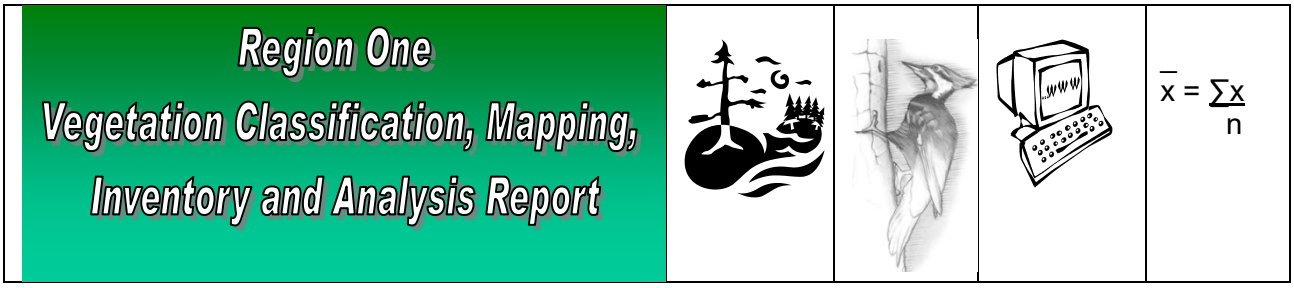


Report 19-1 v2.5 August 5, 2019

Mid-cycle Remeasurement of FIA Plots Using IM Protocols

Table of Contents

Section 1: Overview

Region 1, in collaboration with the Remote Sensing Application Center (RSAC) and IW-FIA, developed a set of protocols to re-measure FIA and intensified grid plots after they have been burned by wildfire.

Data from the previous measurement will be retrieved from FSVeg and loaded into an Exams software .IM file. Although much of this data was collected using FIA protocols, any codes that are displayed or recorded will use definitions and codes defined in the R1 Common Stand Exam and Inventory and Monitoring Field Guide. All attribute tolerances, unless otherwise specified in this protocol, are found in Appendix T of the R1 Common Stand Exam and Inventory and Monitoring Field Guide.

***Note:** the purpose of this inventory is to update the inventory data to reflect the effects of fire and/or insects post disturbance. In general, natural succession changes will not be measured, such as remeasurement of diameters, however, microplot data, on seedling, will be done as will looking for the presence of aspen on the plot. Errors and omissions made in the last measurement will not be fixed since Interior West FIA is responsible for the oversight of the production plots and, at this time, there is not a mechanism to provide them such feedback.

Safety

Working in burned areas is dangerous. Many snags may appear sound, but the root systems have been compromised by fire making them extremely prone to falling over. Tops of trees are often precariously attached as fire frequently burns around and in pre-existing cavities.

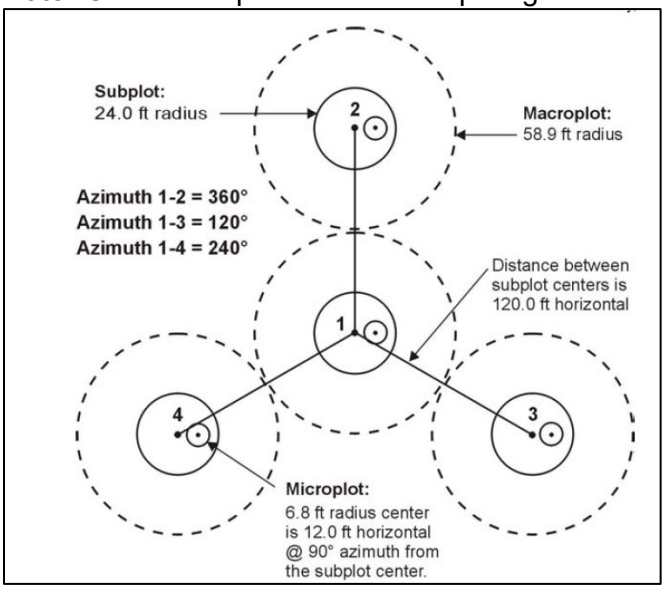
Always wear a hard hat, and use sound judgment when working in burned areas in windy conditions. Park vehicles wisely relative to unstable snags and potential flash floods. Carry a FS radio cloned for the project area and know how to use it. Check in with local dispatch, some districts require daily notification. Soil that has been subject to high temperatures often becomes slick when saturated making for difficult walking conditions. If you feel you are in danger, leave the area.

Plot Layout

Note:
- Declination, for plot layout, is set to 0 degrees

Figure 1.1: Plot and Subplot Layout

Note: Correct subplot radius for slope if greater than 10%.



Sample Design

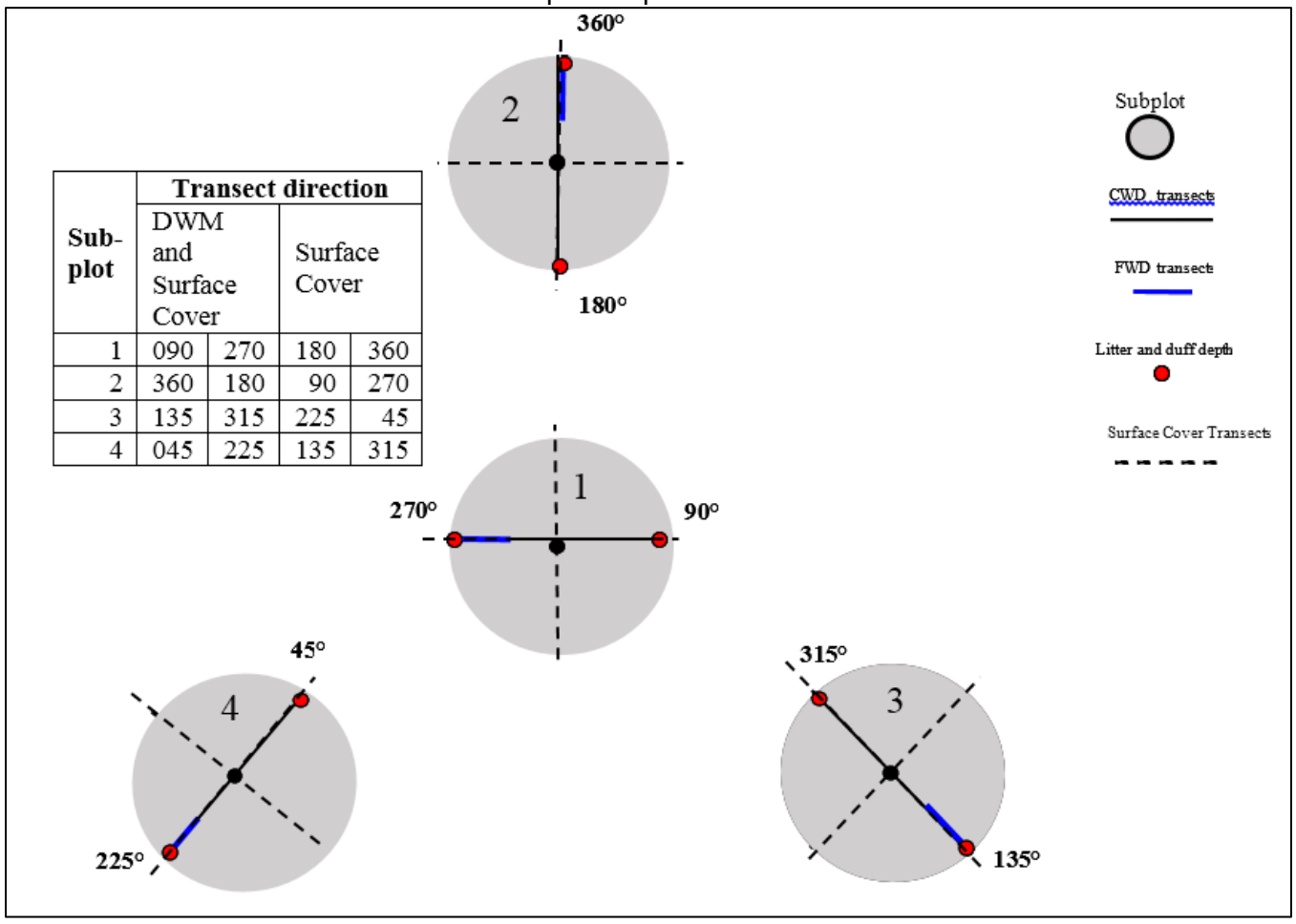
Table 1.2: Sample Designs

Population of Interest		Type/Size of plot	Information to collect	Section
Vegetation Composition	**Lifeform**			**6**
Cover by Lifeform	Tree, Shrub, Forb, Grass	Fixed Radius/24.0’	Complete new % cover	6A
Cover by Lifeform by Layer	Tree, Shrub	Fixed Radius/24.0’	Complete new % cover	6A
Cover of noxious species	MT noxious species	Fixed Radius/24.0’	Complete new % cover	6B
Cover of aspen	Aspen	Fixed Radius/24.0’	% cover	6B
Surface Cover		Transect/ 4 x 25.0 feet (slope distance)	Complete cover transects	6C
Down Woody Material	Diameter Range (cross section)			**7**
1-hour	0.01 to 0.24 in	Transect/ 6.0’ (horizontal)	14 to 20 feet	7.5.1
10-hour	0.25 to 0.99 in	Transect/ 6.0’ (horizontal)	14 to 20 feet	7.5.2

Population of Interest		Type/Size of plot	Information to collect	Section
100-hour	1.00 to 2.99 in	Transect/ 10.0' (horizontal)	14 to 24 feet	7.5.3
3"+ CWD measurements	3.00"+	Transect/ 2 x 48.0' (horizontal)	0 to 24 feet	7.8-7.12
Trees	Tree Size (DBH/DRC)			**5**
All live trees and snags	≥ 5.0 inches	Fixed Radius/24.0' (horizontal)	Update trees as per protocols	5.A
Saplings	1.0- to 4.9-inches	Fixed Radius/6.8' (horizontal)	Update trees as per protocols	5.B
Seedling Count	< 1" DBH or 1' ≤ ht < 4.5' tall	Fixed Radius/6.8' (horizontal)	Complete new seedling count	5.C

Figure 1.3: Down-woody Material and Surface Cover Transect Layout-

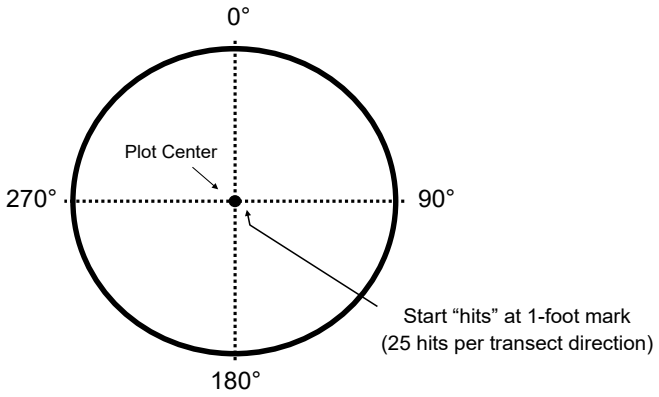
NOTE: DWM transects are corrected for slope if slope exceeds 10%.



Sub-plot	Transect direction			
	DWM and Surface Cover		Surface Cover	
1	090	270	180	360
2	360	180	90	270
3	135	315	225	45
4	045	225	135	315

Figure 1.4: Ground Surface Cover Transects Configuration

The following figure shows the surface cover layout for subplots 1 and 2 with 25' transects at 360, 90, 180, and 270 degrees. On subplots 3 and 4, transects are in the azimuths of 45, 135, 225, and 315 degrees.



Uncommon data anomalies that may be encountered:

Macroplots were part of the sample design

- ¼ acre macroplots were installed on FIA plots that were installed/measured from 1998-2002 on the Nez Perce-Clearwater and Idaho Panhandle National Forests. Trees 5.0-20.9" DBH were sampled on the 1/24th acre subplot and trees 21.0"+ DBH were measured on the ¼ acre macroplot. The mid-cycle remeasurement will remeasure all trees 5"+ DBH on the 1/24th acre subplot, which mimics current FIA protocols. However, be aware that you may find nails on trees that are not tallied, because they were on the macroplot. Macroplot trees had tree numbers greater than 100.

Information included in the Plot Packet may be from a measurement that is more recent than what is loaded into FSVeg

- In rare cases, the information provided in the Plot Packet, from FIA, is from a very recent measurement of the plot, whose data has not been migrated from FIA into FSVeg, and therefore is not in Exams software. If this is the case, it will be clearly indicated on the Plot Packet.

