally qualifications:

- For **Log Decay Class 1- 4**, tally a piece if it is ≥ 3.0 inches in diameter at the point of intersection with the transect. The piece must be ≥ 3.0 feet in length and greater than or equal to 3.0 inches in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the piece (to the nearest 0.1 inch) to verify.

- For **Log Decay Class 5**, tally a piece if it is ≥ 5.0 inches in diameter at the point of intersection and ≥ 5.0 inches high from the ground. The piece must be 3.0 feet in length and ≥ 5.0 inches in diameter along that length. Only pieces that have some shape or log form qualify for tally. Humps of decomposed wood that are becoming part of the duff layer do not qualify for tally. Note: Because decay class 5 pieces are difficult to identify, especially when they are decomposed, they are treated differently than decay class 1 - 4 pieces.

  - **Tolerance** (Log Decay Class): ± 1 class

CSE 7.10 Diameter (at point of intersection) (3,1-digit; xxx.y) *Required*
For each CWD piece tallied, record the diameter at the point where the transect intersects the longitudinal center of the piece (intersect diameter). Record the intersect diameter to the nearest inch.

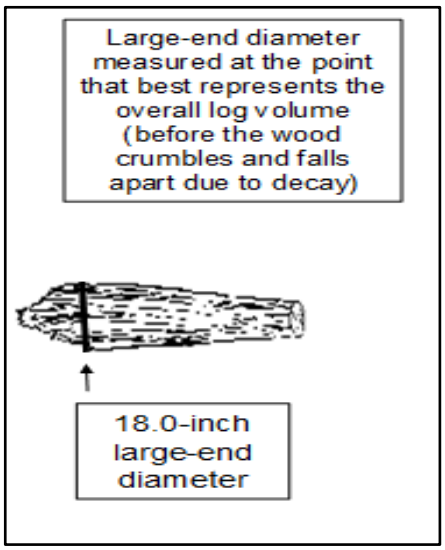
If the diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually ≥ 3.0 inches and a valid tally piece.

- **Tolerance** (Diameter – at point of intersection): ± 1 inch

Diameter Measurement Guidelines:

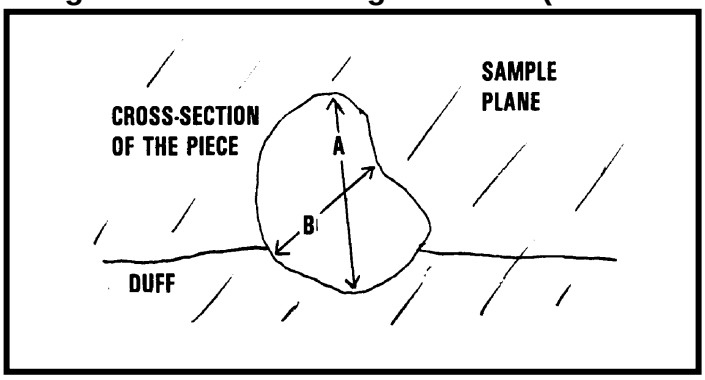
The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length (see figure 7.8). It is useful to carry a steel carpenter's retracting tape to measure diameters. Other methods include wrapping a tape around the bole (if possible), holding a straight-edge ruler above the piece, or using calipers.

Figure 7.8 – Diameter Measurement



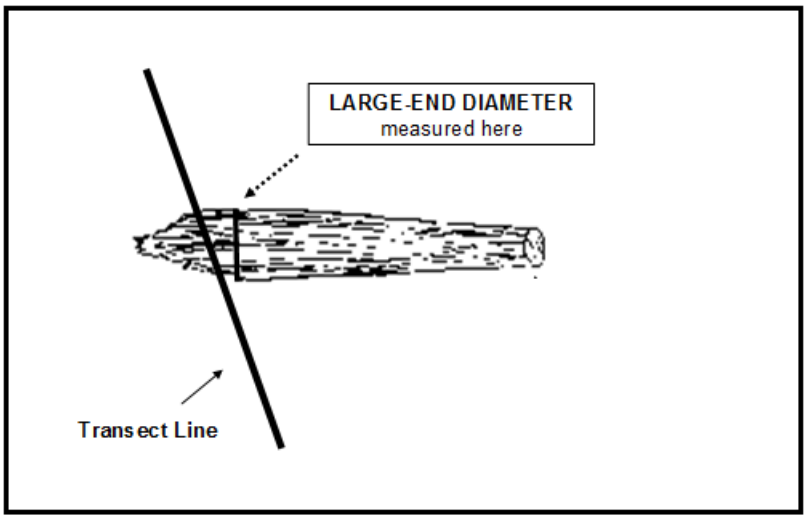
Odd-shaped Diameter: For pieces that are not round in cross-section (because of missing chunks of wood or "settling" due to decay), measure the diameter in two directions and take an average. Estimate the longest and shortest axis of the cross-section ("A" and "B" in figure 7.9), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

Figure 7.9 – Estimating Diameter (Pieces that are Not Round in Cross-Section)



Splintered-End Intersect Diameter: As an exception to the tally rules, if the transect intersects the log at the decayed or splintered end (i.e., the portion where we do not consider it part of the log because it is falling apart), record the intersect diameter at this location (see figure 7.10). However, record the large-end diameter according to the established rules (i.e., at the point where it best represents the log volume). If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – treat it as one log (in this situation) and take the intersect diameter around the splintered end (take two measurements and calculate an average if it is odd shaped). Measure PIECE LENGTH between the large-end and small-end diameters.

Figure 7.10 – Example of Decayed End Intersecting the Transect



CSE 7.11 Piece Length (3,1-digit; xxx.y) *Required*

For each CWD piece tallied, record length to the nearest 0.1 foot. If the end of a CWD piece is buried underground, take length measurements only on the part that is above the ground (see CWD tally rules). CWD total length is the length of the piece that lies between the piece's recorded diameter at the small end (three inch minimum diameter) and diameter at the large end.

- **Tolerance** (Piece Length): ± 10 percent

CSE 7.12 Diameter Large End (3,1 digit; xxx.y) *Required*

For each CWD piece tallied, record the diameter of the piece's large end (large-end diameter). Record the large-end diameter to the nearest inch. The large-end diameter will occur at: (1) a broken or sawn end, (2) a fracture, or (3) the root collar. If the end of the CWD piece is splintered or decomposing (sloughing off), measure the large-end diameter at the point where it best represents the overall log volume. Refer to the diameter measurement guidelines mentioned above under DIAMETER - at point of intersection, item 7.10.

- **Tolerance** (Diameter – Large End):
  - Pieces < 20.0 in diameter: ± 2 in
  - Pieces ≥ 20.0 in diameter: ± 15 percent

Literature Cited

Region 1 Common Stand Exam and Inventory and Monitoring Field Guide. Region 1 Vegetation, Classification, Mapping, Inventory, and Analysis Report #15-02. http://fsweb.r1.fs.fed.us/forest/inv/cse_exams/guides.shtml

Milburn, A., B. Bollenbacher, M. Manning, R. Bush. Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. Region 1 Vegetation, Classification, Mapping, Inventory, and Analysis Report #15-4. 2015. http://fsweb.r1.fs.fed.us/forest/inv/r1_tools/R1_allVeg_Groups.pdf

APPENDICES:

A	Data Collection Forms: A1: Plot Location Reference Form (Supplemental) A2: Plot Location Photo Placard A3: Plot and Tree Data Form A4: Grid Intensification Microplot Seedling Data Collection Form A5: Vegetation Composition Form A6: Ground Surface Cover Transects Form A7: Down-Woody Materials Form
B	Generalized GPS Settings
C	Finding the Plot Center using Baseline Techniques
D	Tolerances for R1 Intensified Grid Inventory
E	Tally Tree Species (Timber and Woodland Species)
F	Plot Packet Contents and Plot Packet Bundles
G	Recommended Field Gear
H	Editing an Exams Software Intensification Template File
I	Noxious and Sensitive Plants Lists
J	R1 Habitat Type Groups

Appendix A: Data Collection Forms

The form labeled "*Supplemental*" will need to be completed for each plot location (refer to section 2, Plot Location Reference Form). The Plot Location Photo Placard form is to serve as a display in plot location photography; refer to Photographing the Plot (end of section 4) for instructions.

Always take the other paper forms to each plot location in the event that the PDR is not functioning (to use as a backup for data entry).

Appendix A1: Plot Location Reference Form (*Supplemental*)
* Always complete this form as thoroughly as possible on the paper form as it serves as a valuable reference for field navigation. Complete a brand new form for plot remeasures, updating fields as necessary. Do not just overwrite on the original.

Appendix A2: Plot Location Photo Placard
The Plot Location Photo Placard form is to serve as a display in plot photos; refer to Photographing the Plot (end of section 4) for instructions.

Appendix A3: Plot and Tree Data Form

Appendix A4: Grid Intensification Microplot Seedling Data Collection Form

Appendix A5: Vegetation Composition Form

Appendix A6: Ground Cover Sample Form

Appendix A7: Down-Woody Materials Form

Appendix A1: PLOT LOCATION REFERENCE FORM

PROJECT NAME: (25 character) GRID INT _

Region (2.2) XX	Forest (2.3) XX	State (2.8) XX	County (2.9) XXX	Location (2.5) (XXXX)	Stand/Plot # (2.6) XXXX	Date (2.11) MM/DD/YYYY
01	_ _	_ _	_ _ _	_ _ _ _	_ _ _ _	_ _/_ _/_ _ _ _

Examiner(s) (2.28) (15-character)

_ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Vehicle Coordinates (1.B.2):

Zone (1.B.2.3): _____

Easting (1.B.2.1): _____ **Northing (1.B.2.2):** _____

Travel Description (1.B.1): _____

_____

_____

_____

_____

_____

_____

Reference Point (1.B.3): Species (1.B.3.2): _____ Diameter (1.B.3.3): _____

Remarks (1.B.4.3): _____

RP to PC Traverse Info: Azimuth (1.B.4.1): _____ Slope Distance (1.B.4.2): _____

RP Coordinates:

Easting (1.B.3.4.1)_____

Northing (1.B.3.4.2) _____

Zone (1.B.3.4.3): _____ Error (1.B.3.4.3): _____

#Hits (1.B.3.4.4): _____

PC Coordinates:

