Region One
Vegetation Classification, Mapping, Inventory and Analysis Report

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

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Region 1 Intensified Grid Field Procedures Using Inventory and Monitoring Protocols

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FIGURES AND TABLE

Introduction

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

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

Section 1, Data Collection Overview, has been divided into the following subsections: (A) General Information, (B) Finding Plot Center and Plot Monumentation, (C) Selecting Witness Trees and Witness Tree/Navigation Form (D) Plot Layout, and (E) Photographing the Plot. The remaining sections in this manual (Sections 2 through 7) directly correspond *R1 CSE/IM Field Guide* sections in the current manual. For example, Section 2 relates to the Setting Form in both manuals. The only exception to this is found in Section 1.C.1.3 Witness Tree Data Items, which are found in Section R1-G in the R1 CSE/IM Field Guide Supplemental Appendices.

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

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

Section 1: Data Collection Overview

Remeasurement information has been highlighted throughout this document

1.A. General Information

1.A.1 Data Collection

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

All data collected for the R1 Intensified Grid Inventory is recorded on a portable data recorder (PDR) using Exams software. The Region 1 Analysis Team only provides support for Juniper Systems Allegros. Paper data forms may be used to record field data in the event of PDR malfunction at the time of data collection, (refer to Appendix A). If

paper forms are utilized for data collection due to PDR malfunction, the data collected on the forms will be entered into the PDR when repaired, or may be directly entered into ExamsPC software on a computer. As an exception, *always* complete the **Plot Location Reference Form** (Appendix A1; also refer to Section 1.B) on paper; this form is labeled "Supplemental" in the upper right corner of the form.

The Forest may also specify additional attributes to collect. See Appendix K for the R1 Lynx Horizontal Cover Protocol.

Exams software: Prior to data collection, ensure that the most current version of Exams software, for the appropriate model of PDR and the PC, is downloaded. Each field crew will be provided with an intensification template file with intensified grid parameters set. This file includes the sample design and all valid lookup codes for discrete attributes. The default values, referenced in this manual, require no additional keystrokes for data entry using the Exams software.

> Remeasurement Prior Measurement Data: Field crews will be provided an intensification data file with information from the previous measurement included in the Witness, Setting, Plot, and Tree form. See Table 1.3 – Witness Tree Reference Attributes, Table 2.1 – Setting Data Form Required Attributes, Table 4.1 – Plot Form Required Attributes, Table 5.2 – Required Attributes for the R1 Intensified Grid Inventory Tree Data Form for detailed information. Not all attributes from the previous measurement are included. Data reports containing all pertinent information from the last measurement and plot relocation information will be supplied prior to field work in either hard copy or electronic form. Additional paper forms and information may be included as per contract or forest inventory contact specifies.

Websites:

Exams software is available at -

- FS employees: http://fsweb.nrm.fs.fed.us/support/docs.php?appname=fsveg
- Contractors: http://www.fs.fed.us/nrm/fsveg/

R1 FSVeg Plant List (species codes) is available at –

- FS employees at: http://fsweb.r1.fs.fed.us/forest/inv/fia_data/int_grid.htm
- Contractors: electronic copies are available from your forest contact

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

1.A.1.2 GPS Requirements

Use a GPS receiver that has the ability to be WAAS enabled and obtain the stated accuracy of ± 15 meters (49.2 feet) or less in the horizontal dimension. The latitude and longitude coordinates acquired by the GPS for the PC must be ± 10 meters (32.8 feet) of the stated plot location center. In latitude and longitude, this equates to roughly 3/10 of one second. The GPS must be capable of using waypoints and must have a route or distance function for navigation.

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

1.A.2 Quality Control

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

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

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

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

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

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

1.A.3 Situation Prohibiting Data Collection

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

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

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

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

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

1.A.4 Order of Data Collection

The suggested order of data collection is as follows:

- Plot Location Reference Form items
- Take photo (if required) while collecting GPS point data
- Vegetation Composition
- Ground Surface Cover
- Down-Woody Material data and Crown Cover information
- Tree data

1.B Finding the Plot Center and Plot Monumentation

1.B.1 Travel Description

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

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

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

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

- Trail name/number – if applicable
- Name of drainage/creek/ridge – if applicable
- Major landmarks
- Approximate distances on and between trails, creeks, landmarks, etc.
- Distance and azimuth from trail to plot center

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

The travel directions must be added to the electronic Exams data file in **Plot Data<Witness Tree/Navigation Information,** it may be easier to enter this information into ExamsPC once the data file has been moved to the PC and opened in ExamsPC.

- ❖ Tolerance (Travel Description):
  Both Route *and* Hiking directions must be present with all applicable bulleted information listed in Section 1.B.1. Travel descriptions missing required applicable bulleted elements will not receive credit for meeting tolerance standards.

1.B.2 Vehicle Coordinates

Record GPS coordinates to indicate the vehicle parking location.

1.B.2.1 Latitude

Record the latitude for the vehicle parking location on the **Plot Location Reference Form**. Record as an 8-digit code comprising the following values and in the following order: a 2-digit "degree" value, a 2-digit "minute" value, a 2-digit "seconds" value, and a 2-digit "hundredths of a second" value.

1.B.2.2 Longitude

Record the longitude for the vehicle parking location on the **Plot Location Reference Form**. Record as an 8-digit code comprising the following values and in the following order: a 2-digit "degree" value, a 2-digit "minute" value, a 2-digit "seconds" value, and a 2-digit "hundredths of a second" value.

Remeasurement: Complete a new Plot Location Reference Form at each remeasurement, updating fields as necessary. Do not overwrite values on the form from the previous measurement that is provided.

The map should include landmarks that will help future crews park, hike to and locate the plot center. Re-transcribe all travel and parking location information, if the supplied information is incorrect or incomplete then update the information.

1.B.3 Reference Point

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

Choose a RP that is readily identifiable on both the ground and the aerial photograph/DOQ (digital ortho-quad). Select a landmark such as a prominent tree or large boulder, a sharp bend in a road, a fence corner, etc. If a tree (preferred) is designated for the RP, select a tree that is not likely to die or be removed within the next 10-15 years. If possible, choose 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.

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

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

Tag the RP as follows:

Nail aluminum tags with aluminum nails on two sides of the tree approximately 6 feet above ground level, and with at least 1 inch of nail exposed (to allow for tree growth between inventories). Nail one of the tags facing in the general route of approach to the RP when following the travel directions and nail a second tag 6 feet above ground on the opposite side of the tree. Nail a third tag at ground level facing towards PC. If the RP is in a place where there is a high probability that a tag at 6 feet above the ground may be observed and subsequently vandalized (such as highly visible from a designated trail), only attach the tag at ground level and make a note on the paper Plot Location Reference Form in the RP box in the Remarks field (1.B.4.3) (Appendix A1). If no tree is available, mark rocks or other objects with a paint pen or however possible and record in the Remarks field (1.B.4.3). If RP is an aspen, do not tag, be sure it is only marked with a paint pen. Avoid aspen, if possible.

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

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

1.B.3.1 Remarks

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

1.B.3.2 Reference Point Species

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

- Tolerance (RP):
  Species: No Errors

1.B.3.3 Reference Point Diameter

Record DBH to the nearest 0.1 inch

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

1.B.3.4 Reference Point Coordinates

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

1.B.3.4.1 Latitude

Record the latitude for the RP as measured by a GPS. Record an 8-digit value comprised of: 2-digit "degree", 2-digit "minute", 2-digit "seconds" value, and a 2-digit "hundredths of a second".

- Tolerance (RP):
  (10 meters or 32.8 feet)

One second latitude equals approximately 100 feet horizontal distance on the ground, 1/10" ≈ 10 feet, and 1/100" ≈ 1 foot. The tolerance is approximated by 3.3 tenths of a second.

1.B.3.4.2 Longitude

Record the longitude for the RP as measured by a GPS. Record an 9-digit value comprised of: 3-digit "degree", 2-digit "minute", 2-digit "seconds" value, and a 2-digit "hundredths of a second".

- Tolerance (RP):
  (10 meters or 32.8 feet)

One second longitude equals approximately 70 feet horizontal distance. The tolerance is approximated by or 4.7 tenths of a second.

1.B.3.4.3 Error (Hits)

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

- Tolerance (RP):
  < 70 feet

Remeasurement Reference Point:
Re-monument when the RP tags cannot be found, when the old tags have been damaged, or if the RP has grown such that less than 1" of nail is exposed between the bark and tag. When pulling nails, it often helps to pound them in slightly prior to pulling to break the nail free of the tree's sap. When replacing a RP tag, remove the old tag before nailing in the new tag. Remeasure the RP Diameter. Recollect all RP GPS information. If RP is no longer viable, establish a new RP using installation protocols and collect all required data.

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

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

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

*Note: GPS distances will be in horizontal distance; be sure to compensate for slope when navigating to PC.

When necessary, plot the location of the PC on topographic maps and/or aerial photography prior to locating the PC on the ground. Record RP to PC traverse information (azimuth and slope distance) on the **Plot Location Reference Form,** Appendix A1, during initial installation.

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

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

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

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

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

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

Record the following to indicate the location of the PC:

1.B.5.1 Latitude

See section **4.2.1 Latitude** on the Plot Form for more information on this attribute. Record the value collected on the paper Plot Location Reference Form.

- Tolerance (RP):
  ± 10 meters (32.8 feet) of the stated plot location center

One second latitude equals approximately 100 feet horizontal distance on the ground, 1/10" ≈ 10 feet and 1/100" ≈ 1 foot. The tolerance is approximated by 3.3 tenths of a second.

1.B.5.2 Longitude

See section **4.2.2 Longitude** on the Plot Form for more information on this attribute. Record the value collected on the paper Plot Location Reference Form.

- Tolerance (RP):
  ± 10 meters (32.8 feet) of the stated plot location center

One second longitude equals approximately 70 feet horizontal distance. The tolerance is approximated by or 4.7 tenths of a second.

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

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

- Tolerance (PC):
  < 70 feet

Remeasurement Finding Plot Center:

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

Review the Plot Location Reference Form included in the plot packet. Review the travel descriptions prior to traveling to the plot. Once the vehicle is parked, collect a GPS location for the truck, store it on the GPS unit, and record on the Plot Location Reference Form for the current measurement. Use the map, photos, crew notes and the PC/RP information to help relocate the plot.

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

Once the crew arrives in the vicinity of the plot, based on the GPS reading, they should look for the witness trees (X and Y). The crew should also look for old flagging, plot stakes, and nails in trees at 4.5' (DBH). The X tree will be marked with a silver tag with the letter "X" scribed on it above DBH facing the plot center. When possible, the X tree will be located on an extension of the course followed from the RP to the plot center. Both the X and Y trees have silver tags with "X" or "Y" scribed on them nailed less than 1 foot above the ground surface, facing the plot center. The Y tree should be located at a right angle to the line from the X tree to the plot center. The X and Y trees can be used to triangulate the center stake location. In general, the crews try to select an X tree between 25-30 feet from the PC and a Y tree that is as close to the PC as possible.

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

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

Contractors:

If a plot cannot be re-located after one hour of searching, the plot can be declared 'unfound'. The Contracting Officer's Representative (COR)/inspectors will then attempt to locate the plot within that same timeframe. If the plot is located within that timeframe, it will be flagged by the COR/inspectors, and the field crew will be required to return to plot and remeasure with no monetary compensation adjustment or forfeit all compensation for that plot. If the COR/inspectors

are unable to find the plot within an hour's time, the field crew will be compensated for their initial attempt at plot re-location at the full rate of plot remeasurement.

If the original 'on the ground' plot cannot be found with the supplied monumentation and coordinates, do not establish a new plot. Never establish a completely new 'on the ground' plot location when attempting to remeasure a plot. Inform COR/Inspector about lost plots.

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

Mark the plot location center (PC) by inserting a metal stake in the ground. If a metal stake cannot be placed in the ground because of bedrock, etc., build a rock cairn (rock pile) around the stake.

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

Remeasurement Plot Center Monumentation:
If plot center monumentation is damaged or the stake is missing, follow the instructions in this section to re-monument the original plot center location using Witness Trees or previously established plot tally trees to re-establish the original plot center location.

1.B.6.1 Plot Location Map.

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

1.B.6.2 Plot Narrative/Remarks.

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

1.C Witness Trees

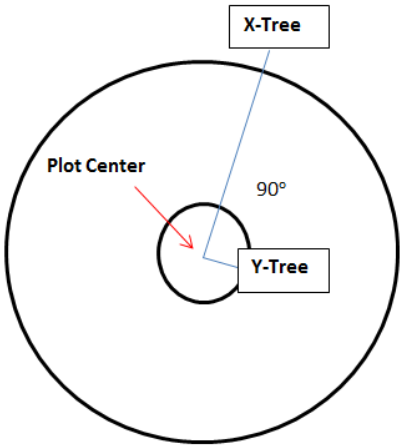
1.C.1 Selecting Witness Trees

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

Choose an X tree that is easily identifiable on the ground and in an aerial photo, if possible. Choose a Y witness trees with a trajectory to plot center which is as close to 90

degrees from the X tree to plot center trajectory as possible. The farther the two witness trees are from a right angle to each other, the less useful they will be for triangulating the plot center for relocation.

Figure 1.1 – Witness Tree Configuration



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

1.C.1.1 Witness Tree Specifications

Preferably, witness trees should meet the following criteria:

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

"X" Tree:

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

"Y" Tree:

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

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

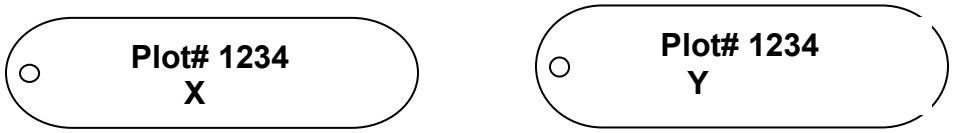
Record all **X/Y** information under **Plot Data>Witness Tree|Navigation** in Exams software as well as on the paper **Plot Location Reference Form**, Appendix A1.

1.C.1.2 Tagging Witness Trees

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

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

Figure 1.2 – Example of a racetrack tag scribed with Plot ID and witness tree information.



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

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

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

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

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

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

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

1.C.1.3 Witness Tree Form

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

Table 1.3 – Witness Tree Reference Attributes

Item number	Attribute	Description
1.C.1.3.1	Monument Type	Enter X or Y (Default in Exams)
1.C.1.3.2	Witness Type Code	Refer to Table 1.4. Enter the code for the type of witness item that is being used.
1.C.1.3.3	Tag ID	If the witness tree is a tally tree, indicate the tally tree number. Note: this will need to be filled out after the tree data has been collected.
1.C.1.3.4	Species	This attribute is recorded when Witness Type is TR. Enter the tree species (PLANTS code).
1.C.1.3.5	DBH |DRC	This attribute is recorded when Witness Type Code is TR. Indicate DBH or DRC, depending on species of tree. Note, if you enter a tally tree Tag ID, and the tree has already been entered on the Tree Form, this item will auto fill in Exams.
1.C.1.3.6	Diameter	This attribute is only available when Witness Type Code is TR. Enter the diameter of the tree. Note, if you enter a tally tree Tag ID, and the tree has already been entered on the Tree Form, this item will auto fill in Exams.
		Remeasurement: Prior measurement will be provided. Remeasure diameter and update.

Item number	Attribute	Description
1.C.1.3.7	Azimuth	Azimuth *from* plot center to the center of the bole of the witness tree or other witness object. Note: Declination is set at 0 degrees.
		Remeasurement: Update if outside tolerance.
1.C.1.3.8	Slope Distance	Record slope distance *from* plot center to the center of the *face* of the witness tree or object, see Figure 1.5. Record to the nearest 1/10th foot. *Note: Auto fill from tally tree Tag ID will populate horizontal distance.
		Remeasurement: Update if outside tolerance.
1.C.1.3.9	Remarks	Make comments about witness items, if necessary. This is especially important when trees are not the witness item. Record remarks to aid in plot re-location, for example, give a specific description of a boulder used for a witness item ("X is a gray boulder roughly 2'X5'X4', measurement from the boulder was taken at an apex in the rock on the southwest side").
1.B.1	Travel Description to plot center	Describe how to locate the plot from a known location that will remain intact for the foreseeable future. See 1.B.1 Travel Descriptions. This is written on the Plot Location Reference Form, Appendix 1A.

❖ Tolerance (PC Witness Trees):
Species: No Errors
Diameter: ± 0.2 inch per 20 inches of diameter
Azimuth: ± 10 degrees
Slope Distance: ± 0.2 feet

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

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

Figure 1.5 – Record the distance from plot center to the center of the face of the witness tree at the aluminum tag/nail location.

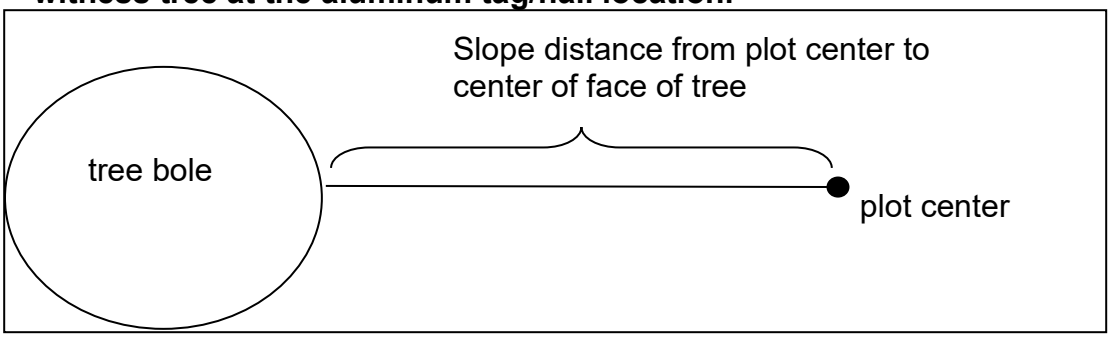
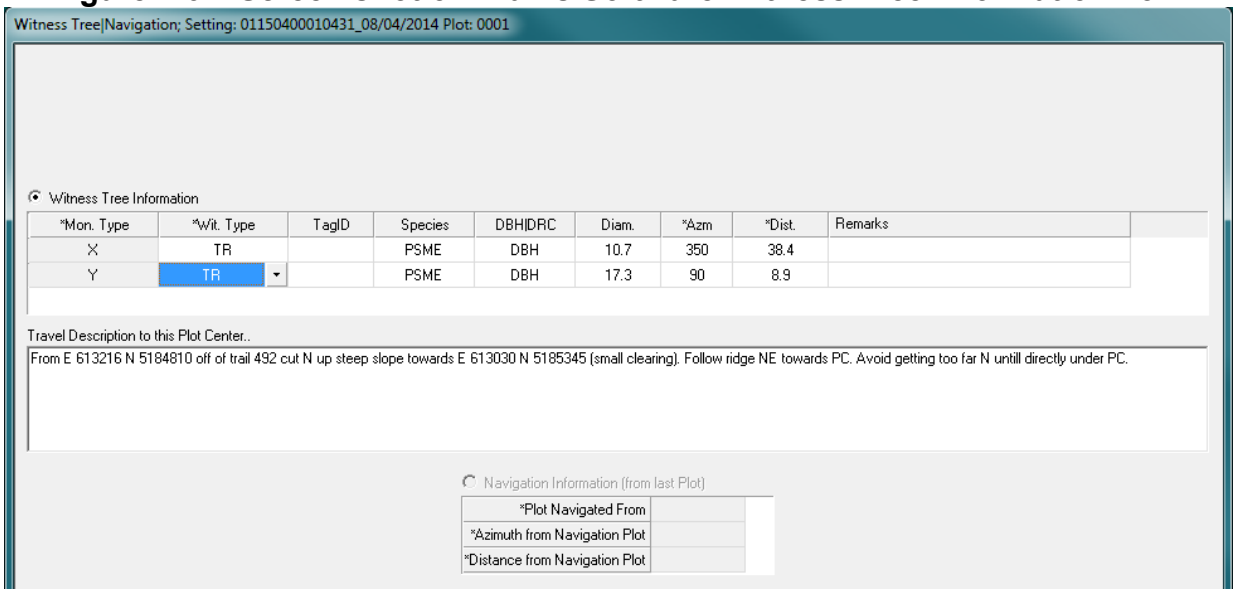


Figure 1.6 – Screen shot of Exams Software Witness Tree Information Form



1.D Plot Layout

The plot layout consists of a **subplot** (1/24th-acre fixed-radius plot) and a **microplot** (1/300th-acre fixed-radius plot). Each sample plot area is used to inventory **trees** of a specified range of heights and diameters, as indicated below. The subplot area is also used to sample the shrub, forb, and grass **vegetation composition**. All sample plot areas are centered on the PC stake.