Plot Packet Contents:

Each plot packet contains the following:

On Plot Packet envelope:

- State, County, and plot number (referred to as LOC)
- Plot Center coordinates are written in red after NAD83 LC Coords.

Within Plot Packet:

- NAIP photo with plot identified. At the bottom of the map is the plot number (state-county-plot), scale of the map, mileage reference, date of imagery, and 2 red circles, one that is 1 acre in size, one that is 2.5 acres in size. These circles are for reference only.
- Quad map with the plot identified. At the bottom of the map is the plot number (state-county-plot), scale of the map, and mileage reference.
- Field Location Reference Form(s) from FIA. Review these sheets, one will be a copy of hand-written notes about finding the plot. What is provided varies between the various measurement years but, there should be:

    - Travel Notes or Travel Description which describes the roads to take to drive as close to the plot as possible.
    - Truck coordinates: which provides information about where the truck was parked the last time. **Note:** *always* get truck coordinates before heading in the field. This is for safety purposes.
    - Plot Center (PC) or Location Center (LC) coordinates which are the coordinates for subplot stake 1. These are in NAD83 projection.
    - PC or LC Witness Tree coordinates.
    - Field Location Map which may be useful in relocating the plot.
- FIA inventory datasheets from the most recent measurement. The species codes used by FIA are in Appendix A. There will be more than one version of data from FIA. One of the reports has more columns of information, including a field named Standing Dead. Make note of this field, if it is blank, it means the tree was alive and standing during the last measurement, if it is a 1, it means the tree was dead and standing, if it is a 0, it means the tree was tallied in a previous measurement but now is down or missing from the plot. These forms are provided for reference if needed to identify trees on the ground only. Field crews should use the data provided in the PDR and in the FSVeg print-outs as the base data they will be updating.
- FIA Inventory data pulled from FSVeg.
    - The Data Report printed through Exams contains a full set of information collected by FIA during the last measurement. The codes used align with the information in Exams software.
    - A spreadsheet of the tree data extracted from FSVeg. This provides information about subplot number, measurement date, tree tag number, azimuth, distance, tree status, species symbol, diameter, and other attributes that are not included in the Exams Data Report.

Locating the Plot

Review the travel descriptions, located in the Plot Packet prior to traveling to the plot. Once you park the vehicle, collect a GPS location for the truck and store on your GPS unit.

Use the map, photos and the red PC/LC coordinates, found on the envelope, to navigate to the plot as well as the crew notes. Review the **Field Location Reference Form** included in the plot packet.

A reference point (RP) and witness trees were established in the previous inventory to aid in relocating the plot. The RP is a landmark (usually a tree) that is identifiable on both the ground and the plot photo, and is described on the Field 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 tags nailed approximately 6 feet above the ground. One of the tags is silver and facing the direction of approach to the plot and the other is a black diamond shaped tag which will face the location of the plot center.

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

The X tree was either scribed with an “X” or was marked with a silver tag with the letter “X” scribed on it above DBH. Both the X and Y trees should have silver tags with “X” or “Y” scribed on them nailed below 1 foot, 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 X and Y trees that are within the subplot perimeter.

To triangulate the plot center location using the witness trees, measure the **slope** distance from the base of the X tree specified on the Field 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). There will also likely be a stake 6.8' at 90° from the center stake to mark the center of the microplot. Do not mistake the microplot stake for the plot center stake.

Depending on the severity of the fire at the LC/PC, standing live trees may be missing, may have died, or may be logs on the ground. Tags and nails may be blackened, deformed, and/or missing. Witness trees may have died, fallen over, or in rare cases, may be missing. When the witness trees can't be found, two plot trees can be used to triangulate the center, keep in mind that the horizontal distance is recorded for plot trees. The tree number was scribed or written on the tree nails.

Once you have subplot 1 located, be ready to use the plot layout information to chain to the other subplot locations.

Location Monumentation on Reserved Land/Wilderness Areas: In Wilderness areas, less visible markings are used: no flagging is left; there is only one tag on the RP and X and Y tree, which are brown, and nailed below the 1' mark (stump height), facing plot center; nail heads are painted brown, at ground surface, if the plot is facing a trail, the nails will be away from the trail; subplot center is monumentated with a staple or rebar, but rebar will only extend up to 1" above ground. The center stake of subplot 1 is either referred to as Location Center (LC) or Plot Center (PC).

Order of Data Collection

Data Collection Checklist (In suggested order of collection)

- Surface Cover
- Down Woody
- Vegetation Composition
- Tree Data
- Plot Data
- Setting Data

After all field data has been collected, fill out the Setting Form. Review to ensure that all data has been filled out as specified.

Section 2: Setting Form

The following fields will be displayed on the Setting Form. Only update the following fields if indicated. Much of the data in the Setting Form is already populated with the information from the previous measurement or has been updated prior to going in the field.

Some of the attributes in the Setting Form are best updated after visiting all of the subplots. Be sure to review this form after completing measurements on the plot.

Table 2.1: Setting Form Attributes

CSE #	Attribute Name	Value	Comments
2.1	Project Name	FIA MC REMEAS	All FIA plots that are remeasured by NFS crews using Exams software must have this Project Name.
2.2	Proclaimed Region	01	Already populated in Exams software. Do NOT change this value. If county is incorrect, make note of it in the Setting Remarks Form.
2.3	Proclaimed National Forest	Default	Already populated in Exams software. Do NOT change this value. If county is incorrect, make note of it in the Setting Remarks Form.
2.4	District		Should be populated in Exams software data file. If this value is incorrect, update and put explicit information in the Setting Remarks field. NOTE: This is the District number that is associated with the Proclaimed Forest.
2.5	Location	01	Already populated in Exams software. Note: this is NOT the LOC (plot number) from FIA, as it is called in the plot packet.
2.6	Stand Number		Already populated in Exams software. Note: this is the FIA LOC, i.e. plot number, as it is called in the plot packet.
2.7	Owner	USFS	Already populated in Exams software.
2.8	State	Default	Already populated in Exams software. Do NOT change this value. If county is incorrect, make note of it in the Setting Remarks Form.
2.9	County	Default	Already populated in Exams software. Do NOT change this value. If county is incorrect, make note of it in the Setting Remarks Form.
2.10	Administrative Forest	Default	Already populated in Exams software.
2.11	Date		Update in the field. This should reflect the day that data collection started (if more than one day).
2.12	Photo ID	Not used	
2.13	Exam Level	2221	Already populated in Exams software. If Exam Level is NOT set to this, then update.
2.14	Exam Purpose	FI	Already populated in Exams software.
2.15	Stratum	null	Not used.
2.16	Existing Veg Reference	null	Not used.
2.17	Existing Veg Composition Type.	null	Not used.
2.18	Potential Vegetation Reference	Default	Already populated in Exams software.
2.19	Potential Vegetation		Already populated in Exams software. Do not change.
2.20	Structure	Null	Not used.
2.21	Setting Capable Growing Area	Null	Not used.

CSE #	Attribute Name	Value	Comments
2.22	Setting Fuel Model	Null	Not used.
2.23	Setting Elevation		Should be populated in Exams software data file. This is the elevation at subplot 1. If this value is not within tolerance, update and put explicit information in the Setting Remarks field.
2.24	Setting Aspect		Should be populated in Exams software data file. This is the predominate aspect for the 4 subplots.
2.25	Setting Slope		Should be populated in Exams software data file. This is the predominate aspect for the 4 subplots.
2.26	Setting Slope Position	Null	Not used.
2.27	Acres	Null	Not used.
2.28	Examiner		Required. See CSE Field Guide.
2.29	Precision Protocol	CSE	Already populated in Exams software. If Precision Protocol is NOT set to this, then update.
2.30	Radial Growth Interval	10	Already populated in Exams software.
2.31	Radial Growth Interval 2	Null	Not used.
2.32	Height Growth Interval	5	Already populated in Exams software.
2.33	Fuel Photo Reference	Null	Not used.
2.34	Setting User Code		If an entire plot or portion of a plot has become inaccessible due to fire, record the appropriate four digit code as indicated, below.
2.35	Setting Lat Long Reference Datum	NAD 83	Already populated in Exams software.
2.36	Magnetic Declination	0	Already populated in Exams software. Make sure compass declination is set to 0.
2.37	Measurement Number		Do not change. Already populated in Exams software.
2.38	Setting Remarks		If updates have been made to any Setting Form attributes and protocols specify to make note in the Setting Remarks Form, include note here.

CSE #	Attribute Name	Value	Comments
2.39	Setting Damage Category		Update with setting damages that are caused by the fire, that have occurred since previous measurement and are *not* recorded on the tree form. Valid damage categories are: • 11 Bark Beetles • 70 Human activities • 71 Harvest For definition of setting damage category and valid codes, see R1 Common Stand Exam field guide item 2.36 and appendix R. Up to three setting damage categories, agents, and severities can be recorded.
2.40	Setting Damage Agent		Update setting damage agents that are caused by the fire and related effects that have occurred since inventory. Valid damage agents are found under the categories listed above. For definitions of damage agents and codes, see R1 Common Stand Exam field guide item 2.37 and appendix R. If a category is coded, record an agent.
2.41	Setting Damage Severity		Update with setting damage severities that are caused by the fire that has occurred since inventory. Valid damage severities are associated with each agent. For definitions of severities and valid codes, see R1 Common Stand Exam field guide item 2.38 and appendix R. If a category is coded, record a severity.
2.42	Species of Management Interest		Not used.

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

If an entire subplot, or portion of a subplot, 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 nonsampled. Zero fill leading digits as shown below.

If a plot has a subplot that was not measured by the FIA crew because they ran out of time, do not measure any data that was not measured by FIA on that subplot. Record Setting User Code

Table 2.2: Setting User Code

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

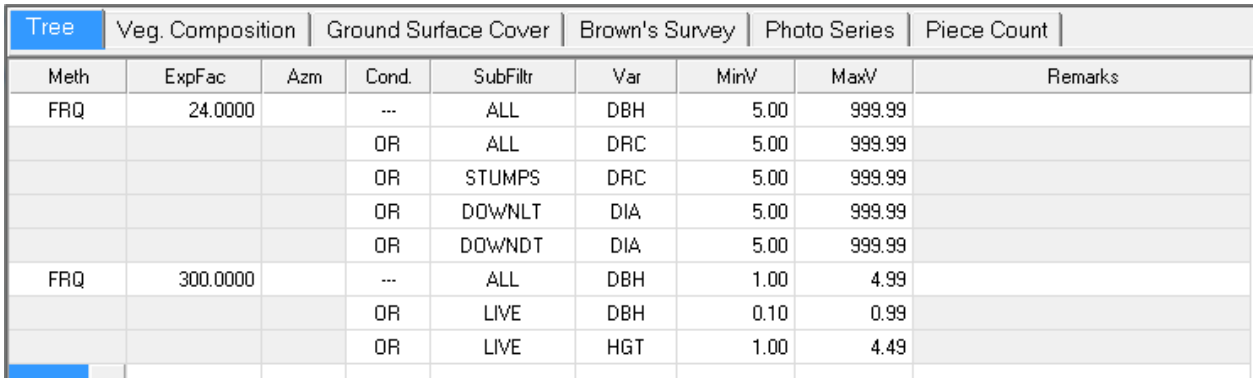
First digit Code	Situation prohibiting data collection:
1	inaccessible/hazardous
2	private land

3	Hazardous water – too deep or fast to sample in
4	other (use this code if any other situation/condition prohibits data collection, such as an improved road, maintained rights-of-way, developed structure, etc)
5	Other fire related reason

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%*).

