Region 1
Grid Intensification
Using CSE Protocols
Field Procedures

Version 1.2
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Table of Contents

Introduction

This Region 1 (R1) manual supplement outlines the procedures for the field implementation of the "Intensification of the FIA Grid Using CSE Protocols" resource inventory (referred to as the "R1 Intensified Grid Inventory" in this document). This inventory will combine: (1) Common Stand Exam (CSE) 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 CSE Field Guide (version 1.7.7). FIA definitions and procedures necessary for field implementation have been incorporated into this document.

As with the R1 CSE Field Guide, this document is divided into section chapters. Section 1 has been divided into the following subsections: (A) General Information, (B) Finding the Plot Center and Plot Monumentation, (C) Plot Location Layout, and (D) Sampling Procedures. The remaining sections in this manual supplement (sections 2 through 7) directly correspond to the section chapters in the most current version of the R1 CSE Field Guide (available: http://fsweb.r1.fs.fed.us/forest/inv). For example, section 2 in this document and in the R1 CSE Field Guide relate to the Setting Form. To further assist the reader, all data items that pertain to the R1 CSE 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 fields addressed in this manual are those that are required by the Region. These fields are included in the default intensification template for the Exams software program (refer to section 1.1, Data Entry).

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

Section 1: Data Collection Overview

This section contains the following subsections: (A) General Information, (B) Finding the Plot Center and Plot Monumentation, (C) Plot Location Layout, and (D) Sampling Procedures.

A. General Information

1.1 Data Entry (Use of Juniper Allegro)

For the R1 Intensified Grid Inventory, record all data using a Juniper Systems Allegro Field PC (hereafter referred to as the PDR) using the Exams software (*this software is available at the website listed below*). In the event that the PDR is not functioning at the time of the inventory, use paper data forms to record field data (refer to appendix A). As an exception, always record Plot Location Reference Items (refer to section 2) and Ground Surface Cover Transects Data (refer to section 6) on the paper form; these forms are labeled "Supplemental" in the top right corner of the paper form. The Forest or contract may also specify additional attributes to collect. Record all data items on the PDR, using Exams software, or on the specified form at the time of the inventory.

Exams software (*available at website listed below*) – Exams software users need to ensure that the most current version 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 Intensification 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.

Refer to appendix H for guidelines on creating an intensification template file to be used with the Exams software. Electronic versions of these template files are available at the website listed below.

R1 Websites:

Exams software – available at: http://fsweb.r1.fs.fed.us/forest/inv/
R1 Intensification Plant List (species codes) – available at: http://fsweb.r1.fs.fed.us/forest/inv/
Exams Software Intensification Template File – available at: http://fsweb.r1.fs.fed.us/forest/inv

Note: The only CSE fields addressed in this manual are those that are required by the Region. These fields are included in the default intensification template for the Exams software program (refer to section 1.1, Data Entry).

1.2 Quality Control

The goal of the quality assurance program is to ensure that all resource inventory data are scientifically sound, of known quality, and thoroughly documented. 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**. Data item tolerance limits are indicated throughout this manual (also refer to appendix D). Both contractors and forest account crews will be subject to periodic on-site inspections of plot locations to ensure that the 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 blind or 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 strict data standards are maintained.

1.3 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. If the actual plot center cannot be occupied, consider the entire plot inaccessible because accurate data cannot be collected without occupying the pc. Never sample private land. If a plot lands on private land (a very rare situation), contact the Regional Field Coordinator to develop a solution. On the Setting and Plot Location Reference Form, complete the following items:

- SETTING USER CODE (item 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 CSE 2.34 for further detail.

- SETTING REMARKS (item CSE 2.35) – Describe the situation/condition prohibiting data collection in the SETTING REMARKS.

1.4 Order of Data Collection

The suggested order of data collection is as follows:

- Take photo (if required for the project) while collecting GPS point data
- Collect vegetation composition and ground surface cover information
- Collect down-woody material data
- Collect tree data

1.5 Compass Declination

For this inventory, set the compass declination to zero (magnetic north). Use this setting for all sampling protocol (e.g., compass readings, directions, tree azimuths).

B. Finding the Plot Center and Plot Monumentation

1.6 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, described below). Refer to section 2, Plot Location Reference Items, for instructions on recording a travel description on the Setting and Plot Location Reference Form.

1.7 Finding the Plot Center (GPS Method)

It is the responsibility of the field crew to locate the plot location center (PC) on the ground as indicated by the stated plot coordinates. Wherever possible, use the following global positioning system (GPS) procedures as the primary method for locating the PC. Refer to figure 1 for the plot location layout (see 1.11). 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.

Refer to appendix B for GPS operating instructions for a Garmin 76s GPS unit.

GPS Method to Establishing the PC:

1. **GPS Receiver 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 of a route or distance function for navigation.

All GPS data must use the following format for Universal Transverse Mercator (UTM) coordinates:

- Map Projection – UTM, Zone is specific to project area
- Geodetic Datum – NAD83
- Coordinate System – UTM
- Geographic System – Latitude/Longitude (Lat/Long)

2. **RP Selection.** Prior to locating the PC using the GPS, it is necessary to designate a plot location 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.

   Designate a RP that is readily identifiable on both the ground and the aerial photograph/DOQ (digital ortho-quad). The RP should be close to the plot location, but at least 100 feet from the PC. 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 a RP with a view of the southern sky to allow for optimum satellite reception. Do not select a 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. As a recommendation, place an additional pinprick at the location of the RP on the aerial photograph with the PC pinprick. Circle and label the RP on the back of the photograph.

   Refer to section 2 for instructions on recording RP items (e.g., RP species, RP diameter, RP description) on the Setting and Plot Location Reference Form.

3. **Tagging the RP.** Attach to the RP, when appropriate, aluminum racetrack tags scribed with “RP PLOT #". If a tree is selected as the RP, 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. 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, only attach the tag at ground level and make a note on the Setting and Plot Location Reference Form under STAND NARRATIVE/REMARKS (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.

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. The heads of all aluminum nails should also be painted brown.

4. **Acquiring GPS Coordinates for the RP/PC.** Use the GPS to find the position (coordinates) of the RP and PC. However, prior to obtaining coordinates for the PC, first obtain the coordinates for the RP and determine a distance and azimuth from the RP to PC. The UTM coordinates obtained for the PC are dependent on the UTM coordinates that are first obtained for RP.

   As previously stated, refer to appendix B for GPS operating instructions for a Garmin 76s GPS unit.

   Record RP and PC UTM coordinate information on the Setting and Plot Location Reference Form (refer to section 2, Plot Location Reference Items).

   GPS Tips:

   - Use the **Averaging** option of the GPS to provide coordinates for the position of the RP (or PC) on the UTM grid system (refer to appendix B).

   - Elevate the GPS receiver off the ground and remove all obstructions that may block reception; use the external antenna if necessary.

   - 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. After the almanac has been collected, proceed to collect and record the coordinates of the location of the RP or PC.

   - Point features are surveyed when the GPS antenna is over the RP or PC for a period of time. During that time, 180 individual GPS position fixes are collected and averaged to give a single location for the point. While acquiring 180 fixes, the GPS receiver must not move as satellite signals are continuously received.

5. **Traversing from the RP to the PC.** Using the GPS, determine the distance and azimuth from the RP to the PC waypoint. Using a tape, compass, and clinometer, traverse from the RP to PC along the determined distance and azimuth correcting the distance for slope if it exceeds 10 percent.

   Record RP to PC traverse information (azimuth, horizontal distance, slope distance) on the Setting and Plot Location Reference Form, as specified in section 2, Plot Location Reference Items.

6. **PC Verification.** Upon arrival at the PC, put a metal stake in the ground. As described in step 4 above, use the GPS to acquire the UTM coordinates for the position of the PC which must be within 15 meters of the theoretical plot coordinates.

   Check aerial photographs and the topographic map to verify the PC position. If the aerial photograph has a PC pinprick, also verify the placement of the PC pinprick. If the PC pinprick and the GPS placement disagree by more than 0.1 inches, re-pinprick the aerial photograph and indicate the correct position of the PC on the back of the photo.

❖ **Tolerance (Finding the PC):**
- Estimated Horizontal Error (acquiring RP/PC coordinates): ± 15 meters
- RP Selection: at least 100 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).

1.8 Monumentation of the Plot Center

Mark the plot location center (PC) on the ground with a metal stake. If a metal stake cannot be placed in the ground because of bedrock, etc., build a rock cairn (rock pile) around the stake. If the PC cannot be monumented at all (e.g., in a river, on a paved road), place an offset stake where possible. Record the **azimuth** (to the nearest degree) and **slope distance** (to the nearest 0.1 foot) from the offset stake to the PC on the Setting and Plot Location Reference Form under PC COORDINATES (appendix A1). Take all measurements for data samples from the actual PC, not from the offset stake.

1.9 Plot Center Witness Trees

Reference the PC with two witness trees ("X" and "Y" trees). Record witness tree information (tree number, species, diameter, azimuth, slope distance to PC) on the Setting and Plot Location Reference Form, as specified in section 2, Plot Location Reference Items.

1. **Witness Tree Selection.** Preferably, witness trees should be as follows:

   "X" Tree:

   - On the extension of the RP to PC azimuth, if possible.
   - Ideally, a distance of 25-30 feet from the PC.
   - If there are no suitable trees at 25-30 feet, use a tree within the subplot radius (24.0 feet or less).

"Y" Tree:

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

"X and Y " trees should be:

- Not likely to die within 10 years.
- A species easily located on the site (e.g. an Engelmann spruce in 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 for timber species.

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). Describe the alternative landmarks selected on the Setting and Plot Location Reference Form under STAND NARRATIVE/REMARKS (appendix A1). If appropriate, mark the landmark in some manner (e.g., use a paint pen or tag if possible).

2. Tagging Witness Trees.

- **For X trees**: Scribe two aluminum racetrack tags, labeled "X PLOT #" (with the actual plot number). 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 small tree is used, do not tag the tree above the ground at 6 feet, but record a note on the Setting and Plot Location Reference Form under STAND NARRATIVE/REMARKS (appendix A.1).

- **For Y trees**: Scribe one aluminum racetrack tag, labeled "Y PLOT #". Nail the tag to the base of the tree, with the tag facing the PC stake.

1.10 Photographing the Plot Location *(if required)*

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

Procedure: At each plot location, stand over the PC stake and take four photographs in the cardinal directions (i.e., take pictures facing north, east, south, and west). Include a Plot Location Photo Placard in each picture (appendix A.2), placed in the lower right-hand corner of the view, indicating the State, County, Plot (Location) Number, and direction faced (N, E, S, or W). Be sure the placard is legible, but do not allow the placard to obstruct the view of the site. Note: Field compass declination is set to 0 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.).

C. Plot Location Layout

1.11 Plot Location Layout

The plot location layout (figure 1) consists of a **subplot** (1/24th-acre fixed-radius plot), a **microplot** (1/300th-acre fixed-radius plot), **two 60-foot transects,** and **four 25-foot transects.** Each sample plot area is used to inventory **trees** of a specified diameter size, as indicated below. The subplot area is also used to sample **vegetation composition**. The 60-foot transects (*horizontal distance*) are used for sampling **down-woody materials**, and the 25-foot transects (*slope distance*) are used for collecting **ground surface cover** information. All sample plot areas are centered on the PC stake. All transects extend outward from the PC stake. Sampling procedures are specified below.

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*).

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

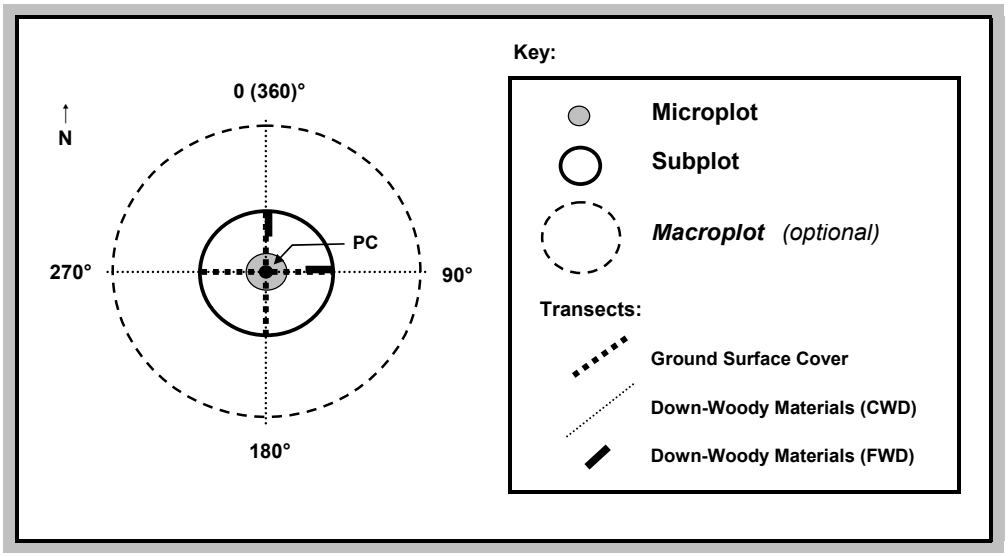
* Tally Tree species (appendix E)

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

* Tally Tree species (appendix E)

NOTE: Prior to implementing this option, Forests must first acquire approval from the Regional Office.



Sample Plot Area	Plot Radius (horizontal distance)	Sample Items:
Subplot	24.0 feet	▪ Trees: ≥ 5.0-inches DBH/DRC *(or 5.0- to 20.9-inches for Macroplot option)* ▪ Vegetation Composition
Microplot	6.8 feet	▪ Trees: 1.0- to 4.9-inches DBH/DRC ▪ Seedling counts
Macroplot (optional)	*58.9 feet*	▪ *Trees: ≥ 21.0-inches DBH/DRC*

Transects:	Length:
Ground Surface Cover	four 25-ft transects, slope distance *(at 0, 90, 180, and 270 degrees)*
Down-Woody Materials:	
Coarse-Woody Debris (CWD)	two 60-ft transects, horizontal distance *(0 and 180 degrees for even-numbered plots; 90 and 270 degrees for odd-numbered plots)*
Fine-Woody Debris (FWD)	6- to 10-foot subsection, horz. distance *(between 14- and 24-feet on north or east transect)*

Figure 1 – Plot location layout.

1.12 Slope Correction

Sample plot area perimeters are based on **horizontal distance**. Distance correction for slope is necessary when the slope exceeds 10 percent. Use a clinometer to determine the appropriate slope correction (example listed below), or refer to appendix J (Fixed-Radius Plot) of the R1 CSE Field Guide for slope correction tables.

Slope Correction using a clinometer with a SCF scale: Determine the "slope correction factor" (SCF) for the angle of the slope.

