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PORTABLE DATA RECORDER USE

Execute the ExamsCE software

Platform	Process
Casio/Dell Axim/iPAQ	Select " Start ," then select " ExamsCE ." If the exams software does not appear in the Start menu, it means there are nine items (the maximum) already in the Start menu. If this is the case, go to " Settings " then " Start menu " and remove or de-select some of the checked programs. Then check the " ExamsCE " program.
Husky Fex21	Double-click on the " Shortcut to ExamsCE " icon.
Trimble GeoXT/GeoXM	Double-click on the " Shortcut to ExamsCE " icon.
Juniper Allegro Field PC/Allegro CE	Double-click on the " Shortcut to ExamsCE " icon.

General Operating Notes

Random Access Memory

Refer to individual PDR Users Guides on how to check the Random Access Memory (RAM). The last number listed represents the number of characters of available RAM. Approximately 30,000 characters are needed for an average size setting. A PDR is for temporary data storage. Move data from the PDR to a more permanent data storage device such as a compact flash card, pcmcia storage card, or a personal computer.

Battery

1. Refer to individual PDR User Guides on how to check the battery level.
2. Charge the batteries each night for use the next day.
3. Pack spare batteries, use extended life batteries.
4. Get a power adapter for the car to charge the PDR when traveling to and from the site.
5. Remove modem and network cards, they draw extra power from the device even if they are not being used.
6. Turn off the PDR and change the batteries immediately if a low battery message is displayed.
7. If the PDR does not turn on, or the PDR turns on and immediately turns off, change the batteries immediately.
8. Turn the PDR off when not in use.
If there is a power loss in the field, the default file (.cse) is reset to the system default. To restore it to your defaults:
 - Select "**File**" then "**Open**"
 - Select "**sebackup.pdr**"
 - Select "**File**" then "**Save as**"
 - Select "**.cse**"
9. Store data on external card, not internal memory.
10. Turn PDR off between plots to save battery and avoid data corruption.

Operating the Casio

- Use the buttons on the left side of the machine to scroll up or down a line and to access the drop-down menus.
- May use the keyboard up and down arrows to scroll up or down a line.
- To delete a line of data, use the delete button or use the keyboard, highlight a field, and use the backfield key.

Operating the Husky Fex21

If you are unable to go into the field selection area and select or deselect a field to be included in the forms, or get to the tree age field because the recorder skips over the tree age field, do the following:

- From the Husky main menu, select **“Start”** then **“Setting”** then **“Control Panel”**
- Double click on **“Display”** then select **“Appearance”**
- On the right-hand side of the display locate the word **“Scheme:”**
- Beneath the word **“Scheme:”** change the drop-list to **“Windows Standard.”**
- Beneath the word **“Item:”** change the drop-list to **“3-D Objects.”**
- Next to the **“Item:”** drop-list, select the icon and select the lightest shade of gray (row 1, column 2)
- Select **“Apply** and then select the small **“OK”** button located at the top right-hand corner of the **“Display Properties”** window.
- Select **“OK”** and close out to the main menu.

Operating the Compaq iPAQ

Do not load the “Dashboard” software that is on the companion CD. It will lock up your iPAQ. If you need the dashboard software, obtain it from the iPAQ web site at:

<http://www.compaq.com/support/files/handheldiPAQ/us/download/14559.html>

Select file SP21023.

Operating the Juniper

- To improve the Juniper’s display, press the **yellow button** and **F3** key simultaneously to turn on the backlighting.
- To see the CSE program, eliminate the task bar at the bottom of the Juniper by selecting **“Start,” “Settings,”** then **“Task bar.”** Uncheck **“Always on top”** and check **“Auto hide.”**
- If you are unable to go into the field selection area and select or deselect a field to be included in the forms, or get to the tree age field because the recorder skips over the tree age field, do the following:
 - From the Juniper main menu, select **“Start”** then **“Setting”** then **“Control Panel”**
 - Double click on **“Display”** then select **“Appearance”**
 - On the right-hand side of the display locate the word **“Scheme:”**
 - Beneath the word **“Scheme:”** change the drop-list to **“Windows Standard.”**
 - Beneath the word **“Item:”** change the drop-list to **“Desktop.”**
 - Select **“Apply** and then select the small **“OK”** button located at the top right-hand corner of the **“Display Properties”** window.
 - Select **“OK”** and close out to the main menu.