Easting (1.B.5.1): _____

Northing (1.B.5.2): _____

Zone (1.B.5.3):_____ **Error** (1.B.5.4): _____

#Hits (1.B.5.5): _____

PC Witness Trees

X-Tree Tag ID (4.19.3)_____ **Y-Tree TagID (4.19.3)**_____

Species (4.19.4): _____ Species (4.19.4): _____

Diameter (4.19.6): _____ Diameter (4.19.6): _____

Azimuth (4.19.7) : _____ Azimuth: (4.19.7): _____

S. Distance (4.19.8): _____ S. Distance (4.19.8): _____

Remarks (4.19.9):_____

_____

_____

_____

_____

PC Offset (if applicable):

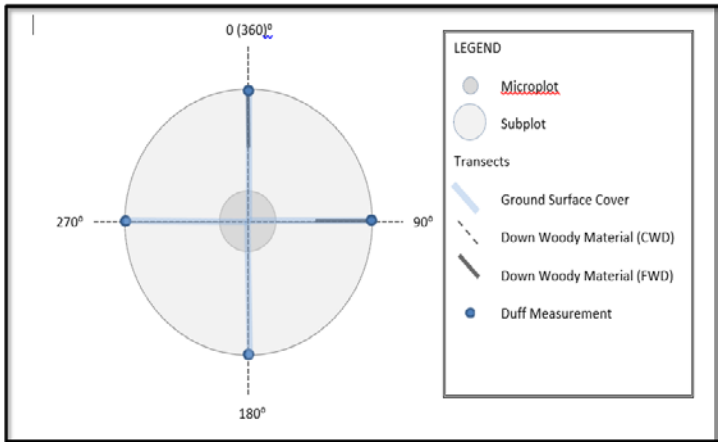
Azimuth (1.B.6.1): _____

Slope Dist (1.B.6.2): _____

* NOTE: Shaded areas are not recorded electronically. Use extra care when recording these

Plot Narrative/Remarks (1.B.6.2)

PLOT LOCATION MAP (1.B.6.1) :
(Vehicle to RP and PC.)
North



Sample Plot Area	Plot Radius (Horizontal Distance)	Sample Items
Subplot	24.0 ft.	Trees ≥ 5.0" DBH/DRC Vegetation Composition
Microplot	6.8 ft.	Trees 1.0" to 4.9" DBH/DRC Seedling Counts
Transects	**Length**	**Direction**
Ground Surface Cover	Four 25' Slope Dist.	At 0, 90, 180, and 270 degrees
CWM	Two 30' Horizontal Dist.	Even plot at 90 and 270 degrees Odd plot at 0 and 180 degrees
FWM	Two 6'-10' Horizontal Dist.	Even plot at 90 and 270 degrees Odd plot at 0 and 180 degrees
Crown Cover	Two 50'	Even plot at 90 and 270 degrees Odd plot at 0 and 180 degrees

Appendix A2: Photo Placard

GRID INT

ST:

CO:

Plot ID:

N E S W

Appendix A3: PLOT AND TREE DATA FORM

Project Name: GRID INT ______________________________

Region: 1 Proclaimed Forest: ________ District: __________ Owner: USFS

Location: ________ Plot #: ________ State: __________ County: __________

Crew Names: ______________________________ Date: __________

____

PV Code: ________ **Aspect:** ________ **Slope Percent:** ________

Tree Measurement:

page _1_ of ____

Tag ID	us (L/D)	e Clas s	Site / GST	Species	e Cou nt	# of Ste ms	DBH / DRC	Height	al Grow th	t Growt h	Age	Crow n Ratio	n Clas s	g Dec ay	Damage 1 Categ ory	Damage 1 Agent	Damage 1 Severit	Damage 2 Categ ory	Damage 2 Agent	Damage 2 Severit	Damage 3 Categ ory	Damage 3 Agent	Damage 3 Severit	Hdist	Azi mut	Tree Remarks: Multistem DRC
xxxx	x	xx	x	xxxxxxxx	xxx	xxx	xxx.x	xxx	xx	xx.x	xxxx	xxx	xx	x	xx	xxx	xx	xx	xxx	xx	xx	xxx	xx	xxx	xxx	drcxxx.x

Appendix A4: Microplot Seedling Data Collection Form

GST	SPECIES	TREE COUNT	DBH	HEIGHT	CROWN RATIO	CROWN CLASS
0.5-4.4 ft.						
4.5 + ft.						
TOTALS, AVERAGES						
GST	**SPECIES**	**TREE COUNT**	**DBH**	**HEIGHT**	**CROWN RATIO**	**CROWN CLASS**
0.5-4.4 ft.						
4.5+ ft.						
TOTALS, AVERAGES						
GST	**SPECIES**	**TREE COUNT**	**DBH**	**HEIGHT**	**CROWN RATIO**	**CROWN CLASS**
0.5-4.4 ft.						
4.5+ ft.						
TOTALS, AVERAGES						

Appendix A5: Vegetation Composition Form

Vegetation Composition: Cover by Lifeform - Tree Canopy Cover **Region 1** **Forest**_____ **District**_____ **Location**_____ **Plot**_____ **State**____ **County**_____ *Measure along two 50' transects																				**Total Cover (ft)**	**Canopy Cover (%)**
Total Tree Cover		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end		Add **Total Cover** from Transect 1 & 2
Transect 1	TOT																				
	Length																				
Transect 2	TOT																				
	Length																				
Tree Cover >6'Tall		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end		Add **Total Cover** from Transect 1 & 2
Transect 1	TOV																				
	Length																				
Transect 2	TOV																				
	Length																				
Tree Cover ≤6' Tall		beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end	beg	end		Add **Total Cover** from Transect 1 & 2
Transect 1	TSA																				
	Length																				
Transect 2	TSA																				
	Length																				

Cover by Lifeform:

1. Calculate total canopy cover by each lifeform based on the area of the ground covered vertical projection of that lifeform i.e.; Shrubs (TOS), Forbs (TOF), Graminoids (TOG).
2. Calculate total canopy coverage of shrubs by layer (**ST**, **SM**, **SL**) in height categories within the 1/24th-acre subplot. See Cover by Species below for more information on layers.

Lifeform	Layer	Code	Attribute	Canopy Cover % (CVR %)
Shrubs	**All**	**TOS**	Total Shrub	
	> 6.0 ft	**ST**	Total Shrub (> 6.0 ft)	
	1.6 – 6.0 ft	**SM**	Total Shrub (1.6 - 6.0 ft)	
	≤ 1.5 ft	**SL**	Total Shrub (≤ 1.5 ft)	
Forbs	**All**	**TOF**	Total Forbs	
Graminoids	**All**	**TOG**	Total Graminoids	

Cover by Species:

1. Record each plant species with canopy cover ≥ 3%, its lifeform, and record in remarks the layer that best represents where most of the cover tops out (based on area of vertical projection, not biomass).
2. Record all invasive species present in the 1/24th-acre subplot regardless of the canopy cover.
3. A circle 4.2 feet in radius, or a 7.4 ft x 7.4 ft square, represents 3% (approx. 54 ft^2) of the total 1/24th-acre subplot area (24.0-ft radius).

Layer	Height Class
1	0.0 - 1.5 feet
2	1.6 - 6.0 feet
3	> 6.0 feet

Lifeform	Species	Cover % (CVR %)	Remarks (Layers)

Appendix A6: Ground Cover Sample Form

Project Name: _____ **Date:** _____
Owner: USFS Region: 1 Proclaimed Forest: _____ **District:** ____
Plot #:_____ **State:** _____ **County:**_____
Crew Members:_____

GROUND SURFACE COVER FORM

Surface Cover Types	Subplot								Plot
	North		East		South		West		
	Hits	Total	Hits	Total	Hits	Total	Hits	Total	Total
ASH									
BAVE									
BARE									
CRYPT									
DEVP									
LICH									
LIT									
MOSS									
PEIS									
ROAD									
ROCK									
TRIS									
UNKN									
WATE									
WOOD									
TOTAL		25		25		25		25	100

Appendix A7: Down-Woody Materials Form

DOWN-WOODY MATERIALS FORM

Project Name: GRID INT _____
Region: 1 Proclaimed Forest: _____ **District:** _____ **Owner: USFS**
Location #: _____ **Plot #:** _____ **State:** _____ **County:** _____
Crew Names: _____ **Date:** _____
_____

Measurement Direction and Distances		FWD			CWD	Litter/Duff	
		Twig 1	Twig 2	Twig 3	1000-Hour	FIRST DUFF	SECOND DUFF
		1-Hour	10-Hour	100-Hour			
Transect Direction	Even# plot	0°	0°	0°	0° and 180°	0°	180°
	Odd# plot	90°	90°	90°	90° and 270°	90°	270°
Horizontal Distance		14 to 20 ft (6 ft)	14 to 20 ft (6 ft)	14 to 24 ft (10 ft)	entire transect (60 ft each)	24-ft mark	24-ft mark

Fine Woody Material (< 3.0 in.), Duff/Litter:

Twig 1 (1-hour) 0.01 - 0 .24 in. xxx	Twig 2 (10-hour) 0.25 – 0.99 in. xxx	Twig 3 (100-hour) 1.00 – 2.99 in. xxx		FIRST DUFF (in.) xx.x "	SECOND DUFF (in.) xx.x "

Coarse Woody Material (>3.0 in.):

Transect Azimuth	Piece Count xxx	Decay Class x	Diameter (in.) xxx.x "	Length (ft.) xxx.x '	Large End (in.) xxx.x "
Notes:					

Coarse Woody Material (>3.0in.)

Transect Azimuth	Piece Count xxx	Decay Class x	Diameter (in.) xxx.x	Length (ft.) xxx.x	Large End (in.) xxx.x

Appendix B: Generalized GPS Operating Instructions

There are many makes and models of GPS that can be used to establish, re-measure and qualtiy check plot locations. Following are some guidelines on how to set up GPS units for this inventory. Before verifying the initial settings and navigation with the unit, become familial with installing batteries, the function of each key/rocker and using/connecting the power source by reading the owner's manual and quick start guide. The proper initial settings are necessary for positioning and navigational accuracy and once selected, become the default values each time the GPS is turned on.