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

OR

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

Example:

If SCF = 1.03 (25 percent slope)

To determine the slope distance needed to equal 24.0 ft horizontal distance:

Slope Ground Dist. = 24.0 x 1.03

Slope Ground Dist. = 24.72 feet

Therefore, measure out 24.7 feet along the slope of the ground to equal 24.0 feet horizontal distance.

Note:
Do not assign one slope corrected distance to the entire plot as stated in appendix J of the CSE manual. Instead, do one horizontal distance for each tree. Additionally, figure a horizontal distance for each plant species that only needs to be present to be recorded, for example: noxious weeds.

D. Sampling Procedures

1.13 Tree Sampling Procedures

Sample all plot areas (subplot, microplot, *and macroplot, if approved*) as described below. Refer to section 5 for details on Tree data items.

Tally trees – timber and woodland species: "Tally Trees" is a term used to refer to all of the qualifying trees (see below) that are sampled on the subplot and microplot (*and macroplot, if approved*). 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 diameters are measured 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 section 5, CSE 5.9 DBH/DRC.

Tally tree terminology (live tree, standing dead tree, sapling, etc.) is presented in further detail in section 5, Tree Data Form (see Tally Tree Definitions).

Macroplot Option: Sampling procedures/criteria for large trees (≥ 5.0 inches DBH/DRC) on the subplot and macroplot are listed below in "comment boxes." Procedures for the sapling tally and seedling counts are the same for all sampling options. Prior to implementing this option, Forests must first obtain approval from the Regional Office.

Procedures:

1. **Large Tree Tally (Subplot).**

   a. **Procedures.** Stand directly over the PC stake. Starting at 1 degree azimuth (declination set at zero), 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 stem(s), or the center of the bole (pith) at the base of the tree, must be 24.0 feet or less. Refer to section 5, Tree Data Form (CSE 5.2 TAG ID NUMBER), for tree numbering specifications.

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 subplot (24.0-ft horizontal distance) and the macroplot (58.9-ft horizontal distance). Refer to section 5, Tree Data Form (CSE 5.2 TAG ID NUMBER), for tree numbering specifications.

1) **Subplot trees –** Tally all qualifying trees with a diameter between 5.0 and 20.9 inches. 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 24.0 feet or less.

2) **Macroplot trees –** 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.

b. Qualifying Trees. Trees qualifying for tally are classified as follows:

1) Live timber species trees (5.0 inches DBH and larger).

> **Macroplot option:** Use 5.0- to 20.9-inches DBH for the subplot, and ≥ 21.0 inches DBH for the macroplot.

Trees are defined as being "alive" if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement. 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 as follows (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):

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

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

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

2) **Live woodland species trees** (5.0 inches DRC and larger).

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.

> **Macroplot option:** 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 to 20.9 inches for the subplot, or 21.0 inches or larger for the macroplot.

Trees are defined as being "alive" if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement. 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.

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.

3) **Standing dead timber species** (5.0 inches DBH and larger).

> **Macroplot option:** Use 5.0- to 20.9-inches DBH for the subplot, and ≥ 21.0 inches DBH for the macroplot.

To qualify as a standing timber species, the main tree stem/bole must be at least 4.5 feet tall (i.e., a standing timber species cannot be broken below 4.5 feet) and 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.

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.

Standing dead timber species trees are further classified as either salvable (hard) or non-salvable (soft):

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

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

2. Sapling Tally (Microplot).

a. 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 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 stem(s), or the center of the bole (pith) at the base of the tree, must be 6.8 feet or less. Trees are tallied and numbered clockwise starting with the last number recorded on the subplot (*and macroplot, if established*). Refer to section 5 (CSE 5.2 TAG ID NUMBER) for tree numbering specifications.

b. Qualifying trees.

1) Live timber species saplings (1.0- to 4.9-inches DBH).

Live timber species saplings are further classified as either growing-stock (sound) or rough as follows (note: to classify, examine these trees from a 1-foot stump to a 1.0-inch top diameter).

a) A **growing-stock** (sound) live timber species sapling is one that is expected to become a growing-stock (sound) tree 5.0-inches DBH or larger at maturity.

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

2) **Live woodland species saplings** (1.0- to 4.9-inches DRC).

   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 the cumulative (calculated) DRC must be between 1.0 and 4.9 inches DRC and 1 foot in length.

3. **Seedling Counts (Microplot).**

   Procedures: Within the perimeter of the microplot area (6.8 feet horizontal distance), record the number of live tree seedlings by species. Only include species listed as tally tree species (refer to appendix E).

   To Qualify for the Seedling Count:

   Conifer seedlings must be at least 1.0 inch in length and less than 1.0 inch at DBH in order to qualify for counting. Hardwood seedlings must be at least 1.0 foot 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 and at least 1.0 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.

   Note: Seedling counts (grouped by species) are further divided into height classes and called **seedling groups**. Data collection for seedling groups is described in further detail in section 5 (refer to TREE COUNT, CSE 5.7, for height classes).

1.14 Vegetation Composition Sampling Procedures

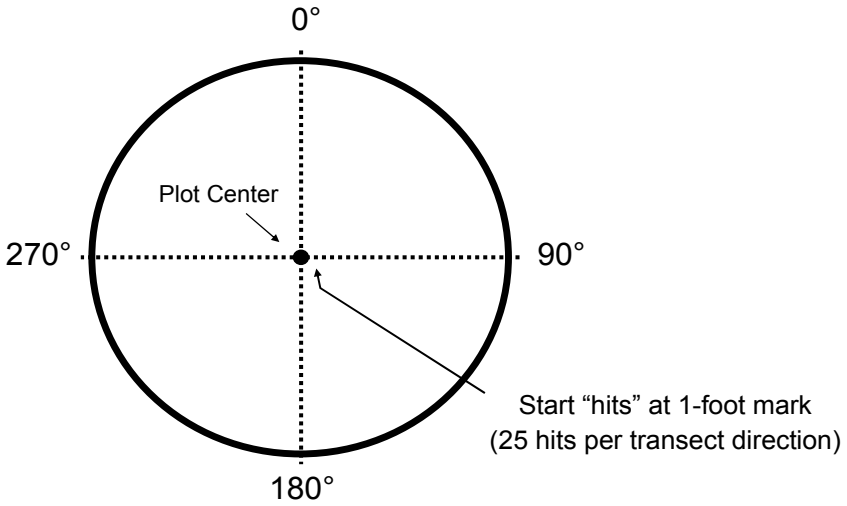
On the 1/24th-acre subplot area, estimate Vegetation Composition canopy coverage, (Total Vegetation, Cover by Lifeform, Cover by Lifeform by Layer), and complete a Species List for all species with 5 percent cover or greater. Also, complete an Invasive Species List for "designated" species, regardless of cover, as specified in section 6. 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). Additionally, section 6 has a method for *measuring* canopy cover on a 100 foot transect.

Refer to section 6 (Vegetation Composition Cover by Lifeform and Vegetation Composition Cover by Species) for details on data items and sampling protocol.

1.15 Ground Surface Cover Line Intercept Sampling Procedures

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. For this sample, 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 Popsicle stick.

Ground Surface Cover Transects configuration:



Beginning at the 1-foot mark from PC (*along each transect direction*), place a tip of a plot stake or sharply pointed staff on the ground along the transect line at each 1-foot mark (against the right side of the tape with your back to plot center). Record each point, referred to as a "hit," on the Ground Surface Cover Transects Form (*supplemental form - appendix A5*) by the appropriate ground surface cover type category (*see section 6 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.

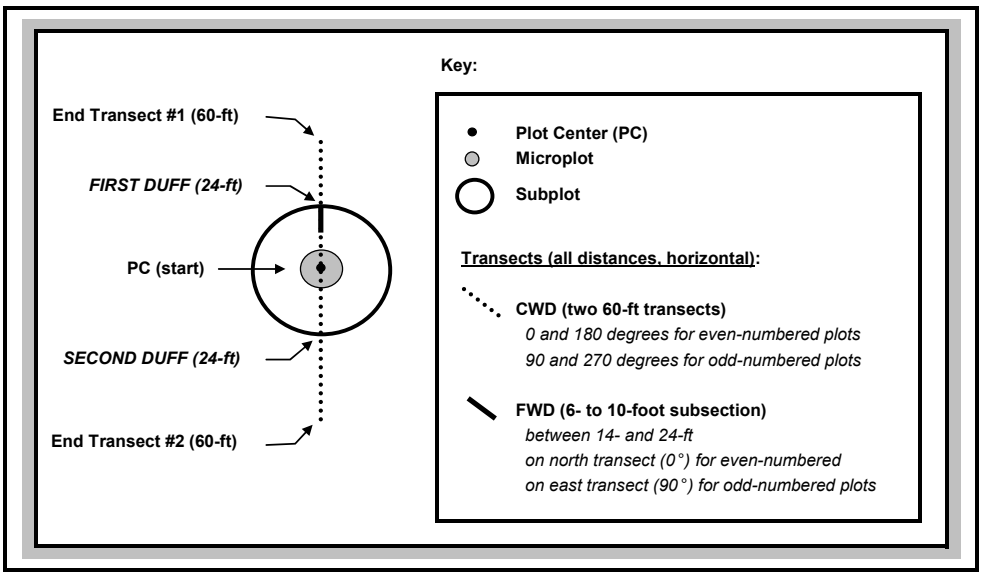
Repeat procedure for each transect direction. Each of the four transect directions will contain 25 hits (for a total of 100 hits for the entire plot).

Refer to section 6 (Ground Surface Cover Transects Form) for details on data items and sampling protocol.

1.16 Down-Woody Materials Sampling Procedures

Lay out **two transects** that originate from plot center (PC stake) and extend outward **60.0 feet horizontal distance.** For even-numbered plots, orient transects at azimuths of 0 (360) and 180 degrees. For odd-numbered plots, orient transects at azimuths of 90 and 270 degrees. Mark the end of each transect with a pin or Popsicle stick.

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 north transect (*oriented at 0 degrees*). For odd-numbered plots, sample FWD on the east transect (*oriented at 90 degrees*).



Refer to section 7 (Down-Woody Materials Form) for details on data items and sampling protocol.

Section 2: Setting and Plot Location Reference Form

This section describes attributes collected on the Setting and Plot Location Reference Form. It contains the following subsections: (A) Setting Items, and (B) Plot Location Reference Items.

Setting items (preceded by CSE) are data items (fields) that are collected electronically with Exams software.

Plot Location Reference Items includes variables related to finding and monumenting the plot location (e.g., Reference Point, RP to PC Traverse Info, PC Witness Trees). These items MUST be recorded on the "paper" data form (refer to the Setting and Plot Location Reference Form, appendix A1).

A. Setting Items

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

CSE 2.1 Project Name (25-character) *Default*
Record the project name. Preface each project name with **'GRID INT'** (use this preface for all project names associated with the R1 Intensified Grid Inventory).

CSE 2.2 Proclaimed Region (2-digit) *Default*

CSE 2.3 Proclaimed National Forest (2-digit) *Default*

CSE 2.4 District (2-digit) *Default*

CSE 2.5 Location (2-digit) *Required*
Use the LOCATION code assigned by the R1 Intensification Plot Location Software.

CSE 2.6 Stand Number/Plotid (4-digit) *Required*
Use the PLOTID code assigned by the R1 Intensification Plot Location Software.

CSE 2.7 Owner (4-character) *Default*

CSE 2.8 State (2-character) *Default*

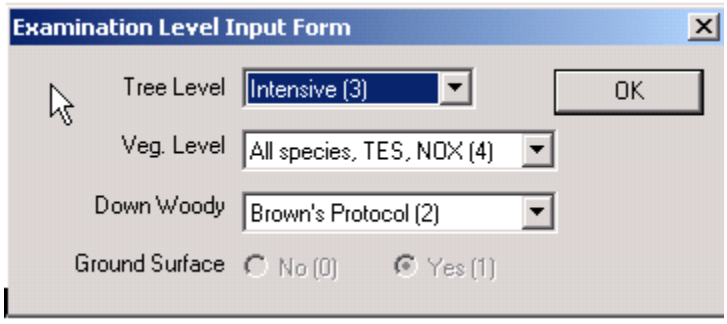
CSE 2.9 County (3-digit) *Default*
Record the code identifying the county where the plot center is located. Some intensification projects may encompass more than one county. Refer to the "drop-down menu" in the Exams software for a list of all valid county codes.

CSE 2.10 Administrative Forest (2-digit) *Default*

CSE 2.11 Date (8-digit) *Required*
For new plots (data not previously entered into the Exams software), the date will be automatically inserted. For all other plots (some data previously recorded into the Exams software), update the code by placing the cursor in the date field and recording the calendar month, day, and year that the plot is completed (MMDDYYYY).

CSE 2.12 Photo ID – *Do NOT record*

CSE 2.13 Examination Level (4-digit) *Default*
Record the examination level (3421) for the R1 Intensified Grid Inventory as follows:



CSE 2.14 Exam Purpose (2-character) *Default*
Record 'FI' for FIA Grid Intensification.

CSE 2.15 Stratum (6-character) *NOT required*

CSE 2.16 Existing Vegetation Reference (3-character) *NOT required*

CSE 2.17 Existing Vegetation Composition Type – *Do NOT record*

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, CSE 4.11).

CSE 2.19 Potential Vegetation – *Do NOT record*

CSE 2.20 Structure (2-character) *NOT required*

CSE 2.21 Setting Capable Growing Area: Forest Land Area (3-digit) *Required*

Estimate the percent of the **subplot** area (24.0-ft radius) that meets the following "Forest Land" definitions. A SETTING CAPABLE GROWING AREA code of "100" indicates an entirely forested plot. A SETTING CAPABLE GROWING AREA code of "0" indicates a non-forested plot, such as a meadow. If the plot has both forested and non-forested conditions that meet minimum requirements, then record the percent of the subplot area that is in the forested condition.

> **Macroplot option:** If this option is used, base the SETTING CAPABLE GROWING AREA estimate on the 1/4th-acre area (58.9-ft radius).

NOTE: If a portion of the plot area is located in a condition that cannot be sampled (e.g., due to a hazardous condition, water, private ownership), do not include, *or deduct,* the nonsampled portion in the estimate. Base the entire SETTING CAPABLE GROWING AREA estimate only on the portion of the plot area that would qualify for sample. For example, if 10% of the plot area extends onto private land, but the remainder of the plot is entirely forested, then record "100" (*since the qualifying portion of the plot is 100% forest land)*. On the other hand, if 10% of the plot area extends onto private land, but the remaining portion of the plot is 60% forest land and 40% nonforest, then record "60" (*since the qualifying portion of the plot is 60% forest land*).