Transects extend outward from the PC stake. **Tree canopy cover, surface cover,** and **down-woody material** are collected on the transects (or portions of). Figures 1.7 and 1.8 demonstrate how a transects are laid out depending on whether it is an odd or even setting/plot number. Table 1.9 describes which sample populations are selected using which methods.

Figure 1.7 – Plot layout for even numbered plots

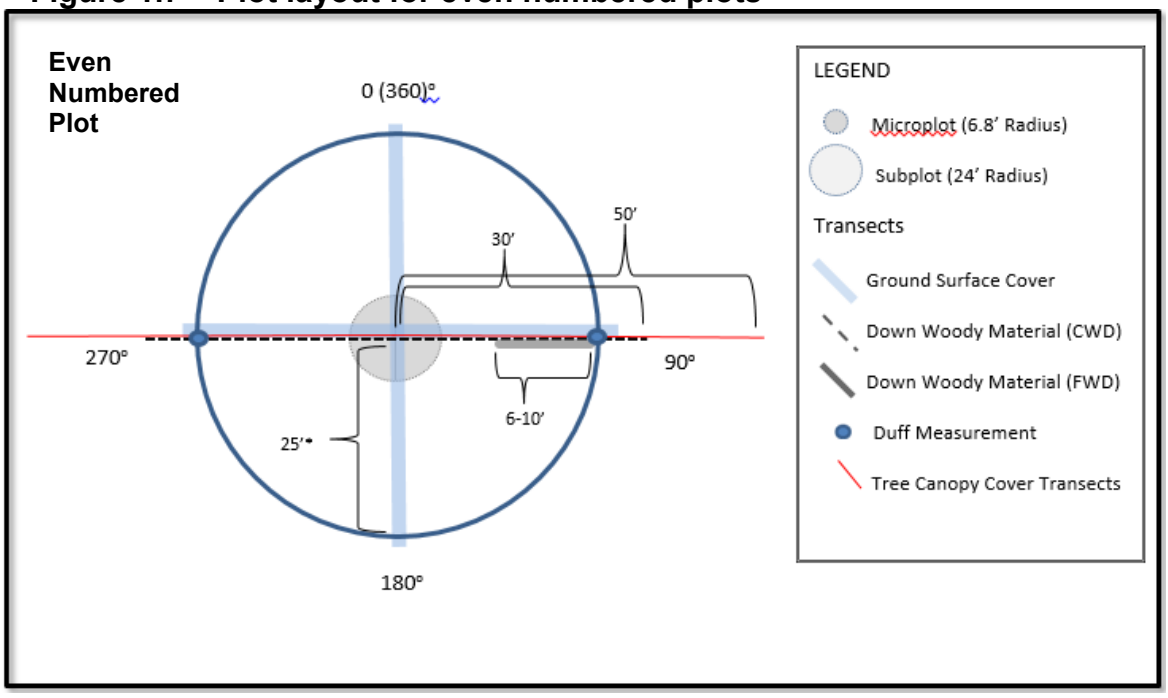
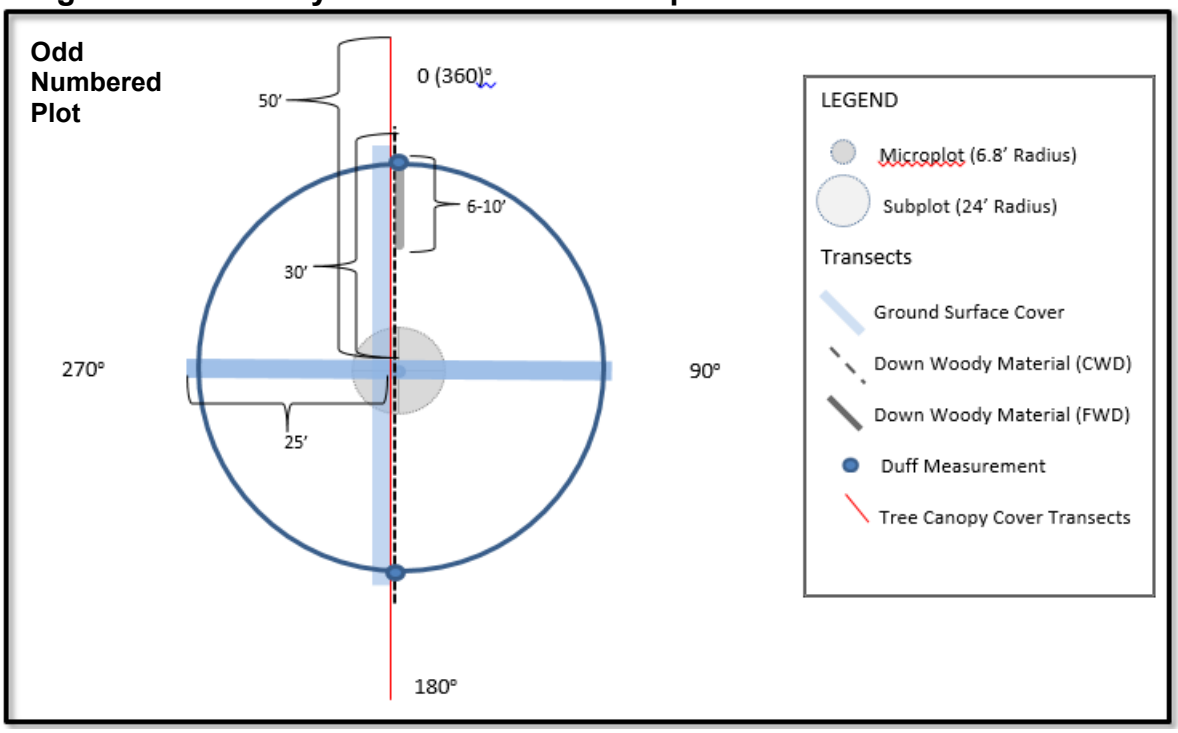


Figure 1.8 – Plot layout for odd numbered plots



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

Table 1.9 – Plot Layout Sampling Description

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

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

Lynx Horizontal Cover Option: Forests may choose to collect lynx horizontal cover estimates on plots. See Appendix K for detailed information on collecting this attribute.

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

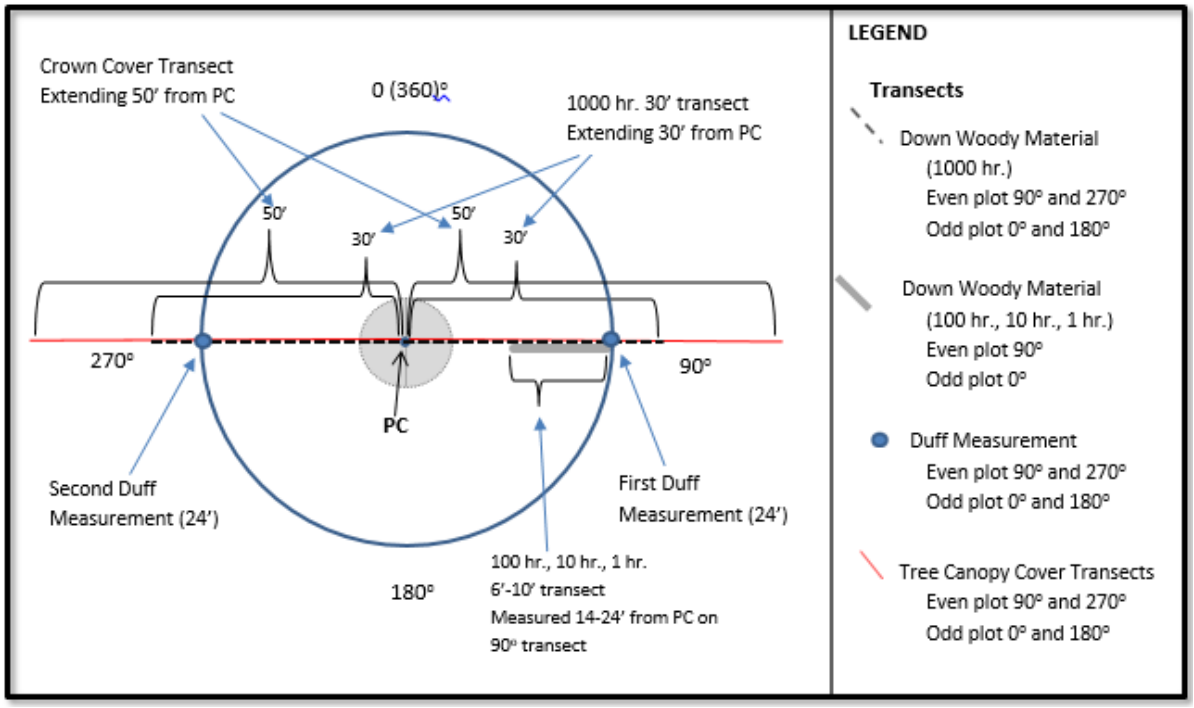
The **subplot** has a radius of 24.0' horizontal distance. If the slope distance is greater than 10% then follow the slope correction procedures, Section 1.D.1, to determine the slope distance of the plot radius.

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

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

- ❖ Transect Tolerance: Azimuths: ± 10 degrees

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



Tree Canopy Cover is sampled along both 50 ft. transects.

Sample **1000 hr. fuels** along the first 30 foot horizontal distance of both transects. Sample **100 hr., 10 hr. and 1 hr. fuels** along a 6- to 10-foot subsection of transect located between 14- and 24-feet, horizontal distance. For even-numbered plots, sample 100 hr., 10 hr. and 1 hr. fuels on the east transect (*oriented at 90 degrees*). For odd-numbered plots, sample 100 hr., 10 hr. and 1 hr. fuels on the north transect (*oriented at 0 degrees*). Refer to Section 7 for more detailed information on sampling down-woody material.

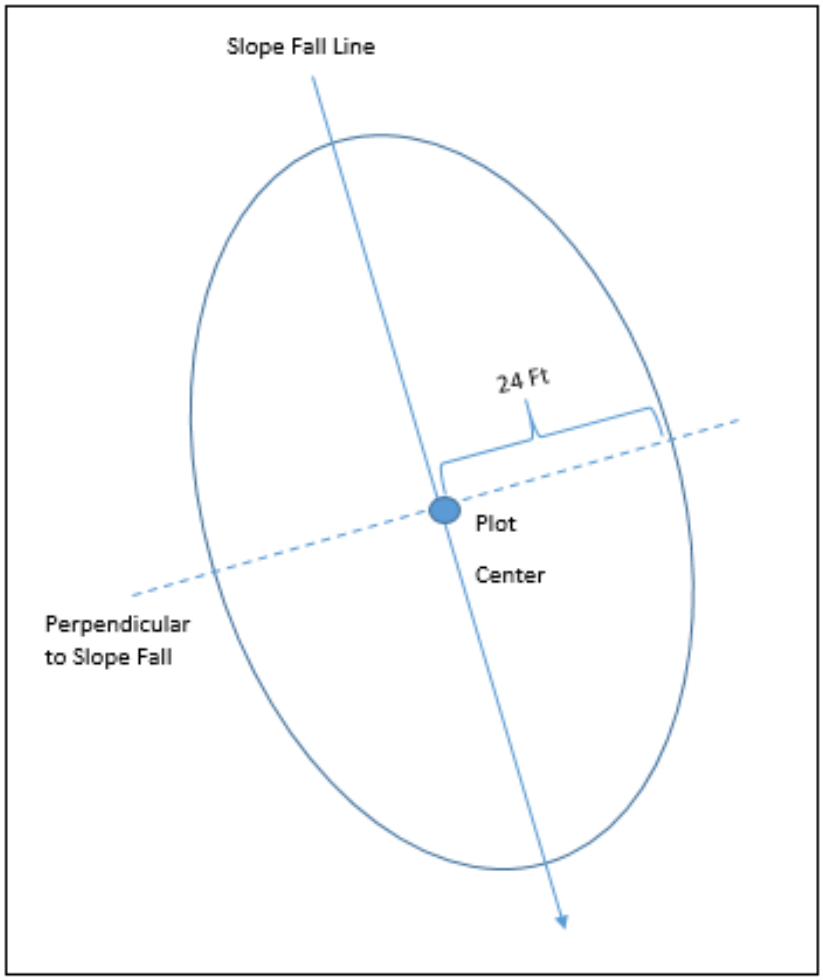
Lay out four transects that originate from plot center and extend out **25.0 feet slope distance** at 0(360), 90, 180, 270 degrees. These transects will be used to sample surface cover, sampling cover at each foot mark. The Ground Cover Sample Form will be used to collect hits and calculate totals that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

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

1.D.1 Correcting for Slope

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

Figure 1.11 – Fixed Radius Plot Orientation when Slope Fall Line is >10%



The slope correction factor can be determined in two ways:

- Use a clinometer to measure the slope percent and then determine the correction factor from Table 1.12
- Use a clinometer with the slope correction factor built in (% slope and slope correction factor are on the dial)

Table 1.12 – Slope Correction Factors

Percent of Slope	Slope Correction Factor (SCF)	Percent of Slope	Slope Correction Factor (SCF)
0 - 9	1.00	103 to 104	1.44
10 - 17	1.01	105	1.45
18 - 22	1.02	106 to 107	1.46
23 - 26	1.03	108	1.47
27 to 30	1.04	109	1.48
31 to 33	1.05	110 to 111	1.49
34 to 36	1.06	112	1.50
37 to 39	1.07	113	1.51

Percent of Slope	Slope Correction Factor (SCF)	Percent of Slope	Slope Correction Factor (SCF)
40 to 42	1.08	114 to 115	1.52
43 to 44	1.09	116	1.53
45 to 47	1.10	117	1.54
48 to 49	1.11	118 to 119	1.55
50 to 51	1.12	120	1.56
52 to 53	1.13	121	1.57
54 to 55	1.14	122	1.58
56 to 57	1.15	123 to 124	1.59
58 to 59	1.16	125	1.60
60 to 61	1.17	126	1.61
62 to 63	1.18	127 to 128	1.62
64 to 65	1.19	129	1.63
66 to 67	1.20	130	1.64
68 to 69	1.21	131	1.65
70	1.22	132 to 133	1.66
71 to 72	1.23	134	1.67
73 to 74	1.24	135	1.68
75	1.25	136	1.69
89	1.34	137 to 138	1.70
90 to 91	1.35	139	1.71
92	1.36	140	1.72
93 to 94	1.37	141	1.73
95	1.38	142 to 143	1.74
96 to 97	1.39	144	1.75
98	1.40	145	1.76
99 to 100	1.41	146	1.77
101	1.42	147	1.78
102	1.43	148 to 149	1.79

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

Example:

If there is a 25% slope, along the slope of the ground from PC to tree, then SCF = 1.03

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

Slope Ground Dist. = 24.0 x 1.03

Slope Ground Dist. = 24.72 feet

The example above shows how to correct the plot boundary for slope if the slope between the center of the plot and the pith of a tree at ground level is measured with a clinometer to be 25%. In this example, the tree would be "in" if the measured distance between the tree and the plot center stake is less than, or equal to 24.72 feet.

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

Figure 1.13 – Macroplot Option Information

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

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

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

1.E Photographing the Plot

1.E.1 Photographing the Plot

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

Procedure: At each plot location, stand over the PC stake and take a photograph in each cardinal direction. Include a Plot Photo Placard in each picture (Appendix A2), placed in the lower right-hand corner of the photo, indicating the Proclaimed Forest, Proclaimed District, State, County, Plot ID, Measurement # and direction the photo is facing: N, E, S, W. Be sure the placard is legible and not obscured by light reflections, vegetation, or darkness; but do not allow the placard to obstruct the view of the site. If lynx horizontal cover measurements are measured on the plot, include the cover-board in the photo. Note: Compass declination is set to 0 degrees.

It is best to take the photographs in moderate light conditions. Shade the lens from direct sunlight when necessary and use the flash in dark conditions (dense stands, cloudy days, etc.).

Remeasurement Plot Photos:
Take photos as specified above.

When back in the office, plot photos will be named County_Plotid_Direction.jpg (CCC_PPPP_D.jpg) where CCC = the three-digit County Code, PPPP = the four digit Plot ID, and D = the cardinal direction the camera was pointing when the photo was taken.

Section 2: Setting Form

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

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

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

Table 2.1 – Setting Data Form Required Attributes

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

CSE Attrib #	Attribute Name	Value	Comments
2.1(1)*	Project Name	GRID INT XXXXX	Select correct Project Name from Drop down list
			Remeasurement: Ensure that the RM# in the Project Name matches the value of the Measurement #.
2.2(1)	Proclaimed Region	01	Default in Exams software template file
2.3(1)*	Proclaimed National Forest	Default	Default in Exams software template file
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.4(1)*	Proclaimed District	Required	Choose from pick list
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36). Do not change the district if it has changed due to combining districts on a Forest since last measurement.
2.5(1)	Location	Required	Enter the Location code as indicated.
			Remeasurement: Keep Location code that is in Exams file.

CSE Attrib #	Attribute Name	Value	Comments
2.6(1)	Stand Number/ Plot ID	Required	Enter the Stand Number as indicated
			Remeasurement: Keep Stand Number that is in Exams file
2.7(1)*	Owner	USFS	Default in Exams software template file
2.8(2)*	State	Default	Default in Exams software template file
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.9(2)*	County	Required	Record the code identifying the county where the plot center is located. Some intensification projects may encompass more than one county. Refer to the "drop-down menu" in the Exams software for a list of all valid county codes.
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.10(2)*	Administrative Forest	Default	Default in Exams software template file.
			Remeasurement: Check value in Exams file. If it is modified, note in Setting Remarks (2.36)
2.11(2)	Date	Date of inventory	For new plots (data not previously entered into the Exams software), the date will be automatically inserted when the Setting Form is filled out.
			Remeasurement: Ensure that this field is updated to reflect the date of data collection by tabbing into the date field and recording the calendar month, day, and year that the plot is completed (MMDDYYYY). Default value in remeasure template will be the day the data was backloaded into the template.
2.12(2)	Photo ID	Null	Do not record

CSE Attrib #	Attribute Name	Value	Comments
2.13(1)*	Exam Level	3421	Default in Exams software template file. Tree Form = 3, Intensive Exam Veg Comp Form = 4, indicates collecting Lifeform information, All species above minimum cover level, and species on lists to trace. DWM Form = 2, indicates using Brown's Protocols. Surface Cover Form = 1, collected
			Remeasurement: Default in the remeasurement file will be 3421. If not 3421, update this code to 3421 prior to data collection.
2.14(2)*	Exam Purpose	FI	Default in Exams software template file. 'FI' indicates Forest Inventory
2.15(2)	Stratum	Null	**Do not record.**
2.16(2)	Existing Veg Reference	Null	**Do not record.**
2.17(2)	Existing Veg Composition Type	Null	**Do no record.**
2.18(2)*	Potential Vegetation Reference	Required	**Record the code identifying the reference used to obtain Plot Potential Vegetation (refer to Appendix F, CSE Field Guide).**
			Remeasurement: **Check. Correct if needed.**
2.19(2)	Potential Vegetation	Null	Do not record on the Setting Form.
			Remeasurement: **Will be Null. Recorded on Plot Form.**
2.20(3)	Structure	Null	Do not record.
2.21(3)	Setting Capable Growing Area	Null	Do not record.
2.22(3)	Setting Fuel Model	Null	Do not record.
2.23(3)	Setting Elevation	Required	Record the elevation (to the nearest foot) as determined from the GPS unit.