A. Settings

Turn the unit on and once the Warning screen appears, press the **PAGE** key. The unit will start acquiring satellites. Press **MENU** twice to navigate to the Main Menu. Toggle down using th rocker pad to **Setup** and press **ENTER**. At the top of this screen there are 8 tabs that can be navigated through using the rocker pad. Verify the GPS settings using the information below:

General tab

- Mode = Normal
- WAAS = Enabled
- Backlight Timeout = 15 seconds
- Language = English

Altimeter tab

- Altimeter Auto Cal. = On
- Altimeter = On
- Pressure Units = Milibars
- Barometer Mode = Variable Elevation

Compass tab

- Compass = On
- Use GPS if Speed is Above = 10 mph
- Use Compass if Speed is Below 10 mph for at least = 1 ½ minutes

Time tab

- Time Format = 12 Hour
- Time Zone = Mountain
- Daylight Savings Time = Auto
- Current Date = Correct Current Date
- Current Time = Correct Current Time

Units– Note: these items may be found under different menus on different units.

- Coordinates: UTM
- Datum – NAD 1983 CONUS

- WAAS: Enabled
- North Reference: True

C. Collecting Points

Always average 30 points or more to collect PC, RP, or vehicle coordinates. Methods for doing this vary depending on unit, but generally select menu in the position screen and then select: average points.

D. Improving Satellite Reception

Use an external remote antenna to improve satellite reception when under heavy canopy/cloud cover, north facing slopes, or any other area that may have poor reception. An external antenna will improve the GPS performance by about 15-20%.

GPS Requirements and Tips:

- Use a GPS receiver that has the ability to obtain the stated accuracy of ± 15 meters (49.2 feet), for each plot, in the horizontal dimension. Newly installed plots must be within ± 10 meters of their provided theoretical coordinates in both Easting and Northing UTM values.
- Elevate the GPS receiver off the ground and remove all obstructions that may block reception; use the external antenna if necessary.
- Use the **Averaging** option of the GPS to provide coordinates for the position of the RP (or PC) on the UTM grid system.
- Acquire an almanac and assure a current position fix of three-dimensional "3D" status by remaining in the same location for at least 3 minutes (or longer if needed to acquire a minimum of at least 30 position fixes). After the almanac has been collected, proceed to collect and record the UTM coordinates.
- For Plot Center (PC) coordinates, UTM data must *also* be converted into Latitude/Longitude for entry into Exams software in the Plot Data Form (section 4). See PLOT LATITUDE (item 4.2.1) and PLOT LONGITUDE (item 4.2.2). If this can be done efficiently and accurately in the field by the GPS unit, then these data may be entered at that time on a PDR. These data can also be converted through the Montana State University geographic unit converter website, or similarly accurate website, and then manually entered into Exams PC before plots are submitted. Use the following link for UTM-Lat/Long conversion: http://www.rcn.montana.edu/Resources/Converter.aspx
- For each point feature, at least 30 position fixes should be collected at an error of 50 feet or less.
- Point features are surveyed when the GPS antenna is at plot center for a period of time. During that time, 30 individual GPS position fixes are collected and averaged to give a single location for that point. While acquiring 30 fixes, the GPS receiver must not move as satellite signals are continuously received.

E. Obtaining an Averaged Location

- Averaged coordinates will be collected at the truck parking spot, reference point, and location center

- With the unit on, press and hold the Enter/Mark key for 2 seconds until the Mark Waypoint screen appears.
- Press the Menu key and a separate screen appears with average Location highlighted.
- Press Enter and the Average Location screen appear and if there is good satellite reception, the Measurement Count will start.

Appendix C: Finding the Plot Center using Baseline Techniques

Use the following procedures to locate the plot location center (PC) when the GPS receiver is malfunctioning, or if it is not possible to obtain satellite coverage to navigate to the PC (e.g., heavy canopy cover, dead batteries, poor satellite reception). If necessary, plot the location of the PC on topographic maps and/or aerial photography prior to locating the PC in the field.

C.1 Establishing a Baseline and Scale

Establish a baseline and scale using either (1) the ground/photo method:

1. Ground/Photo Method.

    a. **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 PC location. On the back of the photo, circle and label one of the landmark pinpricks as "A" and the other as "B".

    b. **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.

    c. **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:

        Horizontal Ground Distance = (Slope Ground Distance)/(Slope Correction Factor)

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

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

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

B. Selecting a Reference Point

Once the baseline azimuth and scale have been determined (ground/photo), designate a reference point (RP) readily identifiable on both the ground and the photograph. Refer to RP selection criteria in section 1, 1.B, Finding the Plot Center (GPS Method).

C. Calculating Azimuth and Distance

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

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

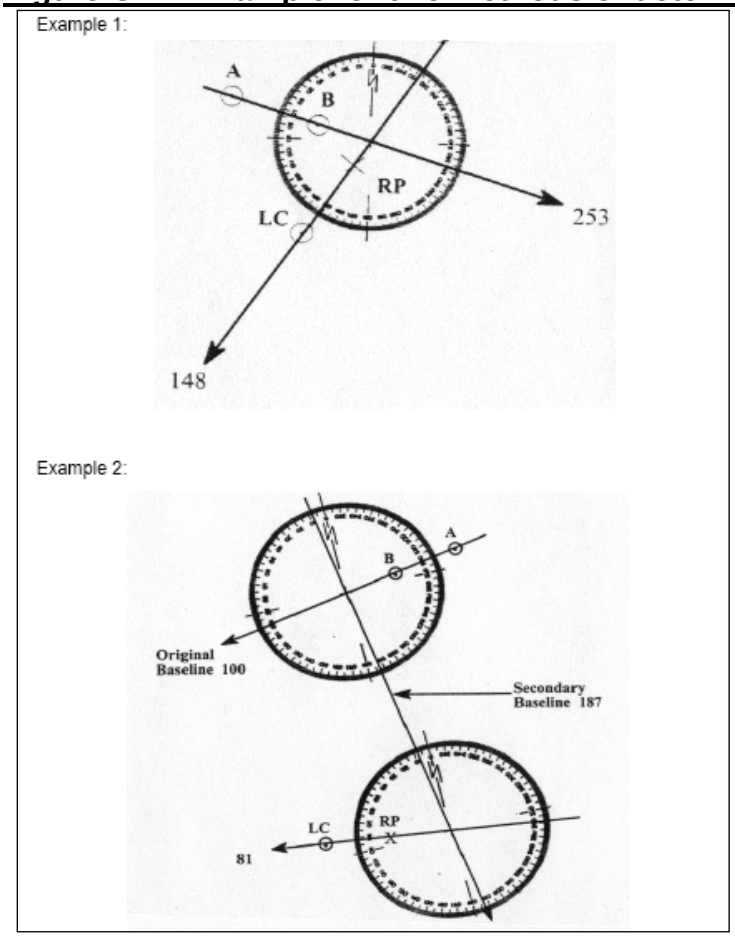
2. **Determine RP-PC azimuth.** To obtain the RP to PC azimuth, orient a photo-scale protractor **inverted** over the line intersections (in other words, position the protractor "**wrong side**" up because the photo work is carried out on the back of the photo). Determine the azimuth from the RP to the PC by lining up the correct azimuth over the baseline and reading the azimuth corresponding to the RP-PC line (figure C.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-PC line to obtain the RP to PC azimuth. On the back of the photo, record the azimuths along each traverse line. Also record the following information on the back of the aerial photograph containing the PC pinprick in the lower left or right hand corner (depending on photo pinprick location):

RP Info:	Course to Plot: RP to PC	Baseline Info: A to B	Baseline Info: RP to PC
Species	Azimuth	Azimuth	Azimuth
Diameter	Distance	Ground Distance	Photo Distance
RP Coordinates	PC Coordinates	Photo Distance	PSR

RP Info:	Course to Plot: RP to PC	Baseline Info: A to B	Baseline Info: RP to PC
		PSR	Ground Distance
		PSR Adjustment	PSR Adjustment

Figure C.1 – Example for two methods of determining azimuth from RP to PC.



Example 1: The simple baseline
Example 2: The secondary baseline

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

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

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

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

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

D. Traversing to the PC

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

E. PC Verification

Upon arrival at the end of the traverse, determine if the calculated ground point is in agreement with the PC pinpricked on the photograph. Examine the ground features near the PC area that would be noticeable on the aerial photograph such as individual trees or tree groupings, openings in the crown canopy, rock outcroppings, etc. If the calculated ground point and the photo point are clearly not in agreement,

1. Recheck the azimuth and distance calculations for possible errors.

2. **Determine the correct ground location** based on the photos and map, and place a second stake at the correct ground location. If the RP is visible from the corrected PC, remeasure the actual azimuth and distance directly. Otherwise, determine the azimuth and distance from the initial stake (incorrect location) to the second stake (corrected location). Remove the first stake. Record all adjusted measurements on the Setting and Plot Location Reference Form (appendix A1) under PC COORDINATES and include a note under STAND NARRATIVE/REMARKS explaining the situation.

❖ Tolerance (Finding the PC):

- RP Selection: at least 75 feet from the PC, unless extenuating circumstances apply
- Placement of PC (RP to PC traverse):

- RP to PC Azimuth: ± 2 degrees
- RP to PC Distance: ± 6 feet per 100 feet of transect (30 feet maximum).

Appendix D: Tolerances for the R1 Intensified Grid Inventory

Setting/Plot Location Reference Form – Setting Items:

CSE Item No.	Field Name	Tolerance
2.1	Project Name	No Errors
2.2	Proclaimed Region	No Errors
2.3	Proclaimed National Forest	No Errors
2.4	District	No Errors
2.5	Location	No Errors
2.6	Stand Number	No Errors
2.7	Owner	No Errors
2.8	State	No Errors
2.9	County	No Errors
2.10	Administrative Forest	No Errors
2.11	Date	No Errors
2.13	Examination Level	No Errors
2.14	Exam Purpose	No Errors
2.15	Stratum (NOT required)	No Errors
2.16	Existing Vegetation Reference (NOT required)	No Errors
2.18	Potential Vegetation Reference	No Errors
2.20	Structure (NOT required)	No Errors
2.23	Setting Elevation	± 100 feet
2.28	Examiner	No Errors
2.29	Precision Protocol	No Errors
2.30	Radial Growth Interval	No Errors
2.31	Radial Growth Interval 2 (NOT required)	No Errors
2.32	Height Growth Interval	No Errors
2.33	Fuel Photo Reference (NOT required)	No Errors
2.34	Setting User Code	No Errors
2.35	Setting Remarks	No Errors
2.36	Setting Damage Category	No Errors
2.37	Setting Damage Agent	No Errors
2.38	Setting Damage Severity	± 1 category
2.39	Species of Management Interest (NOT required)	No Errors

Setting/Plot Location Reference Form – Plot Location Reference Items:

Item	Tolerance
Reference Point (RP):	
Species	No Errors
Diameter	± 0.2 inch per 20 inches of diameter
RP Selection	At least 75 feet from the PC, unless extenuating circumstances apply
RP to Plot Center (PC) Traverse:	
RP to PC Azimuth	± 10 degrees
RP to PC Distance	± 6 feet per 100 feet of transect (30 feet maximum)
PC Coordinates:	
Zone	No Errors
Easting and Northing	± 10 meters (16.4 feet) of the stated plot location center
Error	< 70 feet
Number of Hits	≥ 30
PC Witness Trees:	
Species	No Errors
Diameter	± 0.2 inch per 20 inches of diameter
Azimuth	± 10 degrees
Slope Distance	± 0.2 feet
Travel Description	Both road travel and hiking directions must be present.