"Forest Land" is defined as:

(a) Land that is at *least 10-percent stocked* by trees of any size, *or has been* at least 10-percent stocked in the past. Land is considered to be 10-percent stocked if it has 5 percent crown cover of trees or has any combination of 40 seedling or saplings per acre. Additionally, "Forest Land" is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities. The area of "Forest Land" must be *at least 1.0 acre* in size and 120 feet wide measured from the outermost edges. Forested strips must be 120 feet wide for a continuous length of at least 363 feet in order to meet the acre threshold.

(b) Exceptions to the minimum size requirement include the following:

- Improved roads (paved roads, gravel roads, or improved dirt roads maintained for long-term use)
- Maintained rights-of-way (corridors created for railroads, power lines, gas lines, etc., which are treated to limit the establishment and growth of trees and shrubs)

- Developments (structures and the maintained area next to a structure; houses, trailers, barns, sheds, etc.)
- Linear water features that are at least 30.0 feet wide (the width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees)

(c) Within "Forest Land" unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 acre in size and less than 120.0 feet in width are considered forest land.

(d) Transition zones between forested and nonforest lands are considered forested.

Lands that do not meet the "Forest Land" definition are considered "Nonforest Land."

❖ **Tolerance (Setting Capable Growing Area: Forest Land Area)**: ± 25 percent

CSE 2.22 Setting Fuel Model – *Do NOT record*

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 2.24 Aspect – *Do NOT record*

CSE 2.25 Slope – *Do NOT record*

CSE 2.26 Slope Position – *Do NOT record*

CSE 2.27 Acres – *Do NOT record*

CSE 2.28 Examiner (12-character) *Required*

CSE 2.29 Precision Protocol (6-character) *NOT required*

CSE 2.30 Radial Growth Interval (2-digit) *NOT required*

CSE 2.31 Radial Growth Interval 2 (2-digit) *NOT required*

CSE 2.32 Height Growth Interval (2-digit) *NOT required*

CSE 2.33 Fuel Photo Reference (3-digit) *NOT required*

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. Never sample private land.

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 nonsampled. Zero fill leading digits as shown below.

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

First digit code	Situation prohibiting data collection:
1	inaccessible/hazardous
2	private land
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. However, if such a situation/condition does not prohibit data collection, do not record SETTING USER CODE; instead, sample the entire plot area, and use SETTING CAPABLE GROWING AREA, item 2.21, to indicate the percentage of the plot that is forest land)*

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 2.35 Setting Remarks (242-character)

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

Also, use this section to describe a condition/situation in further detail if one of the following circumstances applies:

1) The plot contains a **nonforest condition/feature within the sampled portion** of the plot area, such as a meadow or improved road (i.e., SETTING CAPABLE AREA: FOREST LAND AREA is not 100%), or
2) 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).

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

CSE 2.36 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 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 2.37 Setting Damage Agent (3-digit) *Required if applicable*

CSE 2.38 Setting Damage Severity (2-character) *Required if applicable*

- **Tolerance (Setting Damage Severity)**: ± 1 category.

CSE 2.39 Species of Management Interest (8-character) *NOT required*

B. Plot Location Reference Items

Record the following plot location reference information on the Setting and Plot Location Reference Form in the appropriate spaces (refer to appendix A1). **Data for reference items will not be recorded in Exams software**. Refer to section 1, Finding the Plot Center and Plot Monumentation, for procedures on locating/monumenting the PC, and for guidelines on selecting/tagging the RP and PC witness tree landmarks.

1. **Travel Description.** Under the TRAVEL DESCRIPTION (on the back of the Setting and Plot Location Reference Form, side 2), record road directions from a highway intersection or other prominent landmark to the vicinity of the RP. Include travel information that will assist in relocating the plot location in future inventories (such as hiking direction and direction from the parking location to the RP).

   Road directions 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

   Walking directions 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.

2. **Truck Coordinates.** Record the following information (on the back of the Setting and Plot Location Reference Form, side 2) to indicate the location of the truck parking spot.

   a. **Zone** (valid options: 11U, 11T, 12U, 12T, 13U, 13T)
   b. **Easting**
   c. **Northing**
   d. **Error** (to the nearest foot, as shown on the GPS unit)

3. **Reference Point (RP).**

   a. **Description –** 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."
   b. **Species**
   c. **Diameter** (to the last whole 0.1 inch)
   d. **RP Coordinates –** As determined by the GPS unit, record the following information indicating the position of the RP on the Universal Transverse Mercator (UTM) NAD 1983 grid system:

      1) **Zone** (valid options: 11U, 11T, 12U, 12T, 13U, 13T)
      2) **Easting**
      3) **Northing**
      4) **Error** (to the nearest foot, as shown on the GPS unit)
      5) **Number of Hits**

      ❖ **Tolerance (RP):**
      - Species: No Errors
      - Diameter: ± 0.2 inch per 20 inches of diameter
      - RP Selection: at least 100 feet from the PC, unless extenuating circumstances apply
      - RP Coordinates: Tolerance for coordinates are as documented for PC coordinates below

4. **RP to PC Traverse Information.** Record the following information to indicate the traverse from the RP to the PC.

   a. **Azimuth** (to the nearest degree; in 3 digits)
   b. **Horizontal Distance** (to the nearest foot)
   c. **Slope Distance** (record to the nearest foot)

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

5. **Plot Center (PC) Coordinates.** As determined by the GPS unit, record the following information indicating the position of the PC on the Universal Transverse Mercator (UTM) NAD 1983 grid system.

   Note: If it is unlikely that tolerances can be met using the GPS Method to locate the PC (as described in section 1.7), then use alternative baseline techniques to locate the PC (refer to appendix C).

   a. **Zone** (valid options: 11U, 11T, 12U, 12T, 13U, 13T)
   b. **Easting**
   c. **Northing**

d. **Error** (to the nearest foot, as shown on the GPS unit)
e. **Number of Hits**
f. **Offset Azimuth and Slope Distance** (*record only if applicable* – record when 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 azimuth, to the nearest degree, and slope distance, to the nearest 0.1 foot, from the offset stake to the PC; take all data samples from the actual PC, not the offset stake; refer to section 1.8)

❖ **Tolerance (PC and RP Coordinates):**
- Zone: No Errors
- Easting and Northing: ± 10 meters (32.8 feet) of the stated plot location center
- Error: < 70 feet
- Number of Hits: ≥ 180

6. **PC Witness Trees.** Record the following information for the X tree and the Y tree. 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 on the Setting and Plot Location Reference Form (under STAND NARRATIVE/REMARKS).

a. **Tree Number** (if the witness tree is also a tally tree, record the tally tree number)
b. **Species**
b. **Diameter** (to the last whole 0.1 inch)
c. **Azimuth** (to the nearest degree; in 3 digits) – record azimuth from the PC to center of the tree/landmark at its base.
d. **Slope Distance** (to the nearest 0.1 foot) – record slope distance from the top of the PC stake to the nailed tag at the base; if an alternative landmark is used, record the slope distance from the PC stake to the face of the landmark (or to the tag if it acceptable to place a tag on the landmark).

❖ **Tolerance (PC Witness Trees):**
- Species: No Errors
- Diameter: ± 0.2 inch per 20 inches of diameter
- Azimuth: ± 2 degrees
- Slope Distance: ± 0.2 feet

7. **Plot Location Map.** Draw a simple sketch of the plot location and hiking route from the vehicle to the PC. 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).

8. **Stand 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, etc.

Section 3: Sample Design Form

The sample design is standard for all intensified plots and is included in the Exams software intensification template file available from http://fsweb.r1.fs.fed.us/forest/inv/ .

Tree | Veg. Composition | Ground Surface Cover | Down Woody Material (Brown's Survey)

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV
FRQ	24.07		---	ALL	DBH	5.00	999.99
			OR	ALL	DRC	5.00	999.99
FRQ	299.86		---	LIVE	DBH	0.01	4.99
			OR	LIVE	DRC	0.01	4.99
			OR	LIVE	HGT	0.09	4.49

Section 4: Plot Data Form

Follow the procedures indicated in section 4 of the R1 CSE 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 Field Guide. Enter all plot data items into Exams software.

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

CSE 4.2.1 Plot Latitude – *Do NOT record*

CSE 4.2.2 Plot Longitude – *Do NOT record*

CSE 4.3 Plot Capable Growing Area Percent (3-digit) *Required*

PLOT CAPABLE GROWING AREA PERCENT indicates the amount of the "forested" portion of the **subplot** (24.0-ft radius) that is stockable. Land is considered non-stockable if it contains ground conditions and/or vegetation that will inhibit regeneration establishment. Valid inhibiting ground conditions are rock, water, and compacted soil.

To determine PLOT CAPABLE GROWING AREA PERCENT, only examine the forested (Forest Land) portion of the subplot. See section 2, item CSE 2.21, SETTING CAPABLE GROWING AREA PERCENT, for definition of "Forest Land." Record, to the nearest percent, the amount of the forested area that is stockable (i.e., the percent of the forested area that does not contain inhibiting ground conditions and/or vegetation). Examples are listed below.

> **Macroplot option:** If this option is used, examine the forested (Forest Land) portion of the **macroplot** (58.9-ft radius).

Examples:

Setting Capable Growing Area (portion of plot meeting Forest Land definition)	Setting Capable Growing Area Percent	Plot Capable Growing Area (Stockability of Forested portion)	Plot Capable Growing Area Percent
Entirely Forested	100%	Entire plot is within a Forest Land condition and is stockable.	100%
Entirely Forested	100%	Entire plot is within a Forest Land condition, however, approximately 25% of the plot has rock outcropping.	75%
Half Forested and Half a Meadow	50%	Although only half of the plot is within a Forest Land condition, the entire forested portion is stockable.	100%
Half Forested and Half a Meadow	50%	Half of the plot is within a Forest Land condition, and approximately 25% of this forested portion has rock outcropping.	75%
Entirely Non-forested	0%	Entire plot is nonforest - therefore there is no stockable percent.	0%

- **Tolerance (plot capable growing area):**
  - Plot Capable Growing Area not off by more than 25 percent

CSE 4.4 Plot Aspect (3 digit) *Required*

If the setting capable growing area is 0%, record 0 for Plot Aspect.

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

If the setting capable growing area is 0%, record 0 for Plot Slope.

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, the PC stake. 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: (1) a transition zone, (2) an area that encompasses both a forest and a nonforest type, or (3) 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 G in the R1 CSE Field Guide for a complete list of Potential Vegetation codes. The *reference* used to obtain PLOT POTENTIAL VEGETATION is to be recorded under POTENTIAL VEGETATION REFERENCE (refer to section 2, CSE 2.18). **Note:** Contract specifications may require a habitat type field form to be completed.

- **Tolerance (Plot Potential Vegetation):**
  - Series: Accurate to series, understory union, and Forest/District or contract specified phases

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 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 Field Guide. Enter all tree data items into Exams software.

A. Tally Tree Definitions

Each of the sample plot areas on the plot location (subplot, microplot, *and macroplot, if approved*) is used to inventory trees of a specified diameter size, as indicated below. Refer to section 1, Plot Location Layout, for a diagram of the plot layout. Refer to section 1, Sampling Procedures, for instructions related to the sampling of qualifying trees on each sample plot area.

Sample Plot Area	**Plot Radius (horizontal distance)**	**Tally Tree Diameter Size:**
Subplot	24.0 feet	▪ ≥ 5.0-inches DBH/DRC *(or 5.0- to 20.9-inches for Macroplot option)*
Microplot	6.8 feet	▪ 1.0- to 4.9-inches DBH/DRC ▪ Seedling counts
Macroplot (optional)*	*58.9 feet*	▪ *≥ 21.0-inches DBH/DRC*

** Prior to implementing this option, Forests must first acquire approval from the Regional Office.*

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 approved* (refer to section 1.13, Tree Sampling Procedures, Qualifying Trees). This includes all live and standing dead trees that are tallied on the subplot (*and macroplot*), and all live trees that are tallied on the microplot, the first time the plots are established. Tally tree is also a term used to refer to qualifying trees that grow into a plot thereafter (future inventories). These data yield information on tree volume, growth, mortality, and removals; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Tally Tree Definitions (qualifying trees):

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. Note: Tree species that are not on the "Tally Tree Species" list in appendix E are to be included in the Vegetation Composition sample (refer to section 6). Tally trees are tallied individually.

2. **Saplings.** This term is applied to trees with a diameter at least 1.0 inch but less than 5.0 inches; these trees are sampled on the microplot. "Tally saplings" are defined as all live 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.

3. **Seedlings.** Conifer seedlings must be at least 1.0 inch in length and less than 1.0 inch at DBH in order to qualify for counting. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH to qualify for counting. For woodland species, each stem on a single tree must be less than 1.0 inch at DRC. Refer to section 1.13 for seedling count procedures. 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.

4. **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 (refer to section 1, Tree Sampling Procedures, Qualifying Trees for specifications).

4. **Standing Dead Trees (timber species).** To qualify as a standing dead timber species tally tree, dead trees must be at least 5.0 inches in diameter, have a bole that has an "unbroken actual length" of at least 4.5 feet, and lean less than 45 degrees from vertical.

   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 over 5.0 inches 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 1, Tree Sampling Procedures, Qualifying Trees for specifications).

   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.

B. Tree Data Items

Required fields for the R1 Intensified Grid Inventory:

R1 CSE Field Guide Item No.	Field	When Required
5.2	Tag ID Number	Defaulted by software
5.3	Tree Status	All trees
5.4	Tree Class	All tally trees
5.5	Growth Sample Tree (GST)	GST trees (see GST selection rules)
5.6	Tree Species	All trees
5.7	Tree Count	Seedling counts (defaulted for tally trees)
5.8	Number of Stems	Woodland species ≥ 1.0-inch DRC
5.9	DBH / DRC	• Timber species ≥ 4.5 feet tall • Woodland species ≥ 1 foot tall • Seedling groups (timber species if ≥ 4.5 feet tall; woodland species if ≥ 1 foot tall)
5.10	Height	• All GST trees • Trees with broken tops • Seedling groups • Dead trees
5.12	Radial Growth	GST trees > 3” diameter
5.14	Height Growth	GST trees 1.0-2.9 inch diameter
5.15	Tree Age	GST trees
5.16	Crown Ratio	All live trees
5.17	Crown Class	Live tally trees
5.20	Snag Decay Class	Dead trees only
5.22	Tree Damage Category	Live tally trees when damage meets definition, for mortality trees (died <5 yrs ago) use as a cause of death
5.23	Tree Damage Agent	Live tally trees when damage meets definition, for mortality trees (died <5 yrs ago) use as part of cause of death
5.25	Tree Damage Severity	Live tally trees when damage meets definition code highest possible for mortality

5.26	Tree Remarks	• Estimated Age Flag recorded for trees with estimated age • Horizontal Distance and Azimuth recorded for all trees • DBH Height recorded as needed • Woodland Tree Items recorded as needed • other remarks as needed

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 azimuth 001 to 360 degrees, and outwards from the PC stake to the sample plot perimeter. Refer to section 1, Tree Sampling Procedures, for qualifying tree specifications. Refer to appendix E for a list of accepted tally tree species.