CSE Attrib #	Attribute Name	Value	Comments
			Remeasurement: Check value in Exams file and ensure it is within tolerance. Correct if needed and note in Setting Remarks (2.36) if modified.
2.24(3)	Setting Aspect	Null	Do not record in Exams on the Setting Form. Only record in Exams on the Plot Form.
			Remeasurement: Should be Null. Delete if not blank.
2.25(3)	Setting Slope	Null	Do not record in Exams on the Setting Form. Only record in Exams on the Plot Form.
			Remeasurement: Should be Null. Delete if not blank.
2.26(3)	Setting Slope Position	Null	Do not record.
2.27(3)	Acres	Null	Do not record
			Remeasurement: Should be Null. Delete if not blank.
2.28(4)	Examiner	Required	Required
			Remeasurement: This will be blank. Required. Enter new Examiner information.
2.29(4)*	Precision Protocol	CSE	Defaulted in Exams template file.
2.30(3)*	Radial Growth Interval	10	Defaulted in Exams template file.
2.31(3)	Radial Growth Interval 2	Null	Do not record. Not used
2.32(4)*	Height Growth Interval	5	Defaulted in Exams template file.
2.33(4)	Fuel Photo Reference	Null	Do not record.
2.34(4)	Setting User Code	Required if plot area contains a situation that prohibits data collection	See information, item 2.34, below.

CSE Attrib #	Attribute Name	Value	Comments
2.35(4)*	Setting Lat/Long Reference Datum	NAD83	Default in Exams software template file.
2.36(4)*	Magnetic Declination	0	Default in Exams software template file. Note: Compasses must be set to 0 degrees declination
2.37(1)	Measurement Number	Required	Installation: 1 will be default
			Remeasurement: Automatically updated so keep value in data file.
2.38	Setting Remarks	Required if applicable	Use this section to record remarks about setting conditions not already described elsewhere. See item 2.38.
			Remeasurement: Update as needed. Use this section to note changes needed in other setting values.
2.39	Setting Damage Category	Required if applicable;	See item 2.39 below
2.40	Setting Damage Agent	Required if applicable	See item 2.40 below
2.41	Setting Damage Severity	Required if applicable	See item 2.41 below.
2.42	Species of Management Interest	Null	Do not use this form

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

CSE 2.5 Location (4-digit)
Use the LOCATION code as indicated.

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

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

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

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

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

Remeasurement Exam Level:
The Examination Level in the data file may be defaulted to 2421 from backloading pull of data. Change to 3421 prior to tree data collection.

CSE 2.18 Potential Vegetation Reference (3-digit)
Record the code identifying the reference used to obtain PLOT POTENTIAL VEGETATION (refer to Section 4, Item 4.11). Generally, this is defaulted in the Exams template file.

- Tolerance (PV Reference): No errors

CSE 2.23 Setting Elevation (5-digit)
Record the elevation (to the nearest foot) as determined from the GPS unit

- Tolerance (Elevation): ± 100 feet

CSE 2.28 Examiner (12-character)
Record the crew name for the individual(s) responsible for data collection. **Do not use reserved characters such as +, /, -, or * in this field.**

Remeasurement Examiner:
Required. Enter examiner information.

CSE 2.34 Setting User Code (4-character) ***Required if plot area contains a situation that prohibits data collection***
If an entire plot, or portion of a plot, cannot be sampled, record SETTING USER CODE to indicate the following: (a) the reason why data could not be collected, and (b) the portion of the plot that has missing data.

Record Setting User Code as a four-digit code. Use the first digit to indicate the situation/condition that prohibits data collection; use the last three digits to indicate the percentage of the plot that is non-sampled. Zero fill leading digits as shown below.If a plot lands on private land, see protocols in Section 1.A.3 of this document for relocating the plot.

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

Table 2.2 – Setting User Code

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

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

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

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

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

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

CSE 2.39 Setting Damage Category (2-digit)

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

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

CSE 2.40 Setting Damage Agent (3-digit)

Record Agent if Setting Damage Category (2.39) is recorded

CSE 2.41 Setting Damage Severity (2-character)

Record Agent if Setting Damage Category (2.39) is recorded

- Tolerance (Setting Damage Severity):
  + 1 category

Section 3: Sample Design Form

Remeasurement Sample Design:
Do not change the sample design form

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

Figure 3.1 – Tree Sample Design

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

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

Figure 3.2 – Vegetation Composition Sample Design

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

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

Figure 3.3 – Surface Cover Sample Design

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

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

Figure 3.4 – Down-woody Material Sample Design

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

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

Section 4: Plot Data Form

Remeasurement Plot Data:
Follow instructions under Remeasurement column, Table 4.1 below.

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

Table 4.1 – Plot Form Required Attributes

CSE Attribute #	Attribute name	Comments	Remeasurement
4.1	Plot Number	This will always be 1.	Default
4.2.1	Plot Latitude	Required. See CSE 4.2 and 4.2.1 below.	Always acquire new value. Update if prior value out of tolerance, make note in the Plot Remarks Field (CSE 4.1.8), and bring to the attention of COR, if applicable.
4.2.2	Plot Longitude	Required. See CSE 4.2 and 4.2.2 below	Always acquire a new value. Update if prior value out of tolerance, make note in the Plot Remarks Field (CSE 4.1.8), and bring to the attention of COR, if applicable.
4.4	Plot Aspect	Required. See CSE 4.4 below.	Update if outside of tolerance, make note in the Plot Remarks Field (CSE 4.1.8).
4.5	Plot Slope	Required. See CSE 4.5 below.	Update if outside tolerance, make note in the Plot Remarks Field (CSE 4.1.8).
4.11	Plot Potential Veg.	Required. See CSE 4.11 below.	Update if outside tolerance, make note in the Plot Remarks Field (CSE 4.1.8).
4.15	Plot User Code	Required if collecting lynx horizontal cover	If collecting lynx horizontal cover, remeasure.
4.18	Plot Remarks	See below.	In addition to recording as indicated, below. Enter notes when plot data fields are updated.

CSE 4.1 Plot Number (4-digit)

Plot Number will always be 1.

CSE 4.2 GPS Locations

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

Remeasurement PC Lat/Long:
Update latitude and longitude if out of tolerance. If either latitude and/or longitude from prior measurement were outside of tolerance, make note in Plot Remarks (CSE 4.18). Contact the COR if the prior latitude and/or longitude were found to be out of tolerance and required updating.

CSE 4.2.1 Plot Latitude

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

- Tolerance (PC):
  ±10 meters or 32.8 feet

One second latitude equals approximately 100 feet horizontal distance on the ground, 1/10" ≈ 10 feet, and 1/100" ≈ 1 foot. The tolerance is approximated by 3.3 tenths of a second.

CSE 4.2.2 Plot Longitude

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

- Tolerance (PC):
  ±10 meters or 32.8 feet

One second longitude equals approximately 70 feet horizontal distance. Using these guidelines, the tolerance for this measure is approximated by 4.7 tenths of a second.

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

CSE 4.4 Plot Aspect (3 digit)

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

- Tolerance (Plot Aspect):
  ± 45 degrees

Remeasurement Aspect:
If Aspect is outside of tolerance, update. Make note of change in Plot Remarks field (Item 4.18).

CSE 4.5 Plot Slope (3-digit)

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

- Tolerance (Plot Slope):
  ± 10 percent

Remeasurement Slope:
If Slope is outside of tolerance, update. Make note of change in Plot Remarks field (Item 4.18).

CSE 4.11 Plot Potential Vegetation (3-digit)

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

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

- Tolerance (Plot Potential Vegetation):

Accurate to R1 Habitat Type Group (see Appendix J). These tolerances are from *Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring. Milburn et al. 2015*) unless specified otherwise by Forest.

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

CSE 4.15 Plot User Code

Appendix K provides optional instructions for collecting Lynx Horizontal Cover on intensified grid plots. The average Horizontal Cover %, based on the 4 cardinal direction measurements, will be entered into the Plot User Code as LXX or LXXX, where L denotes Plot User Code is being used to collect Lynx Horizontal Cover and XX or XXX is the Plot Horizontal Cover percent entered as a 2 or 3 digit number (60% horizontal cover would be entered as L60).

CSE 4.18 Plot Remarks (242-characters)

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

Section 5: Tree Data Form

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

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

Remeasurement Tree Data:
Follow instructions in Table 5.2 Tree Data Items under remeasurement. There may also be additional information under each tree data item narrative.

5.A Tally Tree Definitions

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

Table 5.1– Sample Tree Specifications

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

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

Tally Tree Definitions:

5.A.1 Live Trees

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

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

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

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

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

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

5.A.1.2: Saplings

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

For a multi-stemmed woodland species sapling to qualify for tally, at least one measured stem must be 1.0-inch DRC or larger and 1 foot in length, and the cumulative (calculated) DRC must be between 1.0 and 4.9 inches DRC. Treat all woodland species that have several stems clumped together, with a unified crown, and appearing to be from the same root origin, as a single tree.

5.A.1.3 Seedlings

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

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

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

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

For trees with broken or missing tops, measure height to the tip of the dead snag. The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the base of the tree to the top of the unbroken actual length.

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

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

Standing dead timber species trees are further classified as either **salvable** (hard) or **non-salvable** (soft) based on the level of rotten and/or missing material (refer to Section 5.B, Subsection 5.4, Tree Class). Working around dead trees is a safety hazard - crews should exercise extreme caution and wear hard hats! Trees that are deemed unsafe to measure should be estimated.

5.B Tree Data Items

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

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

Table 5.2 – Required Attributes for the R1 Intensified Grid Inventory Tree Data Form

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.2	Tag ID Number	Defaulted by software	**Do not change**. If trees are added, use the *next* available number in Exams, if trees disappear/no longer standing, delete the tree record and retire the Tag ID. **See specification in CSE 5.2, below.** Seedling groups from the prior measurement have been deleted in the data file. Completely remeasure seedlings.
5.3	Tree Status	Required for all trees	Value from previous measurement will be included. Update as needed.
5.4	Tree Class	Required for all trees	Value from previous measurement will be included. Update as needed.
5.5	Growth Sample Tree (GST)	See Item 5.5, below.	Value from previous measurement will be included. Add new GSTs due to ingrowth into GST classes that do not have a living GSTs, or were missed on prior measurement, or for replacement of GSTs that have died or are no longer suitable. Do not recalculate radial growth or add any years to ages that are loaded into Exams.
5.6	Tree Species	Required for all trees	Value from previous measurement will be included. Update if wrong species code entered on previous inventory. If updated, make note in Tree Remarks (CSE 5.26).

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.7	Tree Count	Required for seedling groups, defaulted for tally trees (non-woodland species)	Redo seedling counts.
5.8	Number of Stems	Woodland species ≥ 1.0" DRC	Update as needed.
5.9	DBH / DRC	• Timber species ≥ 4.5' tall and ≥ 1.0" DBH • Woodland species ≥ 1' tall and ≥ 1.0" DRC • Dead trees ≥ 4.5' tall and ≥ 1.0" DBH • Seedling groups (timber species if ≥ 0.5' tall and < 1.0" DBH; hardwood species if ≥ 1' tall and < 1" DBH; woodland species if the cumulative DRC <1.0" and height is at least 1')	Value from previous measurement will be included. Remeasure at location of previous measurement (just above nail). Measure for ingrowth trees and saplings.
5.10	Height	• All GST trees • Trees with broken tops • Seedling groups • Dead trees	Value will be blank unless the height was measured during the prior inventory, then the last height will be included. Remeasure for all GST trees, including ingrowth, replacement and newly designated GST trees and saplings, trees with broken tops, and dead trees. Estimate average for all individual seedling groups.
5.12	Radial Growth	GST trees ≥ 3.0" DBH	Value will be blank unless the radial growth was measured during the prior inventory, then the radial will be included. **Do not remeasure. Only** measure radial growth on newly designated GST trees and saplings ≥3.0" DBH.

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.14	Height Growth	GST trees 1.0”-2.9” DBH	Value will be blank. Measure on all GST trees, both previously established and newly designated GST trees in the 1.0-2.9” DBH range.
5.15	Tree Age	All GST trees	Value will be blank unless the age was measured during the prior inventory, then the age will be included. **Do not remeasure trees that have already been bored**. **Only** measure on newly designated GST trees, including trees that were erroneously recorded as dead on previous measurement and are needed to fill a GST class. Do not recollect.
5.16	Crown Ratio	All live trees	Value will be blank. Remeasure.
5.17	Crown Class	Live tally trees	Value will be blank. Remeasure.
5.20	Snag Decay Class	Dead trees only	Value will be blank. Remeasure.
5.22	Tree Damage Category	Live tally trees. For dead trees (died <5 yrs ago with Snag Decay Class = 1) record damage category that is cause of death.	Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement. If Snag Decay Class >1, delete all damages except broken/missing top.

CSE Attribute #	Attribute Name	Comments	Remeasurement
5.23	Tree Damage Agent	Live tally trees. For dead trees (died <5 yrs ago with Snag Decay Class = 1) record damage agent that is cause of death.	Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement. If Snag Decay Class >1, delete all damages except broken/missing top.
5.25	Tree Damage Severity	All live trees with Damage Agent and Category collected when damage meets severity definition. For recent mortality trees, code highest severity.	Value from previous measurement will be included. Re-evaluate. If a damage that had been previously recorded is no longer detectable, delete. Record any new damages now present and not recorded at last measurement for live trees and trees that have died since last measurement. If Snag Decay Class >1, delete all damages except broken/missing top.
5.26	Tree Remarks	See 5.26 for information on what to record in tree remarks.	Update if necessary. Delete Remarks that are no longer pertinent to the tree.
5.29	Tree Distance	All tally trees and saplings. Distance is not recorded for seedlings	Value from previous measurement will be included. If horizontal distance recorded is outside of tolerance, then update. If horizontal distance is changed, record ADC in the tree remarks field.
5.30	Tree Azimuth	All tally trees and saplings. Azimuth is not recorded for seedlings.	Value from previous measurement will be included. If azimuth recorded is outside of tolerance, then update. If tree azimuth is changed, record ADC in the tree remarks field.

CSE 5.2 Tag ID Number (4-digit)
Tally qualifying trees that fall within the **horizontal distance** of the sample plot perimeter.

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

Tally Tree Procedures:

1) Subplot Tally (*and macroplot, if applicable*). Starting at 1 degree azimuth rotate clockwise and tally all qualifying trees with a diameter ≥ 5.0 inches that fall within the perimeter of the subplot (24.0-ft horizontal distance). **For a qualifying tree to be tallied, the horizontal distance from the PC stake to the geographic center of the bole (pith) at the base of the tree, or stem(s) must be 24.0 feet horizontal distance or less**. Refer to Section 5.29 Tree Distance, and Section 1.D.1 for directions on correcting for slope to determine whether a tree is in or out. Trees qualifying for tally are defined in Section 5.A.

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

2) Sapling Tally (Microplot). Stand directly over the PC stake. Starting at 1 degree azimuth rotate clockwise and tally all qualifying trees (Live and dead trees 1.0-4.9" DBH/DRC) that fall within the perimeter of the microplot (6.8-ft horizontal distance). For a qualifying tree to be tallied, the horizontal distance from the PC stake to the geographic center of the bole (pith) or stem(s) at the base of the sapling must be 6.8 feet or less horizontal distance. Trees are tallied and numbered clockwise starting with the last number recorded on the subplot (*and macroplot, if established*). Trees qualifying for tally are defined in Section 5.A.

Remeasurement Subplot Tally Trees and Microplot Sapling Tally Trees:
In order to track trees over time, use the assigned Tag ID in Exams software. Retain the Tag ID for saplings formerly tallied on microplots, that have grown onto the subplot (i.e. DBH for timber species is 5.0" or larger). Any missed trees will be assigned the next Tag ID available regardless of where they are located on the subplot. For example, if the last tree tallied on the last measurement was 11, the next available tree number is 12. NEVER renumber the trees on the plot after installation in order to assign a more "correct" tree number to a missed tree.

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

Assign new GST designations for ingrowth tally trees and saplings and collect appropriate data. Assign new Tag ID Numbers to all new saplings, live or dead,

added since the previous measurement, and collect appropriate data. Disregard Tag IDs assigned to prior *seedling* counts, as they will be fully remeasured after sapling remeasurement.

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

3) Seedling Counts (Microplot). Within the perimeter of the microplot area (6.8 feet horizontal distance), record the number of live tree seedlings by species and height classes. Only include species listed as tally tree species (refer to Appendix E). Although seedling groups are assigned a unique number by the software program, seedlings are not permanently identified until they meet sapling definitions. Refer to Appendix A6 for the Microplot Seedling Data Collection Form to aid with collecting seedling data.

Figure 5.3 – Row of Microplot Seedling Count Data Collection Form

Microplot Seedling Count

Species: _____	Tree Count	DBH <1.0"	Height	CR	Crown class
0.5-4.4 ft.					
Tot Tally			(ave)	(ave)	(ave)
4.5+ ft.					
Tot Tally			(ave)	(ave)	(ave)
Species: _____	**Tree Count**	**DBH**	**Height**	**CR**	**Crown class**

Spin the microplot looking for seedlings (DBH< 1 inch). For each species of seedling use the Tree Count, DBH, Height, Crown Ratio, and Crown Class boxes to tally seedling information by size class on the microplot. Write the total tree count in the Total Tally row in the Tree Count box. Determine the averages of the other values collected and enter these into the appropriate boxes in the Total Tally row. Repeat for each species/size class combination encountered on the microplot.

Remeasurement Microplot Seedlings:
Disregard Tag IDs assigned to prior seedling counts, as they will be fully remeasured after sapling remeasurement. Do not reuse any Tag IDs from prior measurements if assigning new tally trees.

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

Macroplot Option – use the following procedures:

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

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

CSE 5.3 Tree Status (1-character)

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

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

CSE 5.4 Tree Class (2-characters)

Record for all tally trees. Assign a code to each tree individually without regards to the status of other trees on the plot (refer to Table 5.3 below). Note: the **merchantable bole** on a timber species is defined as the portion of a tree, 5.0-inches DBH or larger, between a 1-foot stump and a 4.0-inch top diameter.