Sample Design Form – provided in template form:

CSE Item No.	Field Name	Tolerance
3.1	Form Type	
3.2	Sample Selection Method Type	No Errors
3.3	Sample Expansion Factor	No Errors
3.5	Subpopulation Filter	No Errors
3.6	Sample Design Remarks	No Errors

CSE Item No.	Field Name	Tolerance
3.7	Selection Criteria Number or Criteria Condition	No Errors
3.8	Subpopulation Variable	No Errors
3.9	Subpopulation Minimum Value	No Errors
3.10	Subpopulation Maximum Value	No Errors

Plot Data Form:

CSE Item No.	Field Name	Tolerance
4.1	Plot Number	No Errors
4.4	Plot Aspect	± 45 degrees
4.5	Plot Slope	± 10 percent
4.11	Plot Potential Vegetation	Accurate to R1 Habitat Type Group; see Appendix J

Tree Data Form:

CSE Item No.	Field Name	Tolerance
5.1	Plot Number	No Errors
5.2	Tag ID Number	No Errors
5.3	Tree Status	No Errors
5.4	Tree Class	Tree Class Code / Tolerance GS / GS, RF RF / GS, RF, RN RN / RF, RN SL / SL, US US / SL, US • No errors 90% of time
5.5	Growth Sample Trees (GST)	No Errors

CSE Item No.	Field Name	Tolerance
5.6	Tree Species	No Errors
5.7	Tree Count	Number of Trees on Plot / Diameter (DBH/DRC) / Height or Height Class / Missed/Extra Tree Tolerance 0 — NA — NA — No errors 1+ — 1.0-in+ — NA — No errors Seedling Groups: 1 - 5 — 0.1- to 0.9-in * — 0.5-4.4 ft — ± 1 tree 6+ — 0.1- to 0.9-in * — 0.5-4.4 ft — ± 20% 1 - 5 — 0.1- to 0.9-in — ≥ 5.0 feet — ± 1 tree 6+ — 0.1- to 0.9-in — ≥ 5.0 feet — ± 10% * woodland species seedling groups
5.8	Number Stems	No Errors
5.9	DBH/DRC	• **Live Timber Trees:** ± 0.1 inch per 20.0-inch increment of measured diameter • Standing Dead Timber Species, with Snag Decay Class of 1 or 2: ± 0.1 inch per 20.0-inch increment of measured diameter • Standing Dead Timber Species with Snag Decay Class of 3, 4, or 5: ± 0.1 inch per 20.0-inch increment of measured diameter • Live Woodland Species: ± 0.2 inch per stem
5.10	Height	± 10 percent of actual standing tree height
5.12	Radial Growth	± 1/20th inch
5.14	Height Growth	trees ≥ 6 feet: ± 1 foot trees < 6 feet: ± 0.1 foot
5.15	Tree Age	trees < 300 years old: ± 10 percent trees ≥ 300 years old: ± 15 percent
5.16	Crown Ratio	± 10 percent

CSE Item No.	Field Name	Tolerance
5.17	Crown Class	± 1 class
5.20	Snag Decay Class	± 1 class
5.22	Tree Damage Category	No Errors (unless otherwise specified) Refer to Damage Category Table below
5.23	Tree Damage Agent	(see Damage Category)
5.25	Tree Damage Severity	(see Damage Category)
5.26	Tree Remarks (additional items):	
	• Estimated Age Flag	Recorded when applicable
	• DBH Height	Recorded when applicable
	• Woodland Tree Items (multi-stemmed species): ➢ Stem DRC – individual stem DRCs • Stem Status – record "d" for dead stems	Recorded when applicable
5.29	• Horizontal Distance	Microplot: ± 0.2 foot Subplot: ± 1.0 foot from 0-22.9 ft. ± 0.1 foot for > 23.0 feet Macroplot: ± 3.0 feet
5.30	• Azimuth	± 10 degrees

Damage Category (CSE item 5.22):

Code	Category	Damage Tolerance	Severity Tolerance
11	Bark Beetles	No misses on live trees with a severity ≥ 2	± 0
12	Defoliators	No misses on live trees with a severity ≥ 3	± 1 code
13	Chewing Insects	No misses on live trees with a severity of 2	± 0
14	Sucking Insects	No misses on live trees with a severity of 2	± 0

Code	Category	Damage Tolerance	Severity Tolerance
15	Boring Insects	No misses on weevils (Pissodes) or shoot moths (Eucosma) on live trees	± 0
16	Seed/Cone/ Flower/Fruit Insects	No misses of shoot moths (Eucosma) on live trees	± 0
17	Gallmaker Insects	No misses on live trees with a severity of 2	± 0
18	Insect Predators	No misses on live trees with a severity of 2	± 0
19	General Disease	No misses on live trees with a severity of 2	± 0
20	Biotic Damage	No misses on live trees with a severity of 2	± 0
21	Root/Butt Diseases	No misses on live trees with a severity ≥ 2	± 0
22	Stem Decays/Cankers	No misses on live trees with a severity ≥ 3	± 1 code
23	Parasitic - Mistletoe	No misses on live trees with a severity of ≥ 3	± 1 code
24	Decline Complexes/Dieback/Wilts	No misses on live trees with a severity of 2	± 0
25	Foliage Diseases	No misses on Elytroderma on live trees	± 0
26	Stem Rusts	No misses on live trees with a severity of ≥ 2	± 0
27	Broom Rusts	No misses on live trees with a severity of 2	± 0
30	Fire	No misses if damage affects > ¼ of the bole circumference, or if an open wound is in contact with the ground	± 0
41	Wild Animals	No misses on live trees with terminal leader damage, or with greater than ¼ of bole circumference affected	± 0
42	Domestic Animals	No misses on live trees with terminal leader damage, or with greater than ¼ of bole circumference affected	± 0

Code	Category	Damage Tolerance	Severity Tolerance
50	Abiotic Damage	No misses on wind, snow, or ice bending, breakage, or bole cracks and frost damage to shoots on trees < 1-inch diameter, and lightning on trees ≥ 5-inch diameter	± 0
60	Competition	No misses on live trees with a severity of 2	± 0
70, 71	Human Activity, Harvest	No misses on live trees for logging, human activity, or fire if the damage affects > ¼ of the bole circumference, or if an open wound is in contact with the ground	± 0
80	Multi-Damage (Insect/Disease)	No misses on live trees with a severity of 2	± 0
90	Unknown	No misses on live trees with a severity of 2 (≥ 20 percent)	± 10 percent
99	Physical Effects	No misses on live trees with a severity of ≥ 2 (≥ 20 percent)	± 10 percent

Vegetation Composition:

Item	Tolerance
Lifeform	No Errors
Canopy Cover	± 10 percent
Layer	No Errors
Genus	No Errors
Species	No Errors

Ground Surface Cover Transects:

Item	Tolerance
Transect Azimuth	± 10 degrees

Number of Hits per category	± 10 percent
Cover Type Category	No Errors
Ground Surface Cover Percent	± 10 percent

Down-Woody Materials Form:

Item No.	Field Name	Tolerance
DWM Sample Transect Azimuths		± 10 degrees
7.1	Plot Number	No Errors
7.2	First Duff	± 1/2 inch
7.3	Second Duff	± 1/2 inch
7.5.1	Twig1 (0.01 to 0.24 inch)	± 40 percent
7.5.2	Twig2 (0.25 to 0.99 inch)	± 30 percent
7.5.3	Twig3 (1.00 to 2.99 inches)	± 20 percent
7.8	Piece Count (CWD Transects)	No Errors
7.9	Log Decay Class	± 1 class
7.10	Diameter (at point of intersection)	± 1 inch
7.11	Piece Length	± 10 percent
7.12	Diameter Large End	• Pieces < 20.0 in: ± 2 in • Pieces > 20.0 in: ± 15%

Appendix E: Tally Tree Species (Timber and Woodland Species)

The following is a list of "tally tree" species for the R1 Intensified Grid Inventory (refer to section 1, Tree Sampling Procedures). These species are further classified as "timber" or "woodland" species. Timber species are measured for diameter at breast height, 4.5 feet above the ground (Diameter at Breast Height, DBH); exceptions apply to trees with bole irregularities. Woodland species are measured for diameter at ground level or the stem-root collar, whichever is higher (Diameter at Root Collar, DRC); a cumulative DRC is computed for multi-stemmed woodland species. Refer to CSE/IM 5.9 DBH/DRC.

Note: This list is limited to FIA tally tree species that are found in the Region 1 area.