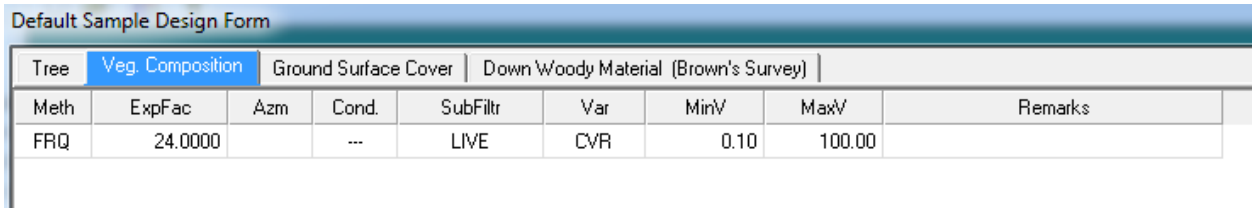
Section 3: Sample Design Form –

Figure 3.1: Tree Sample Design Form



Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	24.0000		---	ALL	DBH	5.00	999.99	
			OR	ALL	DRC	5.00	999.99	
			OR	STUMPS	DRC	5.00	999.99	
			OR	DOWNLT	DIA	5.00	999.99	
			OR	DOWNDT	DIA	5.00	999.99	
FRQ	300.0000		---	ALL	DBH	1.00	4.99	
			OR	LIVE	DBH	0.10	0.99	
			OR	LIVE	HGT	1.00	4.49	

Figure 3.2: Veg Composition Sample Design Form

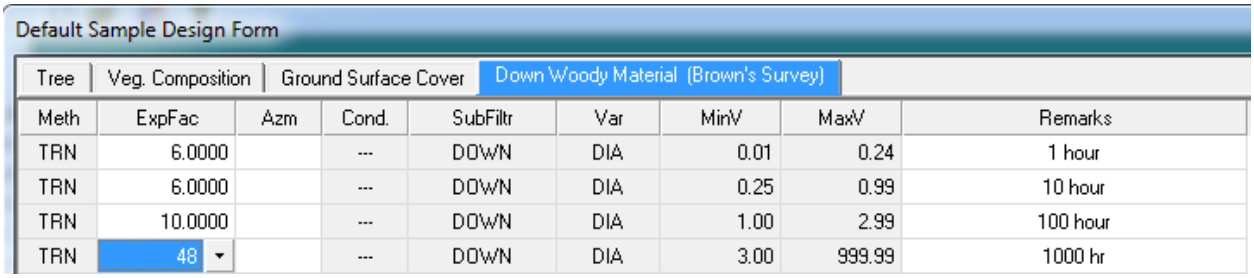


Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	24.0000		---	LIVE	CVR	0.10	100.00	

Figure 3.3: Ground Surface Cover Sample Design Form

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 Form



Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
TRN	6.0000		---	DOWN	DIA	0.01	0.24	1 hour
TRN	6.0000		---	DOWN	DIA	0.25	0.99	10 hour
TRN	10.0000		---	DOWN	DIA	1.00	2.99	100 hour
TRN	48		---	DOWN	DIA	3.00	999.99	1000 hr

Section 4: Plot Data Form

4.A Plot Re-establishment Protocols

If any of the subplot or microplot stakes need to be reinstalled, triangulate the correct location for the subplot, or microplot center, and install a new stake. Double check the new stake with the distance and azimuth information on some of the trees to make sure that the new stake has been put in the correct location. Make a note in the Plot History|Remarks form.

4.B Plot Measurements

Follow the definitions and procedures for measurement indicated in section 4 of the *R1 CSE/IM Field Guide* for the attributes listed below unless specifically indicated in this section. Enter all plot data items into Exams software. If an attribute is listed in the R1 CSE Field Guide but not listed here, do not record the attribute.

Table 4.1: Plot Data Form

CSE Attribute #	Attribute Name	Comments
4.1	Plot Number	Use the pre-assigned plot number.
4.4	Plot Aspect	Use the subplot values on the *FIA* electronic data sheet in the plot packet. (Declination is set to 0 degrees) Do not update unless values is outside of tolerance. Tolerance ± 10 degrees.
4.5	Plot Slope	Use the subplot values on the *FIA* electronic data sheet in the plot packet. Do not update unless values is outside of tolerance. Tolerance ± 10%.
4.11	Plot Potential Veg.	Should be populated in Exams software data file. If this value is outside of tolerance, update and put explicit information in the Plot History|Remarks form. Remember, this is pre-fire habitat type, which will probably represent the true potential vegetation if the fire has greatly disturbed the site.
4.15	Plot User Code	Enter the code for the fire related impacts to the plot. See the code definitions provided below.
4.18	Plot History/Remarks Form	• Record code for the evidence of maximum flame length observed on the plot. See 4.18 Plot History/Remarks below for more information. • Record code for crown fire evidence from the last fire. • If the subplot stake was replaced, note here.

CSE 4.15 Plot User Code (Required)

Record every PLOT USER CODE that is applicable, for the fire related impacts, seen on the plot. If more than one fire related impact is seen within the 1/24th acre subplot, enter all applicable codes without spaces, commas or dashes between codes. For example, if evidence of fire is seen on the subplot in addition to secondary insects and salvage logging, record FIL in the PLOT USER CODE.

Table 4.2: Plot User Codes

Plot User Code	Description
F	Indication that fire has occurred within the 1/24th acre subplot
E	Evidence of post-fire erosion within 1/24th acre subplot
I	Insects, such as beetles, have attacked since fire
L	Salvage logging after fire suppression within 1/24th acre subplot
P	Evidence of planting after fire observed within 1/24th acre subplot
S	Evidence of fire suppression within 1/24th acre subplot, such as fireline
T	Tree felling for fire suppression within 1/24th acre subplot
All	All of the above appear to have happened on the plot
None	No fire effects on plot

CSE 4.18 Plot History/Remarks (Required)

This field is used to enter information about the plot that is not captured elsewhere. Separate the following information with a space between each entry.

A. Flame length information
Record the highest observed char height, based on the height of bole char seen on any of the trees, observed within the 24' radius subplot. Record FLXX, where XX is the height (feet) rounded to the nearest foot.

B. Active crown fire evidence
An active crown fire spreads from tree crown to tree crown to consume most-to-all needles in the forest canopy. If there is evidence that a crown fire occurred on the subplot, then record CRYXXX, where XXX is the percent of the subplot with evidence of crown fire. If there is no evidence a crown fire occurred, then record CRN.

C. If the plot stake was not relocated by the crew and a replacement was installed, make a note here.
PC Install = crew could not relocate the plot center stake and installed a temporary replacement.
MP Install = crew could not relocate the microplot center stake and installed a temporary replacement.

Section 5: Tree Form

The following fields will be displayed on the Tree Form. Only update the fields that are indicated.

Follow the definitions and procedures for measurement indicated in 5 of the *R1 CSE/IM Field Guide* for the attributes listed below unless specifically indicated in this section. If an attribute is not listed in table 5.1, it is not recorded. Field number, name, and size (digit/character width) are as defined in the *R1 Common Stand Exam and Inventory and Monitoring Field Guide*. See Appendix T of the *R1 Common Stand Exam and Inventory and Monitoring Field Guide* Tree Data Form – Intensive Exam Level for attribute tolerances. Enter all tree data items into Exams software.

Table 5.1: Tree Form attributes

R1 CSE Field Guide Item No.	Attribute	Comments
5.1	Plot Number	Do not update.
5.2	Tag ID Number	Do not update for prior tallied trees. Do not add missed, or ingrowth tally trees (> 5" DBH). New saplings and seedling counts from the microplots will use the next available tag numbers. If, the data in Exams software is not from the most recent measurement (as indicated on the Plot Packet), and is a recognized, but rare event, any additional trees that are indicated in the electronic data from FIA, should be added into Exams, using the tree number written on the nail.
5.3	Tree Status	Update tree status if it has changed for all tally trees and saplings. See codes below. Record for new tallied saplings seedling groups from the microplot.
5.4	Tree Class	Update for all tally trees as per specifications below. Record for new saplings and seedling groups on microplot (see protocols below).
5.5	Growth Sample Tree	Do not update.
5.6	Tree Species	If this value is incorrect, update and put explicit information in the Tree Remarks field. Record for new saplings and seedling groups on microplot (see protocols below).
5.7	Tree Count	Do not update for tally trees and saplings. Record for new sapling and seedling groups on microplot (see protocols below).
5.8	Number of Stems	Woodland species ≥ 1.0" DRC

R1 CSE Field Guide Item No.	Attribute	Comments
5.9	DBH	Do not update for tally trees and saplings. Record for new tallied sapling and seedling groups on microplot (see protocols below).
5.10	Height	Record for all tally trees and for saplings on the microplot with tops that have *broken or broken further* since the previous measurement. Record for new saplings and seedling groups (which do not have an average DBH recorded) on microplot (see protocols below).
5.12	Radial Growth	Do not update.
5.14	Height Growth	Do not record.
5.15	Tree Age	Do not update.
5.16	Crown Ratio	Update for all live tally trees. This is the *live* crown ratio. Record for new saplings and seedling groups on microplot (see protocols below).
5.17	Crown Class	Do not update for tally trees and saplings on the microplot. Record for new saplings and seedling groups on microplot (see protocols below).
5.20	Snag Decay Class	Record for all trees and saplings on the microplot that have changed TREE STATUS from Live to Dead. Update, if needed, for trees that were dead in the previous measurement. See protocols below.

R1 CSE Field Guide Item No.	Attribute	Comments
5.22	Tree Damage Category	If one of the fire related damages listed below is present, delete prior damages and update with the current damage code(s). If none of the fire related damages listed below are present, leave damages coded during prior measurement. For live trees and saplings on the microplot, record up to three tree damage categories, agents, and severities. *Damages due to fire, or secondary effects of the fire must be noted* For definitions of these damage categories and valid agent and severity codes, see R1 Common Stand Exam field guide Items 5.22 – 5.25 and Appendix R. Damage categories associated with fire are: • 11 Bark Beetles • 30 Fire • 70 Human Activities • 71 Harvest • 99 Physical Effects: Note especially, the following: 18 – Uprooted 19 – Scorched Foliage, See 5.22 below. 20 – Scorched Bark (severity is % of the bark that is charred), See 5.22 below for detailed information on how to collect these attributes. **Please note:** if a tree died since fire because of one of the above *fire* related reasons, record damage category that is cause of death.
5.23	Tree Damage Agent	For live trees and saplings on the microplot, record up to three tree damage categories, agents, and severities if it is a result of the fire that occurred since inventory. For definition of these damage agents, see R1 Common Stand Exam field guide item 5.23 and Appendix R. For *fire* caused dead trees record damage agent that is cause of death.
5.25	Tree Damage Severity	For live trees and saplings on the microplot, record tree damage categories, agents, and severities, if a result of the fire that occurred since inventory. For definition of damage severities see R1 Common Stand Exam field guide item 5.25 and Appendix R. For *fire* related mortality trees, code highest severity.
5.26	Tree Remarks	Record information about tree damage that was caused by fire and was not collected in another field.
5.27	Tree User Code	Record Tree User Code for all tally trees and for saplings on the microplot. See protocols below.
5.29	Tree Distance	**Do not update**. Record for ingrowth and missed saplings.
5.30	Tree Azimuth	**Do not update**. Record for ingrowth and missed saplings. NOTE: be sure that declination is set to 0 as indicated in the Magnetic Declination field on the Setting Form.

5.A Tally Tree Procedures

Do not replace tree nails, tags or any other permanent tree monumentation. Flagging may be used to mark trees during measurement, but all flagging shall be removed before leaving the plot.

CSE 5.3 Tree Status (1-character)

Review TREE STATUS and update as needed.

Table 5.2: Tree Status Codes

Code	Tree Status	Description
L	Live	Trees that have at least one green point of growth. Includes deciduous trees that have lost their foliage for the season and trees that have recently lost their leaves to defoliators or crown scorch but will re-flush.
D	Dead	Trees that are 4.5 feet or taller, without a green point of growth. Trees that have been uprooted and no longer have any roots in the soil are considered dead. Note: Many of the Tree Data fields are not used for dead trees and if a tree changes status, certain fields should automatically null out. SNAG DECAY CLASS (item 5.20) is required to be collected/reviewed.
X	Down dead/ Stump/ Missing	Includes all dead trees that are leaning 45 degrees or more or have their main stem lying on the ground.

CSE 5.4 Tree Class (2-characters)

(2-characters) Required for tally trees

Update for all **t**ally trees and saplings that are live or standing dead. 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.

Table 5.3: Tree Class Codes

Code	Tree Class	Live	Must have the following characteristics:
GS	Growing Stock		All trees species except JUSC2 or CELE3: • 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. JUSC2 and CELE3 (all live) are always GS

Code	Tree Class	Live	Must have the following characteristics:
RF	Rough	Y	All trees species except JUSC2 or CELE3: • A live sapling (1.0- to 4.9-inches DBH) with form defects or evidence of insects and disease that will preclude it from becoming a growing-stock (sound) tree of good form, 5.0 inches DBH or larger. • A live tree, 5.0 inches DBH or larger with 67 percent or more of the merchantable volume cull, and more than half of this cull due to sound-dead wood volume loss or severe form-defect volume loss. • A live tree, 5.0 inches DBH or larger, that does not now, nor prospectively, have at least one solid 8 foot section, reasonably free of form defect, on the merchantable bole.
RN	Rotten	Y	All live trees species (except JUSC2 or CELE3), 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)	N	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has a minimum of 33 percent of the original merchantable volume sound (less than 67 percent rotten and/or missing).
US	Non-salvable dead (Soft)	N	A standing dead **timber species** tree, 1.0 inch DBH or larger, that has less than 33 percent of the original merchantable volume sound (more than 67 percent rotten and/or missing).