Tally Tree Procedures:

1. **Subplot Tally (*and macroplot, if approved*).** Standing over the PC, start at 001 degree azimuth and rotate clockwise recording sequentially all tally trees 5.0-inches and greater. 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 the PC first.

2. **Microplot Tally.** Next, standing over the PC, begin at 001 degree azimuth and rotate clockwise to number the live tally tree saplings (1.0- to 4.9-inches DBH/DRC). Finally, record the seedling groups. Although seedling groups are assigned a unique number by the software program, seedlings are not permanently identified until they meet sapling definitions.

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

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 area (refer to table 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):** No Errors 90% of the time

Code	Tree Class	Live	Must have the following characteristics:
GS	Growing Stock	Y	**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	Y	**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.
RN	Rotten	Y	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.

Code	Tree Class	Live	Must have the following characteristics:
SV	Salvable dead (Hard)	N	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)	N	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).

CSE 5.5 Growth Sample Tree (1-character) ***Required for GST trees***

For the R1 Intensified Grid Inventory, 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: For the R1 Intensified Grid Inventory, select the first tally tree of each species by diameter class.

GST items to collect by diameter class range:

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

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

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): Seedling counts (grouped by species, refer to section 1.13) are further divided into height classes and 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 as follows:

Seedling Height Class	Recorded Height	Actual Diameter	Recorded Diameter
<0.5 feet	Average of seedlings in the group	NA	null
1.0 – 4.0 feet	Average of seedlings in the group	< 1.0 inch(1)	Average of seedlings in the group (1)
5.0 + 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 1.0 inch in length and less than 1.0 inch at DBH to qualify for the seedling counts. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting. For woodland species, each stem on a single tree must be less than 1.0 inch at DRC and at least 1 foot long.

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.

Missed/Extra Tree Tolerance:

Number of Trees on Plot	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
Seedling Groups:			
Number of Trees in seedling group	**Diameter (DBH/DRC)**	**Height or Height Class**	**Missed/Extra Tree Tolerance**
1 - 5	0.1- to 0.9-inch *	1 inch < height class ≤ 4 feet	± 1 tree
6+	0.1- to 0.9-inch *	1 inch < height class ≤ 4.0 feet	± 20%
1 - 5	0.1- to 0.9-inch	≥ 5.0 feet	± 1 tree
6+	0.1- to 0.9-inch	≥ 5.0 feet	± 10%

* Only applicable to woodland species seedling group 1 foot – 4-foot tall

- **Tolerance (Missed/Extra Trees):**
  - Plot locations with no trees present within the plot perimeter: No Errors – it is unacceptable to classify a tree as a tally tree (including seedlings) if no trees are actually present within any of the plot area perimeters.
  - Plot locations with one or more trees within the plot perimeter: Refer to the above table for tolerance limits; each missed/extra tree, 1.0-inches DBH/DRC and larger, will result in one "error." The recording of seedlings outside of the stated tolerance limits will result in one "error" per diameter range listed.

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.

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 ≥ 6 inches***

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. Tree marking procedures are described below.

1. **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 5.0 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 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 appendix L and appendix M in the R1 CSE 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:

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

To compute by calculator (use calculator with MRC, M-, M+, and square root function keys), and again using a multi-stemmed tree with individual stem diameters of 12.2, 13.2, 3.8, and 22.1 inches, calculate as follows:

- Enter: 12.2 x M+, then 13.2 x M+, then 3.8 x M+, then 22.1 x M+ (the result should equal 488.41)
- Push: MRC, the memory recall function key (the result should equal 825.93)
- Push: the square root function key (the result should equal 28.74)
- Round 28.74 down to 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

2. **Marking Tally Trees.** 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.

   b. **Note: Do not mark non-tally trees with a nail. Trees close to being in (4.9 in dia on subplot or 2.9 in dia 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, 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.

   c. **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-in`ch 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).

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

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

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

CSE 5.15 Tree Age **(4-digit)** ***Required for GST trees do not record on Junipers less than three inches DRC***

CSE 5.16 Crown Ratio **(3-digit)** ***Required for live trees***

Record average crown ratio for seedling groups.

CSE 5.17 Crown Class (2-character) *Required for live trees ≥ 1.0-inch DBH/DRC*

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

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.
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.

CSE 5.20 Snag Decay Class (1-digit) *Required for dead trees* When determining Snag Decay Class, put a strong emphasis on rot and available merchantable product.

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 a primary, secondary, and tertiary damage code (only code if applicable). For recently dead trees (those that died within the last 5 years), 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. Additionally, code broken top on all trees including non-mortality (died more than five years ago).

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 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 General Descriptions of Insects and Diseases for more specific identification information.

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 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 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 Horizontal Distance ('HD' + 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. Record '**HDxxx**' where xxx is the horizontal distance. Do not record a decimal point (the tenth of foot is assumed). For a multi-stemmed woodland tree, the geographic center is a point of equal distance between all tallied stems.

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

5.26.3 Azimuth ('AZ' + 3 digit) *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). Record '**AZxxx**' where xxx is the azimuth. For a multi-stemmed woodland tree, the geographic center is a point of equal distance between all tallied stems.

- **Tolerance (Tree Azimuth):** ± 10 degrees

5.26.4 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).

Section 6: Vegetation Composition and Ground Surface Cover Transects Forms

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

Follow the procedures indicated below in this manual. Section 6 in the R1 CSE Field Guide is not applicable to R1 Intensified Grid Inventory.

Enter Vegetation Composition data items in the Exams software.

For the Ground Surface Cover Transects sample, record specified items on the "paper" Ground Surface Cover Transects Form (appendix A.5), and enter calculated GROUND SURFACE COVER PERCENT by cover type in the Exams software (procedures described below in subsection D).

A. Vegetation Composition and Ground Cover Overview

On the subplot sample area (24.0-ft radius), estimate and record vegetation composition data using the following sampling requirements. Refer to section 1.11 for the Plot Location Layout. For tree cover, only include seedlings and saplings (≤5" DBH/DRC).

Complete the following:

- **Cover by Lifeform** (1/24th-acre subplot area)
- **Cover by Species** (1/24th-acre subplot area): Record all species with at least 5 percent cover; additionally, record the presence of any "designated" invasive species regardless of percent cover.
- **Ground Surface Cover** (transects): 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.

Follow procedures outlined in the sections below.

Exam Level Code	Subpop. Min.	Subpop. Max.	Cover by Lifeform	Cover by Species and Layer	Cover by Species	Ground Surface Cover Transects
4	5% cover	100	Required	FORM NOT USED	Individual species with at least 5 percent cover. Presence of all invasives from a list.	Required

- **Tolerance (Vegetation Composition):**
  - Plant Identification :
    - **Genus: No Errors**
    - **Species: No Errors**
  - Layer: No Errors
  - Cover: ± 10 percent

Note:
When computing cover percentages, include all accessible forest land. If a forest road or small stream is on the plot include that in the vegetation cover estimate. For Example, if a road takes up 40 percent of the plot and no vegetation overhangs the road then the most cover you could possibly have is 60 percent. If a portion of the plot is too hazardous to occupy such as an interstate or cliff remove that from the total such that in the example above 60 percent of the plot is now 100 percent.

B. Vegetation Composition/Tree Canopy Cover – Cover by Lifeform Form

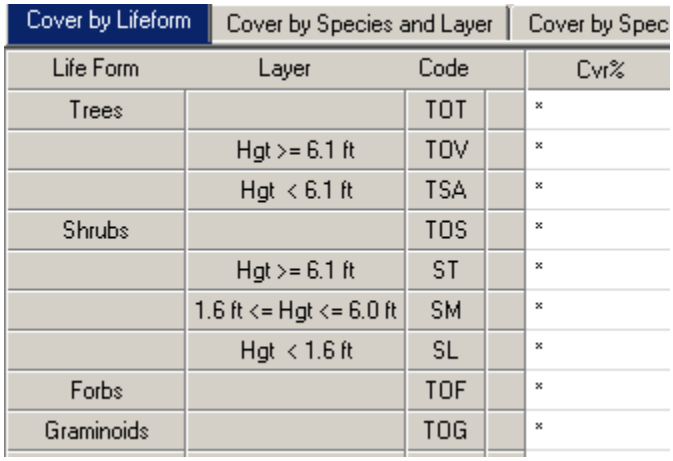
Cover by Lifeform

For the 1/24th-acre subplot area, determine canopy cover, to the nearest percent, for the following categories (procedures specified below):

- **Total Vegetation**
- **Cover by Lifeform**
- **Cover by Lifeform by Layer**

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).

Exams Cover by Lifeform Form:



Cover by Lifeform | Cover by Species and Layer | Cover by Spec

Life Form	Layer	Code		Cvr%
Trees		TOT		*
	Hgt >= 6.1 ft	TOV		*
	Hgt < 6.1 ft	TSA		*
Shrubs		TOS		*
	Hgt >= 6.1 ft	ST		*
	1.6 ft <= Hgt <= 6.0 ft	SM		*
	Hgt < 1.6 ft	SL		*
Forbs		TOF		*
Graminoids		TOG		*

Exams Cover by Lifeform Attributes:

Lifeform	Code	Attribute
	TV	Total of All Vegetation
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

- **Tolerance (Canopy Cover):** ± 10 percent

1. **Total Vegetation (TV).** Determine the total canopy cover of all Lifeforms (trees, shrubs, forbs, and graminoids), by estimating the area of the ground surface covered by a vertical projection of the canopy of all Lifeforms combined. 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.

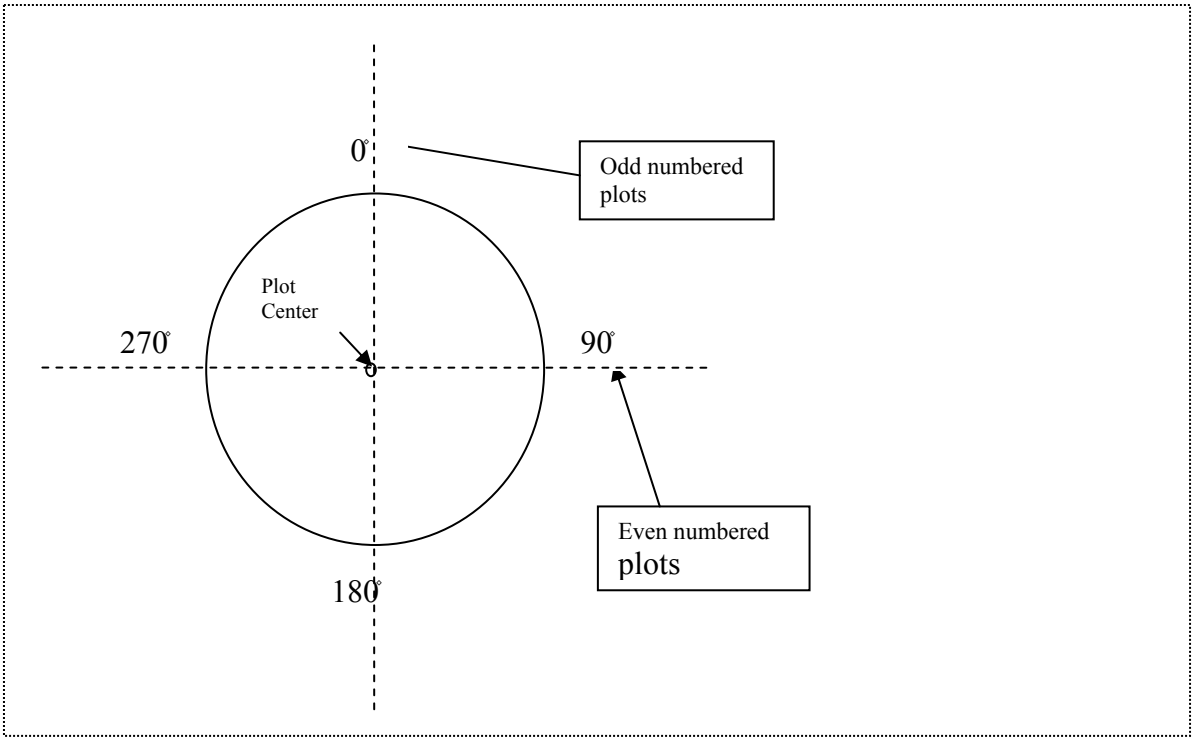
2. **Canopy Cover by Lifeform (TOT, TOS, TOF, TOG).** Determine the total canopy cover by Lifeform (shrubs, forbs, and graminoids). Examine each Lifeform (except trees, see below) individually as if the other Lifeforms do not exist. Do not double count overlapping layers within a Lifeform. To determine, estimate the area of ground surface covered by a vertical projection of the canopy for the particular Lifeform. 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.
   As an exception, use the following protocols to record tree canopy cover:

Methodology:

Along two 50' transects, measure linear feet of tape that has tree crown above it to the nearest foot. *Every* tree including seedlings and saplings should be considered. No other growth forms, only trees, should be included in the measurement. Sum up the total linear feet for a transect, this is the percent cover for the plot.

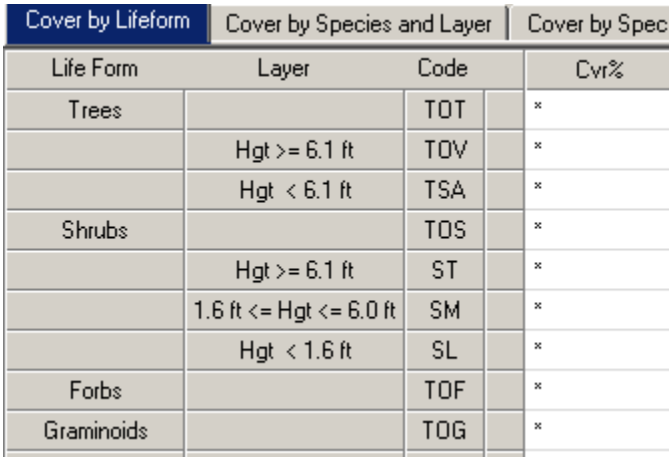
Transect layout:

For intensified grid data, center the 100 foot transect on the plot center such that 50 feet extend east of plot center and 50 feet extend west for even numbered plots and north south for odd number plots. If the slope exceeds 10 percent correct both the transect length and feet of canopy cover prior to entering a percent (see Appendix J CSE Manual).