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

Table 5.4 – Tree Class Definitions

Code	Tree Class	Status	Must have the following characteristics:
GS	Growing Stock	L	Timber Species: • A live sapling (1.0- to 4.9-inches DBH) with minor or no evidence of form defects, insects, or disease, that is expected to become a growing-stock (sound) tree 5.0 inches DBH or larger with good form or vigor. • A live tree, 5.0 inches DBH or larger, that has less than 67 percent of the merchantable voulume cull, and contains at least one solid 8-foot section (now or prospectively for poletimber-sized trees), reasonable free of form defect, on the merchantable bole. Woodland Species (all live)

Code	Tree Class	Status	Must have the following characteristics:
RF	Rough	L	Timber Species: • A live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a growing-stock (sound) tree of good form, 5.0 inches DBH or larger. • A live tree, 5.0 inches DBH or larger with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound-dead wood volume loss or severe form-defect volume loss. • A live tree, 5.0 inches DBH or larger, that does not now, nor prospectively, have at least one solid 8 foot section, reasonably free of form defect, on the merchantable bole.
RN	Rotten	L	A live **timber species** tree, 5.0 inches DBH or larger, with 67 percent or more of the merchantable volume cull, and more than half of this cull due to rotten and/or missing volume loss.
SV	Salvable dead (Hard)	D	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
US	Non-salvable dead (Soft)	D	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

Remeasurement Tree Class:
Prior value included. Update, if needed.

CSE 5.5 Growth Sample Tree *(1-character)*

Record this item only for Growth Sample Trees (GST). Leave blank for all other trees. GST are defined as all trees meeting the "GST Selection Guidelines" below.

GST Code	Description
G	Growth Sample Tree

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

Table 5.5 – GST Measurements by Diameter Class Range

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

Remeasurement Growth Sample Tree:
Prior value included. Remeasure GST data on prior GST trees except age and radial growth. Delete GST designation on trees that are no longer suitable. Record all required fields for new ingrowth GST trees into unrepresented classes, or GST trees that were missed on prior measurement, or for replacement of GST trees that have died or are no longer suitable.

CSE 5.6 Tree Species (8-character)

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

CSE 5.7 Tree Count *(3-digit)*
Record the number of trees represented by each line of tree data.

Seedlings (trees with a diameter < 1.0 inch): Seedlings, grouped by species and height classes, are called **seedling groups**. Use a single data line for each seedling group, and record the actual number of trees within the group for TREE COUNT. Record the average DBH/DRC (CSE 5.9) *when applicable*, HEIGHT (CSE 5.10), and CROWN RATIO (CSE 5.16) for each seedling group. Seedling groups are listed in Table 5.6 below. Appendix A6, Microplot Seedling Data Collection Form, can be utilized for collecting seedling information when microplots have multiple seedlings.

Table 5.6 – Seedling Height Class Groups

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

(1) For woodland species seedling groups.

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

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

Remeasurement Seedling Counts:
Prior data not included. Complete a new seedling count during remeasurement as seedling numbers are not included in the permanent record until they have reached at least 1.0” DBH (saplings).

- **Missed/Extra Tree Tolerance:**

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

Number of Trees on Plot (subplot/saplings)	Diameter (DBH/DRC)	Height or Height Class	Missed/Extra Tree Tolerance
6+	0.1- to 0.9-inch *	0.5 - 4.4 feet	± 20%
1 – 5	0.1- to 0.9-inch	≥ 4.5 feet	± 1 tree
6+	0.1- to 0.9-inch	≥ 4.5 feet	± 10%

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

CSE 5.8 Number of Stems *(3-digit) Required for DRC woodland species*

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.

Remeasurement Number of Stems:
Update as necessary. This field is required for all woodland species.

CSE 5.9 DBH/DRC *(3,1-digit; xxx.y)*

Tree diameters are measured at either breast height or ground level (root-collar) depending on the species type (timber or woodland species). Refer to Appendix E for a list of timber and woodland tally tree species.

Diameter Measurement.

a. **Timber Species.** Record the **Diameter at Breast Height (DBH)** for all timber species, 1.0-inch in diameter and larger. Record DBH to the nearest 0.1 inch; always round down. Record an average DBH for timber species **seedling groups** if the average height is 4.5 feet or more.

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

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

   For trees with bole irregularities at breast height, such as branches, swellings, or depressions, measure DBH as close as possible to breast height (4.5 feet), but above or below the deformity. Additionally, record '**DBHxx**' under **TREE REMARKS** (CSE 5.26) where xx indicates the height of the diameter measurement to the nearest tenth of foot. Refer to Appendices L and M, R1

CSE/IM Field Guide, for instructions on measuring DBH and examples of measuring trees with bole irregularities.

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

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

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

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

2) Computing and Recording DRC – Woodland tree DRC is computed as the square root of the sum of the squared stem diameters. For single-stemmed trees, the computed DRC is equal to the single diameter measured. For multi-stemmed woodland trees (with at least one qualifying stem) use the formula below to compute DRC. Record DRC to the nearest tenth inch; always round down.

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

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

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

- Tolerance (DBH/DRC):
  - Live Timber Species: ± 0.1 inch per 20.0-inch increment of measured diameter

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

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

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

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

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

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

b. Woodland Species. For tally trees, 1.0-inch DRC and larger (and at least 1-foot tall), mark the exact location of stem diameter measurement with a **lumber crayon or paint pen**. Draw a small line (at least 1.0-inch long and parallel to the diameter tape placement on the stem) on each stem measured for DRC. In addition, for all standing woodland trees, 3.0-inches DRC and larger, place a **nail** at the base of one stem, preferably the largest or main stem, on the uphill side of the tree. Write the TAG ID NUMBER (CSE 5.2) on the head of the nail (or below the paint mark on a main stem for trees 1.0- to 2.9-inches DRC).

- ❖ Tolerance (DBH Measurement Position):
  ± 0.2 inch from 4.5 feet (initial nail placement in tree)
  ± 12.0 inches from 4.5 feet (tree remeasurement)

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

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

Remeasure DBH at the same location as the prior measurement, just above the nail. Do not move tree nails unless they are > 12 inches from 4.5 ft. It is important that DBH measurements are taken at a consistent height on the tree over time, so only adjust the nail height if it is more than 12 inches from 4.5 feet. If it is not physically possible to remeasure the tree in exactly the same location (e.g. tree was buried by mudslide) estimate DBH/DRC and note in Tree Remarks that DBH was estimated. If an action has caused major disturbance and a tree has a new terminal leader (e.g. tree harvested below DBH and new leader has emerged) retire Tag ID# and assign new Tag ID#. Treat as a new ingrown tree.

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

Record HEIGHT (total standing tree height, to the nearest 1.0 foot) from the ground line on the uphill side of the tree, to the uppermost tip for the following types of trees:

- **Growth Sample Trees (GST)**
- **All trees with broken or missing tops –** Record standing height from the ground line to the break, and record a TREE DAMAGE CATEGORY of "broken or missing top" (damage code 99-001; see Item 5.22 in the CSE Field Guide).
- **Dead trees**
- **All seedling groups (trees with DBH < 1.0 inch) –** For timber trees ≥ 0.5 feet tall, record HEIGHT to the nearest 1.0 foot. For woodland species trees > 1.0 feet tall, record HEIGHT to the nearest 1.0 foot. See CSE 5.7 for Seedling Height Class Groups.

❖ Tolerance (Height):
± 10% of actual standing tree height.

Remeasurement Height:
Prior data will only be included for trees with heights that were measured in the last inventory. Remeasure for all GST trees, trees with broken tops, seedling groups, and dead trees. Determine the average height for each seedling group recorded.

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

Record RADIAL GROWTH (10-year increment) for all Growth Sample Trees with a diameter ≥ 3.0 inches. Measure the last 10 years of radial growth from an increment core taken directly below the point of diameter measurement, at a right angle to the bole. To reduce bias, bore on the side of the tree facing plot center (when possible). Using a ruler

with a 1/20th-inch scale, measure the width of the outer complete 10 annual increments (most recent). Record RADIAL GROWTH to the nearest 1/20th of an inch, using integers only (e.g., record 16/20th as '16,' and 6/20th as '06'). Refer to Appendix N of the R1 CSE/IM Field Guide for additional guidelines on measuring radial growth.

- Tolerance (Radial Growth):
  ± 1/20th inch

Note: Do not bore aspen trees on plot. Attempt to find an aspen in the same size class as the GST tree off the plot. Bore the tree that is off plot and use that as an estimate.

Remeasurement Radial Growth:
Data will be included on previously recorded GST trees. Only collect radial growth on newly established GST trees that have not been previously recorded. Radial growth does not need to be measured in subsequent measurements because it can be calculated from measured diameters.

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

Record HEIGHT GROWTH (5-year) for all for Growth Sample Trees that are < 3.0 inches in diameter and ≥ 5 years old. Measure the most recent five complete height segments (to the nearest 0.1 foot). Record HEIGHT GROWTH in feet and tenths of feet (e.g., record a 5-year height growth of 2.8 feet as '02.8'). Note: In order for a tree to qualify as a GST, the most recent, complete height increment must be alive and intact.

Refer to CSE 5.14 in the R1 CSE/IM Field Guide and Appendix N of the R1 CSE/IM Field Guide for additional guidelines on measuring HEIGHT GROWTH.

- Tolerance (Height Growth):
  For trees with a height ≥ 6 feet: ± 1 foot
  For trees with a height < 6 feet: ± 0.1 foot

Remeasurement Height Growth:
Prior data not included. Remeasure height growth on previously recorded GST trees. Collect height growth for newly established GST trees that have grown into the 1.0-2.9" DBH category.

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

Measure age for all GST trees the first time they are tallied. Determine tree age using an increment bore to sample directly below DBH on the side of the tree facing plot center (when possible) for trees with DBH ≥ 3.0". For trees with DBH < 3.0 determine total age by counting branch whorls. If a tree age can't be determined using the above methods, estimate the age using the method outlined in Appendix O of the R1 CSE/IM Field Guide. See also CSE 5.15 in the R1 CSE/IM Field Guide.

- Tolerance (Tree Age):
  For trees <300 years old: ± 10% of total age
  For trees ≥300 years old: ± 15% of total age

Remeasurement Tree Age:
Prior data will be included. Do not re-bore trees that have already been bored for age. Collect age on newly established GST trees that have not previously been tallied. Age does not need to be measured in subsequent measurements because it can be calculated from measured ages.

Note: Do not bore aspen trees on plot. Attempt to find an aspen in the same size class as the GST tree off the plot. Bore the tree off plot and mark the age as estimated by entering AE1 in the tree remarks.

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

Record CROWN RATIO (to the nearest percent) as the length of the live crown divided by tree height. Live crown length is assessed from the uppermost live leader or branch to the lowest live branch. Visually adjust large openings in the crown or lopsided crowns by transferring lower branches to fill in the holes. Do not excessively compress the live crown length because the crown appears "sparse" or contains "unhealthy" foliage. Refer to Appendix Q of the R1 CSE/IM Field Guide for guidelines on measuring crowns.

- Tolerance (Crown Ratio):
  ± 10 percent

Remeasurement Crown Ratio:
Prior data will not be included. Collect crown ratio on all live trees.

CSE 5.17 Crown Class ***(2-character) Required for all live trees including seedling groups.***

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

- Tolerance (Crown Class):
  ± 1 class

Table 5.7 – 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.

Code	Name	Description
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.

Remeasurement Crown Class:
Prior data will not be included. Assess tree class for all live trees.

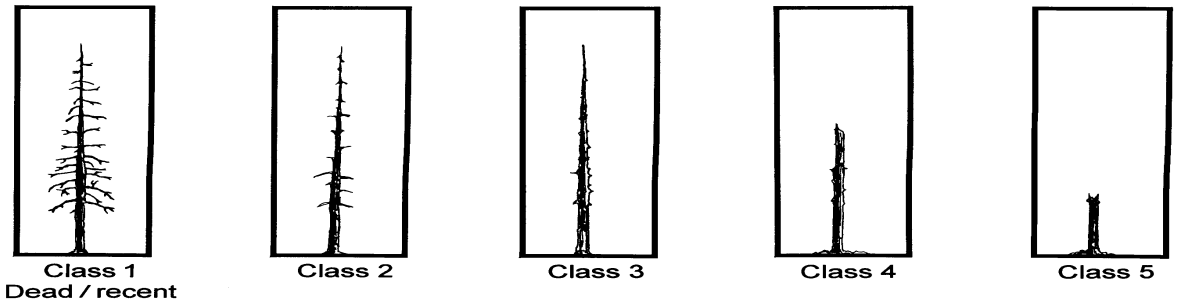
CSE 5.20 Snag Decay Class ***(1-digit) Required for dead trees***

For standing dead trees (snags), record a SNAG DECAY CLASS code to indicate the condition of the tree.

Table 5.8 – SNAG DECAY Classes

Code	Bark	Heartwood Decay	Sapwood Decay	Limbs	Top Breakage	Bole Form	Time Since Death
1	Tight, intact	Minor	None to incipient	Mostly Present	May be present	Intact	1-5 years
2	50% loose or missing	None to advanced	None to incipient	Small limbs missing	May be present	Intact	> 5 years

Code	Bark	Heartwood Decay	Sapwood Decay	Limbs	Top Breakage	Bole Form	Time Since Death
3	75% missing	Incipient to advanced	None to 25%	Few remain	Approx. ⅓	Mostly Intact	> 5 years
4	75% missing	Incipient to advanced	25% +	Few remain	Approx. ⅓ to ½	Losing Form, soft	> 5 years
5	75%+ missing	Advanced to crumbly	50% + advanced	Absent	Approx. ½ +	Form mostly lost	> 5 years



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

Remeasurement Snag Decay Class:
Prior data will not be included. Evaluate Snag Decay Class for all dead tally trees.

- Tolerance (Snag Decay):
  ± 1 class

CSE 5.22 Tree Damage Category (*2-digit) Required for trees ≥ 1.0-inch DBH/DRC, if applicable*
For live tally trees and saplings with serious damage (see rule below), record up to three damages. For recently dead trees (those that died within the last 5 years with Snag Decay Class =1), record damage category as cause of death. For an unknown cause of death on mortality trees code category 90 "Unknown" with a severity of 9.
Code broken top on all trees including non-recent mortality (died more than five years ago with Snag Decay Class >1).

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

Examine physical evidence carefully; general symptoms may be indicative of several damaging agents. Refer to Appendix R in the R1 CSE/IM Field Guide for a complete listing of TREE CATEGORY, AGENT, and SEVERITY codes. Codes are provided for general categories of damaging agents as well as for specific agents. The general category code should be used if there is any question as to the identity of the specific damaging agent. It

is very important to record only accurate pest information for intensified grid plots. See the CSE/IM General Descriptions of Insects and Diseases for more specific identification information.

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

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

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

Record broken/missing top for all live or dead trees. Delete all other damages for dead trees with Snag Decay Class >1 that died more than five years ago.

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

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

CSE 5.26 Tree Remarks (*30-character)*
Use this field to record any notes pertaining to a specific tree that may explain or describe another variable.
Additionally, use TREE REMARKS to record the following information:

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

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

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

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

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

Remeasurement Horizontal Distance:
Do not change the distance unless it is not within the specified tolerances. If the tree distance needs to be changed, enter ADC into the tree remarks field.

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

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

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

Remeasurement Tree Azimuth:
Do not change the azimuth unless it is outside of specified tolerances. If the tree distance needs to be changed, enter ADC into the tree remarks field.

- Tolerance (Tree Azimuth):
  ± 10 degrees

Section 6: Vegetation Composition and Ground Surface Cover Transects Forms

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

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

> Remeasurement Vegetation Composition and Ground Surface Cover:
> Prior inventory will not be included in the data file. Completely remeasure the Vegetation Composition and Ground Surface Cover as per the following instructions.

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

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

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

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

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

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

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

The following Attributes will be measured:

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

Lifeform	Code	Attribute	Data Collection
Trees:	**TOT**	**Total Tree Canopy Cover**	**Transect**
	TOV	**Trees Canopy Cover (layer > 6.0 feet)**	
	TSA	**Trees Canopy Cover (layer ≤ 6.0 feet)**	
Shrubs:	**TOS**	**Total Shrub**	**1/24th Acre Subplot**
	ST	**Shrubs (layer > 6.0 feet)**	
	SM	**Shrubs (layer 1.6 – 6.0 feet)**	
	SL	**Shrubs (layer ≤ 1.5 feet)**	
Forbs:	**TOF**	**Total Forbs**	
Graminoids:	**TOG**	**Total Graminoids**	

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

Measure the Cover of Trees using the following Method.

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

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

- Record tree canopy cover, tree canopy cover >6' tall, and tree canopy cover <6' tall on form A5. Record the position on the tape, where the tree canopy cover begins in the beginning point (beg) box and record where tree canopy ends in the ending point (end) box. Do this every time tree canopy cover bisects the sampling plane.

  Calculate the length of canopy cover along the transect by subtracting the beginning position from the ending position, record the length in the Length box. Add all the Lengths to determine the total length of the transect that has tree canopy cover, record in Total Cover. Repeat for the second transect. Add the totals from both Transects. Record in the Exams Cover by Lifeform form next to TOT.

As you are recording total canopy cover, make not of cover trees >6' and for trees ≤6'. Record in the Exams Cover by Lifeform form next to TOV and TSA.

- TOV and TSA are independent of one another and should reflect the total value within each height class. *Note that these two fields can add to a total greater than TOT because TOV and TSA can be overlapping.*

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

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

Cover by Lifeform | Cover by Species and Layer | Cover

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

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

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

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

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

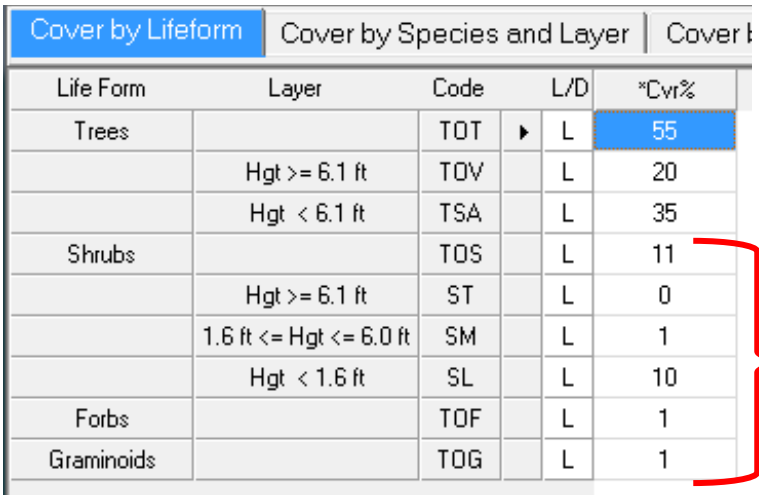
Estimate the percent of 1/24th acre subplot covered by the vertical projection of the canopy for the particular Lifeform: shrubs (TOS), forbs (TOF), graminoids (TOG). Only include vegetation and plant parts within the 1/24th-acre subplot perimeter (horizontal distance), that are alive (or were alive)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

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

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

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

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



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

- Tolerance (Canopy Cover): ± 10 percent

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

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

6.B Vegetation Composition – Cover by Species Form

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

- **Species List** – a listing of all species, with a canopy cover of 3 percent or greater

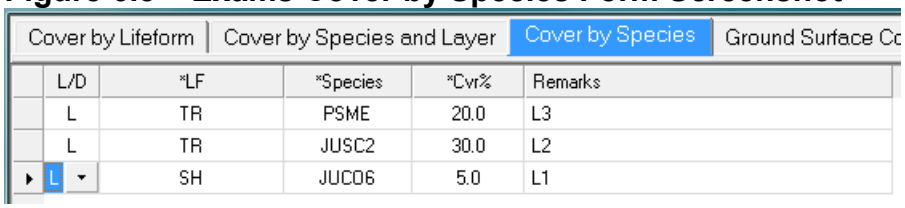
- **Noxious Species List** a listing of the occurrence of any noxious species with *any* canopy cover percent (see Appendix I for complete list).
- **Aspen** -the presence, and cover, of aspen
- **Note:** Forests may include additional species lists

Method: For each species that is being assessed, estimate the percentage of the 1/24th acre subplot area of ground surface that is covered by a vertical projection of the canopy of the species. Base all estimates on the cover of vegetation and plant parts that are (or were) alive during the current growing season, and are located within the subplot perimeter (24.0 ft radius, horizontal distance, see Section 1.D.1 for information on correcting for slope). Only record a species once on this form.