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

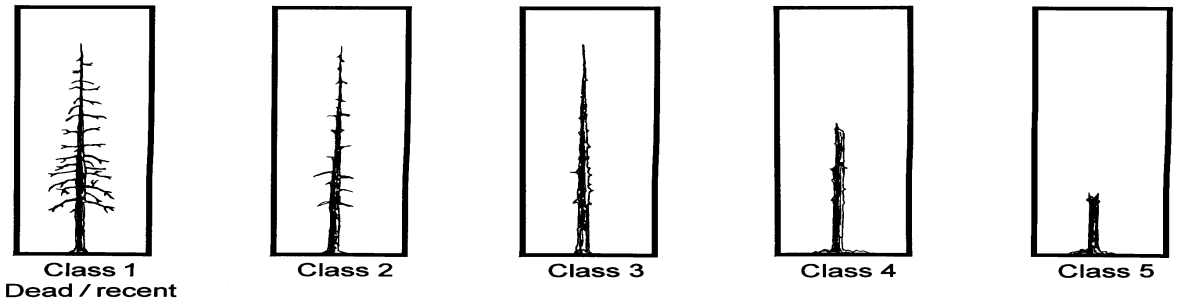
For standing dead trees (snags), record a SNAG DECAY CLASS code to indicate the condition of the tree. The pictures and descriptions below are adapted from: *Wildlife Habitats in Managed Forests of the Blue Mountains of Oregon and Washington (Agriculture Handbook No. 553). Jack Ward Thomas. September 1979. USDA Forest Service.*

When assessing recently burned areas, base Snag Decay Class code on the characteristics of the snag because of the fire and not on the time since death. Heartwood decay, sapwood decay and bole form are the most important characteristics in this assessment.

Table 5.4: 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
3	75% missing	Incipient to advanced	None to 25%	Few remain	Approx. ⅓	Mostly intact	> 5 years

Code	Bark	Heartwood Decay	Sapwood Decay	Limbs	Top Breakage	Bole Form	Time Since Death
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



- Tolerance (Snag Decay Class): ± 1 class

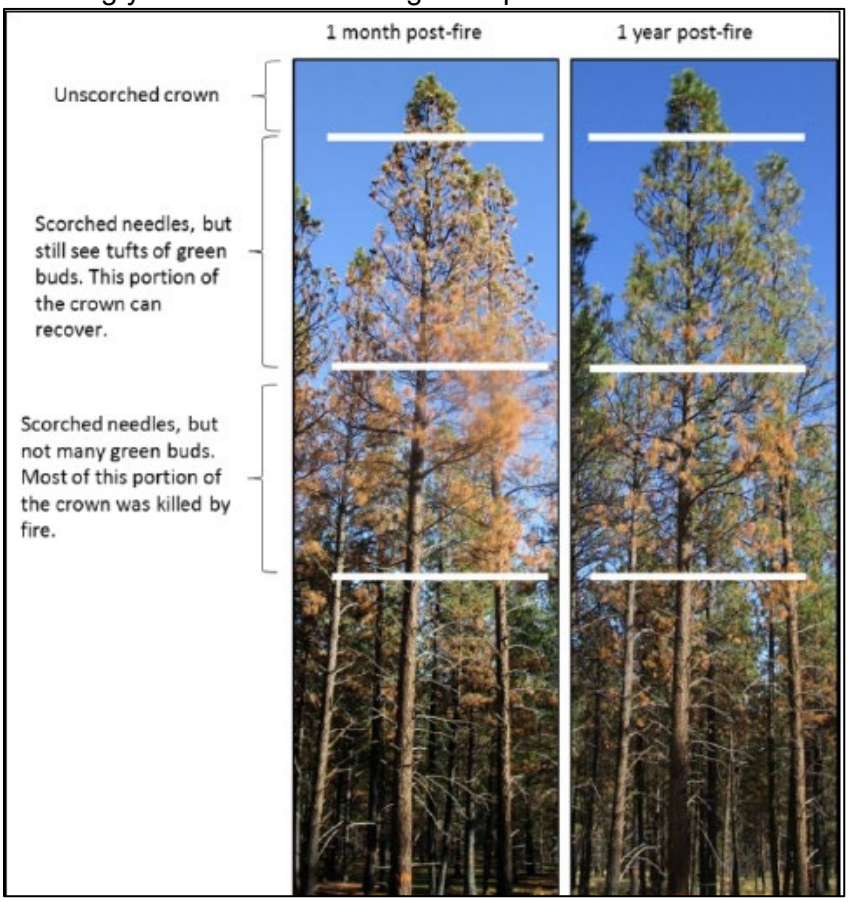
CSE 5.22 Tree Damage Category:
For live trees and saplings, review the damages that have been recorded in the previous measurement. Up to three tree damage categories, agents, and severities may be recorded for a tree. Give precedence to recording damages that are a result of the fire that occurred since previous measurement. Otherwise, do not change the prior damages entered by the FIA crew. Valid categories are listed below. For definitions of these damage categories and valid agent and severity codes, see R1 Common Stand Exam field guide Items 5.22 – 5.25 and Appendix R. For recently dead trees (those that died within the last 5 years with Snag Decay Class =1), record damage category as cause of death. If TREE DAMAGE CATEGORY is recorded, also record TREE DAMAGE AGENT (CSE 5.23) and TREE DAMAGE SEVERITY (CSE 5.25).

Acceptable TREE DAMAGE AGENTS are:
- 11 Bark Beetles
- 30 Fire
- 70 Human Activities
- 71 Harvest
- 99 Physical Effects

For TREE DAMAGE CATEGORY 99:
- TREE DAMAGE AGENT 19 – **Scorched Foliage**:
  For Scorched Foliage, TREE DAMAGE SEVERITY
  Percent scorched foliage is the percent pre-fire crown volume killed by fire. This assessment consists of the pre-fire crown volume that is currently composed of residual scorched foliage, burned or consumed foliage, and branches that have burned but probably were alive and had foliage prior to the fire. Branches lacking fine twigs were likely dead before the fire unless you are in an area of that burned as a very intense active crown fire. To assess pre-fire live crown volume (Hood et al., 2007) for all species *except for PIPO and LALY OR LAOC that have lost their needles*:
  - Be certain the entire tree crown is visible.

- Optimum viewing of the crown is at right angles to the direction of the fire spread and against a blue sky. It is important to stand back from the tree to fully view the entire crown. Assessment cannot be done while standing at the tree base.
- Next reconstruct what the crown looked like before the fire. A tree with areas completely lacking bark and charred wood on the bole was dead before the fire. Pre-fire crown volume can be estimated by looking at the fine branch structure and foliage. Branches lacking fine twigs were likely dead before the fire.
- For asymmetrical crowns, “move” lower branches to even out the crown base. Do not compact crowns beyond their normal growth form.
- Focus on the green foliage rather than the orange and black to determine the percentage of remaining live crown and then subtract from 100 to get the percent scorched foliage.

PIPO Scorched Foliage: Ponderosa pine trees are assessed slightly differently because PIPO branches and buds can survive even if the needles on the branch are scorched and killed. However, sometimes both the buds and needles are killed. You are still assessing the percent of pre-fire crown volume killed by fire. Look for green tufts at the ends of branches and live buds to make this distinction. Do not include portions of ponderosa pine crowns that are scorched, but currently have green tufts at the branch ends and less than 10% blackened or consumed needles because scorched ponderosa pine branches with buds that survived the fire can recover the following year. See the following example.



LALY/LAOC that have lost needs: if Larch still have needles on, record the percent of scorched foliage, as defined above (still the percent of pre-fire crown volume killed by fire) . However, in the event larch must be assessed after needle drop estimate scorched foliage

based on the height of the charring over the length of the bole. All charred branches and branches within the length of the charred bole are considered charred and killed.

Table 5.5: Scorched Foliage Assessment Summary

Species	Scorched Foliage Assessment Method
All species except for PIPO and LAOC/LALY after needle drop	Volume of scorched crown / Estimated pre-fire live crown volume. This is an estimate of the percentage of pre-fire crown volume killed by fire.
PIPO: ponderosa pine	Volume of crown with blackened or consumed needles (red needles on branches with unscorched, living buds are considered unscorched) / Estimated pre-fire live crown volume. This is an estimate of the percentage of pre-fire crown volume killed by fire. The assessment differs from other species because PIPO branches and buds can survive even if the needles on the branch are scorched and killed. However, sometimes both the buds and needles are killed. Look for green tufts at the ends of branches and live buds to make this distinction.
LAOC: western larch LALY: subalpine larch *After* needle drop	If needles have dropped, estimate volume of scorched crown based on scorched branches and branches below the height of bole char / Estimated pre-fire live crown volume based on scorched and unscorched branches

- TREE DAMAGE AGENT 20 **– Scorched Bark** (Charred Bark)
  For Scorched Bark, TREE DAMAGE SEVERITY
  The Scorched Bark (charred bark) Severity is the percent of the tree bole circumference that is charred. Cambium death is caused by high or sustained heating of the tree bole or root collar. The extent and magnitude of bark char at the root collar can be used as a surrogate for estimating the amount of cambium kill by fire in place of direct cambium sampling. The relationship of bark char to cambium kill varies by species (Hood et al. 2008).

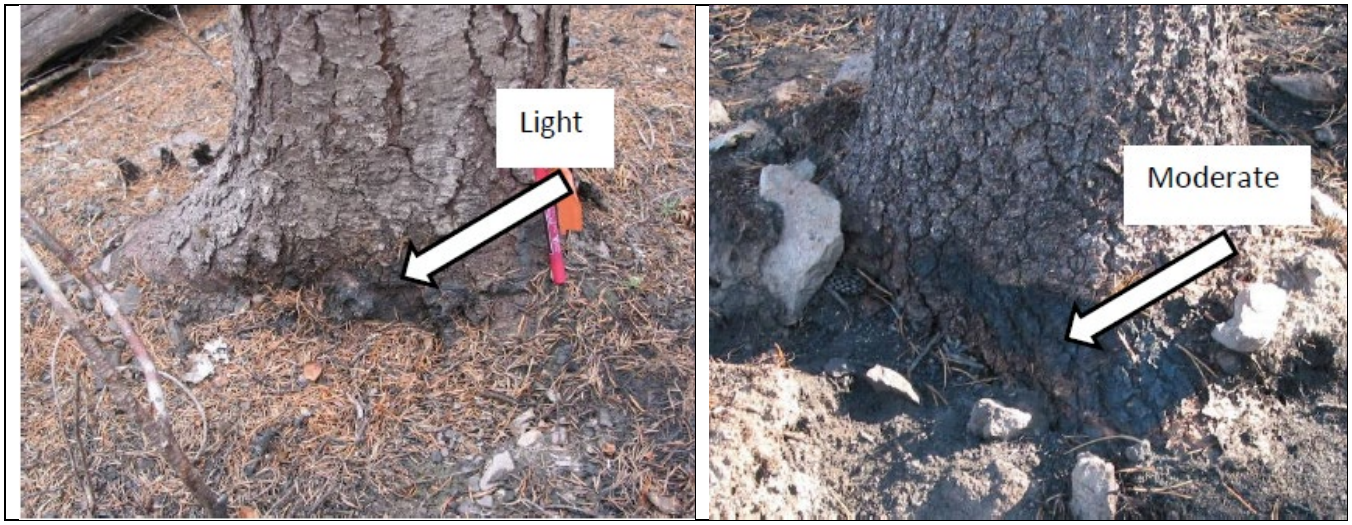
  Any charring on thin barked species, like subalpine fir (ABLA), is indicative that the underlying cambium is dead, and therefore the full percentage of the bole circumference that is charred will be recorded.

  The percentage of char for thick barked species, on the other hand, requires consideration of the magnitude of the char in order to calculate the severity of charred bark. For example, if a PIPO has light and moderate charring around 75% of its bole and deep charring around 10% of the bole, 10% is recorded as the Severity of Charred Bark.