Operating the Dell Axiom

The plastic film screen protectors are shipped with a protective cover. Peel the protective cover off the screen protector before it is placed on the PDR. If the cover is not removed, the screen protector is too thick and the screen will not respond to the touch of the stylus.

PDR Model Specific Notes

DATA COLLECTION PROCEDURES

The following fields are "**required**" regardless of examination level.

Setting	Project Name Region Proclaimed Forest Number District Location Stand Number Date Exam Level Precision Protocol
Design	Selection Method Expansion Factor Plots Installed Subpopulation Variable Subpopulation Minimum Value Subpopulation Maximum Value
Plot	Plot Number
Tree	Status Species

SETTING

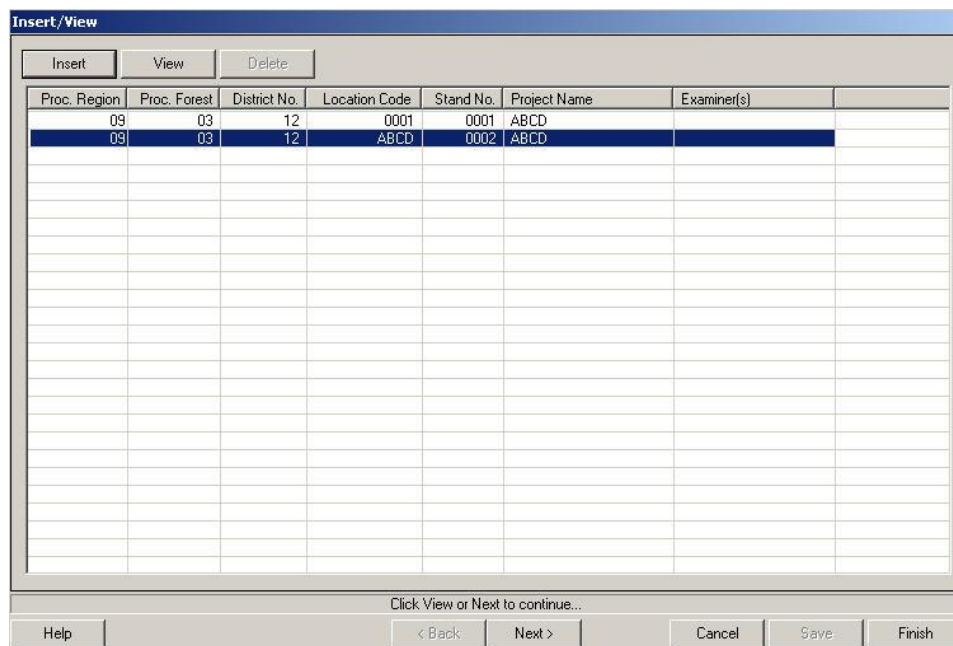
Accuracy standards are for intensive exams types. The accuracy standard is “No Errors” unless otherwise noted.

Setting data can be inserted, edited, and deleted. From the main menu, select “**Setting Data**,” then either “**Setting Data Wizard**” or “**Insert/Edit/Delete**” to enter data.



Using the Setting Data Wizard

The **Setting Data Wizard** allows you to insert new setting information or edit certain portions of existing setting information. All data will be saved into the “.cse” file that is currently opened.