Tally Tree Species for the R1 Intensified Grid Inventory

Symbol (PLANTS)	Scientific Name	Common Name	Type
ABGR	Abies grandis	Grand fir	T
ABLA	Abies lasiocarpa	Subalpine fir	T
ACNE2	Acer negundo	Boxelder	T
ALRH2	Alnus rhombifolia	White alder	T
ALRU2	Alnus rubra	Red alder	T
BEPA	Betula papyrifera	Paper birch	T
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	W
CONU4	Cornus nuttallii	Pacific Dogwood	T
FRPE	Fraxinus pennsylvanica	Green ash	T
JUOS	Juniperus osteosperma	Utah juniper	W
JUSC2	Juniperus scopulorum	Rocky Mountain juniper	W
LALY	Larix lyallii	Subalpine larch	T
LAOC	Larix occidentalis	Western larch	T
MALUS	Malus spp.	Apple species	T
MORUS	Morus spp.	Mulberry species	T
PIEN	Picea engelmannii	Engelmann spruce	T
PIGL	Picea glauca	White spruce	T
PIAL	Pinus albicaulis	Whitebark pine	T
PICO	Pinus contorta	Lodgepole pine	T
PIFL2	Pinus flexilis	Limber pine	T
PIMO3	Pinus monticola	Western white pine	T
PIPO	Pinus ponderosa	Ponderosa pine	T
POAN3	Populus angustifolia	Narrowleaf cottonwood	T
POBA2	Populus balsamifera	Balsam poplar	T
POBAT	Populus balsamifera ssp. trichocarpa	Black cottonwood	T
PODE3	Populus deltoides	Eastern cottonwood	T
PODEM	Populus deltoides ssp. monilifera	Plains cottonwood	T
POTR5	Populus tremuloides	Quaking aspen	T
PSME	Pseudotsuga menziesii	Douglas fir	T

Symbol (PLANTS)	Scientific Name	Common Name	Type
QUMA2	Quercus macrocarpa	Bur oak (this oak classified as a timber species)	T
ROPS	Robinia pseudoacacia	Black locust	T
TABR2	Taxus brevifolia	Pacific yew	T
THPL	Thuja plicata	Western redcedar	T
TSHE	Tsuga heterophylla	Western hemlock	T
TSME	Tsuga mertensiana	Mountain hemlock	T
ULAM	Ulmus americana	American elm	T
ULPU	Ulmus pumila	Siberian elm	T

Type: Timber Species (T), Woodland Species (W)

Appendix F: Individual Plot Packet and Multiple Plot Packet Bundle Contents

Plot Packet Contents:
If putting together plot packets for the field include the following:

Plot Packet Envelope: Place all "plot packet contents" in an envelope that is large enough to accommodate all of the items listed below. Use a separate envelope for each plot location.

Plot Packet Label: In the upper right-hand corner on each envelope, attach a label that includes the following information:

- Project Name
- Region, Proclaimed Forest, District, Location, Stand/plot id
- State, County

Plot Packet Contents: Each plot packet envelope could contain the following items:

- **Topographical Map.**
- **Aerial Photos or NAIP Imagery** which displays the plot location area
- **Data Collection Forms** (paper form size: 8.5 in x 11 in). Each plot packet should contain the following "paper" forms (refer to appendix A).
  - Plot Location Reference Form*
  - Microplot Seedling Data Collection Form*
  - Ground Surface Cover Form*

  These forms (*) need to be completed for each Plot. Refer to Section 1B, Finding Plot Center and Plot Monumentation, Tree Form item 5.7 Tree Count, and Section 6D, Ground Surface Cover Transects Data.

- The following forms should be available should the PDR have issues and paper forms are needed for general data collection:
  - Vegetation Composition Form
  - Plot Photo Placard
  - Plot and Tree Data Form
  - Down-Woody Materials Form

Remeasurement:
If the plots are being remeasured, include the Data Report from the previous measurement.

Individual Plot Submission Requirements:
Each plot that is completed must have a Plot Location Reference Form filled out in its entirety, both for installations and remeasurements, as well as all required electronic files as described below. For remeasurements, the Plot Location Reference Form must not be an overwrite on top of the original installation Plot Location Reference Form, but must be a completely original

form. The electronic file requirements may be adjusted by contract specifications or project specific necessities, however those specifications should include, but are not limited to, the requirements below:

Each individual plot data set should include:

- Completed Plot Location Reference Form
- Electronic plot photo data file in .jpg format
- GPS acquired Plot Center (PC) point (as an electronic .txt file, .doc file, or .xls file
- Error free electronic ExamsPC datafile submitted in ".im" file format
- The Forest will want to include an ExamsPC **Data Report** in each plot folder. After all data have been collected and edited using the Exams software, insert a completed data report into the plot packet envelope.

Plot Packet Bundle for Contractors:

Multiple individual plots may be bundled together in one envelope to complete a packet of plots, however each packet bundle must be unique and distinctly packaged as per the instructions below. Contract specifications and/or project requirements may further detail the requirements of packet bundles. If more than one packet bundle is placed in the same envelope for ease of transport to the COR, the hard copy Plot Location Reference Forms must be distinctly separated into unique packet bundles within that envelope, and electronic files must be clearly named, filed separately, and unique to each packet bundle.

- Plot list(s) containing packet number(s) that those plots are found within, examiner name, and date of measurement(s) delivered in hard copy paper form
- Electronic plot photo data files in .jpg format delivered via flash drive or CD (*note: these files are too large for email*)
- Plot Location Reference Form for each individual plot delivered in hard copy paper form and bundled by packet
- GPS acquired Plot Center (PC) points (*if plot is a new installation/not necessarily required for remeasures*) as an electronic .txt file, .doc file, or .xls file that can be delivered via flash drive, CD, or email
- Error free electronic field data submitted in ExamsPC (.im) file format that can be delivered on flash drive, CD, or via email

Packet contents should be unique to each individual packet of plots (usually 10 plots/packet). Multiple packets may be combined in one submission for convenience so long as individual packet hard copy forms are clearly delineated and separate, and all electronic files are distinct, clearly identified, and unique for each packet.

Field inspection QA/QC will only be performed after all packet contents are received. It may be advantageous to submit electronic files via email ahead of delivery of hard copy forms that are being mailed in, but inspections will not begin until those hard copy forms have been received and inspected for completeness.

*** Refer to individual contract specifications for adjustments and alterations to these general requirements. ***

Appendix G: Recommended Field Gear

The following list of recommended field gear identifies many of the items that are necessary to conduct the field inventory. This list may not include all of the equipment necessary to fulfill some contract specifications.

- **RP tags** (to mark Reference Point – racetrack style tags are preferred)
- **Witness tree tags** (aluminum tags for witness trees – racetrack style tags are preferred)
- **PC metal stakes** (to mark plot location centers)
- **Communication devices** (radio, satellite phone, cell phone)
- **GPS unit** – capable of field averaging, and navigation; including a distance or route function, with a stated accuracy of ± 10 meters (49.2 feet) in the horizontal dimension, and digital compass accuracy of ± 5 degrees (example: Garmin GPSMAP 76s w/ WAAS capability)
- **Personal Data Recorder**
- **Backpack** – with a comfortable fit; sturdy enough to carry 35-50 lbs of field gear.
- **Timber cruising vest**
- **Logger's tape** – 50 ft or 100 ft
- **Diameter tape**
- **Carpenter's tape** – 25 ft (with 0.1 feet and inch marks)
- **Increment borers** – 12 in, and 21 in *(for measuring tree age/radial growth)*
- **Cloth tape** – 100 ft and/or 200 ft (for traversing from the RP to the PC, and sample transects)
- **Hatchet** with flat back and/or **small hammer** (for nailing RP/Witness tree tags, and hammering sample tree nails at DBH/DRC, and sounding for defect)
- **Aluminum nails** (to mark DBH/DRC – do not use steel nails on timber species)
- **Lumber crayons** (for DRC stem measurements)
- **Paint pen** (for marking DBH on all aspen trees, and marking trees < 3.0-inches DBH/DRC)
- **Clipboard** (for paper field forms)
- **Mechanical pencils** and/or **pens**
- **Compass**
- **Clinometer** – preferably with a "slope correction factor" SCF (for measuring tree heights and adjusting for slope distance)
- **Laser range and height measurer** – example: Laser 200 and OPTi-LOGIC 400LH units
- **Ruler** – with 1/10-inch and 1/20-inch scale (for measuring radial growth and duff/litter)
- **Flagging** – one type with a solid color, and another type with a pattern: such as orange flagging and blue/white striped flagging.
- **Calculator** – with the following function keys: MRC, M-, M+, and square root *(highly recommended for calculating DRCs on woodland species)*
- **"Write in the rain" notepad**
- **Digital camera** (for photographing plot)

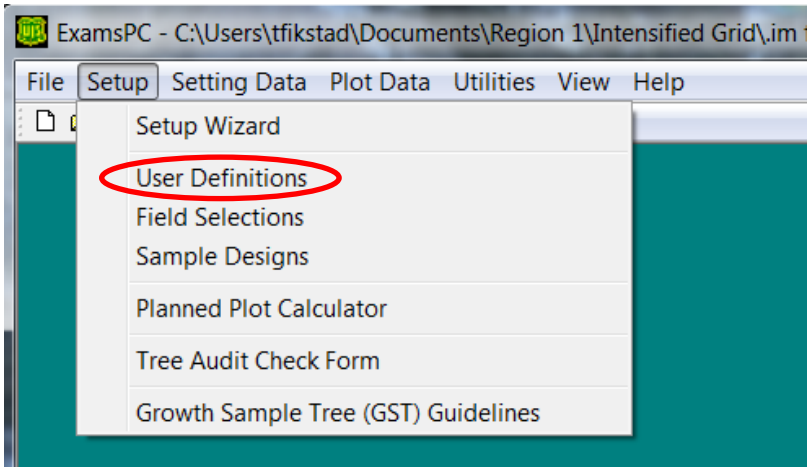
- **Thick black permanent marker** for photo placard and marking trees <3.0” DBH/DRC
- **CSE/IM and Intensified grid field manuals** and **Habitat typing manuals**
- **Plant Identification books** (to aid in vegetation composition sample – tree, forb, shrub, and graminoid identification)
- **Candy cane stakes** (for attaching Logger’s tape/cloth tape at PC location in order to measure tree distances and transect lines without disturbing Pc monumentation stake)
- **Bear pepper spray**
- **First aid kit**
- **Rain gear**
- **Hard hat**
- **Water bottle**
- **Overnight backpack** – with a comfortable fit; sturdy enough to carry 60-80 lbs of field gear including a sleeping bag, cook stove, utensils, water purification system, warm clothing, and food (*to use for remote plots that require camping*).
- **Hiking boots** – with a comfortable fit; it is highly recommended that the top of the boots extend above the ankle *(to provide adequate protection to the feet and ankle)*.