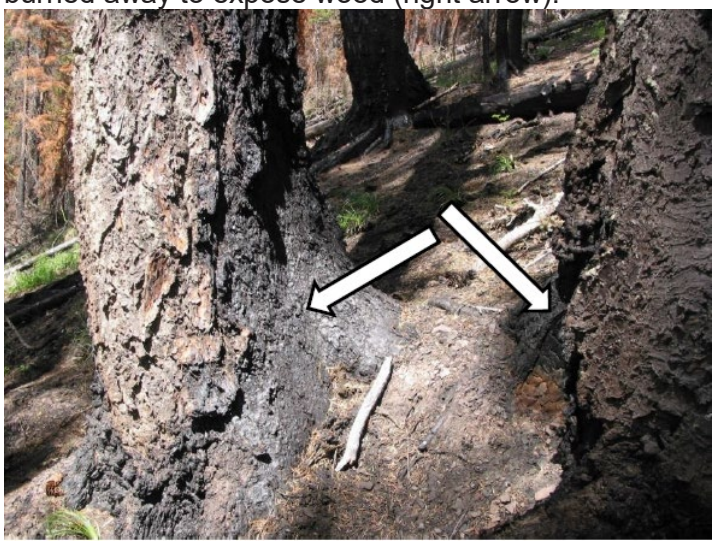
Table 5.6: Bark Char Magnitude Descriptions

Bark Char Magnitude	Bark Appearance
Unburned	No char
Light	Evidence of light scorching; can still identify species based on bark characteristics; bark is not completely blackened; edges of bark plates are charred
Moderate	Bark is uniformly black except possibly some inner fissures; species bark characteristics still discernable
Deep	Bark has been burned into, but not necessarily to the wood; outer bark species characteristics are lost; bark looks smoothed because all ridges are gone.

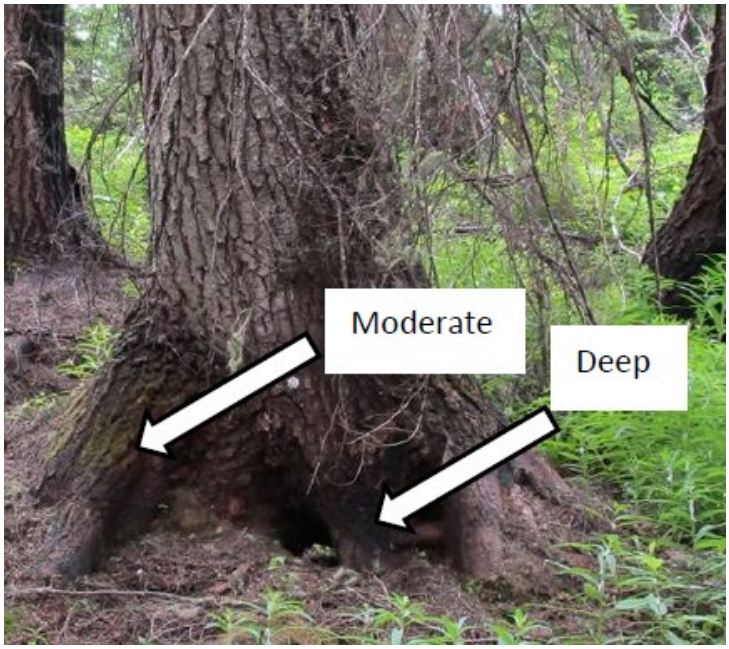
Assess **bole char magnitude** at the base of the tree near the root collar. Bole charring may only occur very low on the bole, but if the underlying cambium is killed then the nutrient translocation is still severed from the crown to the roots. See the following examples.



Deep char on Douglas-fir where outer bark species characteristics are lost (left arrow) and completely burned away to expose wood (right arrow).



Moderate and deep bole char on western hemlock (TSHE). Moderate charring has bark that is uniformly black except possibly some inner fissures and species bark characteristics are still discernable. Species bark characteristics are lost with deep charring.



The **extent** of bark char is based on the percent of the circumference of the root collar of the tree burned. The following table displays the magnitude and extent of bark char observed at the root collar needed to cause cambium kill.

Table 5.7: Species Cambium Kill Indicator Table

Species	Magnitude of bark char at root collar to be considered cambium kill must be ≥ 50% of bole circumference
Thin barked species: ABLA: subalpine fir BEPA: paper birch PIAL: whitebark pine PICO: lodgepole pine PIEN: Engelmann spruce PIFL2: limber pine PIMO3: western white pine POBA2: balsam poplar POBAT: black cottonwood POTR5: quaking aspen THPL: western redcedar TSHE: western hemlock TSME: mountain hemlock ABGR: grand fir (<7” dbh)	*Any* bole charring
ABGR: grand fir (≥7” dbh) LALY: subalpine fir (<5” dbh) LAOC: western larch (<5” dbh) PIPO: ponderosa pine (<5” dbh) PSME: Douglas fir (7”-16.9”dbh)	Moderate or deep charring
Thick bark species: LALY: subalpine fir (≥5” dbh)	Deep charring

Species	Magnitude of bark char at root collar to be considered cambium kill must be ≥ 50% of bole circumference
LAOC: western larch (≥5" dbh) PIPO: ponderosa pine (≥5" dbh) PSME: Douglas fir (17"+ dbh)	

CSE 5.27 Tree User Code:
Record Tree User Code for each tallied tree and tallied sapling on the microplot. This will help to account for how the tree has changed since the previous measurement.

Table 5.8: Tree User Code Definitions

Tree User Code	Previous Inventory	Post Fire
N	No Change	
1	Standing Live	Standing Dead • To qualify as a standing timber species, the main tree stem/bole must be at least 4.5 feet tall (i.e., a standing timber species cannot be broken below 4.5 feet) and lean less than 45 degrees from vertical. Trees supported by other trees or by their own branches are considered standing if lean is < 45 degrees.
2	Standing Live	Down Dead
3	Standing Live	Tree Cut, Removed, or Missing
4	Standing Dead	Down Dead
5	Standing Dead	Tree Cut, Removed or Missing
6	Standing Live	Down Live • Live tree that is leaning 45 degrees or more. A portion of the roots are still intact with the ground and at least a portion of the foliage is green.

5.B Sapling Tally (Microplot)

Procedures:

Stand directly over the microplot stake. Starting at 1 degree azimuth (declination set at zero), rotate clockwise and tally all qualifying trees that fall within the perimeter of the microplot (6.8-ft horizontal distance) by species. For a qualifying tree to be tallied, the horizontal distance from the microplot stake to the geographic center of the stem(s), or the center of the bole (pith) at the base of the tree, must be 6.8 feet or less. Trees are tallied and numbered clockwise starting with the last number recorded on the subplot.

Qualifying trees.
All live trees that are not JUSC2 or CELE3 that are 1.0- to 4.9-inches DBH (saplings)

Live JUSC2 or CELE3 saplings (1.0- to 4.9-inches DRC).
- For a multi-stemmed woodland species sapling to qualify for tally, at least one measured stem must be 1.0-inch DRC or larger, and the cumulative (calculated) DRC must be between 1.0 and 4.9 inches DRC and 1 foot in length.

Review and update the tallied sapling trees from the last measurement. If trees have grown into the sapling size class, that were not previously tallied, record: Tree Status, Tree Class, Tree Species, Tree Count, DBH, Age, Crown Class.

5.C Seedling Counts (Microplot)

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

To Qualify for the Seedling Count.
Conifer seedlings must be at least 1.0 foot in height (length) and less than 1.0 inch at DBH in order to qualify for counting. Hardwood seedlings must be at least 1.0 foot in length and less than 1.0 inch at DBH to qualify for counting. For JUSC2/CELE3 species, each stem on a single tree must be less than 1.0 inch at DRC and at least 1.0 foot in length.

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

Record: Tree Staus, Tree Class, Tree Species, Height (average), DBH (average, if average height is above 4.5’), Crown Ratio (average), Crown Class

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 Transects Form.

Special note: Region One is interested in knowing if any **aspen**, even if only one seedling, are present on the plot. Follow instructions below for tallying aspen, even to a trace percent.

On the subplot sample area (24.0-ft radius), estimate and record vegetation composition data using the following sampling methods.

Base all estimates on the cover by lifeform, lifeform by layer, and cover for specified species on 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).

Remember the area of a circle = πr^2, therefore 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.

Complete the following forms:

- **Cover by Lifeform** (1/24th-acre subplot area)
- **Cover by Species** (1/24th-acre subplot area)
  - noxious weeds (see Appendix D) and aspen
- **Ground Surface Cover** (transects): Collect ground surface cover data on four transects that originate from plot center and extend outward for 25.0 feet slope distance at azimuths of 0, 90, 180, and 270 degrees for subplots 1 and 2; and azimuths of 45, 135, 225, and 315 degrees for subplots 3 and 4.

A. Vegetation Composition - Cover by Lifeform Form

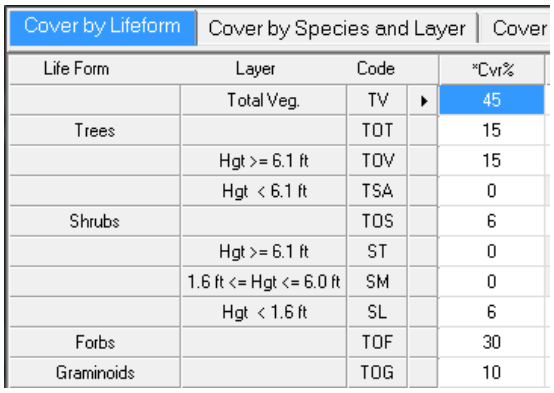
Cover by Lifeform

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

- Cover by Lifeform
- Cover by Lifeform by Layer

Base all estimates on the cover of vegetation and plant parts that are (or were) alive during the current growing season, and are located within the subplot perimeter (24.0-ft radius, horizontal distance).

Figure 6.1: Exams Cover by Lifeform Form



Life Form	Layer	Code	*Cvr%
	Total Veg.	TV	45
Trees		TOT	15
	Hgt >= 6.1 ft	TOV	15
	Hgt < 6.1 ft	TSA	0
Shrubs		TOS	6
	Hgt >= 6.1 ft	ST	0
	1.6 ft <= Hgt <= 6.0 ft	SM	0
	Hgt < 1.6 ft	SL	6
Forbs		TOF	30
Graminoids		TOG	10

Table 6.2: Cover By Lifeform Attributes

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

Canopy Cover by Lifeform (trees, shrubs, forbs, grass).

Determine the total canopy cover by Lifeform (trees, shrubs, forbs, and graminoids). Examine each Lifeform individually as if the other Lifeforms do not exist. Do not double count overlapping layers within a Lifeform. To determine, estimate the area of ground surface covered by a vertical projection of the canopy for the particular Lifeform. Only include vegetation and plant parts within the 1/24th-acre subplot perimeter (horizontal distance), that are alive (or were alive) during the current growing season. Record to the nearest 1 percent. If the canopy cover by lifeform by layer is completed before the total canopy cover, Exams will default the highest percentage entered into the layers for each lifeform (trees, shrubs). The default value will need to be verified/corrected by the crew.

Canopy Cover by Lifeform by Layer (TOV, TSA, ST, SM, SL).

Determine the total canopy cover by lifeform by layer for trees and shrubs. To determine, estimate the area of ground surface covered by a vertical projection of the canopy within the predefined layer for the particular Lifeform. For each Lifeform, partition plants into layers according to the height of the plant. Imagine the shrub lifeform whose plants are 5 feet tall and take up 8 percent cover on the plot. Those shrubs are in the 1.6-6' layer and have 8% cover. 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.

Table 6.3: Canopy Cover Layer

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

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

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

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

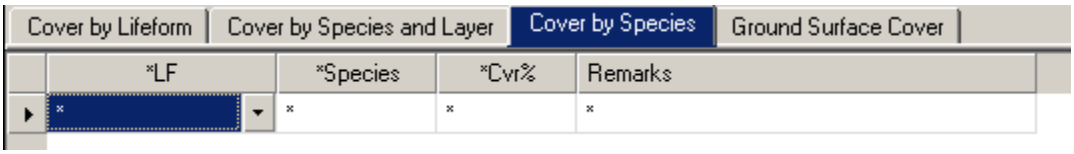
B. Vegetation Composition – Cover by Species Form

Cover by Species

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

- **Noxious Species and Aspen** – record the cover of any noxious species (see Appendix D), as per the Montana state list, found on each subplot. Record the cover of **aspen** if it occurs on the plot.

Figure 6.4: Exams Cover by Species Form



For each noxious species (see Appendix D for list) and for aspen (POTR5) found on the subplot area, 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 Appendix D for species code.
- **Cover** (Cvr%) – record canopy cover to the nearest 1 percent. To determine, estimate the area of ground surface area covered by a vertical projection of the canopy for the species. Do not count overlap of crowns within a species.
- **Layer –** in the **Remarks** column, **record** the **Layer Code** for the layer (listed below) that best represents where most of the cover tops out **Note:** this layer is not necessarily where most of

plant biomass occurs. If a plant species occurs equally in more than one layer, record the highest layer where it occurs.