A screenshot of the 'Insert/View' dialog box. It has three tabs: 'Insert', 'View', and 'Delete'. The 'View' tab is active. Below the tabs is a table with the following columns: 'Proc. Region', 'Proc. Forest', 'District No.', 'Location Code', 'Stand No.', 'Project Name', and 'Examiner(s)'. The table contains two rows of data. The first row has values: 09, 03, 12, 0001, 0001, ABCD. The second row has values: 09, 03, 12, ABCD, 0002, ABCD. Below the table, there is a prompt: 'Click View or Next to continue...'. At the bottom, there are buttons for 'Help', '< Back', 'Next >', 'Cancel', 'Save', and 'Finish'.

When the setting form has been completed and saved for a stand, and the setting is selected, use “**Next**” to page through the Sample Design, Setting Damages, Species of Management Interest, and Setting Remarks forms.

The buttons along the bottom of the screen have the following function:

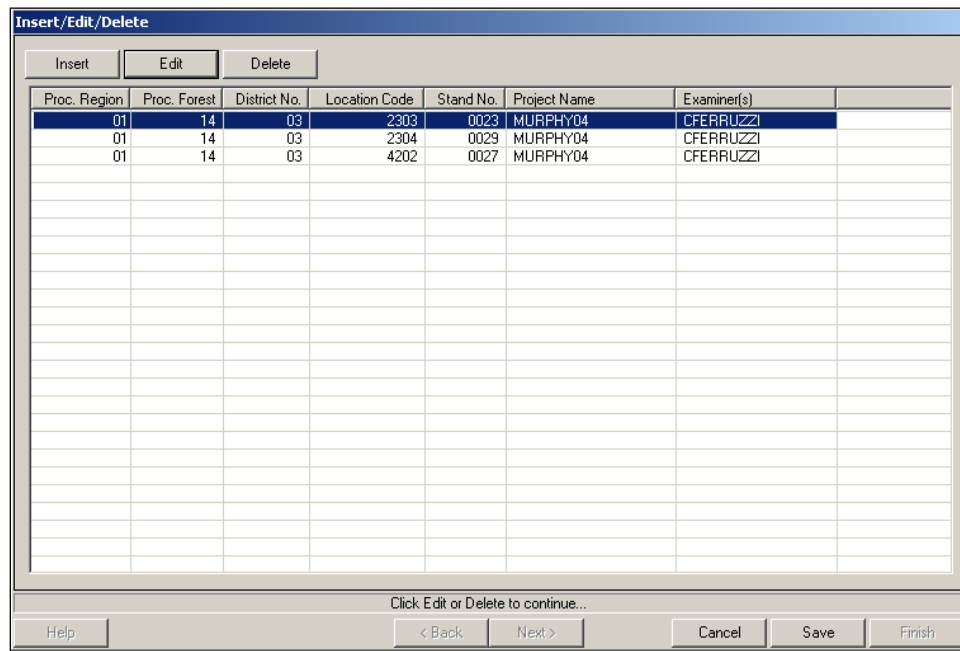
Button	Function
Help	Describes the column headings.
Back	Inactive from this window.
Next	Takes you to the Sample Design form(s).
Cancel	Any modifications since window was opened will not be saved.
Save	Inactive from this window once you've saved your data.
Finish	Returns to main menu.

Using Insert/Edit/Delete in the Setting Data

Under Setting Data in the main window, the **“Insert/Edit/Delete”** options allow you to insert new setting data in the Setting form, edit existing Setting form data for a particular setting, or delete setting data records.



To enter a new setting, select **“Insert.”** To edit data for an existing setting, highlight the setting and select **“Edit.”** To delete a setting and all associated data from the opened **“.cse”** file, highlight the setting and then select **“Delete.”**



Editing the Setting Data

Any defaults that are contained in the “.cse” file will be entered automatically. To move between fields, use the tab key. Once you have finished entering setting data, select “**Save**” to return to the Insert/View form.

If the **Options** button is selected while in a field, a drop-down list of valid values and definitions is displayed.