Recording Canopy Cover

Record Tree Canopy Cover Values on the Cover by Lifeform page of the Vegetation Composition Form as follows:



Cover by Lifeform | Cover by Species and Layer | Cover by Spec

Life Form	Layer	Code		Cvr%
Trees		TOT		*
	Hgt >= 6.1 ft	TOV		*
	Hgt < 6.1 ft	TSA		*
Shrubs		TOS		*
	Hgt >= 6.1 ft	ST		*
	1.6 ft <= Hgt <= 6.0 ft	SM		*
	Hgt < 1.6 ft	SL		*
Forbs		TOF		*
Graminoids		TOG		*

Use the methodology described above to derive estimates of total tree cover (TOT), cover of trees ≤ 6.0' tall (TSA), and cover of trees > 6.0' tall (TOV). Note: after TOT is measured on the 50 foot transects, TSA and TOV can be estimated.

3. **Canopy Cover by Lifeform by Layer (TOV, TSA, ST, SM, SL).** Determine the total canopy cover by Lifeform for shrubs by Layer (defined below). To determine, estimate the area of ground surface covered by a vertical projection of the canopy within the predefined layer for the particular Lifeform. For each Lifeform, partition plants into layers based on those plants whose heights end in that layer (see Agave Rule below). If a Lifeform does not have members that top out within a layer, record a '0' for canopy cover for that layer. 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.

Layers:

Lifeform	Attribute Code	Layer
Trees:	TOV	> 6.0 feet
	TSA	≤ 6.0 feet
Shrubs:	ST	> 6.0 feet
	SM	1.6 – 6.0 feet
	SL	≤ 1.5 feet

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).

Exams Cover by Species and Layer Form – *NOT USED*

C. Vegetation Composition – Cover by Species Form

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

- **Species List** – a listing of all species, including "designated" invasive species, with a canopy cover of 5 percent or greater.
- **Invasive Species List** – a listing of all remaining "designated" invasive species, with a canopy cover less than 5 percent.

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). Only record a species once on this form. Refer to the Invasive Species resource supplement for a list of "designated" species required for identification.

Remember the area of a circle = πr^2 the area of a 24 ft radius circle = 3.14 (24^2) = 1808 ft^2. Therefore, 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.

Exams Cover by Species Form:

1. **Species List (species ≥ 5% cover).** For **each** species on the subplot area that has a canopy cover of 5 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.
   - **Layer –** 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.

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

2. **Invasive Species List** **(additional invasive species < 5% cover).** For all remaining "designated" invasive species on the subplot area (24.0-ft radius), with a canopy cover of less than 5 percent, 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 5 percent cover).
   - **Layer** – in the **Remarks** column, record the code for the layer that best represents where most of the cover tops out (see Species List above for layer codes). If an invasive species occurs equally in more than one layer, record the highest layer where it occurs.

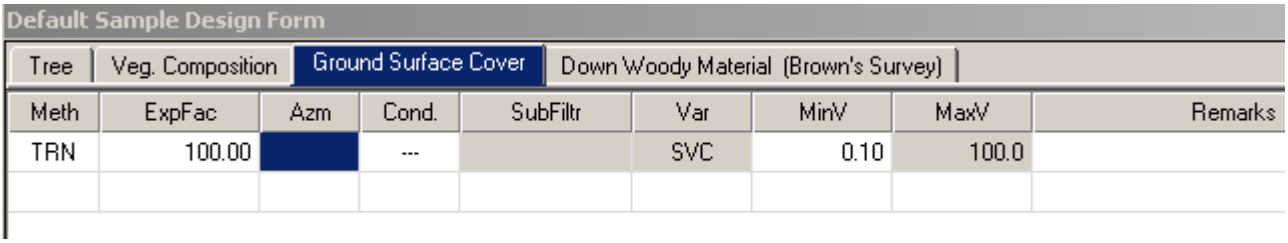
   Refer to the Invasive Species resource supplement for a list of "designated" species required for identification.

D. Ground Surface Line Intercept Form

Exams Ground Surface Cover Transects Form

Complete the following:

- **Sample Design for Ground Surface Cover Transects –** within the Sample Design Form of the Exams software, enter '**TRN**' in the SAMPLE DESIGN REMARKS column.



- **Ground Surface Cover Transects Sample –** Collect ground surface cover data along four transects originating from plot center (*described in further detail below*). Record all data for this sample on the "paper" Ground Surface Cover Transects Form (appendix A5).

- **Exams software entries –** Using the data collected from the Ground Surface Cover Transects Sample, determine ground cover percents by cover type category (*described in further detail below*). On the Ground Surface Cover Form in Exams software, record the category and the GROUND SURFACE COVER PERCENT for each cover type sampled.

1. **Ground Surface Cover Line Intercept Sampling Procedures** *(use supplemental form, appendix A5)*. 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. For this sample, 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 Popsicle stick.

   Ground Surface Cover Transects configuration:

   Beginning at the 1-foot mark from PC (*along each transect direction*), place a tip of a plot stake or sharply pointed staff on the ground along the transect line at each 1-foot mark (against the right side of the tape with your back to plot center). Record each point, referred to as a "hit," on the Ground Surface Cover Transects Form (*supplemental form - appendix A5*) by the appropriate ground surface cover type category (*categories listed below*). If more than one category occurs at a point (e.g., litter on top of a rock), always record the ground cover category that is on top (i.e., the category that the pointed staff touches first). Note: Foliar canopy cover above the soil surface plane is not considered to be ground surface cover.

   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).

   - **Tolerance (Ground Surface Cover Transects Sample):**
     - Transect Azimuth: ± 2 degrees
     - Number of Hits per category: ± 10 percent

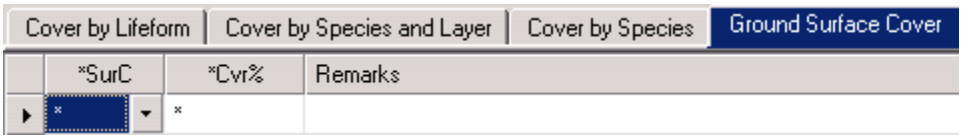
2. **Ground Surface Cover Type Codes and Category Definitions.** Valid Ground Surface Cover Type categories and codes (4-character; *Required)* for the R1 Intensified Grid Inventory are as follows:

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 association. For lichen growing on bare soil in dry rangeland conditions, see cryptogamic crusts.
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 soils 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.

Ground Surface Cover Type Codes (continued):

Code	Description	Definition
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).

3. **GROUND SURFACE COVER PERCENT.** After all of the "hits' for the ground surface cover transects sample have been recorded on the supplemental form, determine a GROUND SURFACE COVER PERCENT for each cover type category sampled, as described below. 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 percents for all categories sampled on a plot MUST total 100 percent.



Determining GROUND SURFACE COVER PERCENT:

- **Category Total –** By category, sum the number of hits sampled on all four transects to obtain the "total number of hits for category" on the plot. *Record category totals on the supplemental form.*

- **Category GROUND SURFACE COVER PERCENT –** By category, determine the cover percent value associated with the total number of hits sampled:

  Category Cover Percent = (# hits for category / # hits for all categories) **x** 100

  Because the "number of hits for all categories is 100," the "cover percent" value for a category calculates to the same number as the "total number of hits" for the category. Therefore, the category cover percent is simply:

  Category Cover Percent = Total # hits for category

  For example, if the total number of hits across all four transects for the LITT category (litter and duff) is 20, then the associated cover percent value on the plot for that category is 20%.

- **"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.

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.

GROUND SURFACE COVER PERCENT

Adjustment for nonsampled transect:

It is a MUST that the individual category percents 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 percents. This procedure adjusts percents 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 percents 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%).

    - 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.

Refer to next page for example

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%

Enter the final adjusted percents in the Exams software.

Section 7: Down-Woody Materials Form

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

Follow the procedures indicated below in this manual. Section 7 in the R1 CSE Field Guide is not applicable to R1 Intensified Grid Inventory.

Enter Down-Woody Materials data items in the Exams software.

A. Definition of Down-Woody Materials

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.

   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).

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).

B. Locating and Establishing Line Transects

Lay out **two transects** that originate from plot center (PC stake) and extend outward **60.0 feet horizontal distance.** For even-numbered plots, orient transects at azimuths of 0 (360) and 180 degrees. For odd-numbered plots, orient transects at azimuths of 90 and 270 degrees. Mark the end of each transect with a pin or Popsicle stick.

- **Tolerance (Down-Woody Materials Sample):**
  - Transect Azimuths: ± 2 degrees

Sample **CWD** along the entire length of both transects. Sample **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 north transect (*oriented at 0 degrees*). For odd-numbered plots, sample FWD on the east transect (*oriented at 90 degrees*). Refer to figure 2 below.

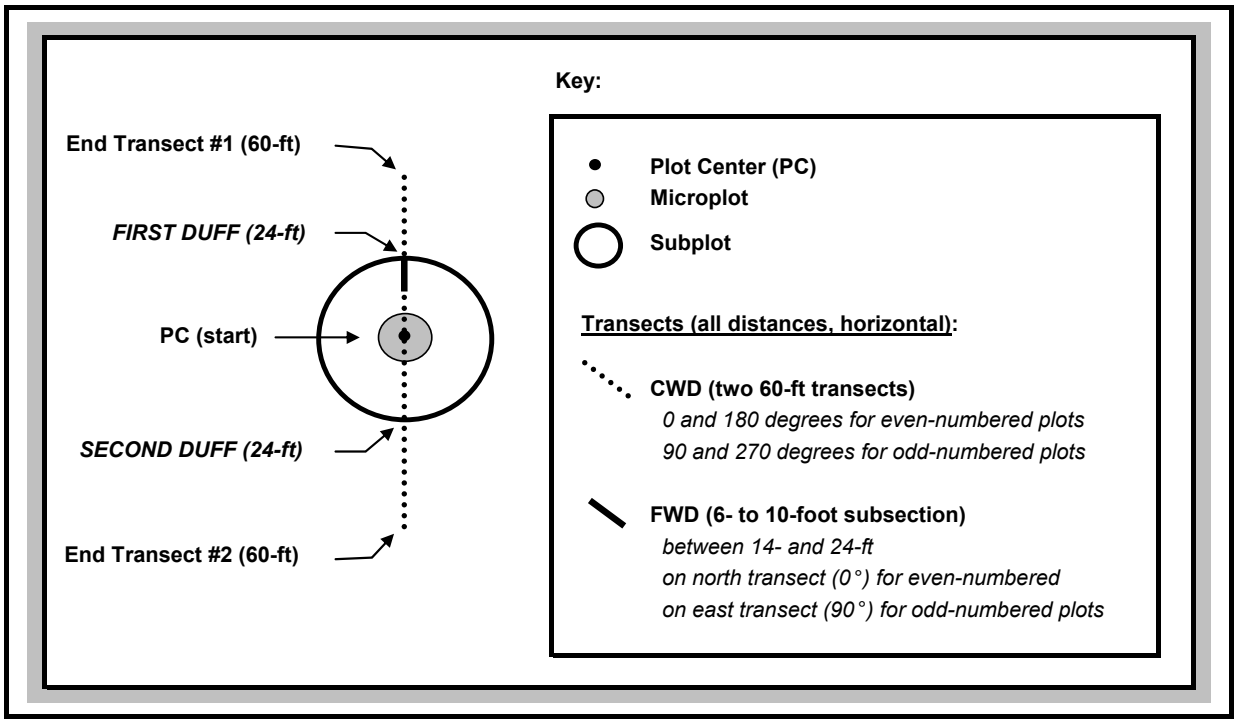


Figure 2 – Down-woody materials transect sample configuration.

Down-Woody Materials

Tree | Veg. Composition | Ground Surface Cover | Down Woody Material (Brown's Survey)

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV
TRN	6.00		---	DOWN	DIA	0.01	0.24
TRN	6.00		---	DOWN	DIA	0.25	0.99
TRN	10.00		---	DOWN	DIA	1.00	2.99
TRN	120.00		---	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, Down-Woody Material, and 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.

Sample Design Form(s); Setting: 01 12 03 0041 3456 08/16/2005

Tree | Veg. Composition | Ground Surface Cover | Down Woody Material (Brown's Survey)

Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV
TRN	6.00		---	DOWN	DIA	0.01	0.24
TRN	6.00		---	DOWN	DIA	0.25	0.99
TRN	10.00		---	DOWN	DIA	1.00	2.99
TRN	24.00		---	DOWN	DIA	3.00	999.99

C. Down-Woody Materials Items

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.

- **Tolerance (Down-Woody Materials Sample):** "No Errors" unless otherwise noted

Required Fields for the R1 Intensified Grid Inventory:

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

Note:
If there is no down wood present and you install a 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.

7.1 Plot Number (3-digit) *Default*

7.2 and 7.3 First Duff and Second Duff (2,1-digit; xx.y) *Required*

Measure FIRST DUFF and SECOND DUFF transect, 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.

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 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.

- **For odd-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.

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

Sampling Methods for Fine Woody Debris (Items 7.5.1, 7.5.2, and 7.5.3):
FWD is sampled along a 6-10 foot subsection of transect, and is tallied within three size classes (Twig1, Twig2, and Twig3) depending on the cross-section diameter size of each piece. Collect FWD data on the north transect (*oriented at 0 degrees*) for even-numbered plots, and on the east transect (*oriented at 90 degrees*) for odd-numbered plots, 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:

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

7.5.1 Twig1 (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

7.5.2 Twig2 (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

7.5.3 Twig3 (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

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 (36.0 to 46.0 foot section) include any FWD that is present on top of these obstructions in the respective FWD counts. If the obstructions are so large (huge boulder) that the top surface cannot be seen, assume the count is zero in this area, and continue counting if there is transect line beyond the boulder.

Sampling Methods for Coarse Woody Debris (Items 7.8, 7.9, 7.10, 7.11, and 7.12): CWD is sampled along two 60-ft transects (see figure 2; *transects oriented north-south for even-numbered plots; transects oriented east-west for odd-numbered plots*). Collect CWD data along the entire length of both transects.

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

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 3).

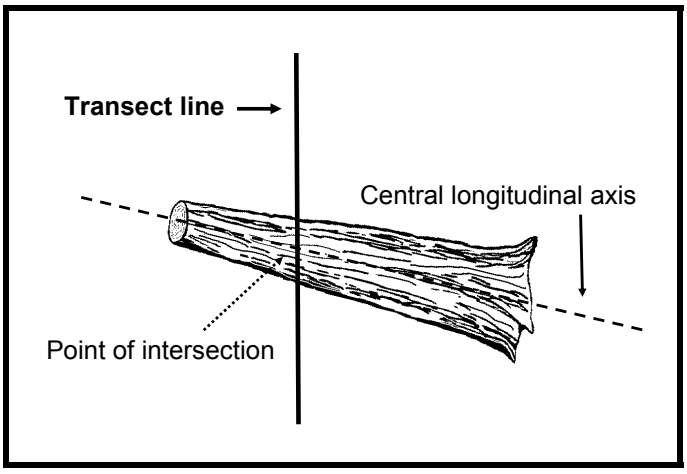


Figure 3 – Tally rules for CWD.