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

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

Figure 6.5 – Exams Cover by Species Form Screenshot



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

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

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

Table 6.6 – Layer Code Definitions

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

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

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

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

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

6.C Ground Surface Cover Form

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

Sampling Method: Refer to Section 1D, Plot Layout.
Lay out **four transects** that originate from plot center (PC stake) and extend outward 25.0 feet **slope distance** at azimuths of 0, 90, 180, and 270 degrees. Lay a cloth tape along the slope of the ground; do not correct the slope distance to obtain horizontal distance. Mark the end of the transect lines with a pin or small twig with a piece of flagging attached. See Figure 1.7 and 1.8 for a diagram of the layout of the ground surface cover transects.

Beginning at the 1-foot mark from PC (*along each transect direction*), place the tip of a plot stake or sharply pointed staff on the ground along the transect line at each 1-foot mark (against the right side of the tape with your back to plot center). Record each point, referred to as a "hit," on the Ground Cover Sample Form (Appendix A6) by the appropriate ground surface cover type category (see Table 6.10) for cover type categories). If more than one category occurs at a point (e.g., litter on top of a rock), always record the ground

cover category that is on top (i.e., the category that the pointed staff touches first). Note: Foliar canopy cover above the soil surface plane is not considered to be ground surface cover.

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

Remeasurement Ground Surface Cover:
Ground surface cover transects are completely remeasured.

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

Code	Description	Definition
ASH	Ash (Organic from fire)	Remaining residue after all combustible material has been burned off.
BARE	Bare soil (soil particles < 2 mm)	Bare soil, not covered by rock, cryptogams or organic material. Does not include any part of a road (see definition for road).
BAVE	Basal vegetation	Basal vegetation not differentiated by Lifeform. For use when basal vegetation is not separated into more detailed codes (BAFO, etc.)
CRYP	Cryptogamic crust	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria).
DEVP	Developed Land	Surface area occupied or covered by any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure, sod/lawn.
LICH	Lichen	Lichens: an organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in a symbiotic
LITT	Litter and duff	Leaf and needle litter, any material < ¼ inch, and duff not yet incorporated into the decomposed top humus layer. Non-continuous litter is not included (for example, scattered needles over soil is classified as Bare)
MOSS	Moss	Nonvascular, terrestrial green plants including mosses, hornworts and liverworts - always herbaceous. This code does not apply to moss growing on bare soils in dry rangeland conditions. For rangeland conditions, see cryptogamic crusts.

Code	Description	Definition
PEIS	Permanent ice and snow	Surface area covered with ice & snow at time of plot measurement, considered permanent.
ROAD	Road/Trails	Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained or in long-term continuing use. May be constructed using machinery. Includes cutbanks and fills.
ROCK	Rock	Relatively hard, naturally formed mineral or petrified matter > 1/8 inch in diameter appearing on soil surface as small to large fragments or as relative large bodies, cliffs, outcrops, or peaks. Includes bedrock.
TRIS	Transient ice and snow	Surface area covered by ice and snow at the time of plot measurement, considered transient.
UNKN	Unknown	Other covers not defined elsewhere including trash and garbage.
WATE	Water	Where remaining above the ground surface during the growing season, such as streams, bogs, swamps, marshes and ponds (FIA definition).
WOOD	Wood	Woody material, slash and debris; any woody material, small and large woody debris, regardless of depth. Litter and non-continuous litter are not included (for example, scattered needles over soil is classified as BARE).

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

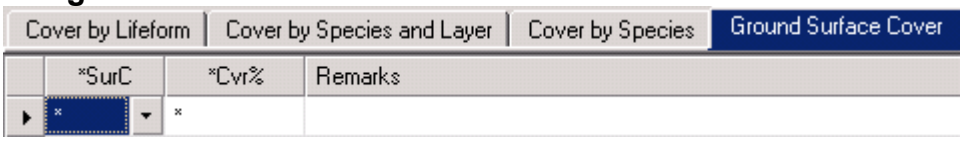
Determining GROUND SURFACE COVER PERCENT for the plot:
Add the Surface Cover Type totals from each transect to determine the surface cover type totals for the plot. Enter these numbers into the plot total column.

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

Category Cover Percent = Total # hits for each category

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

Figure 6.11 – Exams Ground Surface Cover Form



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

Table 6.12 – Ground Surface Cover Adjustment Guidelines

GROUND SURFACE COVER PERCENT – adjustment for partially sampled transects.

Adjustment for nonsampled transect: the individual category percentages that are entered in the Exams software sum to 100 percent. If any portion of a transect cannot be sampled (e.g., due to a hazardous situation), use the following procedures to determine individual category percentages. This procedure adjusts percentages to the area sampled, thus allowing the grand total to equal 100 percent.

Adjustment Procedure:

1) Determine the "total number of hits sampled for the plot."

2) Divide each cover type category total by the "total number of hits sampled for the plot."

3) Verify that the sum of all categories is equal to 100 percent. If the grand total is slightly off (e.g., 98% or 102%), due to categorical rounding, then further adjust one or more of the individual category percentages so that the grand total will equal 100 percent. Use one of the following steps:
   - If the cover type category with the highest percent cover is at least 5% higher than any other category percent, then make the adjustment to that category (e.g., add or subtract 1% or 2%).
   - If two (or more) cover type categories have the highest cover percents (they are less than 5% apart), then make adjustments (equal if possible) to each of the top categories.

Example – GROUND SURFACE COVER PERCENT adjustment for nonsampled transect:

- Categories and number of hits sampled for entire plot:

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

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

- GROUND SURFACE COVER PERCENT adjustment:

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

Total Percent for Plot = 99%

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

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

Total Percent for Plot: 100%

❖ Tolerance Ground Surface Cover Percent:
± 10 percent

Section 7: Down-Woody Materials Form

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

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

Remeasurement Down-Woody Material:
Prior data will not be included. Completely remeasure all down woody material variables as per the instructions below.

7.A Definition of Down-Woody Materials

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

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

CWD does not include:

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

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

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

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

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

FWD does not include:

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

7.B Down-Woody Materials Sampling Procedures

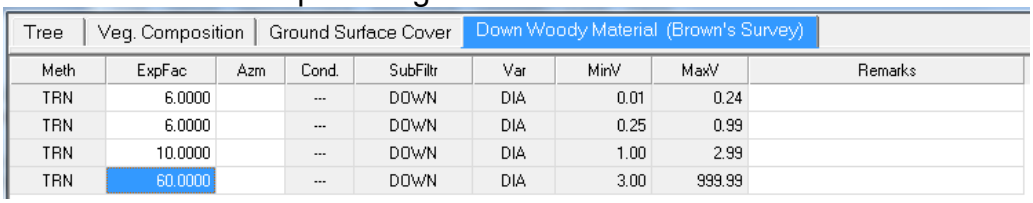
7.B.1 Down-Woody Materials Transect Layout

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

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

Figure 7.1 – Down Woody Materials Adjustment for Nonsampled Transect

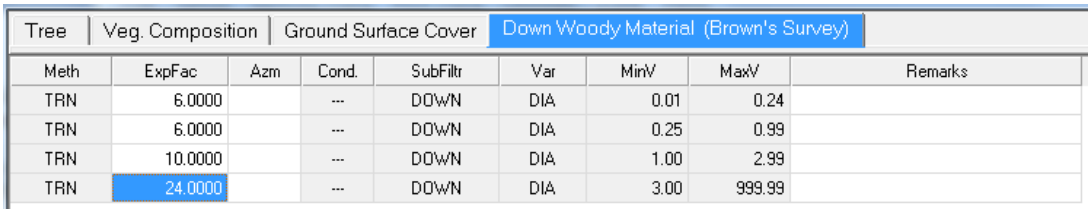
Standard DWM Sample Design:



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

Adjustment for nonsampled transect:

If any portion of a DWM transect cannot be sampled (e.g., due to a hazardous situation), go into Exams software, Setting Data, Sample Designs for the affected plot, Down-Woody Material tab. Enter the actual length sampled (truncate the length for the appropriate transect and plot). The example below shows a plot with a truncated transect length of 24 feet to the north and 0 feet to the south for the piece count of logs 3” and larger.



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

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

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

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

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

Remeasurement:
Prior measurement data will not be included. Re-collect all Down Woody Material data.

Table 7.2 – Required Down Woody Material Fields

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

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

CSE 7.1 Plot Number (4-digit)

CSE 7.2 and 7.3 First Duff and Second Duff (2.1-digit; xx.y)

Take FIRST DUFF and SECOND DUFF measurements as specified below. Although titled "duff," these measurements include both total duff and litter depth at the locations indicated (24-ft, horizontal distance). Record the duff/litter values to the nearest 0.1 inch.

Duff/Litter Sampling Methods

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

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

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

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

- **For odd-numbered plots –** Take the first duff/litter measurement on the north transect (*oriented at 0 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**First Duff**" column. Take the second duff/litter measurement on the south transect (*oriented at 180 degrees*) at 24.0 feet **horizontal distance** from plot center, and record it in the "**Second Duff**" column.

When stumps, logs, and trees occur at the point of measurement, offset 1 foot perpendicular to the right of the sampling plane (with your back to plot center). Include

portions of rotten logs in the depth measurement if the central axis of the rotten log is in the duff layer.

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

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

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

Table 7.3 – FWD Diameter Size Classes

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

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

FWD Tally Rules:

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

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

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

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

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

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

for the 6 foot transect (as long as the remaining transect has a similar density of FWD pieces).

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

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

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

- Tolerance (Twig1):
  ± 40 percent

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

- Tolerance (Twig2):
  ± 30 percent

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

- Tolerance (Twig3):
  ± 20 percent

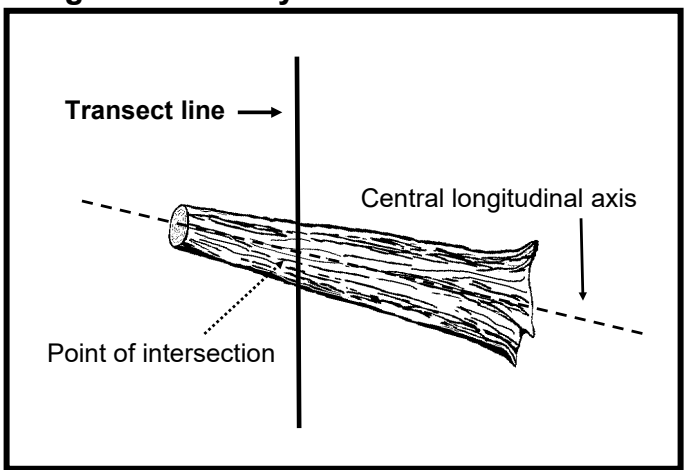
7.B.4 Coarse Woody Debris Sampling Methods (Items 7.8, 7.9, 7.10, 7.11, and 7.12):
CWD is sampled along two 30 foot transects (see Figure 1.7, Section 1.A.5 Plot Layout; *transects oriented east-west for even-numbered plots; transects oriented north-south for odd-numbered plots*). Collect CWD data along the entire length of both transects.
Note 1: Record CWD systematically starting at plot center for each transect in the order as follows for quality control purposes: measure the north transect followed by the south transect for odd plots, and measure the east transect followed by the west transect for even plots.

CWD Tally Rules:

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

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

Figure 7.4 – Tally rules for CWD



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

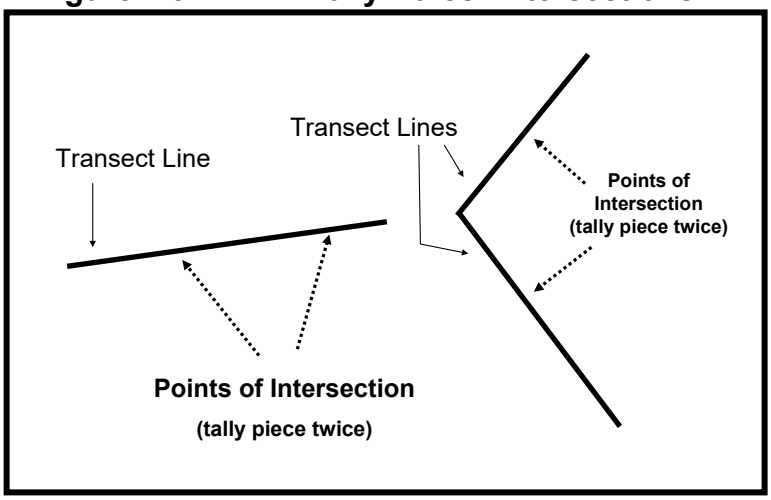
3. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3.0 feet, measure the length to the nearest 0.1 ft to determine if it is ≥ 3.0 feet.

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

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

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

Figure 7.5 – CWD Tally Rules: Intersections



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

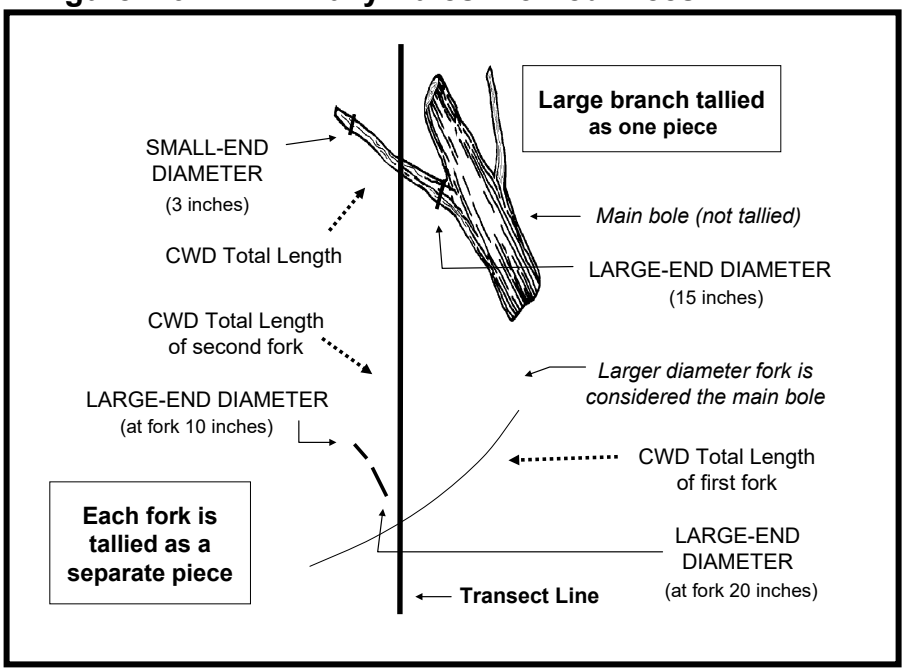
8. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

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

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

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

Figure 7.6 – CWD Tally Rules: Forked Trees



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

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

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

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

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

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

Table 7.7 – Log Decay Class Definitions

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

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

Tally qualifications:

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

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

CSE 7.10 Diameter (at point of intersection) (3,1-digit; xxx.y)

For each CWD piece tallied, record the diameter at the point where the transect intersects the longitudinal center of the piece (intersect diameter). Record the intersect diameter to the nearest inch.

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

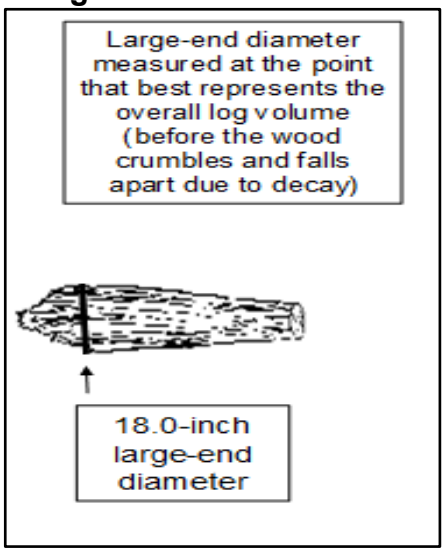
- ❖ Tolerance (Diameter – at point of intersection):
  ± 1 inch

Diameter Measurement Guidelines:

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

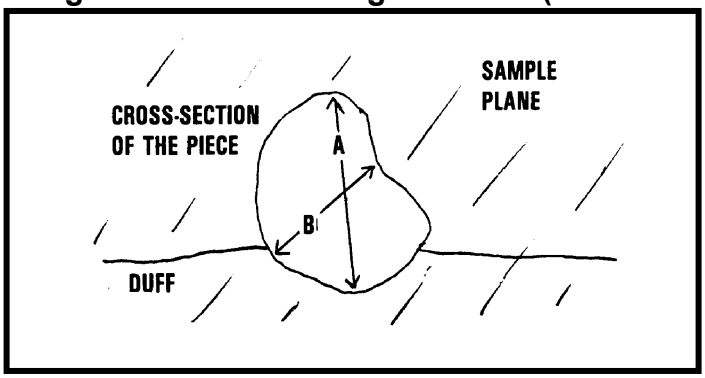
Note: Mark each piece of CWD tallied with a 1 inch mark using a lumber crayon or paint pen at the point of intersection where the transect intersection diameter was taken.

Figure 7.8 – Diameter Measurement



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

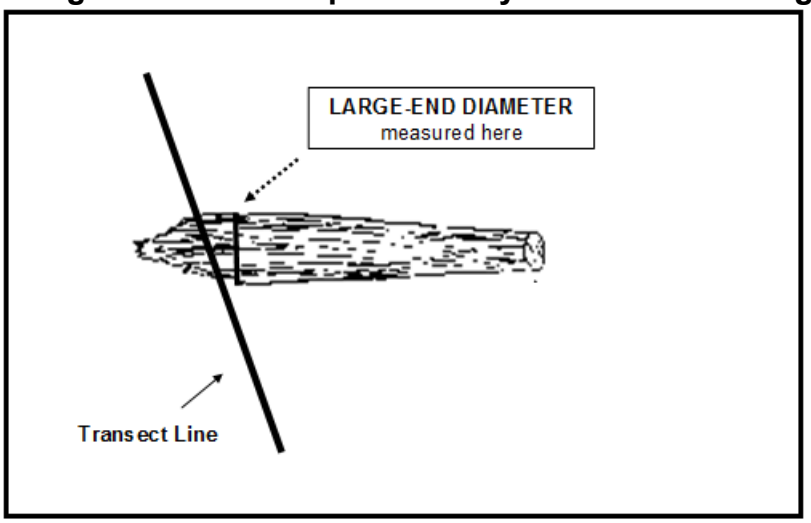
Figure 7.9 – Estimating Diameter (Pieces that are Not Round in Cross-Section)



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

end (take two measurements and calculate an average if it is odd shaped). Measure PIECE LENGTH between the large-end and small-end diameters.