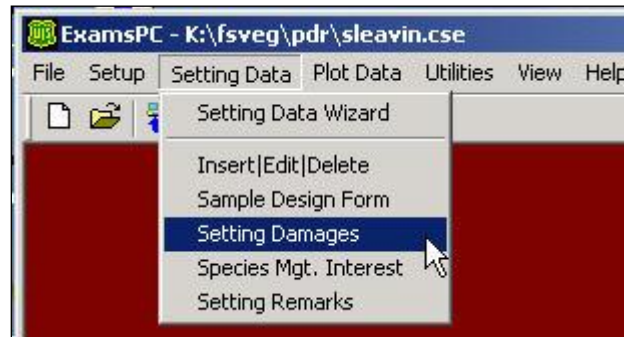
Code	Description
00	Non Forest
201	white spruce
203	balsam poplar
205	mountain hemlock
206	Engelmann spruce - subalpine fir
208	whitebark pine
210	interior Douglas-fir
211	white fir - limber pine
212	western larch
213	grand fir
215	western white pine
216	blue spruce
217	aspen - western forests - middle elevations - interior
218	lodgepole pine
219	limber pine
220	Rocky Mountain juniper
224	western hemlock
227	western redcedar - western hemlock
228	western redcedar
235	cottonwood - willow
237	interior ponderosa pine
238	western juniper
251	white spruce - aspen
252	paper birch

Once a valid code is highlighted, the screen closes and the valid code is inserted in the field.. If “X” or “OK” is selected, the form closes with no value chosen for the field.

Once all of the data has been entered, select “Save” to return to the main setting screen.

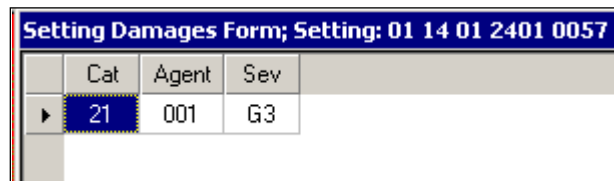
Editing the Setting Damages

From the main menu, choose “Setting Data/Setting Damages.”



A screen of all settings currently saved under the open “.cse” file is shown. Select “Insert” from this screen and the setting form will be displayed. If an existing setting is highlighted, select “Next” to bring up the Setting Damages form.

Use the down arrow to access a new, blank line of setting damage data.

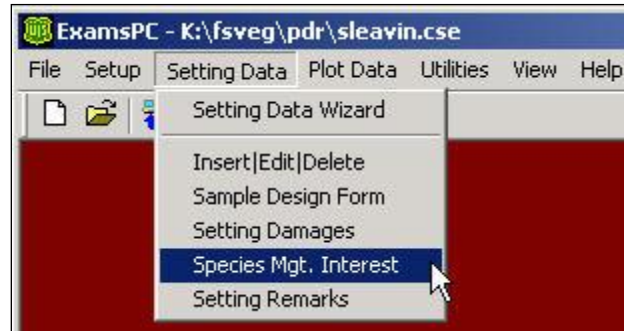


The buttons along the bottom of the screen have the following functions:

Button	Function
Help or “?”	Produce a pull down list of valid codes and definitions for the current field.
Back	Save changes, return to the previous screen to select a new setting.
Cancel	Delete all changes made since entering form; return to main menu. A warning message is displayed.
Save	Save all changes.
Finish	Once data has been saved, returns to the main menu.