Appendix H: Editing an Intensification Template File

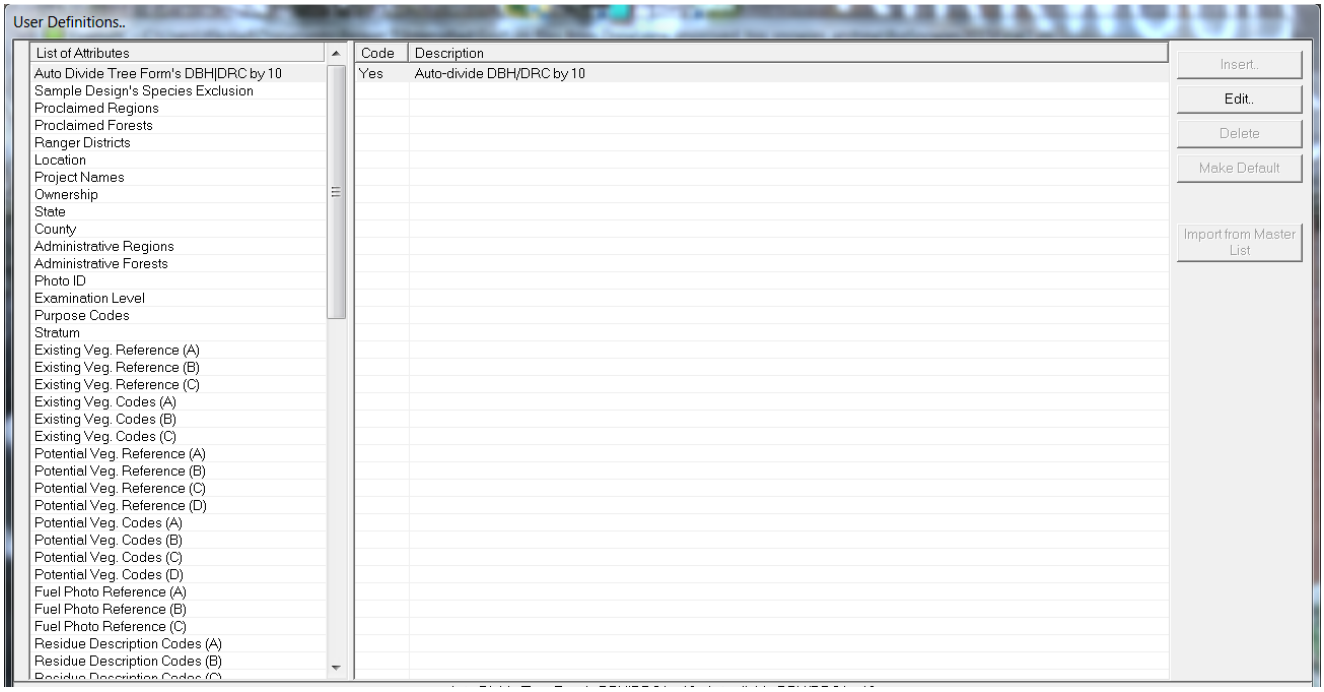
This appendix provides instruction on editing an existing Intensification Exams software template file that is applicable to the R1 Intensified Grid Inventory. To obtain an Intensification template file, go to http://fsweb.r1.fs.fed.us/forest/inv/index.htm. The template file contains the defaults and field selections that are **required** for the R1 Intensified Grid Inventory data collection. See the R1 Common Stand Exam (CSE) Field Guide, Exams Software Use, section 13, for more detailed information on setting up templates.

Modifying the Exams Software Drop-down lists:

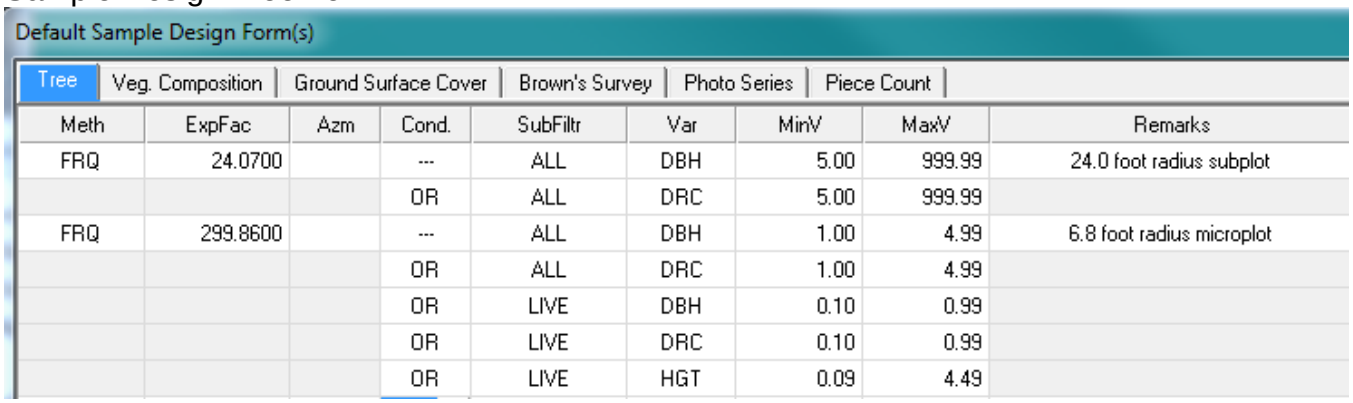
To modify drop-lists and set defaults, click on the **Setup** toolbar button, and then select **User Definitions**. There are 6 drop-fields that need to be modified as shown below.



Set **appropriate defaults** for: Proc. Region, Proc. Forest, Admin. Forest, Project Name, Ownership, State, Admin. Forest, Potential Veg. Reference, District, and County.



Sample Design Tree Form:



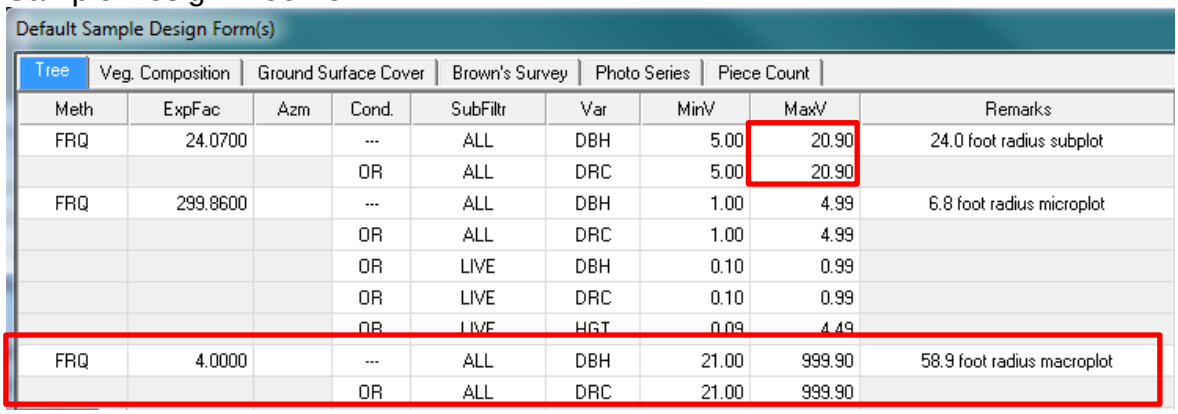
Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	24.0700		---	ALL	DBH	5.00	999.99	24.0 foot radius subplot
			OR	ALL	DRC	5.00	999.99	
FRQ	299.8600		---	ALL	DBH	1.00	4.99	6.8 foot radius microplot
			OR	ALL	DRC	1.00	4.99	
			OR	LIVE	DBH	0.10	0.99	
			OR	LIVE	DRC	0.10	0.99	
			OR	LIVE	HGT	0.09	4.49	

Modifying the Tree Sample Design for Optional Macroplot:

To modify the sample design to include the macroplot option for trees, click on the **Setup** toolbar button, and then select **Sample Design**.

Edit Tree Form as illustrated below by adding the sample design for the macroplot as shown and modifying the Maximum diameter on the subplot to 20.9 inches.

Sample Design Tree Form:



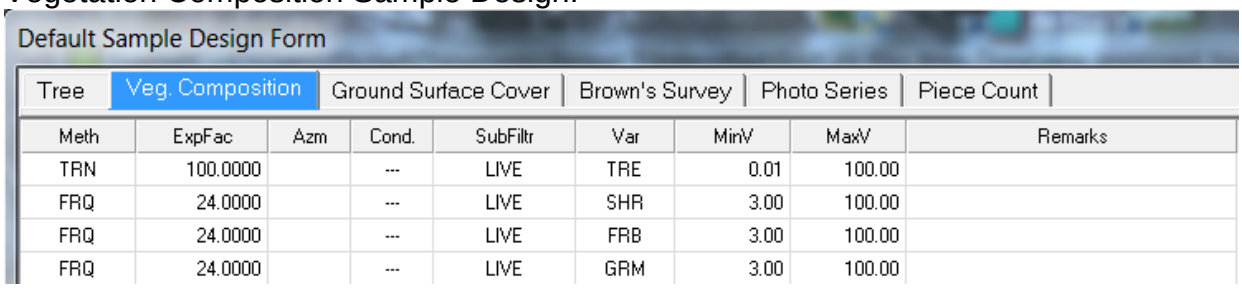
Default Sample Design Form(s)

Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	24.0700		---	ALL	DBH	5.00	20.90	24.0 foot radius subplot
			OR	ALL	DRC	5.00	20.90	
FRQ	299.8600		---	ALL	DBH	1.00	4.99	6.8 foot radius microplot
			OR	ALL	DRC	1.00	4.99	
			OR	LIVE	DBH	0.10	0.99	
			OR	LIVE	DRC	0.10	0.99	
			OR	LIVE	HGT	0.09	4.49	
FRQ	4.0000		---	ALL	DBH	21.00	999.90	58.9 foot radius macroplot
			OR	ALL	DRC	21.00	999.90	

Note: Only include lines highlighted in red if using the macroplot option for large trees. Contact R1 A- team for approval before including macroplot option.