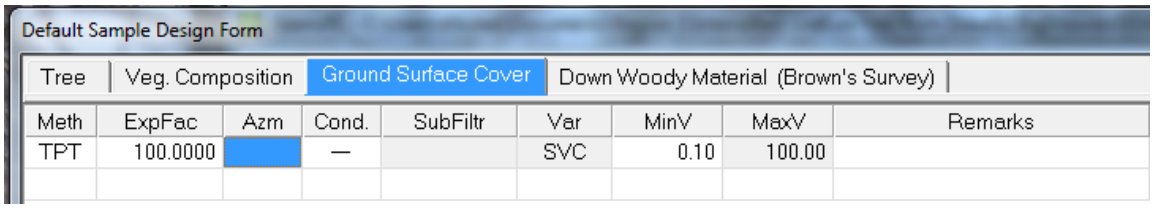
Figure 6.5: Layer Codes For All Lifeforms

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

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

C. Ground Surface Point Intercept Form

Figure 6.6: Exams Ground Surface Cover Transects Form



Ground Surface Cover Transects Sample – Collect ground surface cover data along four transects originating from plot center, Section 1: Sample Design and figures 1.3 and 1.4 for transect layout. Record all data for this sample on the "paper" Ground Surface Cover Transects Form (Appendix B). Figure

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

Ground Surface Cover Point Intercept Sampling Procedures: Lay out four transects that originate from plot center (PC stake) and extend outward 25.0 feet slope distance at azimuths of 0, 90, 180, and 270 degrees for subplots 1 and 2; azimuths of 45, 135, 225, and 315 degrees for subplots 3 and 4. For this sample, lay a cloth tape along the slope of the ground; do not correct the slope distance to obtain horizontal distance.

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

first). Note: Foliar canopy cover above the soil surface plane is not considered to be ground surface cover.

Table 6.7: Ground Surface Cover codes. Ground Surface Cover Type Codes and Category Definitions.

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.
CRYP	Cryptogamic crust	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria).
DEVP	Developed Land	Surface area occupied or covered by any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure, sod/lawn.
LICH	Lichen	Lichens: an organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in a symbiotic association. For lichen growing on bare soil in dry rangeland conditions, see cryptogamic crusts.
LITT	Litter and duff	Leaf and needle litter, any material < ¼ inch, and duff not yet incorporated into the decomposed top humus layer. Non-continuous litter is not included (for example, scattered needles over soils is classified as BARE).
MOSS	Moss	Nonvascular, terrestrial green plants including mosses, hornworts and liverworts - always herbaceous. This code does not apply to moss growing on bare soils in dry rangeland conditions. For rangeland conditions, see cryptogamic crusts.
PEIS	Permanent ice and snow	Surface area covered with ice & snow at time of plot measurement, considered permanent.
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-

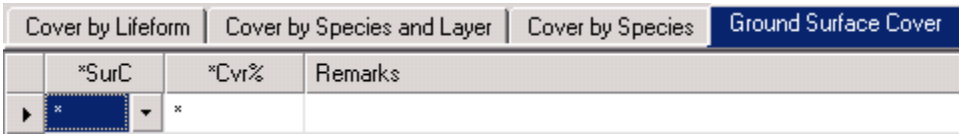
Code	Description	Definition
ASH	Ash (Organic from fire)	Remaining residue after all combustible material has been burned off.
BARE	Bare soil (soil particles < 2 mm)	Bare soil, not covered by rock, cryptogams or organic material. Does not include any part of a road (see definition for road).
		continuous litter are not included (for example, scattered needles over soil is classified as BARE).

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

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

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

Figure 6.7: Ground Surface Cover Form



Determining GROUND SURFACE COVER PERCENT:

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

Category GROUND SURFACE COVER PERCENT – By category, determine the cover percent value associated with the total number of hits sampled. Because the "number of hits for all categories is 100," the "cover percent" value for a category calculates to the same number as the "total number of hits" for the category. Therefore, the category cover percent is simply:

Category Cover Percent = Total # hits for category

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

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

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

Adjustment for nonsampled transect:

It is a MUST that 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%

Enter the final adjusted percentages in the Exams software.

Section 7: Down-Woody Materials Form

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

A. Definition of Down-Woody Materials

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).

Fine Woody Debris (FWD).

In this inventory, FWD includes downed, dead branches, twigs, and small tree or shrub boles that are not attached to a living or standing dead source. FWD can be connected to a larger branch, as long as this branch is on the ground and not connected to a standing dead or live tree. Only the woody branches, twigs, and fragments that intersect the transect are counted. FWD can be connected to a down, dead tree bole or down, dead shrub. FWD can be twigs from shrubs and vines. FWD must be no higher than 6 feet above the ground to be counted.

FWD does not include:

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

B. Locating and Establishing Line Transects

Lay out **two transects** that originate from plot center (PC stake) and extend outward **24.0 feet horizontal distance.** See Table 7.1 for orientation of transects based on subplot number. Mark the ends of the CWD transects with a stick wrapped with some flagging. Do not leave the flagging in wilderness. Mark the location of the diameter measurement on each piece of CWD with line using a timber crayon or a paint pen.

- Tolerance (Down-Woody Materials Sample):
  - Transect Azimuths: ± 10 degrees

See Table 7.2 for information on the transect length to sample TWIG1, TWIG2, TWIG3, and course woody material.

Table 7.1: Azimuth of DWM transects by subplot

Subplot	CWD Transect direction		FWD Transect
1	090	270	270
2	360	180	360
3	135	315	135
4	045	225	225

Table 7.2: Portion of transect and length for measuring DWM

Field	Diameter Size Range (cross section)	Transect Length	Transect Location (horizontal distance) * See Figure 1.3
7.5.1 1-hour	0.01 to 0.24 in	6 feet	14 to 20 feet
7.5.2 10-hour	0.25 to 0.99 in	6 feet	14 to 20 feet
7.5.3 100-hour	1.00 to 2.99 in	10 feet	14 to 24 feet
3"+ CWD measurements	3.00"+	48 feet	0 to 24 feet

Table 7.3: Slope Correction DWM transect lengths

% slope	14 ft	20 ft	24 ft
10	14.1	20.2	24.2
20	14.3	20.4	24.5
25	14.4	20.6	24.7
30	14.6	20.9	25.1
35	14.8	21.2	25.4
40	15.1	21.5	25.8
45	15.4	21.9	26.3
50	17.7	22.4	26.8
55	16.0	22.8	27.4
60	16.3	23.3	28.0
65	16.7	23.6	28.6
70	17.1	24.4	29.3
75	17.5	25.0	30.0
80	17.9	25.6	30.7

% slope	14 ft	20 ft	24 ft
85	18.4	26.2	31.5
90	18.8	26.9	32.3
95	19.3	27.6	33.1

C. Down-Woody Materials Items

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

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

Table 7.4: Required Fields for FIA Remeasurement

Item No.	Field	Recorded
7.1	Plot Number	X
7.2	First Duff and Litter	X
7.3	Second Duff and Litter	X
7.4	Fuel Depth	Not recorded
FWD:		
7.5.1	1-hour; 0.01 to 0.24 inch	X
7.5.2	10-hour; 0.25 to 0.99 inch	X
7.5.3	100-hour; 1.00 to 2.99 inches	X
CWD:		
7.8	Piece Count	3.0-inch diameter and larger
7.9	Log Decay Class	3.0-inch diameter and larger
7.10	Diameter (at point of intersection)	3.0-inch diameter and larger
7.11	Piece Length	3.0-inch diameter and larger
7.12	Diameter Large end	3.0-inch diameter and larger

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 no down-woody material.

7.1 Plot Number (3-digit) Default

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

Measure FIRST DUFF and SECOND DUFF depth, as specified below. Although titled “duff,” these measurements include both duff and litter depth at the points indicated (24-ft, horizontal distance). Record the duff/litter values **in inches** to the nearest 0.1 inch (xx.x).

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:

- **Duff1 –** Take the first duff/litter measurement on the point of the transect with the smallest azimuth at 24.0 feet horizontal distance from plot center, and record it in the "**First Duff**" column. For example, Duff1 on subplot 1 is the measurement taken at 90 degrees.
- **Duff2 –** Take the second duff/litter measurement on the point of the transect with the largest azimuth at 24.0 feet horizontal distance from plot center, and record it in the "**Second Duff**" column. For example, Duff2 on subplot 1 is the measurement taken at 270 degrees.

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

Sampling Methods for Fine Woody Debris (Items 7.5.1, 7.5.2, and 7.5.3):

FWD is sampled along a 6-10 foot subsection of transect (see Table 7.2 for transect orientation), and is tallied within three size classes depending on the cross-section diameter size of each piece. Collect FWD data as indicated in figure 1.3 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:

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 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.

7.5.1 1-hour (0.01 to 0.24 inch) (3-digit) *Required*

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

- ❖ Tolerance 1-hour ± 40 percent

7.5.2 10-hour (0.25 to 0.99 inch) (3-digit) *Required*

Record the number of large twig intersections for each transect. Large twigs are defined as pieces that have a cross section diameter of between 0.25 and 0.99 inch inclusive at the point of intersection with the sampling plane.

- ❖ Tolerance 10-hour: ± 30 percent

7.5.3 100-hour (1.00 to 2.99 inches) (3-digit) *Required*

Record the number of branch intersections for each sampling plot. Branches are defined as pieces with a cross section diameter of between 1.0 and 2.99 inches inclusive at the point of intersection with the sampling plane.

- ❖ Tolerance 100 hour: ± 20 percent

Sampling Methods for Coarse Woody Debris (Items 7.8, 7.9, 7.10, 7.11, and 7.12):

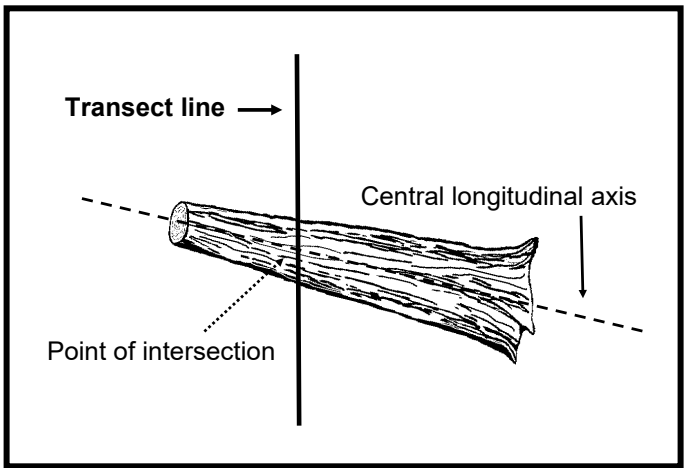
CWD is sampled along two 60-ft transects (see figure 1.3; *transects oriented 90º*/270º on subplot1, 180º/360º on subplot 2, 135º/315º on subplot3, and 45º/225º on subplot 4). Collect CWD data along the entire length of both transects.

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.

Figure 7.5 – Tally rules for CWD.



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

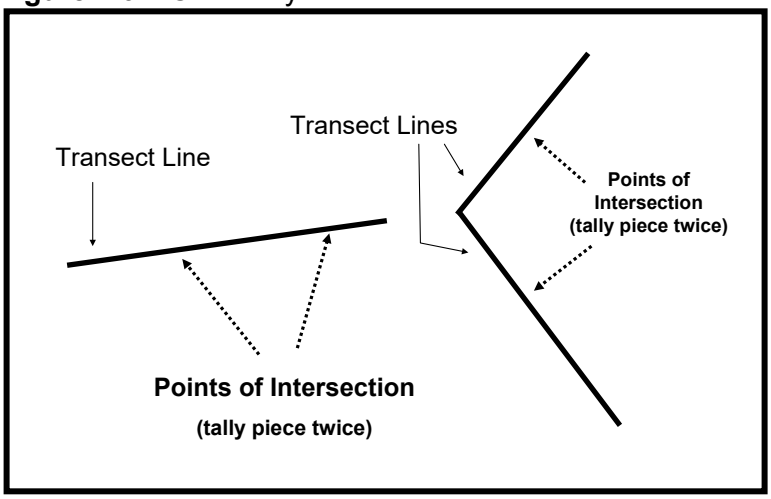
3. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3.0 feet, measure the length to the nearest 0.1 ft to determine if it is ≥ 3.0 feet.

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

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

6. If the central longitudinal axis of a CWD piece is intersected more than once on a transect line or if it is intersected by two transect lines, tally the piece each time it is intersected (uncommon situation, see figure 7.6).