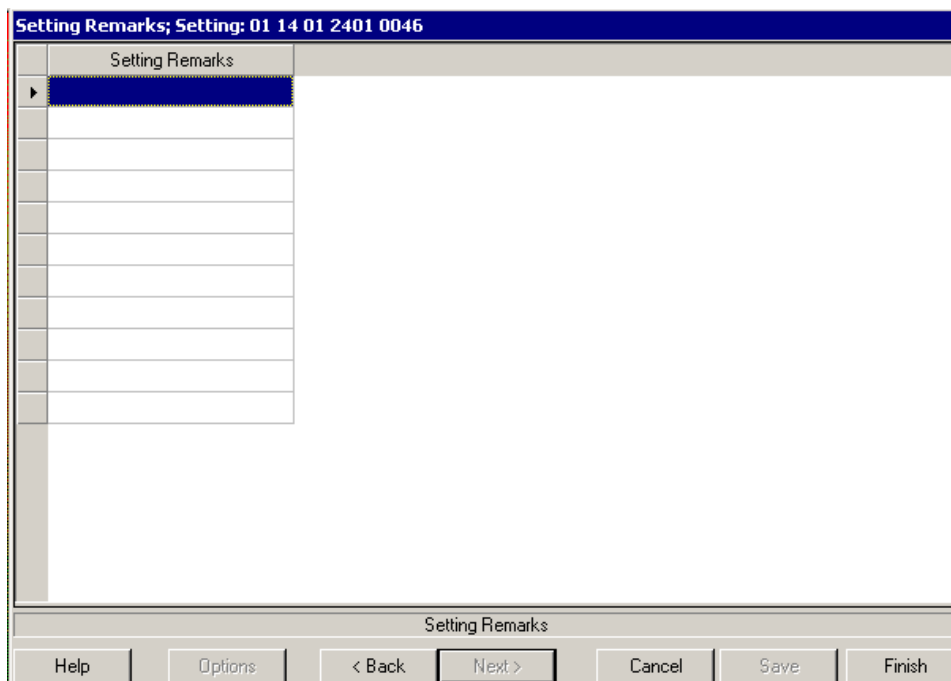
Editing the Setting Species of Management Interest

In the Species of Management Interest form, use the down arrow to access a new, blank line of setting species of management interest.



Editing the Setting Remarks

Enter remarks related to the setting. All text will be converted to upper case.



Project Name (maximum of 25 characters and/or numbers) Required

Record the project name. Multiple settings may use the same project name. A project name is a useful way to group settings. Example project names are “Intermountain FIA,” “Root Rot survey,” “Stand exam,” and “Owl survey.”

Proclaimed Region (maximum of 2 numbers) Required

Use a code of “9” for Region 9.

Proclaimed National Forest (maximum of 2 numbers) Required

This field is required in Region 9.

Code	Forest	Code	Forest
02	Chequamegon	14	Wayne
03	Chippewa	15	Midewin National Tallgrass Prairie
05	Mark Twain	19	Allegheny
06	Nicolet	21	Monongahela
07	Ottawa	22	White Mountain
08	Shawnee	30	Finger Lakes
09	Superior	04	Huron
10	Hiawatha	20	Green Mountain
12	Hoosier	24	Manistee

District (maximum of 2 numbers) Required

Forest	Code	District	Forest	Code	District
Allegheny	2	Marienville	Hiawatha (cont.)	4	Sault St. Marie
	3	Bradford		5	St. Ignace
Chequamegon - Nicolet	1	Medford - Park Falls	Hoosier	2	Brownstown
	2	Great Divide		4	Tell City
	3	Eagle River - Florence			
	4	Lakewood - Laona	Huron-Manistee	1	Baldwin - WC
	5	Washburn		3	Manistee - Cadillac
Chippewa	1	Blackduck		4	White Cloud
	2	Cass Lake		5	Mio
	3	Deer River		6	Huron Shores
	4	Marcell		7	Harrisville
	5	Walker	Mark Twain	03	Huston
		04		Poplar Bluff	
Green Mountain	1	Middlebury		05	Potosi - Fredericktown
	2	Manchester		07	Salem
	3	Hector		08	Cedar Creek
	5	Rochester			
Hiawatha	1	Rapid River		21	Ava - Cassville
	2	Manistique		23	Eleven Point
	3	Munising			

District (cont.)

Forest	Code	District	Forest	Code	District
Monongahela	1	Cheat	Superior	1	Laurentian
	2	Gauley		2	Gunflint
	3	Greenbrier		5	Kawishiwi
	4	Marlinton – White Sulphur		6	Lacroix
	5	Potomac		7	Tofte
Ottawa	1	Bergland	Wayne	1	Athens
	2	Bessemer		3	Ironton
	3	Iron River	White Mountain	1	Ammonoosuc
	4	Kenton		2	Androscoggin
	5	Ontonagon		3	Evans Notch
	6	Watersmeet		4	Pemigewasset
Shawnee	2	Mississippi Bluffs		5	Saco
	4	Hidden Springs		6	Massabesic Exp For.