Vegetation Composition Sample Design:

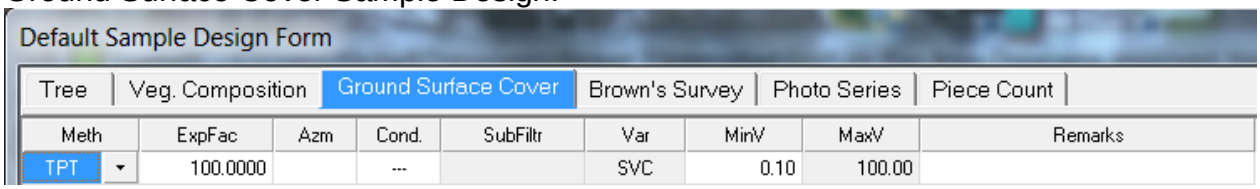


Default Sample Design Form

Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	100.0000		---	LIVE	TRE	0.01	100.00	
FRQ	24.0000		---	LIVE	SHR	3.00	100.00	
FRQ	24.0000		---	LIVE	FRB	3.00	100.00	
FRQ	24.0000		---	LIVE	GRM	3.00	100.00	

Ground Surface Cover Sample Design:

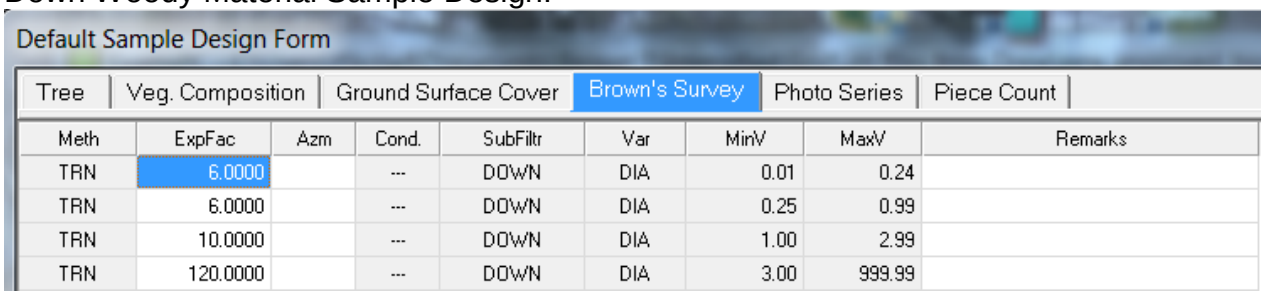


Default Sample Design Form

Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TPT	100.0000		---		SVC	0.10	100.00	

Down Woody Material Sample Design:



Default Sample Design Form

Tree | Veg. Composition | Ground Surface Cover | Brown's Survey | Photo Series | Piece Count

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	6.0000		---	DOWN	DIA	0.01	0.24	
TRN	6.0000		---	DOWN	DIA	0.25	0.99	
TRN	10.0000		---	DOWN	DIA	1.00	2.99	
TRN	120.0000		---	DOWN	DIA	3.00	999.99	

Appendix I: Noxious and Sensitive Plants Lists:

Table 1: State of Montana Noxious Weeds

State of Montana Noxious Weeds		
Scientific Name	**Common Name**	**Code**
Acroptilon repens	Russian knapweed	ACRE3
Cardaria draba	Whitetop or Hoary cress	CARDA2
Centaurea maculosa	Spotted knapweed	CESTM
Centaurea diffusa	Diffuse knapweed	CEDI3
Centaurea solstitialis	Yellow Starthistle	CESO3
Chondrilla juncea	Rush skeletonweed	CHJU
Cirsium arvense	Canada thistle	CIAR4
Convolulvus arvensis	Field bindweed	COAR4
Crupina vulgaris	Common Crupina	CRVU2
Cynoglossum officinale	Houndstongue	HICY
Echium vulgare	Blueweed	ECVU
Euphorbia esula	Leafy Spurge	EUES
Hieracium aurantiacaum	Orange hawkweed	HIAU
Hieracium pretense, H. floribundum, H. piloselloides	Meadow hawkweed	HICA10
Hypericum perforatum	St. Johnswort	HYPE
Iris pseudacorus	Yellowflag iris	IRPS
Isatis tinctoria	Dyer's woad	ISTI
Lepidium latifolium	Perennial pepperweed	LELA2
Leucanthemum vulgare	Oxeye daisy	LEVU
Linaria dalmatica	Dalmatian Toadflax	LIDA
Linaria vulgaris	Yellow Toadflax	LIVU2
Lythrum salicaria, L. virgatum	Purple loosestrife or lythrum	LYTHR
Myriophyllum spicatum	Eurasian watermilfoil	MYSP2
Potentilla recta	Sulphur Cinquefoil	PORE5
Ranunculus acris	Tall buttercup	RAAC3
Senecio jacobea	Tansy ragwort	SEJA
Tamarix spp.	Tamarisk or saltcedar	TAMAR2
Tanacetum vulgare	Common tansy	TAVU

Table 2: State of Idaho Noxious Weeds

State of Idaho Noxious Weeds		
Scientific Name	**Common Name**	**Code**
Acroptilon repens	Russian knapweed	ACRE3
Aegilops cylindrica	Jointed goatgrass	AECY
Ambrosia tomentosa	Skeletonleaf bursage	AMTO3
Cardaria draba	Whitetop or Hoary cress	CARDA2
Carduus nutans	Musk thistle	CANU4
Centaurea maculosa	Spotted knapweed	CESTM
Centaurea nigrescens	Meadow (Tyrol) knapweed	CENI3
Centaurea diffusa	Diffuse knapweed	CEDI3
Centaurea solstitialis	Yellow Starthistle	CESO3
Chondrilla juncea	Rush skeletonweed	CHJU
Cirsium arvense	Canada thistle	CIAR4
Conium maculatum	Poison hemlock	COMA2
Convolulvus arvensis	Field bindweed	COAR4
Crupina vulgaris	Common crupina	CRVU2
Cytisus scoparius	Scotch broom	CYSC4
Euphorbia dentata	Toothed spurge	EUDE2
Euphorbia esula	Leafy spurge	EUES
Hieracium aurantiacaum	Orange hawkweed	HIAU
Hieracium pretense	Meadow hawkweed	HICA10
Hyoscyamus niger	Black henbane	HYNI
Isatis tinctoria	Dyer’s woad	ISTI
Lepidium latifolium	Perennial pepperweed	LELA2
Linaria dalmatica	Dalmatian Toadflax	LIDA
Linaria vulgaris	Yellow Toadflax	LIVU2
Lythrum salicaria	Purple loosestrife or lythrum	LYTHR
Milium vernale	Milium	MIVE3
Myriophyllum spicatum	Eurasian watermilfoil	MYSP2
Nardus stricta	Matgrass	NAST3
Onopordum acanthium	Scotch thistle	ONAC
Senecio jacobea	Tansy ragwort	SEJA
Solanum elaeagnifolium	Silverleaf nightshade	SOEL
Solanum rostratum	Buffalobur	SORO
Sonchus arvensis	Perennial sowthistle	SOAR2
Sorghum halepense	Johnsongrass	SOHA
Tribulus terrestris	Punctureveine	TRTE
Zygophyllum fabago	Syrian beancaper	ZYFA

Appendix J: R1 Habitat Type Groups

R1 Forested Potential Vegetation Group Crosswalk. Labels in parenthesis are the column name in 01_LUT_HT_PVT in the *R1 Inventory Data Look-up Tables Database.*

R1 Broad PVT (R1_Broad_PVT)	R1 Habitat Type Groups (R1_Habitat_type_group)	West MT/ID habitat type groups 2005 (LCFPG05_PVT and LCFPG_Desc)	R1 MT PVT [2] (PVT_MT04_A)	R1 ID PVT [2] (PVT_ID04_A)	ADP[1] Habitat Type Code
Warm Dry	Hot Dry	*1 Warm & Dry*	pifl	Pifl	000, 040, 050, 051, 052, 070, 090[6], 091[6], 092[6], 093[6], 094[6], 095[6]
	Warm Dry	*1 Warm & Dry*	pipo	pipo	100, 110, 130, 140, 141, 142, 160, 161, 162
				none	103[7], 104[7], 100032[8], 100033[8], 100034[8], 100035[8], 100037[8], 105[7], 106[7], 150
			psme1	psme1	200, 210, 220, 230
				none	205[7], 390[7]
			psme2	psme2	311, 380
			psme3	psme3	321
		2 Mod warm & Dry	pipo	pipo	180, 181, 182
	Mod Warm Dry	*2 Mod warm & Dry*	pipo	pipo	170, 171, 172, 190
			picea	picea	430
			abgr1	abgr1	505, 506, 507, 508
			none		
			psme2	psme2	240[7], 250, 260, 261, 262, 263, 280, 281, 282, 283, 292, 310, 312, 313
			psme3	psme3	360, 320, 322, 323, 324, 330, 350, 370, 340
	Mod Warm Mod Dry	*3 moderately warm & moderately dry*	abgr2	abgr2	510, 511, 512, 515, 590, 591, 592
			abgr3	abgr3	523
			psme2	psme2	290, 291, 293
Warm Moist	Mod Warm Moist	*4 moderately warm & Moist*	abgr3	abgr3	500, 516, 517, 518, 519, 520, 521, 522, 524, 525, 526, 529
	Mod Cool Moist to Wet	*5 Moderately Cool & Moist*	thpl1	thpl1	555
			thpl2	thpl2	501, 530, 531, 532, 533, 534, 535, 545, 546, 547, 548
			tshe	tshe	502, 565, 570, 571, 572, 573, 574, 575, 576, 577, 578
		6 Moderately Cool & Wet	thpl1	thpl1	540, 541, 542, 550, 560
		7 Cool & Moist	tshe	tshe	579
Cool Moist	Cool Moist	*7 Cool & Moist*	abla2	abla2	600, 620, 621, 622, 623, 624, 625, 660, 661, 662670, 671, 673, 740
			tsme1	tsme1	685, 686, 687
			tsme2	tsme2	682
				tsme3	680
			picea	picea	400, 420, 421, 422, 460, 461, 462, 470
				none	004[9], 472[7], 475[7]
	Cool Wet	*8 Cool & Wet*	abla1	abla1	610, 630, 635, 636, 637, 650, 651, 652, 653, 654, 655
				none	631, 632
			tsme1	tsme1	675, 677

R1 Broad PVT (R1_Broad_PVT)	R1 Habitat Type Groups (R1_Habitat_type_group)	West MT/ID habitat type groups 2005 (LCFPG05_PVT and LCFPG_Desc)	R1 MT PVT [2] (PVT_MT04_A)	R1 ID PVT [2] (PVT_ID04_A)	ADP[1] Habitat Type Code
			picea	picea	410, 440, 480
	Cool Mod Dry to Moist	*9 Cool & Moderately Dry*	abla2	abla2	663
			abla3	abla3	640, 691, 693, 700, 720, 750, 770, 780, 790, 791, 792
				abla4	690
				none	607, 745
			picea	picea	450
			pico	pico	900, 910, 920, 930, 950
				none	960[7]
			tsme2	tsme2	710, 712
Cold (capable of WBP)	Cold	*10 Cold & Moderately Dry*	abla3	abla4	672, 692, 694, 731, 732, 733,
			abla4	abla4	674, 730, 800, 810, 820, 830, 831, 832
			tsme1	tsme1	676
			tsme2	tsme3	681, 711, 840, 841, 842
			tsme3	tsme3	713
			pico	pico	925, 940
	Timberline	*11 Cold*	laly	laly	860
			pial	pial	850, 870, 890

[1]Automatic Data Processing Code (habitat type publications) - includes all codes from valid references in Region 1 for use with NRM FSVeg. Unless otherwise specified, codes are from 101 (Forest Habitat Types of Montana, Pfister and others 1977) or 110 (Forest Habitat Types of Northern Idaho: a Second Approximation, Cooper and others, 1991)
[2] R1 PVT's based on "Jones" metadata logic and labels.
[3] 579 is in Group 7, Cool & Moist, in R1 HTG (2005) but is included in the Warm/Moist Broad PVT to maintain a connection with the other tshe types.
[6]Reference 199 = FSH 2409.21h R-1 Timber Management Data Handbook. Used in R1 until 2001.
[7]Reference 102= Key to Montana Forest/Woodland Habitat Types East of the Continental Divide. FIA use only.
[8]Reference 114= The Vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer NF: A Habitat Type Classification, Hansen and Hoffman.
[9]Reference 112= Classification and Management of Montana's Riparian and Wetland sites. Hansen, Boggs, Cook and others, 2005.