Figure 7.10 – Example of Decayed End Intersecting the Transect



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

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

- Tolerance (Piece Length):
  ± 10 percent

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

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

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

Literature Cited

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

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

APPENDICES:

A	Data Collection Forms: A1: Plot Location Reference Form (Supplemental) A2: Plot Location Photo Placard A3: Ground Surface Cover Form A4: Plot and Tree Data Collection Form A5: Vegetation Composition Form A6: Microplot Seedling Data Collection Form A7: Down-Woody Materials Form A8: Lynx Horizontal Cover Form
B	Generalized GPS Settings
C	Tolerances for R1 Intensified Grid Inventory
D	Tally Tree Species (Timber and Woodland Species)
E	Plot Packet Contents and Plot Packet Bundles
F	Recommended Field Gear
G	Editing an Exams Software Intensification Template File
H	Noxious Plants Lists
I	R1 Habitat Type Groups
J	Lynx Horizontal Cover (Optional)

Appendix A: Data Collection Forms

Any form labeled "*Required*" will need to be completed for each setting/plot location (refer to Section 1.B, Finding the Plot Center and Plot Monumentation).

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

Appendix A1: Plot Location Reference Form (*Required*)
*** Always complete this form** as thoroughly as possible on paper as it serves as a valuable reference for field navigation. The shaded boxes contain information that is only collected on this form and will not be entered into the electronic file.

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

Appendix A3: Ground Surface Cover Form
See instructions on form use in Section 6, Vegetation Composition and Ground Surface Cover Transects Form in this protocol for more information.

Appendix A4: Microplot Seedling Data Collection Form
This form can be used to collect tree data in the event the PDR is not working or some other extenuating circumstance. In general, tree data should be collected in ExamsPDR because the software provides data checks for required values and GST trees.

Appendix A5: Vegetation Composition Form
See Section 6, Vegetation Composition and Ground Surface Cover Transects Form in this protocol for more information.

Appendix A6: Seedling Data Collection Form
See Seedling Data Collection information in Section 5.B of this protocol.

Appendix A7: Down-Woody Materials Form
See Down-Woody Materials information in Section 7 of this protocol.

Appendix A8: Lynx Horizontal Cover Form
See Appendix K for protocols on collecting lynx horizontal cover.

Appendix A1: Plot Location Reference Form

PROJECT NAME: (25 character) GRID INT _

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

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

Vehicle Coordinates (G.A.2):

Latitude (G.A.2.1): _____ Longitude (G.A..2.2): _____

Travel Description (G.A.1): _____

_____

_____

_____

_____

_____

_____

Reference Point (G.A.3): Species (G.A.3.2): _____ Diameter (G.A.3.3): _____

Remarks (G.A.3.1):_____

RP to PC Traverse Info: Azimuth (G.A.4.1): _____ Slope Distance (G.A.4.2): _____

RP Coordinates:

Latitude (G.A.3.4.1)_____

Longitude (G.A.3.4.2) _____

PC Witness Trees

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

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

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

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

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

Remarks (4.19.9):_____

_____

_____

_____

_____

PC Coordinates

Latitude(4.2.1): _____

Longitude (4.2.2): _____

PC Offset (if applicable):

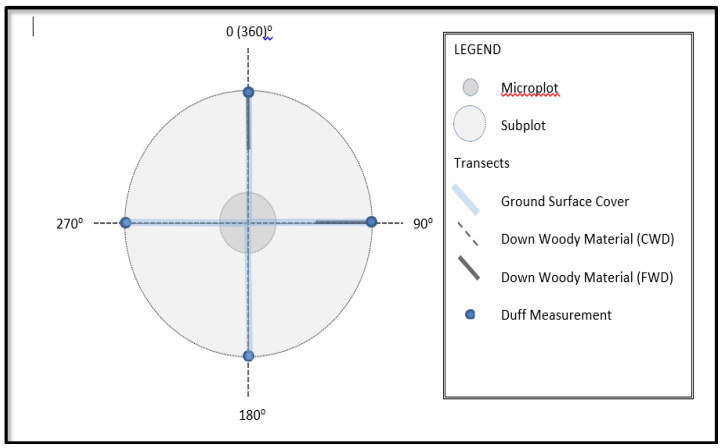
Azimuth (1.B.6.1): _____

Slope Dist (1.B.6.2): _____

* NOTE: Shaded areas are not recorded in Exams. This form is the only record of these attributes.

Plot Narrative/Remarks (1.B.6.2)

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



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

Appendix A2: Photo Placard

GRID INT

Proc Forest:
Proc Dist:
Loc:
State:
County:
Plot ID:
Measurement #:

N E S W

Appendix A3: Ground Surface Cover Sample Form

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

Surface Cover	Transect Azimuth				GROUND SURFACE 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%

Appendix A4: Plot and Tree Data Collection Form

Project Name: GRID INT

Region: 1 Proclaimed Forest: _____ District: _____ Owner: USFS

Location: _____ Plot/Stand ID#: _____ State: _____ County: _____

Crew Names: _____ Date: _____

PV Code _____ Slope _____ Aspect _____

page __1__ of _____

Tree Measurement:

Tag ID	Status (L/D)	Tree Class	GST	Species	H Dist	Azim	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: Multistem DRC, Age Est
																	Category	Agent	Severity	Category	Agent	Severity	Category	Agent	Severity	
xxxx	x	xx	x	xxxxxxxx	xx.x	xxx	xxx	xxx	xxx.x	xxx	xx	xx.x	xxxx	xxx	xx	x	xx	xxx	xx	xx	xxx	xx	xx	xxx	xx	drcxxx.x, AE1

Appendix A5: Vegetation Composition Form

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

Cover by Lifeform:

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

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

Cover by Species:

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

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

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

Appendix A6: Microplot Seedling Data Collection Form

Project Name: Grid Int	Proc. Forest	District	Plot ID	State	County	Loc	Date MM/DD/YYYY __/__/____

Microplot Seedling Count

Species: ________	Tree Count	DBH <1.0”	Height	CR	Crown class
0.5-4.4 ft.					
Tot Tally			(ave)	(ave)	(ave)
4.5+ ft.					
Tot Tally			(ave)	(ave)	(ave)
Species: ________	Tree Count	DBH	Height	CR	Crown class
0.5-4.4 ft.					
Tot Tally:			(ave)	(ave)	(ave)
4.5+ ft.					
Tot Tally:			(ave)	(ave)	(ave)
Species: ________	Tree Count	DBH	Height	CR	Crown class
0.5-4.4 ft.					
Tot Tally:			(ave)	(ave)	(ave)
4.5+ ft.					
Tot Tally:			(ave)	(ave)	(ave)
Species: ________	Tree Count	DBH	Height	CR	Crown class
0.5-4.4 ft.					
Tot Tally:			(ave)	(ave)	(ave)
4.5+ ft.					
Tot Tally:			(ave)	(ave)	(ave)

Appendix A7: Down-Woody Materials Form

Project Name: Grid Int	Proc. Forest	District	Plot ID	State	County	Loc	Date MM/DD/YYYY _ _/_ _/ _ _ _ _

Measurement Direction and Distances		FWD			CWD	Litter/Duff	
		1-Hour	10-Hour	100-Hour	1000-Hour	FIRST DUFF	SECOND DUFF
Transect Direction	Odd# plot	0°	0°	0°	0° and 180°	0°	180°
	Even# 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 (30 ft each)	24-ft mark	24-ft mark

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

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

Coarse Woody Material (>3.0 in.):

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

Coarse Woody Material (>3.0in.)

Transect Azimuth	Piece Count XXX	Decay Class X	Diameter (in.) XXX.X	Length (ft.) XXX.X	Large End (in.) XXX.X

Appendix A8: Lynx Horizontal Cover Estimation Form

Project Name: GRID INT _____

Region: 01 Proclaimed Forest: _____ District:_____

Location:_____ State:____ County:_____

Plot ID: _____ Date:_____

Crew:_____

Azimuth:	0^O	90^O	180^O	270^O
Quadrant 1 Cover %				
Quadrant 2 Cover %				
Quadrant 3 Cover %				
Quadrant 4 Cover %				
Sum of Quadrant Cover Q1 % + Q2 % + Q3 % + Q4 %				
Board Average Cover % $\frac{\text{Sum of Quadrant Cover}}{4}$				
Sum of Board Cover % (0^O+90^O+180^O+270^O)				
Plot Average Cover % $\frac{\text{Sum of Board Cover \%}}{4}$				

Appendix B: Generalized GPS Operating Instructions

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

A. Settings

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

General tab

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

Altimeter tab

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

Compass tab

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

Time tab

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

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

- Coordinates: UTM
- Datum – NAD 1983 CONUS
- WAAS: Enabled
- North Reference: True

C. Collecting Points

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

D. Improving Satellite Reception

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

GPS Requirements and Tips:

- NAD 1983 has been officially adopted as the legal horizontal datum for the United States by the Federal government (Federal Register, Vol. 54, No. 113, page 25318, June 1989).
- Use a GPS receiver that has the ability to obtain the stated accuracy of ± 15 meters (49.2 feet), for each plot, in the horizontal dimension. Newly installed plots must be within ± 10 meters of their provided theoretical coordinates in both latitude and longitude values.
- Elevate the GPS receiver off the ground and remove all obstructions that may block reception; use the external antenna if necessary.
- Use the **Averaging** option of the GPS to provide coordinates for the position of the RP (or PC) on the UTM grid system.
- Acquire an almanac and assure a current position fix of three-dimensional "3D" status by remaining in the same location for at least 3 minutes (or longer if needed to acquire a minimum of at least 30 position fixes). After the almanac has been collected, proceed to collect and record the UTM coordinates.
- For Plot Center (PC) coordinates, UTM data must *also* be converted into Latitude/Longitude for entry into Exams software in the Plot Data Form (Section 4). See PLOT LATITUDE (Item 4.2.1) and PLOT LONGITUDE (Item 4.2.2). If this can be done efficiently and accurately in the field by the GPS unit, then these data may be entered at that time on a PDR. These data can also be converted through the Montana State University geographic unit converter website, or similarly accurate website, and then manually entered into Exams PC before plots are submitted. Use the following link for UTM-Lat/Long conversion: http://www.rcn.montana.edu/Resources/Converter.aspx
- For each point feature, at least 30 position fixes should be collected at an error of 50 feet or less.
- Point features are surveyed when the GPS antenna is at plot center for a period of time. During that time, 30 individual GPS position fixes are collected and averaged to give a single location for that point. While acquiring 30 fixes, the GPS receiver must not move as satellite signals are continuously received.

E. Obtaining an Averaged Location

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

- With the unit on, press and hold the Enter/Mark key for 2 seconds until the Mark Waypoint screen appears.
- Press the Menu key and a separate screen appears with average Location highlighted.

Press Enter and the Average Location screen appear and if there is good satellite reception, the Measurement Count will start.

Appendix C: Tolerances for the R1 Intensified Grid Inventory

Setting/Plot Location Reference Form – Setting Items:

CSE Item No.	Field Name	Tolerance
2.1	Project Name	No Errors
2.2	Proclaimed Region	No Errors
2.3	Proclaimed National Forest	No Errors
2.4	District	No Errors
2.5	Location	No Errors
2.6	Stand Number	No Errors
2.7	Owner	No Errors
2.8	State	No Errors
2.9	County	No Errors
2.10	Administrative Forest	No Errors
2.11	Date	No Errors
2.13	Examination Level	No Errors
2.14	Exam Purpose	No Errors
2.15	Stratum (NOT required)	Specified in Protocol/Contract
2.16	Existing Vegetation Reference (NOT required)	No Errors
2.18	Potential Vegetation Reference	No Errors to R1 Habitat Type Group
2.20	Structure (NOT required)	Specified in Protocol/Contract
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 used in R1
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)	Specified in Protocol/Contract

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

Item	Tolerance
Reference Point (RP):	
Species	No Errors
Diameter	± 0.2 inch per 20 inches of diameter
RP Selection	At least 75 feet from the PC, unless extenuating circumstances apply
RP Selection Criteria Met	No Errors
RP Tagged	No Errors
RP to Plot Center (PC) Traverse:	
RP to PC Azimuth	± 10 degrees
RP to PC Distance	± 6 feet per 100 feet of transect (30 feet maximum)
PC Coordinates:	
Latitude and Longitude	± 10 meters (32.8 feet) of the stated plot location center
Error	< 70 feet
PC Witness Trees:	
X Selection Criteria Met	No Errors
X Tagged	No Errors
Y Selection Criteria Met	No Errors
Y Tagged	No Errors
Species	No Errors
Diameter	± 0.2 inch per 20 inches of diameter
Azimuth	± 10 degrees
Slope Distance	± 0.2 feet
Travel Description	Route and hiking directions contain all applicable elements from section 1.B.1 of this document.
Plot Location Map	Provides useful landmarks for navigating from the parking location to the plot.

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
4.4	Plot Aspect	± 45 degrees
4.5	Plot Slope	± 10 percent
4.11	Plot Potential Vegetation	Accurate to R1 Habitat Type Group; see Appendix I

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

CSE Item No.	Field Name	Tolerance
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 * — 0.5-4.4 ft — ± 1 tree 6+ — 0.1- to 0.9-in * — 0.5-4.4 ft — ± 20% 1 - 5 — 0.1- to 0.9-in — ≥ 5.0 feet — ± 1 tree 6+ — 0.1- to 0.9-in — ≥ 5.0 feet — ± 10% * woodland species seedling groups
5.8	Number Stems	No Errors

CSE Item No.	Field Name	Tolerance	
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 • DBH Measurement Position: ± 0.2 inch from 4.5 feet (nail installation) ± 12 inches from 4.5 feet (remeasure)	
5.10	Height	± 10 percent of actual standing tree height	
5.12	Radial Growth	± 1/20th inch	
5.14	Height Growth	trees ≥ 6 feet: ± 1 foot trees < 6 feet: ± 0.1 foot	
5.15	Tree Age	trees < 300 years old: ± 10 percent trees ≥ 300 years old: ± 15 percent	
5.16	Crown Ratio	± 10 percent	
5.17	Crown Class	± 1 class	
5.20	Snag Decay Class	± 1 class	
5.22	Tree Damage Category	No Errors (unless otherwise specified) Refer to Damage Category Table below	
5.23	Tree Damage Agent	(see Damage Category)	
5.25	Tree Damage Severity	(see Damage Category)	
5.26	Tree Remarks (additional items):		
	• Estimated Age Flag	Recorded when applicable	
	• DBH Height	Recorded when applicable	
	• Woodland Tree Items (multi-stemmed species): ➢ Stem DRC – individual stem DRCs • Stem Status – record "d" for dead stems	Recorded when applicable	

CSE Item No.	Field Name	Tolerance
5.29	• Horizontal Distance	Microplot: ± 0.2 foot Subplot: ± 1.0 foot from 0-22.9 ft. ± 0.1 foot for > 23.0 feet Macroplot: ± 3.0 feet
5.30	• Azimuth	+ 10 degrees

Damage Category (CSE item 5.22):

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

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

Vegetation Composition:

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

Ground Surface Cover Transects:

Item	Tolerance
Transect Azimuth	± 10 degrees
Number of Hits per category	± 10 percent
Cover Type Category	No Errors
Ground Surface Cover Percent	± 10 percent

Down-Woody Materials Form:

Item No.	Field Name	Tolerance
DWM Sample Transect Azimuths		± 10 degrees
7.1	Plot Number	No Errors
7.2	First Duff	± 1/2 inch
7.3	Second Duff	± 1/2 inch
7.5.1	1-Hr (0.01 to 0.24 inch)	± 40 percent
7.5.2	10-Hr (0.25 to 0.99 inch)	± 30 percent
7.5.3	100-Hr (1.00 to 2.99 inches)	± 20 percent
7.8	Piece Count (CWD Transects)	No Errors
7.9	Log Decay Class	± 1 class
7.10	Diameter (at point of intersection)	± 1 inch
7.11	Piece Length	± 10 percent
7.12	Diameter Large End	• Pieces < 20.0 in: ± 2 in • Pieces ≥ 20.0 in: ± 15%

Appendix D: 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 T = "timber" or W = "woodland" species. Timber species are measured for diameter at breast height, 4.5 feet above the ground (Diameter at Breast Height, DBH); exceptions apply to trees with bole irregularities. Woodland species are measured for diameter at ground level or the stem-root collar, whichever is higher (Diameter at Root Collar, DRC); a cumulative DRC is computed for multi-stemmed woodland species. Refer to CSE/IM 5.9 DBH/DRC.

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

Tally Tree Species for the R1 Intensified Grid Inventory

PLANTS code	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

PLANTS code	Scientific Name	Common Name	Type
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

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

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

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

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

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

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

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

- **Topographical Map.**
- **Aerial Photos or NAIP Imagery** which displays the plot location area
- **Data Collection Forms** (paper form size: 8.5 in x 11 in). Each plot packet should contain the following "paper" forms (refer to Appendix A).
  - Plot Location Reference Form* (A1)
  - Plot Photo Placard* (A2)

  These forms (*) need to be completed for each Plot.

- The following forms should be available for general data collection:
  - Ground Surface Cover Form (A3)
  - Plot and Tree Data Form (A4)
  - Vegetation Composition Form (A5)
  - Microplot Seedling Data Collection Form (A6)
  - Down-Woody Materials Form (A7)
  - Lynx Horizontal Cover Form (optional variable) (A8)

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

Each individual plot data set should include:

- Plot list(s) containing packet number(s) that those plots are found within, examiner name, and date of measurement(s) delivered in hard copy paper form
- Electronic plot photo data files in .jpg format delivered via flash drive or CD (*note: these files are too large for email*)
- Plot Location Reference Form for each individual plot delivered in hard copy paper form and bundled by packet
- GPS acquired Plot Center (PC) points as an electronic .txt file, .doc file, or .xls file that can be delivered via flash drive, CD, or email
- Error free electronic field data submitted in ExamsPC (.im) file format that can be delivered on flash drive, CD, or via email

Remeasurement Plot Submission:
The Plot Location Reference Form must not be an overwrite on top of the original installation Plot Location Reference Form. A completely original form will be filled out for each remeasurement.