Location (maximum of 16 characters and/or numbers) Required

Only integers, upper or lower case alpha characters, and underscores are allowed in this field. Leading zeros are required. Region 9 uses a compartment number (no characters) that is a maximum of five digits.

Stand Number (maximum of 4 numbers) Required

Only integers are allowed. Use the RMRS site or CVU polygon number. For Region 9, this must be a number (no characters) that is a maximum of three digits.

Measurement Number (maximum of 4 numbers)

Default is “1” for CSE and new Inventory and Monitoring Exams. This field cannot be edited if doing a CSE Exam.

Owner (maximum of 4 characters)

Use the default of “USFS” for the Forest Service.

State (exactly 2 characters) Settings that cross state boundaries must be subdivided

Code	Description	Code	Description
IL	Illinois	NY	New York
IN	Indiana	OH	Ohio
ME	Maine	PA	Pennsylvania
MI	Michigan	VT	Vermont
MN	Minnesota	WV	West Virginia
MO	Missouri	WI	Wisconsin
NH	New Hampshire		

County (maximum of 3 numbers)

State	Code	County	State	Code	County
Illinois	3	Alexander	Michigan (cont.)	131	Ontonagon
	59	Gallatin		135	Oscoda
	69	Hardin		153	Schoolcraft
	77	Jackson		165	Wexford
	87	Johnson	Minnesota	7	Beltrami
	127	Massac		21	Cass
	151	Pope		31	Cook
	165	Saline		61	Itasca
	181	Union		75	Lake
	199	Williamson		137	St. Louis
Indiana	5	Bartholomew	Missouri	9	Barry
	13	Brown		17	Bollinger
	25	Crawford		19	Boone
	71	Jackson		23	Bulter
	81	Johnson		27	Callaway
	93	Lawrence		35	Carter
	101	Martin		43	Christian
	105	Monroe		55	Crawford
	117	Orange		65	Dent
	123	Perry		67	Douglas
Maine	17	Oxford		91	Howell
Michigan	1	Alcona		93	Iron
	3	Alger		105	Laclede
	13	Baraga		123	Madison
	33	Chippewa		149	Orgeon
	37	Dubois		153	Ozark
	39	Crawford		157	Perry
	41	Delta		161	Phelps
	53	Gogebic		169	Pulaski
	61	Houghton		179	Reynolds
	69	Iosco		181	Ripley
	71	Iron		186	St. Genevieve
	85	Lake		187	St. Francois
	97	Mackinac		203	Shannon
	101	Manistee		209	Stone
	103	Marquette		213	Taney
	105	Mason		215	Texas
	107	Mecosta		221	Washington
	117	Montcalm		223	Wayne
	121	Muskegon		229	Wright
	123	Newaygo	New Hampshire	3	Carroll
	127	Oceana		7	Coos
	129	Ogemaw		9	Grafton

County (cont.)

State	Code	County	State	Code	County
New York	97	Schuyler	West Virginia	1	Barbour
	99	Seneca		23	Grant
Ohio	9	Athens	25	Greenbrier	
	53	Gallia	27	Hampshire	
	73	Hocking	31	Hardy	
	79	Jackson	63	Monroe	
	87	Lawrence	67	Nicholas	
	111	Monroe	71	Pendleton	
	115	Morgan	75	Pocahontas	
	121	Noble	77	Preston	
	127	Perry	83	Randolph	
	131	Pike	93	Tucker	
	141	Ross	101	Webster	
	145	Scioto	Wisconsin	3	Ashland
	163	Vinton	7	Bayfield	
167	Washington	37	Florence		
Pennsylvania	47	Elk	41	Forest	
	53	Forest	67	Langlade	
	83	McKean	83	Oconto	
	123	Warren	85	Oneida	
Vermont	1	Addison	99	Price	
	3	Bennington	113	Sawyer	
	21	Rutland	119	Taylor	
	23	Washington	125	Vilas	
	25	Windham			
	27	Windsor			

Administrative Forest (maximum of 2 numbers) Required

This field is required in Region 9.