Figure 7.6 – CWD tally rules: intersections.



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

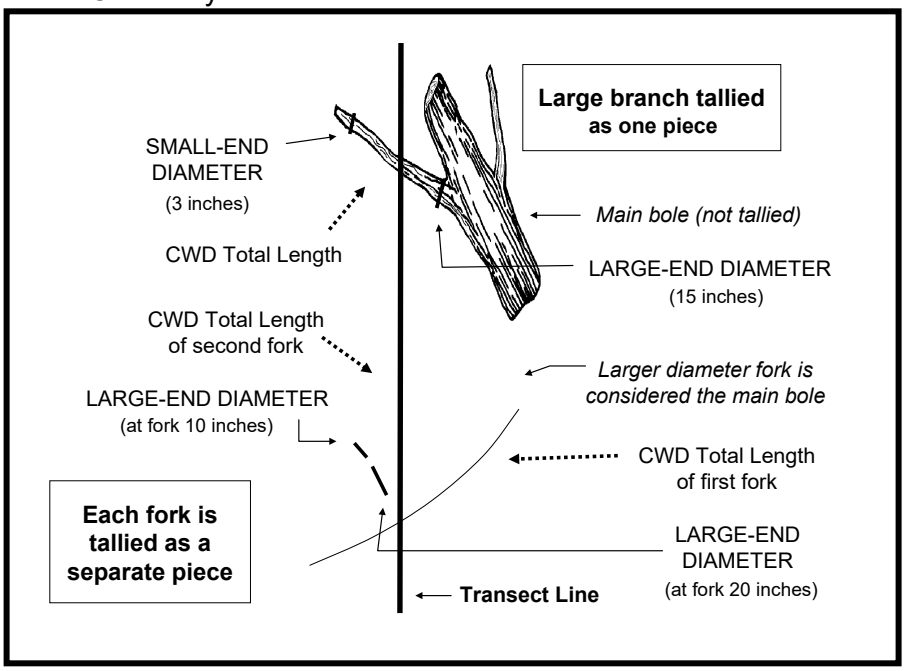
8. If a piece is fractured across its diameter or length, and would pull apart at the fracture if pulled from either end or sides, treat it as two separate pieces. If judged that it would not pull apart, tally as one piece. Tally only the piece intersected by the transect line.

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 7.7)

Figure 7.7: CWD tally rules for forked trees.



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

Tally the CWD transect in the direction of the FWD transects first, then tally the CWD transect in the direction opposite to the FWD transect second. Tally individual CWD pieces according to the CWD tally rules stated below. Generally, CWD piece count is "1."

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

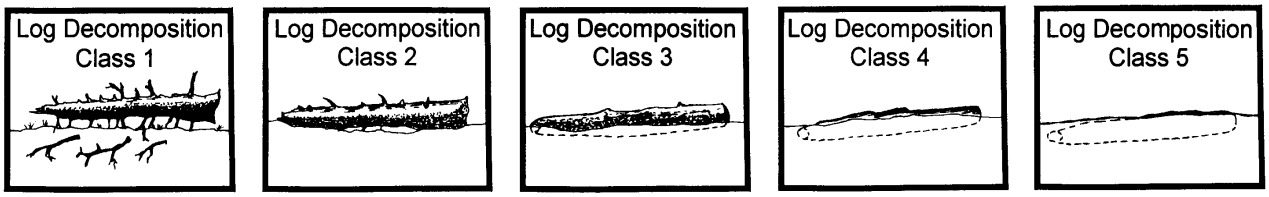
In this inventory, the decay stage of a piece ≥ 3.0 inches (and intersect diameter) will first determine whether the piece qualifies for tally. See tally qualifications below.

For pieces that qualify for tally, record LOG DECAY CLASS according to the class code listed in the following table:

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
4	Absent	Soft blocky pieces	Absent	Round to oval	Light brown to faded brown	Partially below ground

Class Code	Bark	Texture	Twigs	Shape	Wood Color	Portion of log on ground
5	Absent	Soft, powdery	Absent	Oval	Faded light yellow or gray	Mostly below ground



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

Tally qualifications:

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

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

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

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

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

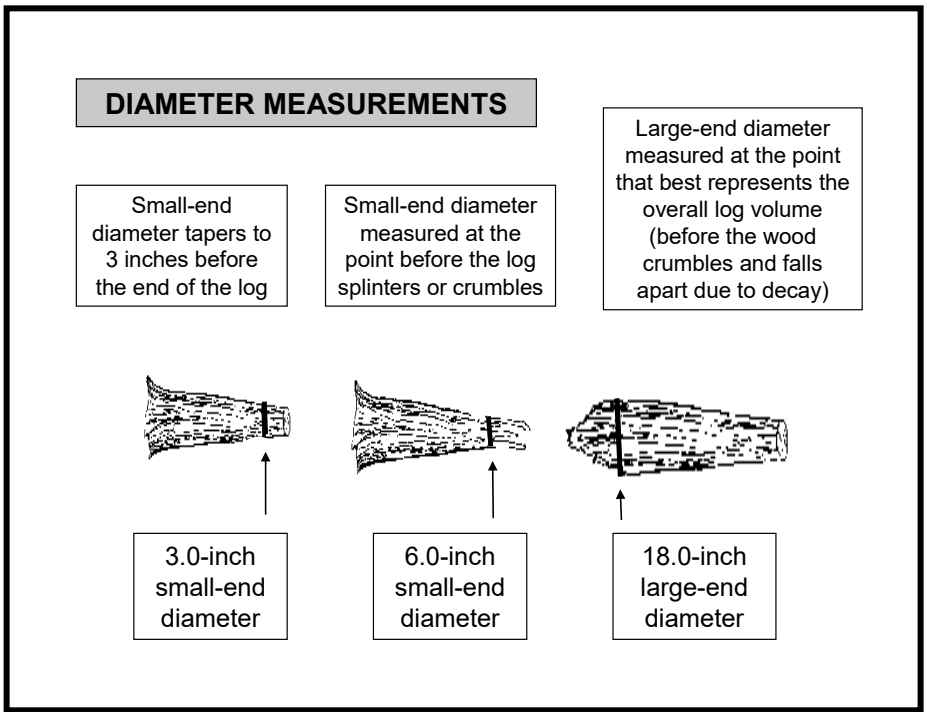
If the diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece is actually ≥ 3.0 inches and a valid tally piece.

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

Diameter Measurement Guidelines:

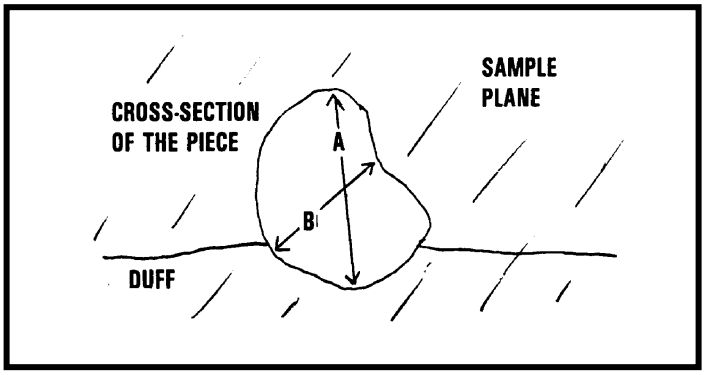
The diameter is most commonly measured by holding a tape above the log, at a position perpendicular to the length (see figure 7.5). It is useful to carry a steel carpenter's retracting tape to measure diameters. Other methods include wrapping a tape around the bole (if possible), holding a straight-edge ruler above the piece, or using calipers.

Figure 7.5: Diameter measurements.



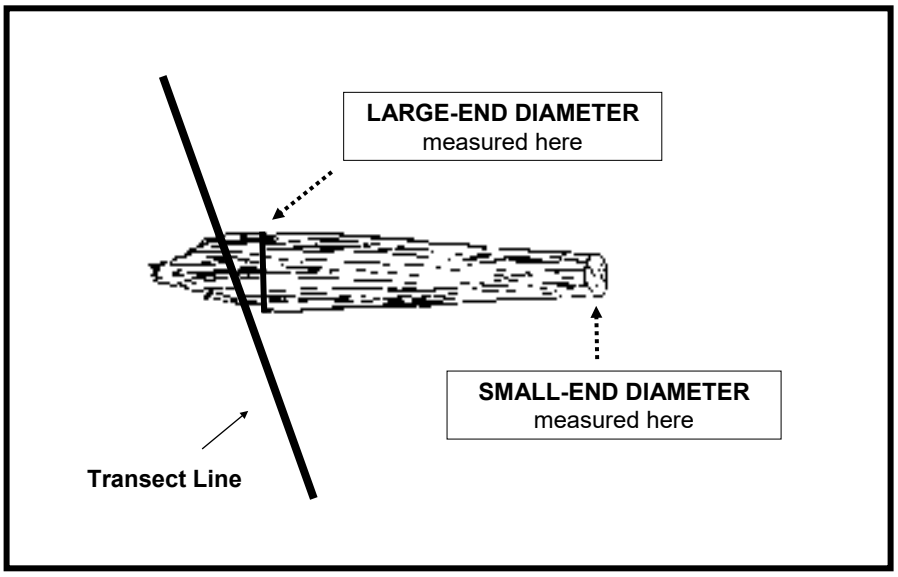
Odd-shaped Diameter: For pieces that are not round in cross-section (because of missing chunks of wood or "settling" due to decay), measure the diameter in two directions and take an average. Estimate the longest and shortest axis of the cross-section ("A" and "B" in figure 7.6), and enter the average in the diameter field. This technique applies to intersect, small-end, and large-end diameters.

Figure 7.6: Estimating the diameter of pieces that are not round in cross-section



Splintered-End Intersect Diameter: As an exception to the tally rules, if the transect intersects the log at the decayed or splintered end (i.e., the portion where we do not consider it part of the log because it is falling apart), record the intersect diameter at this location (see figure 7.7). However, record the large-end and small-end diameters according to the established rules (i.e., at the points where they best represent the log volume). If the splintered end appears to be two separate pieces (i.e., a major split located just at the end) – treat it as one log (in this situation) and take the intersect diameter around the splintered end (take two measurements and calculate an average if it is odd shaped). Measure PIECE LENGTH between the large-end and small-end diameters.

Figure 7.7: Example of decayed end intersecting the transect



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

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

- Tolerance (Piece Length): ± 10 percent

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

For each CWD piece tallied, record the diameter of the piece's large end (large-end diameter). Record the large-end diameter to the nearest inch. The large-end diameter will occur at: (1) a broken or sawn end, (2) a fracture, or (3) the root collar. If the end of the CWD piece is splintered or decomposing (sloughing off), measure the large-end diameter at the point where it best represents the overall log volume. Refer to the diameter measurement guidelines mentioned above under DIAMETER - at point of intersection, item 7.10 (also see figure 6).

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

Literature Cited

Hood, S.M., Cluck, D.R., Smith, S.L., Ryan, K.C., 2008. Using bark char codes to predict post-fire cambium mortality. Fire Ecology 4, 57-73.

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Post-fire Assessment of Tree Status. Region 1 Vegetation Classification, Mapping, Inventory, and Analysis Report #17-16. 2017.
http://fsweb.r1.fs.fed.us/forest/inv/post_fire_2017/Assessing%20_Tree_Status_Post_Fire.pdf

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

Appendix A: PLANTS Species Code/ FIA Numeric Tree Code Crosswalk

Plant Species Code	FIA Numeric Code	Scientific Name
ABGR	017	*Abies grandis*
ABLA	019	*Abies lasiocarpa*
BEPA	375	*Betula papyrifera*
CELE3	475	*Cercocarpus ledifolius*
FRPE	544	*Fraxinus pennsylvanica*
JUSC2	066	*Juniperus scopulorum*
LALY	072	*Larix lyallii*
LAOC	073	*Larix Occidentalis*
PIAL	101	*Pinus albicaulis*
PICO	108	*Pinus contorta*
PIEN	093	*Picea engelmannii*
PIFL2	113	*Pinus flexilis*
PIMO3	119	*Pinus monticola*
PIPO	122	*Pinus ponderosa*
POBAT	747	*Populus balsamifera*
POTR5	746	*Populus tremuloides*
PSME	202	*Pseudotsuga menziesii*
TABR2	231	*Taxus brevifolia*
THPL	242	*Thuja plicata*
TSHE	263	*Tsuga heterophylla*
TSME	264	*Tsuga mertensiana*

Appendix B: Supplemental Data Collection Forms

***Setting/Plot/Witness Form Data Collection**

***Tree Data Form**

Microplot Seedling Data Collection Form

Vegetation Composition: Cover by Lifeform

Vegetation Cover by Lifeform: Cover by Species

Ground Surface Cover Form

Down-Woody Materials Form

Setting Form Attributes					
Project Name		Stand #		Date	
Exam Level		Elevation		Aspect	
Slope		Examiner		Prec. Protocol	
User Code					
Setting Remarks:					
Setting Damage					
Damage Category		Damage Agent		Damage Severity	

Plot Data Form					
Sub-Plot # 1		Aspect		Slope	
User Code					
Plot History/Remarks:					
Flame Length (feet)		Crown Fire ?		Sub-Plot Stake Replaced ?	
Sub-Plot # 2		Aspect		Slope	
User Code					
Plot History/Remarks:					
Flame Length (feet)		Crown Fire ?		Sub-Plot Stake Replaced ?	
Sub-Plot # 3		Aspect		Slope	
User Code					
Plot History/Remarks:					
Flame Length (feet)		Crown Fire ?		Sub-Plot Stake Replaced ?	
Sub-Plot # 4		Aspect		Slope	
User Code					
Plot History/Remarks:					
Flame Length (feet)		Crown Fire ?		Sub-Plot Stake Replaced ?	