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

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

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

Appendix F: Recommended Field Gear

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

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

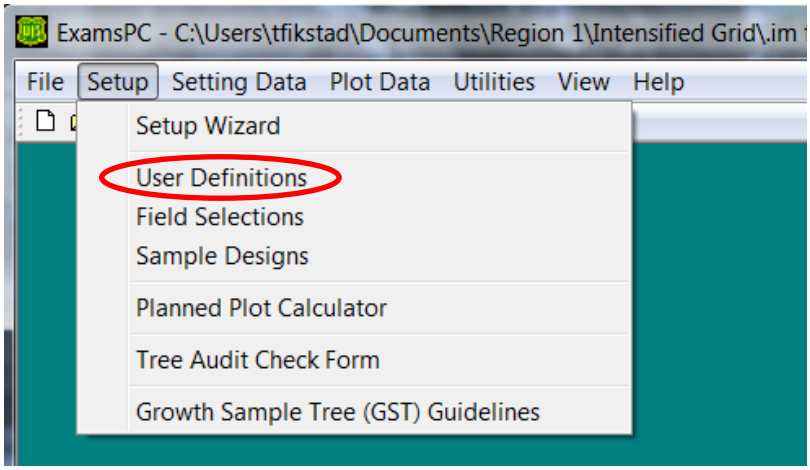
- **CSE/IM and Intensified grid field manuals** and **Habitat typing manuals**
- **Plant Identification books** (to aid in vegetation composition sample – tree, forb, shrub, and graminoid identification)
- **Candy cane stakes** (for attaching Logger's tape/cloth tape at PC location in order to measure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

Appendix G: Editing an Exams Intensification Template File

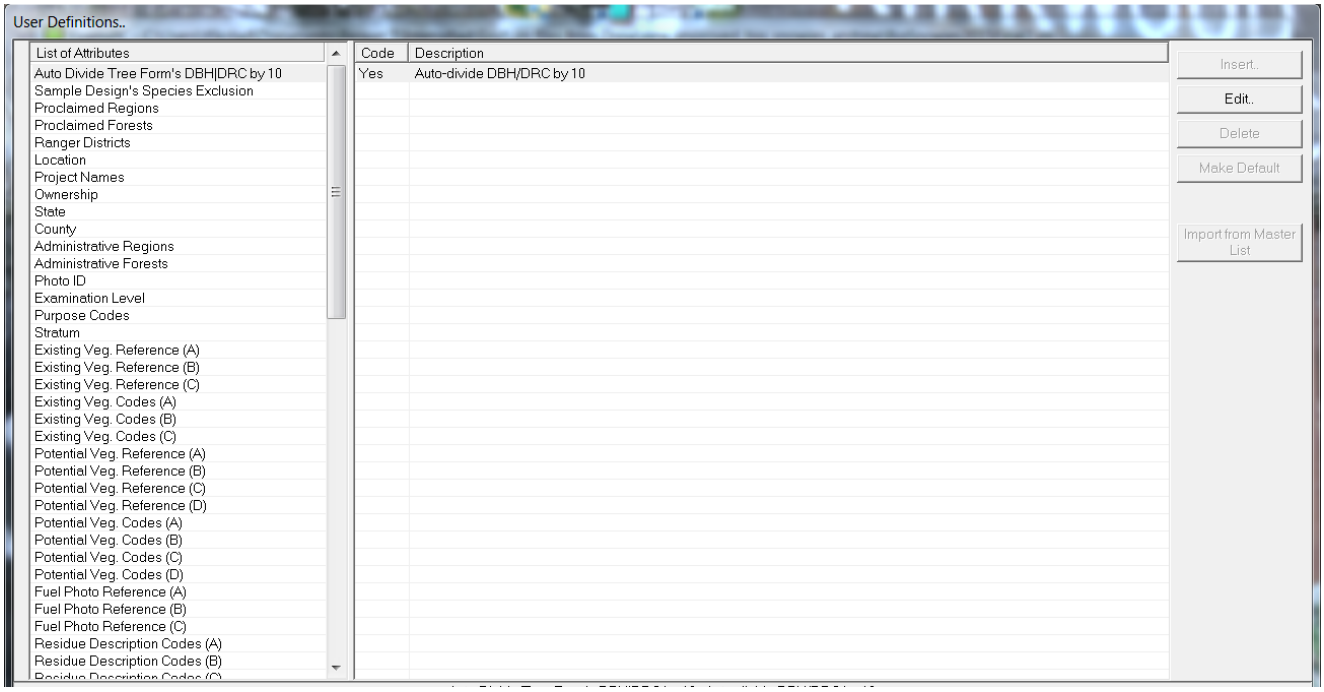
This appendix provides instruction on editing an existing Intensification Exams software template file that is applicable to the R1 Intensified Grid Inventory. To obtain an Intensification template file, contact the A-team. The template file contains the defaults and field selections that are **required** 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 template files.

Modifying the Exams Software Drop-down lists:

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



Set **appropriate defaults** for: Proc. Region, Proc. Forest, Admin. Forest, Project Name, Ownership, State, Admin. Forest, Potential Veg. Reference, District, and County. These fields can be found in Table 2.1. An asterisk in the CSE Attribute # column indicates attributes that should be set as defaults in the template.



Modifying the Tree Sample Design for Optional Macroplot:
To modify the sample design to include the macroplot option for trees, click on the **Setup** toolbar button, and then select **Sample Design**. Edit Tree Form as illustrated below by adding the sample design for the macroplot as shown and modifying the Maximum diameter on the subplot to 20.9 inches.

Sample Design Tree Form:

Default Sample Design Form(s)

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

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

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

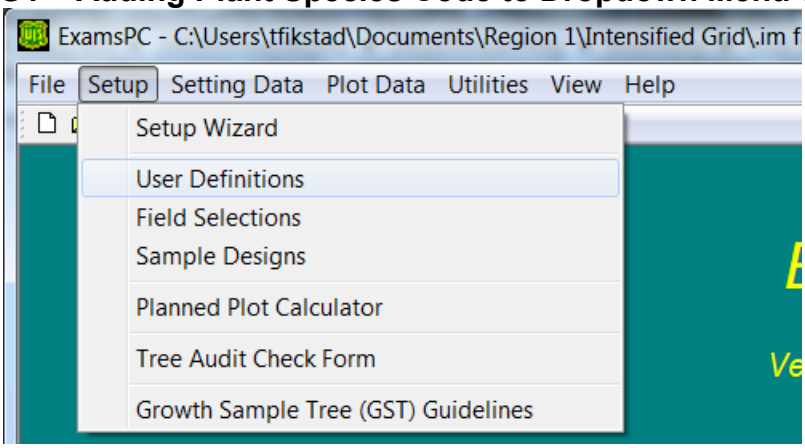
See Section 3: Sample Design Form in this document for screen shots of the Tree Form sample design for a plot without tree data collection on the macroplot, the Vegetation Composition sample design, the Ground Surface Cover sample design and the Down Woody Material sample design.

Making Plant Species Available in the Exams Template.

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

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

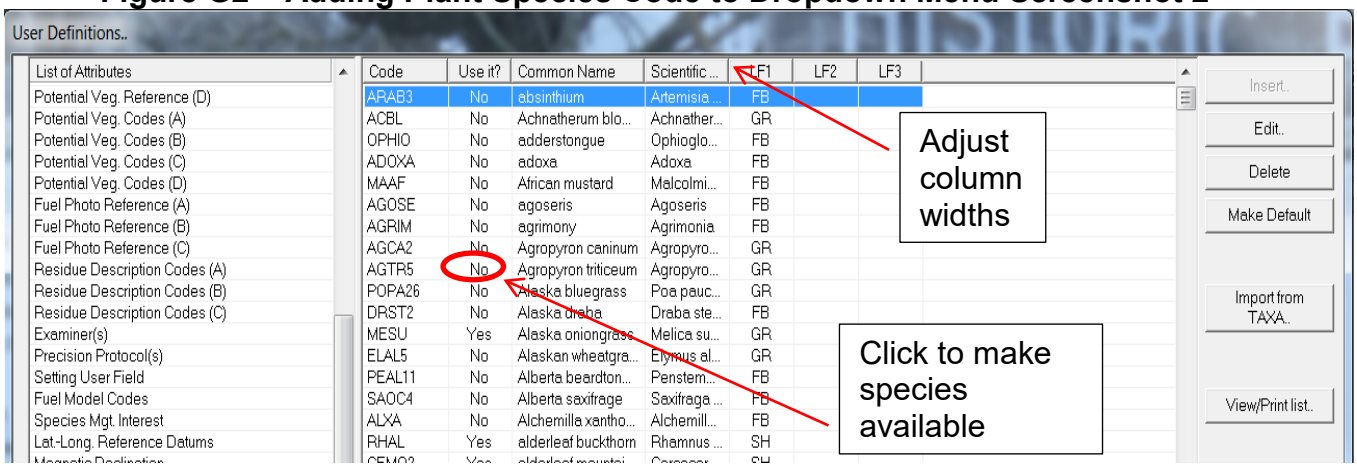
Figure G1 – Adding Plant Species Code to Dropdown Menu Screenshot 1



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

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

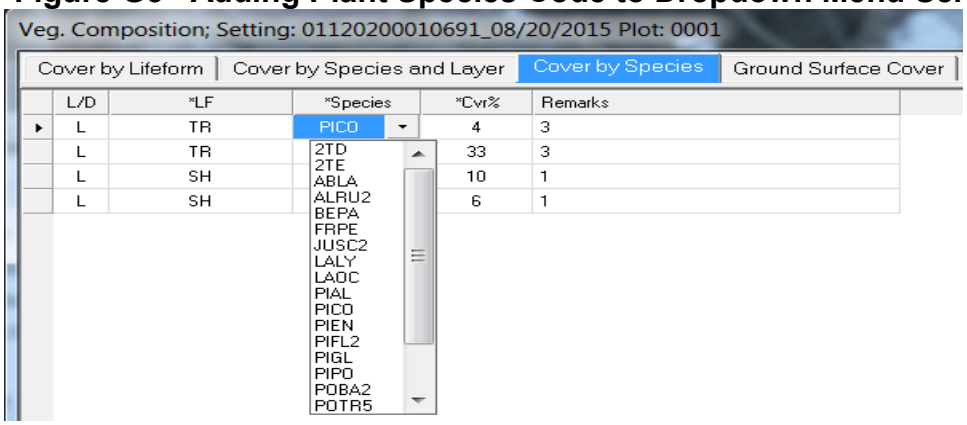
Figure G2 – Adding Plant Species Code to Dropdown Menu Screenshot 2



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

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

Figure G3– Adding Plant Species Code to Dropdown Menu Screenshot 3



Appendix H: Noxious Plants Lists:

***Note: Sensitive Plant Lists may be provided by Forest.**

Table H1 – State of Montana Noxious Weeds

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

Table H2 – State of Idaho Noxious Weeds

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

Appendix I: R1 Habitat Type Groups

R1 Habitat Type Group Crosswalk to ADP codes from *Region 1 Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring.*

R1 Habitat Type Groups	ADP[1] Habitat Type Code
Hot Dry	000, 040, 050, 051, 052, 070, 090[6], 091[6], 092[6], 093[6], 094[6], 095[6]
Warm Dry	100, 110, 130, 140, 141, 142, 160, 161, 162
	103[7], 104[7], 100032[8], 100033[8], 100034[8], 100035[8], 100037[8], 105[7], 106[7], 150
	200, 210, 220, 230
	205[7], 390[7]
	311, 380
	321
	180, 181, 182
Mod Warm Dry	170, 171, 172, 190
	430
	505, 506, 507, 508
	240[7], 250, 260, 261, 262, 263, 280, 281, 282, 283, 292, 310, 312, 313
	360, 320, 322, 323, 324, 330, 350, 370, 340
Mod Warm Mod Dry	510, 511, 512, 515, 590, 591, 592
	523
	290, 291, 293
Mod Warm Moist	500, 516, 517, 518, 519, 520, 521, 522, 524, 525, 526, 529
Mod Cool Moist to Wet	555
	501, 530, 531, 532, 533, 534, 535, 545, 546, 547, 548
	502, 565, 570, 571, 572, 573, 574, 575, 576, 577, 578
	540, 541, 542, 550, 560
	579
Cool Moist	600, 620, 621, 622, 623, 624, 625, 660, 661, 662670, 671, 673, 740
	685, 686, 687
	682
	680
	400, 420, 421, 422, 460, 461, 462, 470
	004[9], 472[7], 475[7]
Cool Wet	610, 630, 635, 636, 637, 650, 651, 652, 653, 654, 655
	631, 632
	675, 677
	410, 440, 480
Cool Mod Dry to Moist	663
	640, 691, 693, 700, 720, 750, 770, 780, 790, 791, 792
	690
	607, 745
	450
	900, 910, 920, 930, 950
	960[7]
	710, 712
Cold	672, 692, 694, 731, 732, 733,
	674, 730, 800, 810, 820, 830, 831, 832
	676
	681, 711, 840, 841, 842
	713
	925, 940
Timberline	860
	850, 870, 890
Bluebunch Wheatgrass	Ref 115: 200, 500, 800 Ref 103: 47130, 47131, 47132, 47140, 47141, 47142, 47143, 47144, 47145, 47146 Ref 114: 100005, 100006, 10010, 100021, 100054, 100055

R1 Habitat Type Groups	ADP[1] Habitat Type Code
Western Wheatgrass	Ref 114: 100001 Ref 115: 100
	Ref 615: GB5917, GB5922 Ref 103: 47003, 47004, 47120, 47121, 47122, 47123, 47124, 47125, 47126, 47127 Ref 114: 100023
Fescue	Ref 103: 47110, 47111, 47112, 47113, 47114, 47115
Mesic Shrubland	Ref 103: 46620, 46621, 46622, 46623
	Ref 110: 030, 031 Ref 112: 156, 157, 158, 159, 160, 161 Ref 115: 2000, 2100, Ref 114: 100052, 100056 Ref 615: SM19
Low Shrubland	Ref 103: 46600, 46601, 46602, 46603
Mountain Shrubland	Ref 103: 46611, 46612, 46613
Xeric Sagebrush	Ref 115: 1100, 1200 Ref 103: 46610, 46614, Ref 114: 100014, 100015
Xeric Shrubland	Ref 103: 46201, 46301, 46630, 46632, 46633 Ref 114: 100028 Ref 115: 1400 Ref 615: SD49
	Ref 103:46640, 46641, 46642, Ref 114: 100046, 100047, 10048
	Ref 114: 100013 Ref 115: 1000
Salt Desert Shrub	Ref 115: 1300, Ref 103: 46650, 46651, 46652 Ref 114: 100049, 100050
Juniper Woodland	Ref 102: 151, 152 Ref 114: 100029, 100030
Aspen Woodland	Ref 102: 351, 356 Ref 112: 117, 118, 119, 120, 121 Ref 114: 100040
Riparian Shrub[3]	Ref 112:030, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 150, 151, 152, 153, 154, 155, SW1117, SW5112, SW5113
Wetland Graminoid	Ref 615: MW19 Ref 112: 200, 201, 202, 203, 204, 205, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, MD3111, MM1912, MM2912, MM2914, MM2915, MM2917, MM2920, MS31111, MW3912, MW4911, MW4912 Ref 103: 47100, 47101
Riparian Deciduous Tree	Ref 102: 301 Ref 110: 20 Ref 112: 103, 104, 105, 106, 110, 111, 112, 113, 114, 115, 116, 122, 123, 124, 125, 130 Ref 114: 100024
Alpine Herbaceous	Ref 113: 001,002, 003,004,005, 006, 009, 010, 012, 013, 015, 016, 018, 019, 022, 023, 024, 025, 026, 027, 028, 029
Alpine Shrub	Ref 113: 007, 008, 011, 014, 017, 020, 021
Sparse	Ref 101: 010

[1]Automatic Data Processing Code (codes used in FSVeg) - includes all codes from valid references in Region 1 for use with NRM FSVeg. Unless otherwise specified, codes are from 101 (Forest Habitat Types of Montana, Pfister and others 1977) or 110 (Forest Habitat Types of Northern Idaho: a Second Approximation, Cooper and others, 1991)

[2] R1 PVT's based on "Jones" metadata logic and labels.

[3] 579 is in Group 7, Cool & Moist, in R1 HTG (2005) but is included in the Warm/Moist Broad PVT to maintain a connection with the other tshe types.

[6]Reference 199 = FSH 2409.21h R-1 Timber Management Data Handbook. Used in R1 until 2001.

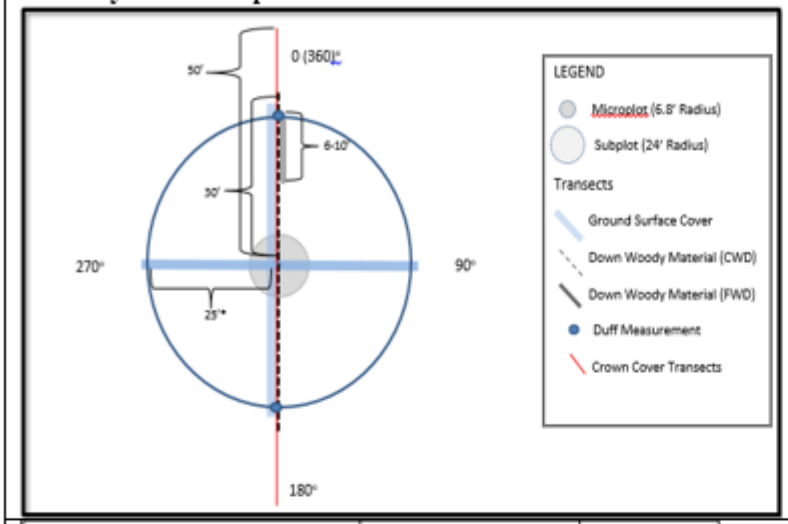
[7]Reference 102= Key to Montana Forest/Woodland Habitat Types East of the Continental Divide. FIA use only.

[8]Reference 114= The Vegetation of the Grand River/Cedar River, Sioux, and Ashland Districts of the Custer NF: A Habitat Type Classification, Hansen and Hoffman.

[9]*Reference 112= Classification and Management of Montana's Riparian and Wetland sites. Hansen, Boggs, Cook and others, 2005.*

Appendix J: Intensified Grid Cheat Sheet

Plot Layout * Example for Odd Numbered Plots



Plot Aspect

Code	Description
0	Flat
360	360°
183	183°
999	No predominant aspect/Undulating

Horizontal Distance (HD) vs. Slope Distance (SD)

Attribute	HD	SD
RP to PC		X
PC to Witness Tree		X
Tally Trees	X	
Tree Canopy Cover	X	
Lifeform/Species Cover	X	
Ground Surface Cover		X
Down Woody Debris	X	

Plot Type	Description/Info.	Plot Size/Length
All Live/Dead Trees	≥ 5.0 inches DBH/DRC	24 ft. Radius
Potential Veg. (Habitat Type)	1/10 acre	37.2 ft. Radius
Microplot (seedling/sapling)	300th ac. plot	6.8 ft. Radius
Tree Canopy Cover	Transects (two 50 ft.) Even E-W, Odd N-S	100 ft. Total Length
Shrub, Forb, Graminoid Canopy Cover and Cover by Species	Cover by Lifeform by Layer / Species with > 3% cover	24 Ft. Fixed Radius
Ground Surface Cover	Four 25 ft. Transects	100 points
Down Woody Material Transect At 90° and 270° for even # plots At 0° and 180° for odd # plots	Transects (two 30 ft.)	**60 ft. Total Length**

Down Woody Material:

Tally the number of logs for the appropriate diameter group and log decay class along two 30 ft. transects. Even-number plots, oriented E-W. Odd-numbered plots oriented N-S. Diameter groupings as follows:

Required Down Woody Material Fields	
First Duff	
Second Duff	
FWD:	
Twig1	0.01 to 0.24
Twig2	0.24 to 0.99
Twig3	1.00 to 2.99
CWD:	
Piece Count	≥ 3.0"
Log Decay	≥ 3.0"
Diameter	≥ 3.0"
Piece Length	≥ 3.0"
Diam. Lrg End	≥ 3.0"

1 hour; 6'@ 14 to 20 ft.
10-hour; 6'@ 14 to 20 ft.
100-hour; 10'@ 14 to 24 ft.

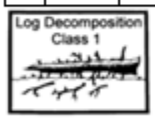
Ground Surface Cover

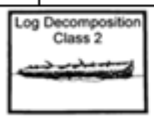
Total must =100%

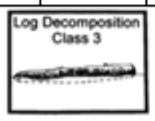
Code	Description
ROCK	Rock
DEVP	Developed Land
WATE	Water
WOOD	Wood
ROAD	Road
LICH	Lichen
MOSS	Moss
LITT	Litter < ¼"
BARE	Bare soil
ASH	Ash (organic, from fire)
BAVE	Basel Veg.
PEIS	Permanent Ice/Snow
TRIS	Transient Ice/Snow
CRYP	Cryptogamic Crust
UNKN	Unknown
Code	**Description**

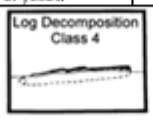
Log Decay Classes

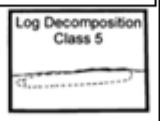
Code	Bark	Twigs	Texture	Shape	Wood color	Part of log on ground
1	Intact	Present	Intact	Round	Original	None, elevated on supporting points
2	Intact	Absent	Intact to soft	Round	Original	Parts touch, elevated, sagging slightly
3	Trace	Absent	Hard large pieces	Round	Original to faded	Bole on ground
4	Absent	Absent	Soft blocky pieces	Round/oval	Light brown to faded brown	Partially below ground
5	Absent	Absent	Soft powdery	Oval	Faded light gray or yellow	Mostly below ground











Cover by Lifeform and Layer Attributes

Lifeform	Code	Attribute	Data collection
Trees	TOT	Total Canopy Cover	Transect
	TOV	Trees CC (>6')	
	TSA	Trees CC (≤ 6')	
Shrubs	TOS	Total Shrubs	1/24th Acre Subplot
	ST	Shrubs (layer >6')	
	SM	Shrubs (layer 1.6-6')	
	SL	Shrubs (layer ≤ 1.5')	
Forbs	TOF	Total Forbs	
Graminoids	TOG	Total Graminoids	

Veg. Layer Code	
Layer Code	Height Class
1	0.0 - 1.5 ft.
2	1.6 - 6.0 ft.
3	➢ 6.0 ft.