Non-forested Potential Vegetation Group Crosswalk

R1 Broad PVT (Broad_PVT)	R1 Habitat Type Groups (R1_Habitat_type_group)	R1 MT PVT [2] (PVT_MT04_A)	R1 ID PVT [2] (PVT_ID04_A)	Habitat Type[2]
Xeric Grassland	Bluebunch Wheatgrass	drygrass	drygrass	Ref 199: 015, 016, 017, 020, 065 Ref 115: 200, 500, 800 Ref 103: 47130, 47131, 47132, 47140, 47141, 47142, 47143, 47144, 47145, 47146 Ref 114: 100005, 100006, 10010, 100021, 100054, 100055,
Mesic Grassland	Western Wheatgrass	agrsmi	agrsmi	Ref 114: 100001 Ref 115: 100
	Fescue	fesida	fesida	Ref 199: 18, 39 Ref 615: GB5917, GB5922 Ref 103: 47003, 47004, 47120, 47121, 47122, 47123, 47124, 47125, 47126, 47127 Ref 114: 100023
		fessca	fessca	Ref 199: 19 Ref 103: 47110, 47111, 47112, 47113, 47114, 47115

R1 Broad PVT (Broad_PVT)	R1 Habitat Type Groups (R1_Habitat_type_group)	R1 MT PVT [2] (PVT_MT04_A)	R1 ID PVT [2] (PVT_ID04_A)	Habitat Type[2]
Mesic Shrubland	Mesic Shrubland	potfru	potfru	Ref 199: 34 Ref 103: 46620, 46621, 46622, 46623
		mesic shrub	mesic shrub	Ref 199: 030 Ref 110: 030, 031 Ref 112: 156, 157, 158, 159, 160, 161 Ref 115: 2000, 2100, Ref 114: 100052, 100056 Ref 615: SM19
Xeric Shrubland/ Woodland	Low Shrubland	sage1	sage1	Ref 199: 031 Ref 103: 46600, 46601, 46602, 46603
	Mountain Shrubland	sage4	sage4	Ref 199: 033 Ref 103: 46611, 46612, 46613
	Xeric Sagebrush	sage3	sage3	Ref 199: 032
		sage2	sage2	Ref 115: 1100, 1200 Ref 103: 46610, 46614, Ref 114: 100014, 100015
	Xeric Shrubland	dry shrub	dry shrub	Ref 103: 46201, 46301, 46630, 46632, 46633 Ref 114: 100028 Ref 115: 1400 Ref 199: 035 Ref 615: SD49
		rhus	rhus	Ref 199: 036, 037 Ref 103:46640, 46641, 46642, Ref 114: 100046, 100047, 10048
		sage 5	sage 5	Ref 114: 100013 Ref 115: 1000
	Salt Desert Shrub	saltshrub	saltshrub	Ref 199: 038 Ref 115: 1300, Ref 103: 46650, 46651, 46652 Ref 114: 100049, 100050
	Juniper Woodland	juniper	juniper	Ref 102: 151, 152 Ref 114: 100029, 100030 Ref 199: 50
Riparian/ Wetland	Aspen Woodland	poptre	poptre	Ref 102: 351, 356 Ref 112: 117, 118, 119, 120, 121 Ref 114: 100040 Ref 199: 078
	Riparian Shrub[3]	ripshrub	ripshrub	Ref 112:030, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 150, 151, 152, 153, 154, 155, SW1117, SW5112, SW5113 Ref 199:071, 072, 073, 074
	Wetland Graminoid	ripgrass	ripgrass	Ref 615: MW19 Ref 199: 021, 061, 070, Ref 112: 200, 201, 202, 203, 204, 205, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, MD3111, MM1912, MM2912, MM2914, MM2915, MM2917, MM2920, MS31111, MW3912, MW4911, MW4912 Ref 103: 47100, 47101
	Riparian Deciduous Tree	ripdecid	ripdecid	Ref 102: 301 Ref 110: 20 Ref 112: 103, 104, 105, 106, 110, 111, 112, 113, 114, 115, 116, 122, 123, 124, 125, 130

R1 Broad PVT (Broad_PVT)	R1 Habitat Type Groups (R1_Habitat_type_group)	R1 MT PVT [2] (PVT_MT04_A)	R1 ID PVT [2] (PVT_ID04_A)	Habitat Type[2]
				Ref 114: 100024 Ref 199: 60, 71, 72, 73, 74, 79
Alpine	Alpine Herbaceous	alpine	alpine	Ref 113: 001,002, 003,004,005, 006, 009, 010, 012, 013, 015, 016, 018, 019, 022, 023, 024, 025, 026, 027, 028, 029 Ref 199: 080, 081, 084
	Alpine Shrub	alpine	alpine	Ref 113: 007, 008, 011, 014, 017, 020, 021 Ref 199: 087
Sparse	Sparse	Sparse	sparse	Ref 101: 010

Index

A

Agave Rule, 64

C

Canopy Cover, 63
Coarse Woody Debris (CWD)
  Definition, 74
  Diameter (at point of intersection), 83
  Diameter Large End, 85
  Sampling Methods, 80
  Tally Rules, 80
County, 33
Cover by Species (Vegetation Composition), 65
Crown Class, 56
Crown Class Categories, 56
  Co-dominant, 56
  Dominant, 56
  Intermediate, 56
  Open-grown, 56
  Overtopped, 56
Crown Ratio, 56

D

Data Collection Forms, 88
Data Entry, 6
Date, 33
DBH/DRC, 52
Diameter at Breast Height (DBH), 52, 53
Diameter at Root Collar (DRC)
  Computing DRC, 53
  Measuring DRC, 53
  Qualifying Stems, 53
Diameter Measurement
  Timber Species, 52
  Woodland Species, 53
District, 33
Down-Woody Materials
  Adjustment for nonsampled transect, 76
Down-Woody Materials (definitions), 74
Duff (First and Second), 77

E

Exams Software Template File, 120

F

Field Gear, 118
Finding the Plot Center
  Baseline Techniques, 101
Fine Woody Debris (FWD)
  Definition, 74
  Sampling Methods, 78
  Tally Rules, 78
  Twig1, 79
  Twig2, 79
  Twig3, 80

G

GPS
  Requirements and Tips, 100
GPS Operating Instructions, 99
Ground Surface Cover Transects
  Codes and Category Definitions, 69
  Ground Surface Cover Percent
    Adjustment for nonsampled transect, 71
  Ground Surface Cover Percent, 70
Growth Sample Tree (GST)
  Selection Guidelines, 50

H

Height, 55
Height Growth, 56

I

Intensified Inventory Template File, 120
Invasive Species List (Vegetation Composition), 66

L

Litter, 77
Live trees (definition), 42
Location, 33
Log Decay Class (CWD), 82

M

Missed/Extra Tree Tolerance, 51
Monumentation of the Plot Center, 15

N

Number of Stems (DRC), 52

O

Offset stake, 15
Order of Data Collection, 8

P

Photographing the Plot Location, 27
Piece Count (CWD), 82
Piece Length (CWD), 85
Plot Location Map, 15
Plot Location Reference Items
  Plot Location Map, 15
  Reference Point (RP), 11
  Stand Narrative/Remarks, 15
  Travel Description, 9
  Truck Coordinates, 9
Plot Monumentation, 15
Plot Packet Contents, 116
Plot Potential Vegetation, 39
Plot Slope, 39
Potential Vegetation Reference, 34

Q

Qualifying Trees
  Macroplot, 46, 47
  Subplot, 46, 47
Quality Control, 7, 8

R

Radial Growth, 56
Recommended Field Gear, 118
Reference Point (RP)
  Diameter, 11
RP to PC Traverse Information
  Slope Distance, 12
RP to PC Traverse Information
  Azimuth, 12

S

Sampling Procedures
  Down-Woody Materials, 75
  Ground Surface Cover Transects, 68
  Vegetation Composition, 62
Sapling Tally, 47
Saplings (definition), 42
Seedling Counts, 47
Seedling Groups, 51
Seedlings (definition), 42
Setting Damage Agent, 35
Setting Damage Category, 35
Setting Damage Severity, 35
Setting Remarks, 35
Situation Prohibiting Data Collection, 7
Slope Correction, 26, 59
Snag Decay Class, 57
Species List (Vegetation Composition), 65
Stand Narrative/Remarks, 15
Stand Number, 33
Standing dead trees (definition), 43

T

Tag ID Number, 46
Tally Tree Definitions, 41
Tally Tree Species (definition), 42
Tally Tree Species (list), 114
Tally Trees (definition), 41
Template File, 120
Timber Species, 42
Timber Species (list), 114
Tolerance limits, 106
Travel Description, 9
Tree Age, 56
Tree Class, 48
  Non-salvable dead (soft), 49
  Rotten, 49
  Rough, 49
  Salvable dead (hard), 49
Tree Count, 50
Tree Damage Agent, 58
Tree Damage Category, 58
Tree Damage Severity, 58
Tree Numbering Procedures, 46
Tree Remarks, 58
  Azimuth, 60
  DBH Height, 59
  Estimated Age Flag, 59
Tree Species, 50
Tree Status, 48
Tree Tally
  Microplot trees, 47
  Seedling Counts, 47
Truck Coordinates, 9

V

Vegetation Composition
  Cover by Species, 65
  Invasive Species List, 66
  Species List, 65

W

Websites, 6
Woodland Species, 42
Woodland Species (list), 114