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 (whereas 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 4).

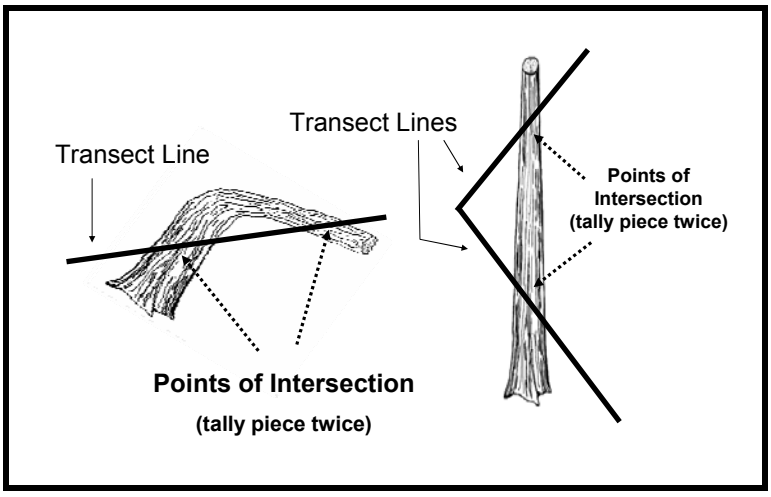


Figure 4 – CWD tally rules: intersections.

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 5).

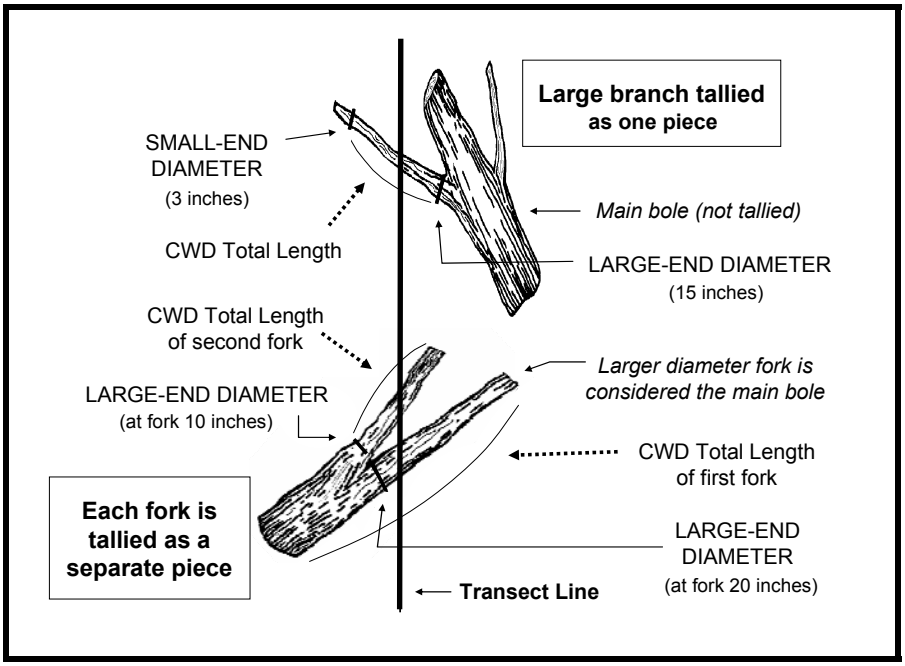


Figure 5 – CWD tally rules: forked trees.

❖ **Tolerance (Tally of CWD):** No Errors

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 listed in the following table:

Log Decay Classes are defined as follows:

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
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 tenth 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

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 6). 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.

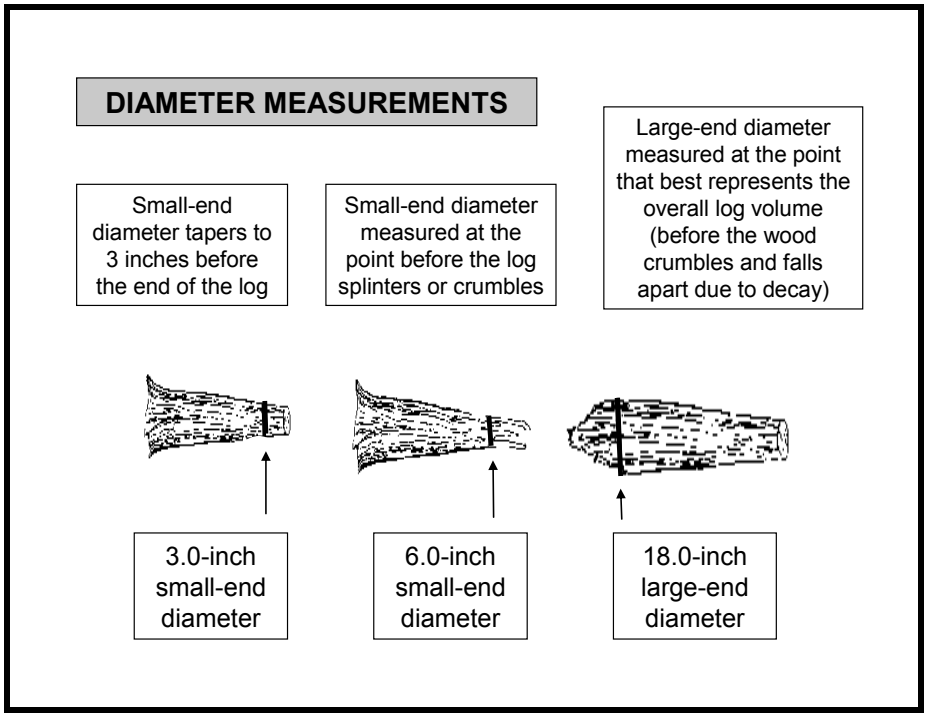


Figure 6 – Diameter measurements.

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), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

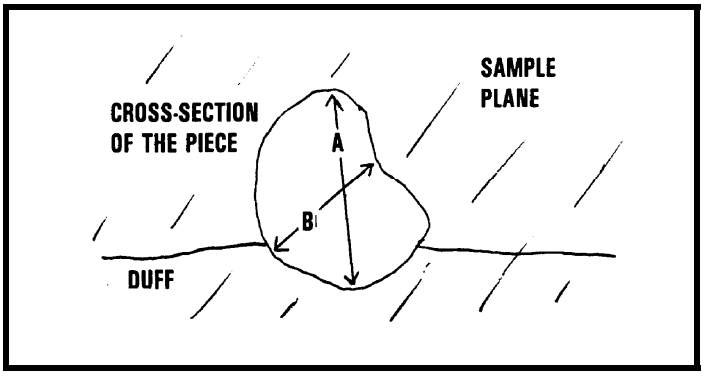


Figure 7 – Estimating the diameter of pieces that are not round in cross-section.

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 8). However, record the large-end and small-end diameters according to the established rules (i.e., at the points where they best represent 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.

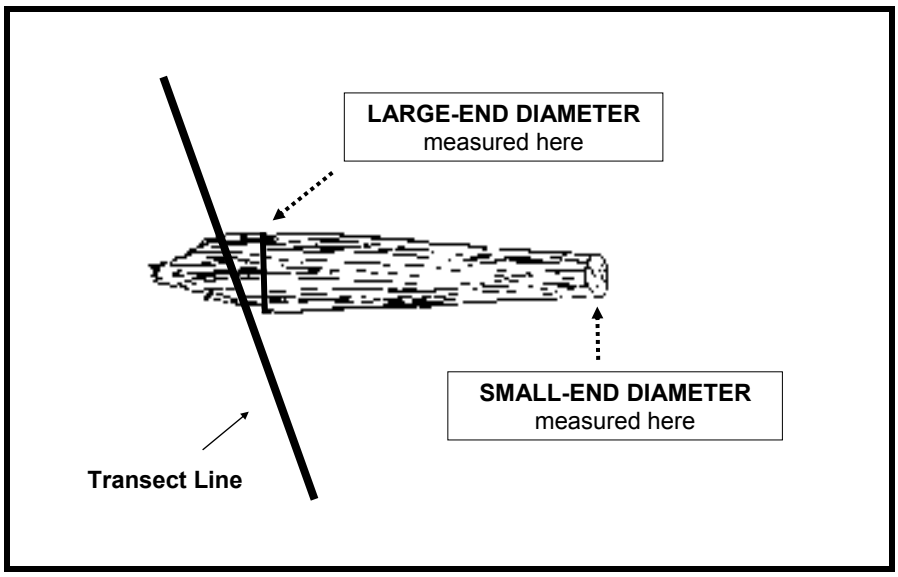


Figure 8 – Example of decayed end intersecting the transect.

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

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 (also see figure 6).

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

7.13 Diameter Small End (3,1 digit; xxx.y) *Required*

For each CWD piece tallied, record the diameter of the piece's small end (small-end diameter). Record the small-end diameter to the nearest inch. The small-end diameter will occur at: (1) the actual end of the piece, if the end has a diameter greater than 3.0 inches, or (2) the point where the piece tapers down to 3.0 inches in diameter. If the end is splintered or decomposing (sloughing off), measure the 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 (also see figure 6).

- **Tolerance (Diameter – Small End):**
  - Pieces < 20.0 in diameter: ± 2 in
  - Pieces > 20.0 in diameter: ± 10 percent

APPENDICES:

A	**Data Collection Forms:** **A1: Setting and Plot Location Reference Form (Supplemental)** **A2: Plot Location Photo Placard** **A3: Plot and Tree Data Form** **A4: Vegetation Composition Form** **A5: Ground Surface Cover Transects Form (Supplemental)** **A6: Down-Woody Materials Form**
B	**GPS Operating Instructions for Garmin 76s**
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**
G	**Recommended Field Gear**
H	**Creating an Exams Software Intensification Template File**

Appendix A: Data Collection Forms

The forms that are labeled "Supplemental" will need to be completed for each plot location (refer to section 2, Plot Location Reference Items, and section 6, Ground Surface Cover Transects Data). The Plot Location Photo Placard form is to serve as a display in plot location photography; refer to Photographing the Plot Location (section 1.10) 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: Setting and Plot Location Reference Form (Supplemental)
** always record Plot Location Reference Items on the paper form*

A2: Plot Location Photo Placard

A3: Plot and Tree Data Form

A4: Vegetation Composition Form

A5: Ground Surface Cover Transects Form (Supplemental)
** always record Ground Surface Cover Transects Data on the paper form*

A6: Down-Woody Materials Form

Appendix A1: Setting and Plot Location Reference Form

Side 1 of Setting and Plot Location Reference Form:

SUPPLEMENTAL

SETTING AND PLOT LOCATION REFERENCE FORM

PROJECT NAME: (25 character) GRID INT _

Region XX	Proc. Forest XX	District XX	Location (4-character)		Plot # XXXX	Owner XXXX	State XX	County XXX	Admin. Forest XX	Date MM/DD/YYYY
01	_ _	_ _	_ _ _ _		_ _ _ _	USFS	_ _	_ _ _	_ _	_ _/_ _/_ _ _ _
Exam Level XXXX	**Exam Purpose XX**	**Potential Veg. Ref XXX**	**Capable Growing XXX**	**Elev. XXXXX**	**Acres**	**Radial Growth Interval**	**Height Growth Interval**	**Damage Category XX**	**Damage Agent XXX**	**Damage Severity XX**
3421	FI	_ _ _	_ _ _	_ _ _ _ _	1	10	5	_ _	_ _ _	_ _

Precision Protocol
XXX
CSE

Examiner (12-character) _ _ _ _ _ _ _ _ _ _ _ _

Reference Point Description (242-characters): _____

Referenc Point: Species: _____ Diamerter: _____

RP to PC Traverse Info: Azimuth: _____ Horizontal Distance: _____ Slope Distance: _____

RP Coordinates:
Zone: _____ Easting: _____ Northing: _____
Error: _____ #Hits: _____

PC Coordinates:
Zone: _____ Easting: _____ Northing: _____
Error: _____ #Hits: _____
OFFSET (if any) – Azimuth: _____ Slope Dist: _____

PC Witness Tress

X-Tree (Tree #_____)
Species: _____
Diameter: _____
Azimuth : _____
Slope Distance: _____

Y-Tree (Tree #_____)
Species: _____
Diameter: _____
Azimuth: _____
Slope Distance: _____

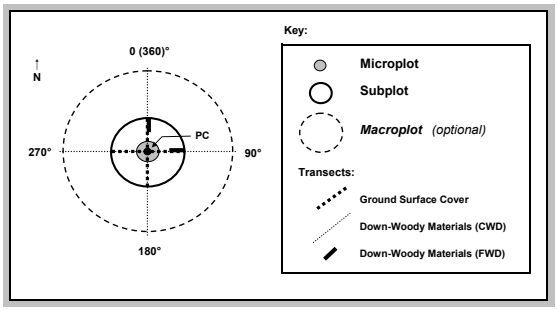
PLOT LOCATION MAP :
(Vehicle to RP and PC. Use Back of sheet if necessary)
North

Stand Narrative/Remarks

R1 Intensification - 05/2006

Side 2 of Setting and Plot Location Reference Form:

Plot Layout Map:



Sample Plot Area	Plot Radius (horizontal distance)	Sample Items:
Subplot	24.0 feet	▪ Trees: ≥ 5.0-inches DBH/DRC *(or 5.0- to 20.9-inches for Macroplot option)* ▪ Vegetation Composition
Microplot	6.8 feet	▪ Trees: 1.0- to 4.9-inches DBH/DRC ▪ Seedling counts
Macroplot (optional)	*58.9 feet*	▪ *Trees: ≥ 21.0-inches DBH/DRC*