Reference areas for 1/24th acre plot %

Cover %	Area (ft²)	Square Side Length (ft)	Circle Radius (ft)
1	18	4.3	2.4
3	54	7.4	4.2
5	90	9.5	5.4
10	181	13.4	7.6

GST (Growth Sample Tree) 5.5

Select the first tally tree of each species by the following diameter classes. **Total Height Measurement Required.**

Table 5.4 GST Measurements by Diameter Class Range

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

Table 5.5- Seedling Height Class Group-- <1.0 inch

Seedling Height class	Record Height	Record Diameter
0.5- 4.4 ft	Ave. of group	Ave. of seedlings in group
4.5 + ft.	Ave. of group	Ave. of group

Hardwoods seedlings must be 1 ft. in length and <1.0" DBH to qualify. Woodland seedlings must be 1 ft. in length and < 1.0' DRC to qualify. Conifer seedlings must be 0.5 ft. in length and <1.0" DBH to qualify.

Tree Status 5.3

Code	Description
L	**Live** - includes all standing trees that have at least one green point of growth. This includes deciduous trees that have lost their foliage for the season, and trees that have recently lost their leaves to defoliators, but will reflush.
D	**Dead** - standing trees without a green point of growth. Note: many of the tree fields are not used if the tree is a dead tree.

Sample Tree Specifications

Sample Plots Area	Plot Radius (horizontal distance)	Tally Tree Diameter Size
Subplot	24.0 feet	L & D Trees ≥ 5.0" DBH/DRC
Microplot	6.8 feet	L saplings (1.0-4.9) D sapling (1.0-4.9) L seedlings counts (< 1.0 inch DBH)

Tree Crown Class Codes

Tree Code	Description
OP	Open-grown or isolated
DO	Dominant
CO	Codominant
IN	Intermediate
OV	Overtopped

Tree Class Codes

Code	Tree Class	Status
GS	Growth Stock	L
RF	Rough	L
RN	Rotten	L
SV	Salvable dead (hard)	D
US	Non-salvable dead (soft)	D

DBH

Measure DBH to the nearest tenth inch (always round down)

Code	Diameter (inches)
.3	0.3"
9.5	9.5"
18.7	18.76"

Height

Code	Actual Height
1	0.5 - 1.4 feet
23	22.5 - 23.4 feet
151	150.5 - 151.4 ft.

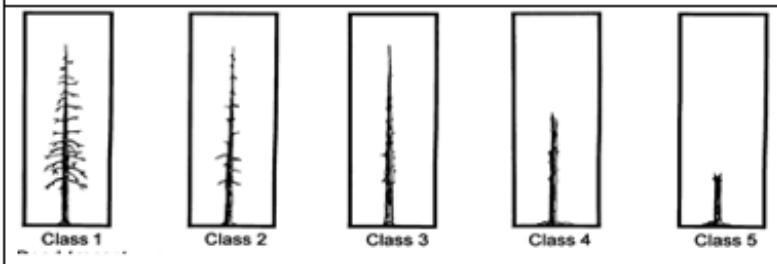
Tree Age

Record the actual ring count, in years (Do **NOT** add 10 years).

Code	3	69
Age	3 years	69 years

Snag Decay Classes

Code	Bark	Heart-wood Decay	Sapwood Decay	Limbs	Top Break-age	Bole Form	Time Since Death (years)
1	Tight, intact	Minor	None to incipient	Mostly Present	May be present	Intact	1-5
2	50% loose or missing	None to advanced	None to incipient	No Small limbs	May be present	Intact	>5
3	75% missing	Incipient to advanced	None to 25%	Few remain	Approx. 1/3	Mostly intact	>5
4	75% missing	Incipient to advanced	25%+	Few remain	Approx. 1/3 to ½	Losing form, soft	>5
5	75%+ missing	Advanc-ed to crumbly	50%+ advanced	Absent	Approx. ½+	Form mostly lost	>5



Height Growth

For GST trees <3" DBH.

Code	5 Yr. Height Growth
0.6	0.6 feet
4.7	4.7 feet

Radial Growth

For GST trees ≥ 3" DBH.

Code	10 Yr. Radial Growth
6	6/20 inch

Commonly Encountered Slope Correction Factors

% Slope	SCF	% Slope	SCF
10	1.01	50	1.12
15	1.01	55	1.14
20	1.02	60	1.17
25	1.03	65	1.19
30	1.04	70	1.22
35	1.06	75	1.25
40	1.08	80	1.28
45	1.10	85	1.31

Appendix K: Lynx Horizontal Cover Measurements

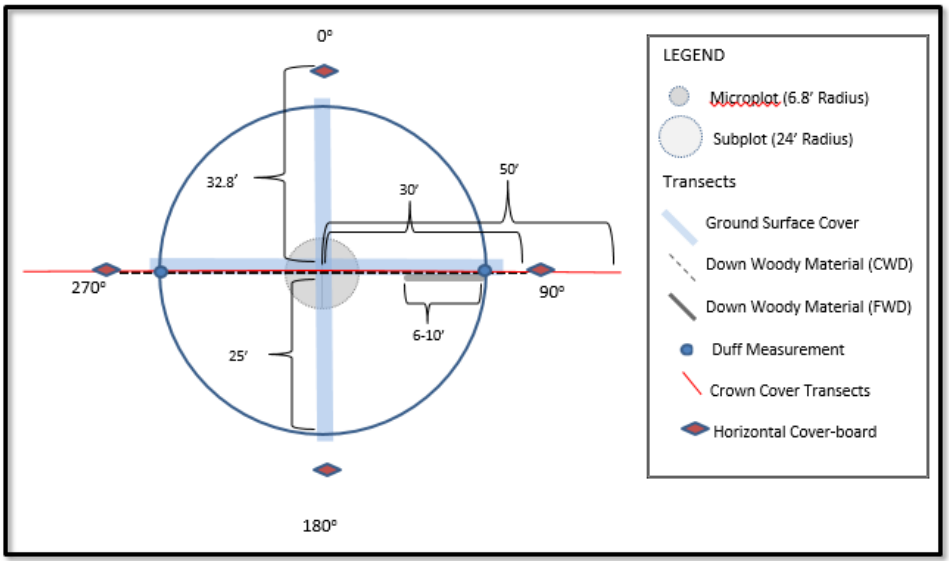
Lynx horizontal cover is calculated by averaging four cover percent estimates taken in four cardinal directions from plot center. A cover board placed 32.8 ft (10 meters), horizontal distance, from plot center is used to measure percent cover.

Cover-board Layout

Cover-board measurements are collected by placing the cover board 32.8 ft (10 meters) *horizontal distance* from plot center in the four cardinal directions: 0º, 90º, 180º, and 270º.

Figure K1 – Horizontal Cover Board positioning

This shows positioning on an even numbered plot, although position does not change for an odd numbered plot.



Cover-board Specifications

Cover-boards, supplied by Region 1, should be utilized. These cover boards consist of a durable waterproof cloth strip, 1.6 ft (0.5 m) X 6.6 ft (2 m), that is divided into 16 blocks measuring 0.8 ft^2 (0.25 $m^{2)}$ in alternating colors of red and white (Figure 2). The top and bottom edges of the cover-board have dowels, 1.6 ft long sewn into the top and bottom seam. The cover board is then suspended from a collapsible tripod or tent pole. The bottom of the cover-board is placed directly along the ground surface.

Figure K2 – Cover Board Layout

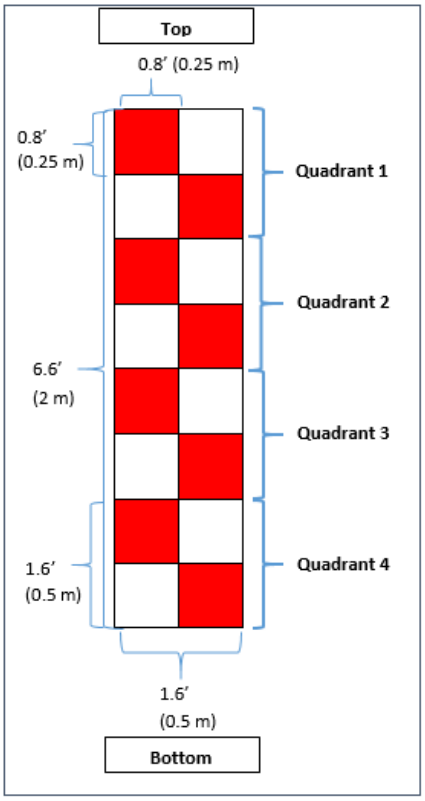
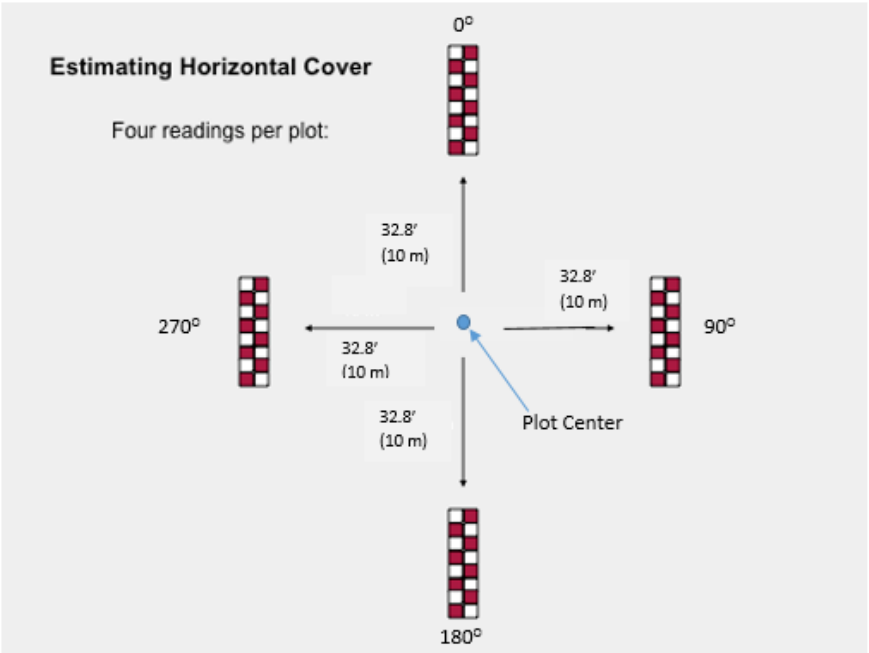


Figure K3 – Estimating Plot Horizontal Cover %



Horizontal Cover Estimation

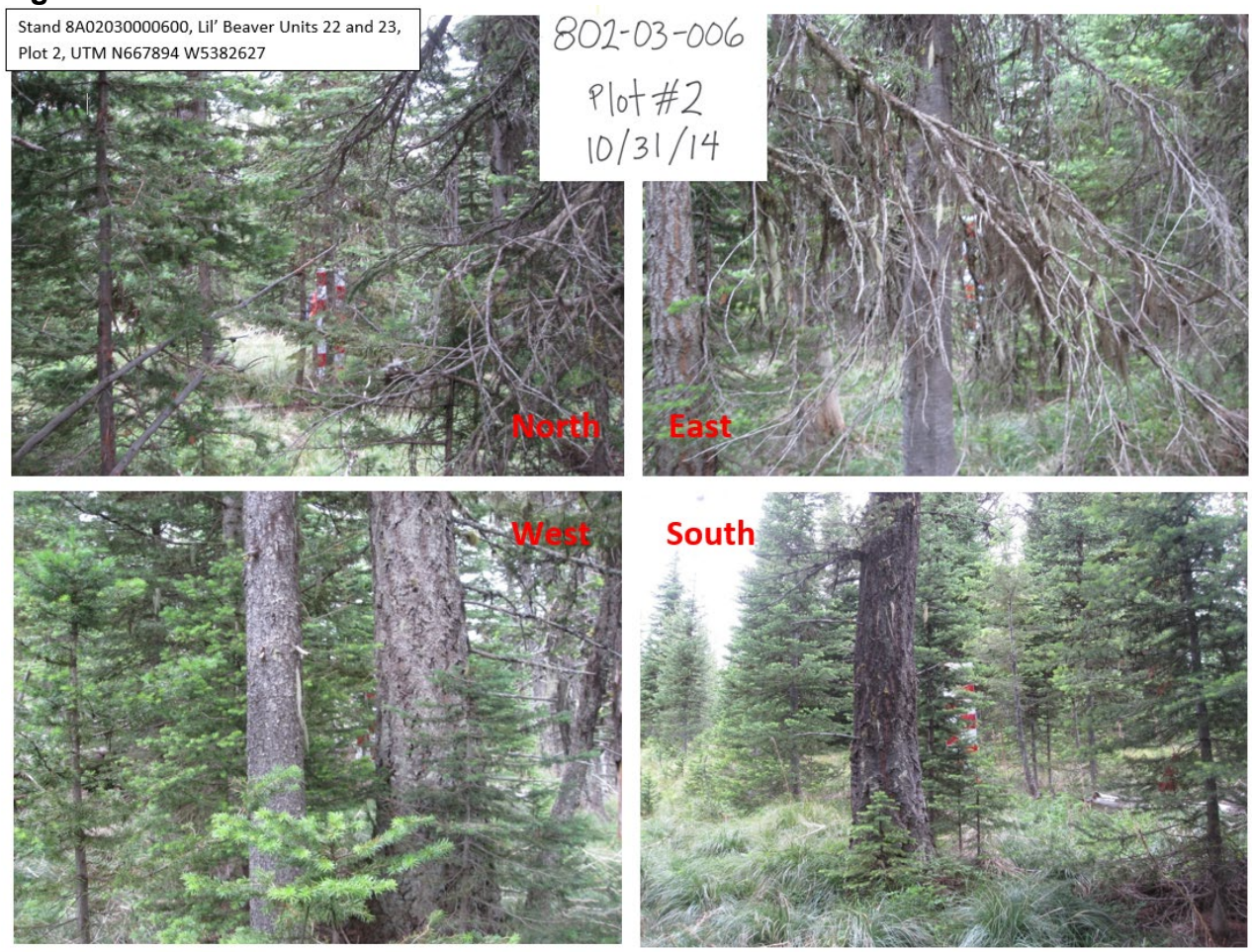
Four cover estimates are collected on each plot, one in each cardinal direction starting with north (0^O) and rotating clockwise (90^O, 180^O, 270^O), see Figure 3. The measurements are

taken from plot center facing the cover-board, which is 32.8 ft (10 meters) *horizontal distance* from plot center. See section 1.D.1 for information on how to calculate horizontal distance if there is a slope > 10% from plot center to cardinal direction.

The collector's eye should be positioned over plot center, 4.5 feet above plot center. The cover-board is visually "divided" into four quadrants. The observer records how much of the board is obscured in each of its quadrants (1st, 2nd, 3rd, 4th). Anything that obscures the cover board is counted as cover, including coniferous needles, deciduous leaves, boles, branches, downed logs, stumps, rocks, the land surface, beargrass clumps, trash, etc. Do not reposition your body to change your line of sight, regardless of vegetation conditions. Consistency in the measurement, 4.5 feet above ground, directly over PC, looking exactly toward the cardinal direction of the measurement. If cover estimates are collected when leaves are off of deciduous trees and shrubs, estimate coverages as if leaf is still on.

The quadrant percentages are then averaged to determine the cover percentage for the board. See the Lynx Horizontal Cover Estimation Form in Appendix A8 of this manual for recording cover estimates. See Figure 4 for examples.

Figure K4 – Horizontal Cover Estimation for Board



Example:

1. Face specified azimuth and determine percent of the board that is covered by visual obstruction for each quadrant, record on the Lynx Horizontal Cover Form.

Azimuth:	0^o
Quadrant 1 Cover %	30
Quadrant 2 Cover %	25
Quadrant 3 Cover %	80
Quadrant 4 Cover %	90
Board Total Cover % Q1 % + Q2 % + Q3 % + Q4 %	
Board Average Cover % $\frac{\text{Board Total Cover \%}}{4}$	

2. Sum the quadrant cover %:

Azimuth:	0^o
Quadrant 1 Cover %	30
Quadrant 2 Cover %	25
Quadrant 3 Cover %	80
Quadrant 4 Cover %	90
Board Total Cover % Q1 % + Q2 % + Q3 % + Q4 %	225
Board Average Cover % $\frac{\text{Board Total Cover \%}}{4}$	

3. Calculate the average by dividing by 4:

Azimuth:	0^o
Quadrant 1 Cover %	30
Quadrant 2 Cover %	25
Quadrant 3 Cover %	80
Quadrant 4 Cover %	90
Board Total Cover % Q1 % + Q2 % + Q3 % + Q4 %	225
Board Average Cover % $\frac{\text{Board Total Cover \%}}{4}$	56

4. Repeat for the three other cardinal directions

Plot Horizontal Cover %

When horizontal cover estimates have been obtained in the four cardinal directions, average the four measurements to calculate the average horizontal cover percent for the plot.

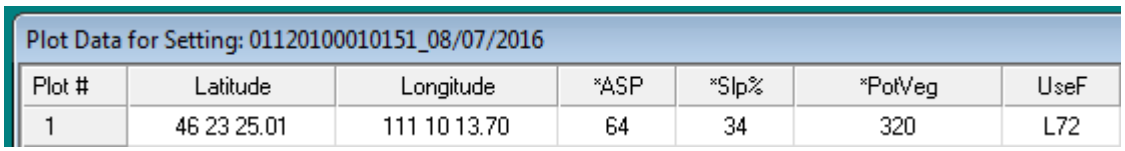
Azimuth:	0°	90°	180°	270°
Quadrant 1 Cover %	30	85	75	45
Quadrant 2 Cover %	25	65	88	55
Quadrant 3 Cover %	80	70	90	70
Quadrant 4 Cover %	90	100	95	85
Sum of Quadrant Cover Q1 % + Q2 % + Q3 % + Q4 %	225	320	348	255
Board Average Cover % Sum of Quadrant Cover / 4	56	80	87	64
Sum of Board Cover % (0°+90°+180°+270°)	287			
Plot Average Cover % Sum of Board Cover % / 4	72			

Plot Horizontal Cover % = 72

Entering Plot Horizontal Cover into Exams Software

The Plot Horizontal Cover % will be entered into the Plot User Code (CSE 4.15) in the Plot Form as LXX or LXXX, where L indicates Lynx Horizontal Cover and XX or XXX is the Plot Horizontal Cover percent entered as a 2 or 3 digit number (72% horizontal cover would be entered as L72). Figure 5 shows the Plot Form in Exams with Lynx Horizontal Cover recorded in the Plot User Code field.

Figure K5 – Entering Horizontal Cover in Plot User Code field of Exams software Plot Form.



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