Project Name: ______________- **Date: ________**
Region: 01 **Proclaimed Forest: ______________** **District: ____**
Loc: ________ Stand #:_____

Plot #	Tag #	Tree Status	Species	Tree Count	DBH	Height	Crown Ratio	Crown Class	Snag Decay	Dam. Categ.	Dam. Agent	Dam. Sever.	User Code	Tree Remarks
XXX	XXXX	X	XXXXXX	XXX	XXX.X	XXX	XXX	XX	X	XX	XXX	XX	XXXX	
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Project Name:	Proclaimed Forest	District	County	Loc	Stand	Plot	MM/DD/YYYY
	_ _ _ _ _	_ _ _ _	_______	___	___		_ _/_ _ / _ _ _ _

Microplot Seedling Count

Species: ________	Tree Count	DBH <1.0”	Tree Class	Tree Status	Height	Crown Ratio	Crown Class
0.5-4.4 ft.							
Tot Tally			(ave)	(ave)	(ave)	(ave)	(ave)
4.5+ ft.							
Tot Tally		(ave)	(ave)	(ave)	(ave)	(ave)	(ave)
Species: ________	**Tree Count**	**DBH**	**Tree Class**	**Tree Status**	**Height**	**Crown Ratio**	**Crown Class**
0.5-4.4 ft.							
Tot Tally:			(ave)	(ave)	(ave)	(ave)	(ave)
4.5+ ft.							
Tot Tally:		(ave)	(ave)	(ave)	(ave)	(ave)	(ave)
Species: ________	**Tree Count**	**DBH**	**Tree Class**	**Tree Status**	**Height**	**Crown Ratio**	**Crown Class**
0.5-4.4 ft.							
Tot Tally:			(ave)	(ave)	(ave)	(ave)	(ave)
4.5+ ft.							
Tot Tally:		(ave)	(ave)	(ave)	(ave)	(ave)	(ave)
Species: ________	**Tree Count**	**DBH**	**Tree Class**	**Tree Status**	**Height**	**Crown Ratio**	**Crown Class**
0.5-4.4 ft.							
Tot Tally:			(ave)	(ave)	(ave)	(ave)	(ave)
4.5+ ft.							
Tot Tally:		(ave)	(ave)	(ave)	(ave)	(ave)	(ave)

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.; Total Veg (TV), Trees (TOT), Shrubs (TOS), Forbs (TOF), Graminoids (TOG).
2. Calculate total canopy coverage of shrubs by layer (**TOV**, **TSA**, **ST**, **SM**, **SL**) in height categories within the plot. See Cover by Species below for more information on layers.

Lifeform	Layer	Code	Attribute	Canopy Cover % (CVR %)
Total Veg	**All**	**TV**	Total Veg all lifeforms	
Trees	**All**	**TOT**	Total Tree all layers	
	> 6.0 ft	**TOV**	Total Tree (> 6.0 ft)	
	≤ 6.0 ft	**TSA**	Total Tree (≤ 6.0 ft)	
Shrubs	**All**	**TOS**	Total Shrub	
	> 6.0 ft	**ST**	Total Shrub (> 6.0 ft)	
	1.6 – 6.0 ft	**SM**	Total Shrub (1.6 - 6.0 ft)	
	≤ 1.5 ft	**SL**	Total Shrub (≤ 1.5 ft)	
Forbs	**All**	**TOF**	Total Forbs	
Graminoids	**All**	**TOG**	Total Graminoids	

Cover by Species:

1. Record all invasive species present in the 1/24th-acre subplot regardless of the canopy cover percent.

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)

Project Name: _____ Date: _____
Owner: USFS Region: 1 Proclaimed Forest: _____ District: ____
State: _____ County:_____ Loc: _____ Stand _____ Plot 1 2 3 4
Crew Members: _____

GROUND SURFACE POINT-INTERCEPT TRANSECTS FORM

Cover Types	Transect							
	1		2		3		4	
	Hits	Total	Hits	Total	Hits	Total	Hits	Total
ASH								
BAVE								
BARE								
CRYPT								
DEVP								
LICH								
LIT								
MOSS								
PEIS								
ROAD								
ROCK								
TRIS								
UNKN								
WATER								
WOOD								
TOTAL		100		100		100		100

DOWN WOODY MATERIALS FORM

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

Measurement Direction and Distances		FWD			CWD	Litter/Duff	
		1-Hour	10-Hour	100-Hour	1000-Hour	FIRST DUFF	SECOND DUFF
Transect Direction	Subplot 1	270°	270°	270°	90° and 270°	90°	270°
	Subplot 2	360°	360°	360°	180° and 360°	180°	360°
	Subplot 3	135°	135°	135°	135° and 315°	135°	315°
	Subplot 4	225°	225°	225°	45° and 225°	45°	225°
Horizontal Distance		14 to 20 ft (6 ft)	14 to 20 ft (6 ft)	14 to 24 ft (10 ft)	entire transect (24 ft each)	24-ft mark	24-ft mark

Sub-Plot #	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 "
1						
2						
3						
4						

Coarse Woody Material (≥ 3.0 in)

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

DOWN WOODY MATERIALS FORM

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

Appendix C: Recommended Field Gear

The following list of recommended field gear identifies many of the items that are necessary to conduct the field inventory.

- **Backpack** – with a comfortable fit; sturdy enough to carry 35-50 lbs of field gear.
- **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)*.
- **PC metal stakes** (to mark subplot and microplot centers)
- Timber cruising vest
- **Logger's Tape** – 50 ft or 100 ft
- Diameter Tape
- **Carpenter's Tape** – 25 ft (with 0.1 feet and inch marks)
- **Cloth Tape** – 100 ft and/or 200 ft (for traversing from the RP to the PC, and sample transects)
- **Clipboard** (for paper field forms)
- Mechanical pencils and/or pens
- Compass
- **Clinometer** – preferably with a "slope correction factor" SCF (for measuring tree heights and adjusting for slope distance)
- **Laser range and height measurer** – example: Laser 200 and OPTi-LOGIC 400LH units
- **GPS unit** – capable of field averaging, and navigation; including a distance or route function, with a stated accuracy of ± 10 meters (49.2 feet) in the horizontal dimension, and digital compass accuracy of ± 5 degrees (example: Garmin GPSMAP 76s w/ WAAS capability)
- **Ruler** – with 1/10-inch and 1/20-inch scale (for measuring radial growth and duff/litter)
- **Flagging** – one type with a solid color, and another type with a pattern: such as orange flagging and blue/white striped flagging.
- **Calculator** – with the following function keys: MRC, M-, M+, and square root *(highly recommended for calculating DRCs on woodland species)*
- "Write in the rain" notepad
- **Plant Identification books** (to aid in vegetation composition sample – tree, forb, shrub, and graminoid identification)
- Bear Pepper Spray
- First Aid Kit
- **Communication devices** (radio, satellite phone, cell phone)
- Rain gear
- Hard Hat
- Water Bottle
- Gardening gloves

Appendix D: Noxious Weed List for Montana

Table 1: State of Montana Noxious Weeds

State of Montana Noxious Weeds 2017		
Scientific Name	**Common Name**	**Code**
Acroptilon repens	Russian knapweed	ACRE3
Berteroa incana	Hoary alyssum	BEIN2
Butomus umbellatus	Flowering Rush	BUUM
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
Cynoglossum officinale	Houndstongue	HICY
Cytisus scoparius	Scotch broom	CYSC4
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
Phragmites australis ssp. australis	Common reed	PHAU7
Polygonum cuspidatum, P. sachalinense, P. bohemicum,	Knotweed complex	POLYG4
Potamogeton crispus	Curlyleaf pondweed	POCR3
Potentilla recta	Sulphur Cinquefoil	PORE5
Ranunculus acris	Tall buttercup	RAAC3
Rhamnus cathartica	Common buckthorn	RHCA3
Senecio jacobea	Tansy ragwort	SEJA
Taeniatherum caput-medusae	Medusahead	TACA8
Tamarix spp.	Tamarisk or saltcedar	TAMAR2
Tanacetum vulgare	Common tansy	TAVU

Table 2: State of Idaho Noxious Weeds

State of Idaho Noxious Weeds		
Scientific Name	**Common Name**	**Code**
Acroptilon repens	Russian knapweed	ACRE3
Aegilops cylindrica	Jointed goatgrass	AECY
Ambrosia tomentosa	Skeletonleaf bursage	AMTO3
Anchusa arvensis	Small bugloss	ANAR16
Berteroa incana	Hoary Alyssum	BEIN2
Bryonya alba	White Bryony	BRAL4
Butomus umbelltus	Flowering rush	BUUM
Cardaria draba	Whitetop or Hoary cress	CARDA2
Carduus acanthoides	Spiny plumeless thistle	CAAC
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
Centaurea virgata	Squarrose knapweed	CEVIS2
Chondrilla juncea	Rush skeletonweed	CHJU
Leucanthemum vulgare	Oxeye Daisy	LEVU
Cirsium arvense	Canada thistle	CIAR4
Conium maculatum	Poison hemlock	COMA2
Convolulvus arvensis	Field bindweed	COAR4
Crupina vulgaris	Common crupina	CRVU2
Hieracium cynoglossoides	Houndstongue	HICY
Cytisus scoparius	Scotch broom	CYSC4
Echium vulgare	Vipers bugloss	ECHIU
Egeria densa	Brizilian elodea	EGDE
Eichhornia crassipes	Water hyacinth	EICR
Euphorbia dentata	Toothed spurge	EUDE4
Euphorbia esula	Leafy spurge	EUES
Heracleum mantegazzianum	Giant Hogweed	HEMA17
Hieracium aurantiacaum	Orange hawkweed	HIAU
Hieracium piloselloides	Tall Hawkweed	HIPI2
Hieracium pretense	Meadow hawkweed	HICA10
Hydrocharis morsus-ranae	Common/European Frogbit	HYMO6
Hydrilla verticillata	Hydrilla	HYVE3
Hyoscyamus niger	Black henbane	HYNI
Impatiens glandulifera	Policeman’s Helmet	IMGL
Iris pseudacorus	Yellow flag iris	IRPS
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

State of Idaho Noxious Weeds		
Scientific Name	**Common Name**	**Code**
Myriophyllum aquaticum	Parrotfeather milfoil	MYAQ2
Myriophyllum heterophyllum	Variable-leaf-milfoil	MYHE2
Myriophyllum spicatum	Eurasian watermilfoil	MYSP2
Nardus stricta	Matgrass	NAST3
Nymphoides peltata	Yellow floating heart	NYPE
Onopordum acanthium	Scotch thistle	ONAC
Phragmites australis	Common reed	PHAU7
Polygonum bohemicum	Bohemian knotweed	POBO10
Polygonum cuspidatum	Japanese knotweed	POCU6
Polygonum sachalinense	Giant knotweed	POSA4
Potamogeton crispus	Curlyleaf pondweed	POCR3
Salvia aethiopis	Mediterranean Sage	SAAE
Senecio jacobea	Tansy ragwort	SEJA
Solanum elaeagnifolium	Silverleaf nightshade	SOEL
Solanum rostratum	Buffalobur	SORO
Sonchus arvensis	Perennial sowthistle	SOAR2
Sorghum halepense	Johnsongrass	SOHA
Tamarix ssp.	Saltcedar	TAMAR2
Tribulus terrestris	PunctureVine	TRTE
Zygophyllum fabago	Syrian beancaper	ZYFA