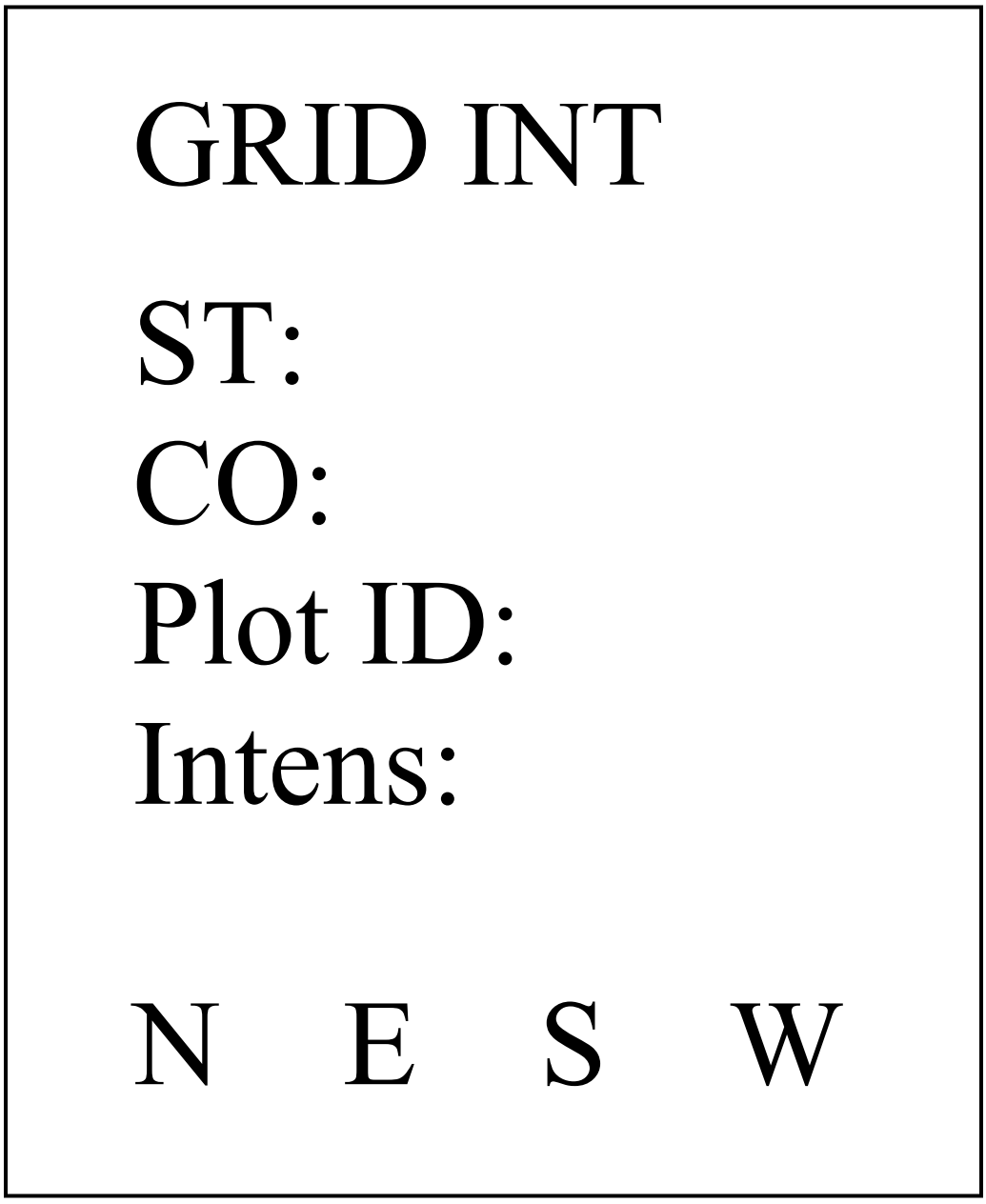
Transects:	Length:
Ground Surface Cover	four 25-ft transects, slope distance *(at 0, 90, 180, and 270 degrees)*
Down-Woody Materials:	
Coarse-Woody Debris (CWD)	two 60-ft transects, horizontal distance *(0 and 180 degrees for even-numbered plots; 90 and 270 degrees for odd-numbered plots)*
Fine-Woody Debris (FWD)	6- to 10-foot subsection, horz. distance *(between 14- and 24-feet on north or east transect)*

Truck Coordinates:
Zone: _____ **Easting:** _____ **Northing:** _____ **Error:** _____

Travel Description: _____

Appendix A2: Plot Location Photo Placard

The Plot Location Photo Placard form is to serve as a display in plot location photography; refer to Photographing the Plot Location (section 1.10) for instructions.



Appendix A3: Plot and Tree Data Form

PLOT AND TREE DATA FORM

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

Capable Growing Area: _____ **Aspect:** _____ **Slope Percent:** _____

Tree Measurement: **page __1__ of _____**

Tag ID	Status (L/D)	Tree Class	Site / GST	Species	Tree Count	# of Stems	DBH/ DRC	Height	Radial Growth	Height Growth	Age	Crown Ratio	Crown Class	Snag Decay	Damage 1			Damage 2			Damage 3			Tree Remarks: Horiz. Dist, Azimuth & Multistem DRC
															Category	Agent	Severity	Category	Agent	Severity	Category	Agent	Severity	
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	hdxxx - azxxx - drcxxx.x

Appendix A4: Vegetation Composition Form

VEGETATION COMPOSITION FORM

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

Cover by Lifeform:

1. Calculate total canopy cover by each lifeform based on a vertical projection of that lifeform i.e.; Trees (TOT), Shrubs (TOS), Forbs (TOF), Graminoids (TOG).
2. Calculate total canopy coverage of all live vegetation within 1/24th-acre subplot. This equals the Total Vegetation (TV) based on the area of the ground covered by a vertical projection of all live vegetation based on above lifeforms.
3. Calculate canopy cover by layer for trees (TOV, TSA) and shrubs (ST, SM, SL) based on height requirements. It might be easier to break out by species to determine the total canopy by layer on Form 3 first, to determine cover by species. Use Appendix H of CSE manual for plant list.

Lifeform	Layer	Code	Attribute	Canopy Cover % (CVR %)
	All	**TV**	Total of All Vegetation	
Trees	**All**	**TOT**	Total Tree	
	> 6.0 ft	**TOV**	Total Tree (> 6.0 ft)	
	≤ 6.0 ft	**TSA**	Total Tree (≤ 6.0 ft)	
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 ≥ 5%, its lifeform, and record in remarks the layer that best represents where most of the cover tops out (based on ground cover, not biomass).
2. Record all invasive species present in the 1/24th-acre subplot regardless of the amount.
3. A circle 5.4 feet in radius, or a 9.5 ft x 9.5 ft square, represents 5% (approx. 90 square ft) 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)

R1 Intensification – 01/2006

Appendix A5: Ground Surface Cover Transects Form

SUPPLEMENTAL

GROUND SURFACE COVER TRANSECTS FORM

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

Step 1: Cover type at hit mark

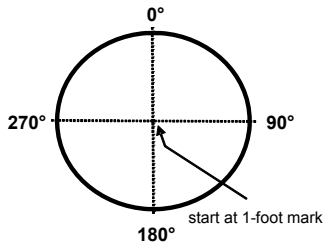
Hit Mark	0°	90°	180°	270°
	Cover Types			
1 ft				
2 ft				
3 ft				
4 ft				
5 ft				
6 ft				
7 ft				
8 ft				
9 ft				
10 ft				
11 ft				
12 ft				
13 ft				
14 ft				
15 ft				
16 ft				
17 ft				
18 ft				
19 ft				
20 ft				
21 ft				
22 ft				
23 ft				
24 ft				
25 ft				

Step 2: Sum by transect **Step 3: Sum for plot**

Cover Types	Transects				GROUND SURFACE COVER PERCENT (Cover %)
	0°	90°	180°	270°	Sum of Hits
ASH					
BAVE					
BARE					
CRYP					
DEVP					
LICH					
LITT					
MOSS					
PEIS					
ROAD					
ROCK					
TRIS					
UNKN					
WATE					
WOOD					
TOTAL					
should be:	25	25	25	25	100%

Notes: _____

Procedure: Lay out four transects (25.0-ft slope distance) from subplot center at 0, 90, 180, and 270 degrees. Start "hits" at the 1-foot mark (for a total of 25 hits per transect, and 100 hits per plot). **STEP 1:** From plot center, facing the plot perimeter, measure hits to the right side of the transect tape. Use the left columns to record the cover type encountered at the specified mark for the transect. **STEP 2:** For each transect direction, determine total hits by category and record count under the "Transects" columns. **STEP 3:** For each cover type category, determine the total number of hits across all transects and record under the "Sum of Hits" column. Because the total number of hits for all categories is 100, the GROUND SURFACE COVER PERCENT for a category is equal to the "Sum of Hits" for the category. Enter the total GROUND SURFACE COVER PERCENT by cover type category in the PDR. For definitions of individual cover types, refer to Field Guide. **Note:** If any portion of a transect cannot be sampled, refer to Field Guide for "GROUND SURFACE COVER PERCENT adjustment" procedures.



R1 Intensification - 05/2006

Appendix A6: 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	SECOND
		1-Hour	10-Hour	100-Hour		DUFF	DUFF
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 '	Small End (in.) xxx.x "	Large End (in.) xxx.x "
Notes:						

R1 Intensification – 05/2006

Appendix B: GPS Operating Instructions for Garmin 76s

Use the instructions below for setting up and operating the Garmin GPSMAP 76S GPS receiver. Before verifying the initial settings and navigating with the unit, become familiar with installing batteries, the function of each key/rocker, and using/connecting the external antenna and power source by reading the owner's manual and quick start guide.

The purpose of this appendix is not to rewrite the owner's manual, but to document the initial settings and enable crews to collect the necessary data for plot establishment. Please refer to section 1.7, Finding the Plot Center (GPS Method), and section 2, Plot Location Reference Items, for more details on data to be collected for the R1 Intensified Grid Inventory.

A. Verify Garmin Settings.

The proper initial settings are necessary for positioning and navigational accuracy and once selected, become the default values each time the GPS is turned on.

With fresh batteries, turn the unit on, and once the WARNING screen appears, press the **PAGE** key. The unit now starts "Acquiring Satellites" and will display the satellite strength signals, date, time, and UTM coordinates.

Press **MENU** twice to navigate to the Main Menu
Toggle down using the rocker pad to "Setup" and press **ENTER**

At the top of this screen there are 8 "tabs" that can be navigated through using the rocker pad. Verify the GPS settings using the information below:

With the "General" tab highlighted:
- Mode = Normal
- WAAS = Enabled
- Backlight Timeout = 15 seconds
- Beeper = On or Off (user preference)
- Language = English

With the "Altimeter" tab highlighted:
- Altimeter Auto Cal. = On
- Altimeter = On
- Pressure Units = Millibars
- Barometer Mode = Variable Elevation

With the "Compass" tab highlighted:
- Compass = On
- Use GPS if Speed is Above = 10 mph
- Use Compass if Below 10 mph for at least = 1 ½ minutes

With the “Time” tab highlighted:
Time Format = 12 Hour
Time Zone = Mountain (Pacific in N. Idaho)
Daylight Savings Time = Auto
Current Date = (Correct Current Date)
Current Time = (Correct Current Time)

With the “Units” tab highlighted:
Elevation = Feet
Vertical Speed = ft/min
Distance and Speed = Statute
Depth = Feet
Temperature = Fahrenheit
Direction Display = Numeric Degrees
Speed Filter = Auto

With the “Location” tab highlighted:
Location Format = UTM UPS
Map Datum = NAD83 CONUS
North Reference = Magnetic
Magnetic Variation = Automatically changes with new location.

With the “Alarms” tab highlighted:
Anchor Drag = Off
Approach and Arrival = Auto
Off Course = Off
Shallow Water = Off
Deep Water = Off

With the “Interface” tab highlighted:
Serial Data Format = Garmin

Once all the settings have been verified, the GPS unit can be used for plot navigation and data collection.

B. Data Collection.

1. Obtaining an Averaged Location.

Use the following steps to collect "averaged UTM coordinates" (count of 180 or better) at the truck parking spot, the Reference Point (RP), and the Plot Center (PC).

- With the unit on, press and hold the **ENTER/MARK** key for 2 seconds until the Mark Waypoint screen appears.
- Press the MENU key. A separate screen appears with Average Location highlighted.
- Press ENTER. The Average Location screen appears (and, if there is good satellite reception, the Measurement Count will start).
- Obtain the averaged UTM coordinates (after the count reaches 180), and record the coordinate information on the Setting and Plot Location Reference Items Form.
- *Repeat the above process at the truck parking spot, the RP, and the PC.*

2. Using Waypoints.

A **Waypoint** is a specific location entered in the GPS unit for future reference. Examples of potential Waypoints include the location of the truck, a trailhead, a critical junction on a travel route to the plot, the reference tree, or the plot center location. There are three ways to enter Waypoints into the Garmin: by uploading the waypoints from a laptop computer using the Map Source software (not described below), by using the **MARK** key, or by manual input of the UTM coordinates.

Instructions for using the **MARK** key and manual input of the coordinates for establishing a waypoint are as follows:

a. Using the MARK key:

- Stand at a desired waypoint (e.g., RP, trail intersection, prominent landmark, or important navigational aid), and then press and hold the **MARK** key until the Mark Waypoint screen appears.
- If the GPS unit is receiving satellite reception, the UTM coordinates will be shown in the Location block.
- After the unit has established reception, change the name of the waypoint (using the rocker) as desired.
- Save the waypoint by highlighting OK and press **ENTER.**
- After a waypoint has been saved, it can be used for navigational purposes in the future.

b. Manually entering Waypoints:

- From the "Map Page," press and hold the **ENTER/MARK** key until the Mark Waypoint screen appears.
- Use the rocker until the Location (UTMs) is highlighted, press **ENTER**, and change the coordinates as needed.
- Once the coordinates are correctly entered, use the rocker to highlight the name of the waypoint and change as desired.
- Save the waypoint by scrolling down until "OK" or "Go To" is highlighted and press **ENTER.**

3. Acquiring RP to PC distance and azimuth:

Acquire the distance and azimuth from the RP to PC using the "**Routes"** function as described below:

- *Prior to using the "Routes" function, the waypoints for the RP and PC must already be saved in the GPS unit (see "Using Waypoints" above).*
- *For best accuracy, use the average function (as described in "Obtaining an Averaged Location" above) to aquire RP coordinates. Once 180 "hits" have been obtained, save and label that waypoint as "RP" or something to designate it as the RP.*
- From the "Map Page" (or any page after turning the unit on), press the **MENU** key twice.
- The Main Menu will appear. Use the rocker and scroll down to "Routes" and press the **ENTER** key.
- The "Routes" screen now appears. With "New" hightlighted, press **ENTER**.
- A new "Route" screen appears. Use the rocker to select the empty field below Waypoint, and press the **ENTER** key.
- A separate "Points" screen appears. Highlight and select "Waypoints."
- The "Nearest Waypoints" screen appears. Select "RP" (or, if applicable, other waypoint name chosen to represent the RP).
- The Waypoint screen appears with the "OK" tab highlighted. Press **ENTER**.
- The "Route" screen appears again. Toggle down to the empty field below the RP waypoint name, and press **ENTER**.
- Select "Waypoints" again (as above).
- Select the PC waypoint (as above).
- Select the OK tab (as above).
    - The "Route" screen should now say RP-PC. The GPS unit can now calculate the distance and azimuth between the two waypoints selected.
- Toggle down to PC and then toggle to the right to switch between Distance (in ft. or miles) and Course (in degrees). To do this, keep toggling to the right to switch fields.

4. Using Waypoints for Navigation.

After a waypoint has been named and stored, it can later be used for navigational purposes using the following steps:

- From the “Map Page,” press the **NAV** key.
- A small screen appears - highlight “Go To Point” and press **ENTER**.
- The “Points” screen appears – select “Waypoints.”
- The “Waypoints by Name” screen appears - use the rocker to scroll through the list until the desired waypoint is selected and press **ENTER**.
- The “Waypoint” screen is now shown - select “Go To.”
- This opens the “Map Page” again. From this point, it is possible to navigate to other locations using the “Bearing” and “Distance to Next” features.

5. Improving Satellite Reception.

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

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.

A. Establishing a Baseline and Scale

Establish a baseline and scale using either (1) the ground/photo method, or (2) the map/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)

2. Map/Photo Method.

a. Select Landmarks. Select two baseline points that are easily identifiable on both the topographic map labeled with the plot location center (PC) and on the aerial photo with the PC location marked. The points must be located stereoscopically on the photo.

Note: Vegetation lines on the topographic maps are often not accurate, so select points such as road and stream intersections. Mountain tops may be used, but it is extremely important that the topo is identifiable by stereoscopic viewing. Label the points as "A" and "B" on the map, and draw a straight line between these points on the map.

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

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

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

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

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

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

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

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

Examples of computation for both situations:

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

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

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

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

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

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

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

   Baseline PSR = (Baseline Map Distance (ft)) X (Map Scale Reciprocal) /(Baseline Photo Distance)

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

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

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

   Baseline PSR = (0.0153 ft × 24,000) / (0.0082) = 44,780

B. Selecting a Reference Point

Once the baseline azimuth and scale have been determined (ground/photo or map/photo method), designate a reference point (RP) readily identifiable on both the ground and the photograph. Refer to RP selection criteria in section 1, 1.7, 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
		PSR	Ground Distance
		PSR Adjustment	PSR Adjustment

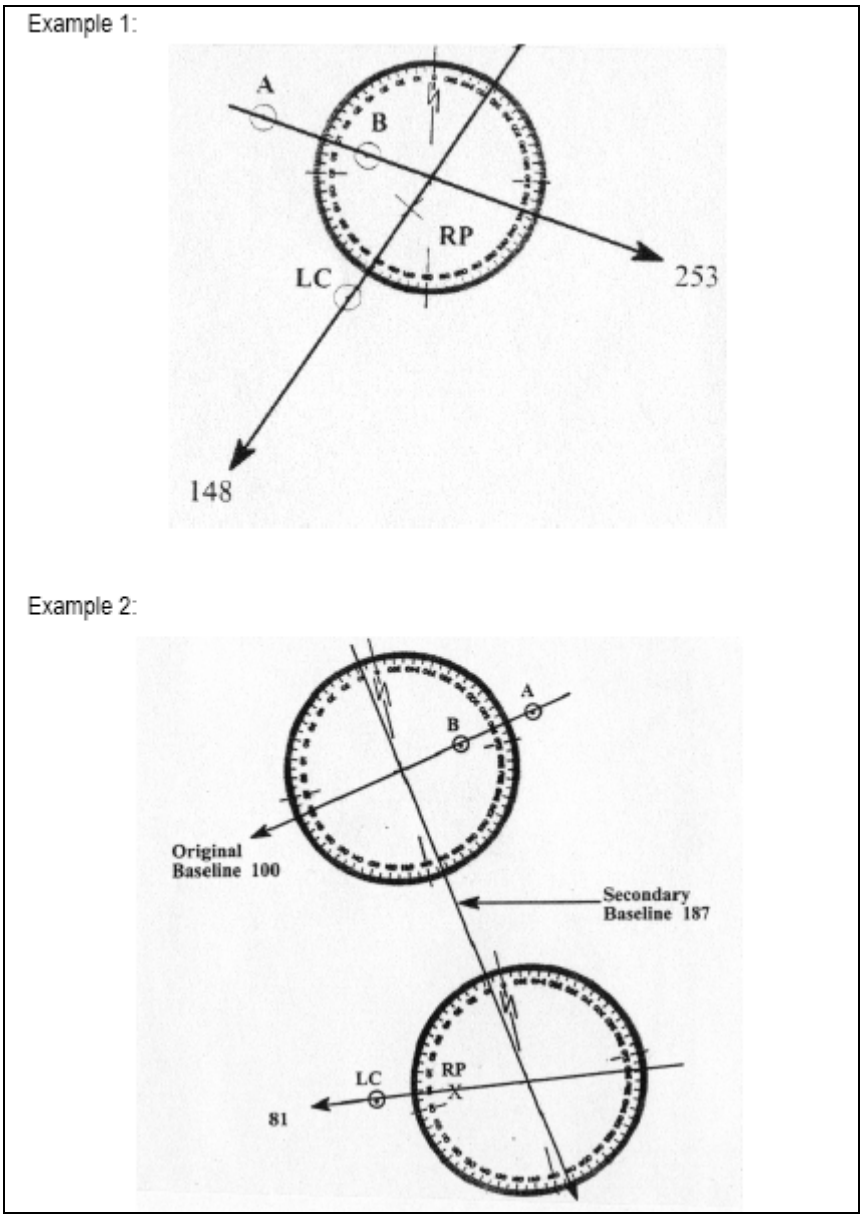


Figure C.1 – Example for two methods of determining azimuth from RP to PC.

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 100 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 and 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
2.21	Setting Capable Growing Area: Forest Land Area	± 25 percent
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 and 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 100 feet from the PC, unless extenuating circumstances apply
RP to Plot Center (PC) Traverse:	
RP to PC Azimuth	± 2 degrees
RP to PC Distance	± 6 feet per 100 feet of transect (30 feet maximum)
PC and RP Coordinates:	
Zone	No Errors
Easting and Northing	± 15 meters (32.8 feet) of the stated plot location center
Error	< 70 feet
Number of Hits	≥ 180
PC Witness Trees:	
Species	No Errors
Diameter	± 0.2 inch per 20 inches of diameter
Azimuth	± 2 degrees
Slope Distance	± 0.2 feet

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
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
4.3	Plot Capable Grow Area Percent	± 25 percent
4.4	Plot Aspect	± 45 degrees
4.5	Plot Slope	± 10 percent
4.11	Plot Potential Vegetation	Accurate to series, understory union, and Forest/District or contract specified phases

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
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 < ht. class ≤ 4.0 feet / ± 1 tree 6+ / 0.1- to 0.9-in * / 0.5 < ht. class ≤ 4.0 feet / ± 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

Tree Data Form (continued):

CSE Item No.	Field Name	Tolerance
5.15	Tree Age	trees < 300 years old: ± 10 percent trees ≥ 300 years old: ± 15 percent
5.16	Crown Ratio	± 10 percent
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
	• Horizontal Distance	Microplot: ± 0.2 foot Subplot: ± 1.0 foot from 0-22.9 feet, ± 0.1 foot for > 23.0 feet Macroplot: ± 3.0 feet
	• Azimuth	± 10 degrees
	• 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

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
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

Damage Category – continued (CSE item 5.22):

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 and Ground Surface Cover Transects Forms:

Vegetation Composition:

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

Ground Surface Cover Transects:

Item	Tolerance
Transect Azimuth	± 2 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		± 2 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%
7.13	Diameter Small 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 5.9 DBH/DRC.

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

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

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
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

Appendix F: Plot Packet Contents

- **Plot Packet Envelop:** Place all "plot packet contents" in an envelop 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 envelop, attach a label that includes the following information:

  - Project Name
  - State, County, Location
  - Township, Range, Section
  - Plot Location coordinates (UTM)
  - Proclaimed Region, Administrative Forest, District

- **Plot Packet Contents:** Each plot packet envelop must contain the following items:

  1. **Topographical Map.** Each plot packet must have a topographic map (Topo Map) that identifies the exact location of the plot center (indicated by the UTM coordinate grid intersection). Using the UTM coordinates provided, accurately mark the plot location center in the following manner:

     - **Northing Line** – Find the specified northing coordinate on the East side and the West side of the map (the same coordinate number on each side of the map). Draw a straight line connecting the two points.
     - **Easting Line** – Find the specified easting coordinate on the North end and the South end of the map (the same coordinate number at the top and bottom of the map). Draw a straight line connecting the two points.

  2. **Aerial Photos or a DOQ** (digital Ortho-quad)**.** Each plot packet must also contain a current aerial photograph or DOQ that displays the plot location area (preferably two aerial photos that allow for stereoscopic viewing). The plot location center (PC) should be pinpricked on the aerial photo/DOQ.

  3. **Data Collection Forms** (paper form size: 8.5 in x 11 in). Each plot packet must contain the following "paper" forms (refer to appendix A).

     - Setting and Plot Location Reference Form (Supplemental)
     - Plot Location Photo Placard (required if taking photos)
     - Plot and Tree Data Form
     - Vegetation Composition Form
     - Ground Surface Cover Transects Form (Supplemental)
     - Down-Woody Materials Form

The forms that are labeled “Supplemental” will need to be completed for each plot location (refer to section 2, Plot Location Reference Items, and section 6, Ground Surface Cover Transects Data). The Plot Location Photo Placard form is to serve as a display in plot location photography; refer to Photographing the Plot Location (section 1.10) 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).

4. **Data Report.** After all data have been collected and edited using the Exams software, insert a completed data report into the plot packet envelop. Refer to contract specifications for data report 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.

- **Backpack** – with a comfortable fit; sturdy enough to carry 35-50 lbs of field gear.
- **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)*.
- **RP tags** *(to mark Reference Point – racetrack style tags are preferred)*
- **Witness Tree tags** *(aluminum tags for X witness trees – racetrack style tags are preferred)*
- **PC metal stakes** *(to mark plot location centers)*
- **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** – 6 in, 12 in, 16 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
- **GPS unit** – capable of field averaging, and navigation; including a distance or route function, with a stated accuracy of ± 15 meters (49.2 feet) in the horizontal dimension, and digital compass accuracy of ± 5 degrees (example: Garmin GPSMAP 76s w/ WAAS capability)

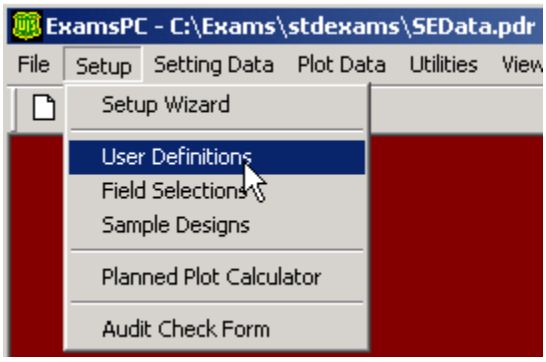
- **Ruler** – with 1/10-inch and 1/20-inch scale *(for measuring radial growth and duff/litter)*
- **Flagging** – one type with a solid color, and another type with a pattern: such as orange flagging and blue/white striped flagging.
- **Calculator** – with the following function keys: MRC, M-, M+, and square root *(highly recommended for calculating DRCs on woodland species)*
- **"Write in the rain" notepad**
- **Digital camera** *(if required for photographing plot)*
- **Black felt tip marker** for photo placard
- **Plant Identification books** *(to aid in vegetation composition sample – tree, forb, shrub, and graminoid identification)*
- **Popsicle sticks** *(to mark ends of transect lines)*
- **Bear Pepper Spray**
- **First Aid Kit**
- **Communication devices** (radio, satellite phone, cell phone)
- **Rain gear**
- **Hard Hat**
- **Water Bottle**

Appendix H: Editing an Intensification Template File

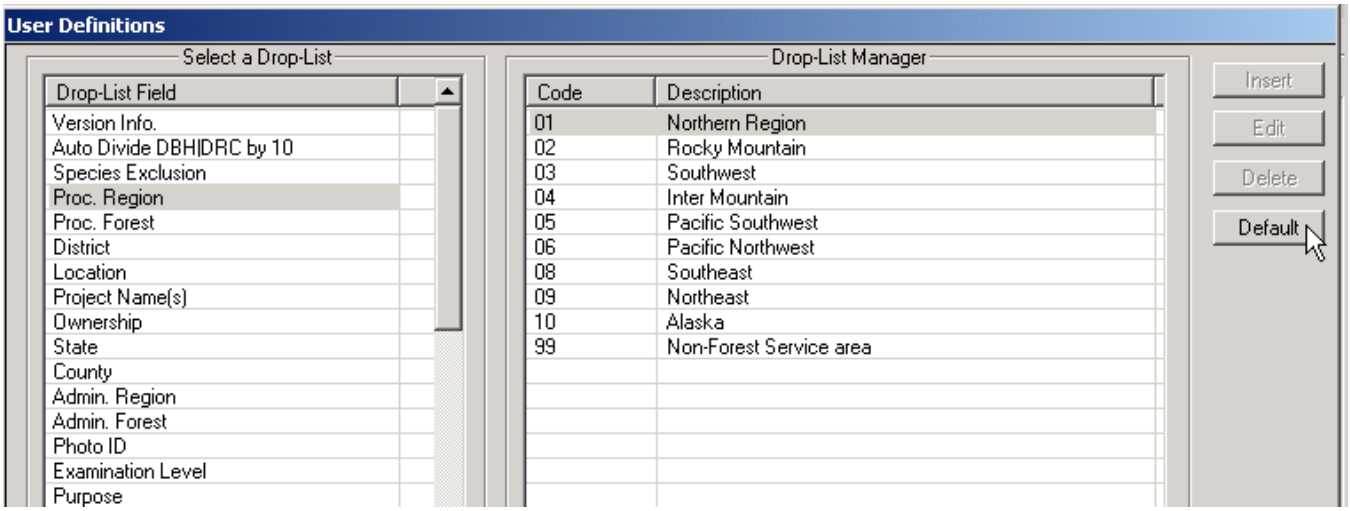
This appendix provides instruction on editing an existing Intensification Exams software template file that is applicable to the R1 Intensified Grid Inventory. To obtain an Intensification template file, go to http://fsweb.r1.fs.fed.us/forest/inv/index.htm. The template file contains the defaults and 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.



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



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

Tree | Veg. Composition | Ground Surface Cover | Down Woody Material

Meth	ExpFac	Azm	Cond	SubFltr	Var	MinV	MaxV	Remarks
FRQ	4.00		--	ALL	DBH	21.00	999.99	58.9 foot radius macroplot
			OR	ALL	DRC	21.00	999.99	
FRQ	24.07		--	ALL	DBH	5.00	20.90	24.0 foot radius subplot
			OR	ALL	DRC	5.00	20.90	

Index

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