Code	Administrative Forest	Code	Administrative Forest
03	Chippewa	13	Chequamegan/Nicolet
04	Huron-Manistee	14	Wayne
05	Mark Twain	15	Midewin National Tallgrass Prairie
07	Ottawa	19	Allegheny
08	Shawnee	20	Green Mountain-Finger Lakes
09	Superior	21	Monongahela
10	Hiawatha	22	White Mountain
12	Hoosier		

Date (exactly 8 numbers) Required

Record the calendar month, day, and year the stand examination was completed. The format is MMDDYYYY. The database forms will accept the date with or without the “/” separator. The database will inset the separator, if not supplied, so the date format is consistent.

Examples are:

01231984 for January 23, 1984
12/07/1997 for December 7, 1997

Photo ID (exactly 14 characters and/or numbers)

Record the Photo ID of the aerial photo where the majority of the setting is located.

For example: 61213012890057

- First six numbers (612130) represent Photo Symbol/Project ID
- Second four numbers (1289) represent the roll number
- Last four numbers (0057) represent the exposure number

Note: When this information is loaded into the database, the Photo ID will be checked against the list of photo IDs stored in the database. If the ID is not already stored in the database, an error will result. You must enter this information via the Interface by pressing the Photo ID button adjacent to the Photo ID field.

Examination Level (exactly 4 numbers) Required

Record the examination level that identifies the scope and range of information being collected. Scope is the breath of information collected (type of form), and range is the precision of information collected (examination level). The intensity implies a measurement standard, sample design, and sample selection criteria. The actual criteria used to sample the stand must be documented on the Sample Design Form.

Tree

For the tree data, record one of the following:

Code	Description
0	This form was not used.
1	Quick Plot
2	Extensive Examination
3	Intensive Examination

Field	Quick Plot	Extensive Plot	Intensive Plot
Tag Number		X	X
Tree Status	X	X	X
Site/GST Tree			X
Tree Species	X	X	X
Tree Count	X	X	X
DBH/DRC	DBH for trees > 4.5 feet tall	DBH for trees > 4.5 feet tall	DBH for trees > 4.5 feet tall

Tree (cont.)

Field	Quick Plot	Extensive Plot	Intensive Plot
Height	Trees < 4.5 feet tall	Trees < 4.5 feet tall	GST only and trees < 4.5 feet tall
Height to Crown			
Radial Growth			GST only
Radial Growth 2			
Height Growth			GST only
Age			GST/Site only
Crown Ratio			Live trees only
Crown Class			
Crown Width			
Damage Category		X	X
Damage Agent			X
Damage Part			
Damage Severity		X	X
Wildlife Use			
Log/Snag Decay		If Dead/Down is taken	If Dead/Down is taken
Cone Serotiny			
Number of Stems	DRC only	DRC only	DRC only
Remarks			

Vegetation Composition and Surface Cover

For the Vegetation Composition and Surface Cover, record one of the following:

Code	Interested in Obtaining	Species to record	Subpop. Min.	Subpop. Max.	Form 1	Form 2	Form 3	Form 4
1	Quick estimate	Life form only	1%	100	Required	Optional	Optional	Optional
2	TES, NOX, and/or the dominant four species	Only specific species	User defined	100	Required	Required	Optional	Optional
3	All species	All species to a specified %	User defined	100	Required	Required	Optional	Optional
4	All species, including TES and NOX to trace	All species to a specified %, but species on a list to trace	User defined	100	Required	Required	Optional	Optional

Down Woody

For the Down Woody data, record one of the following:

Code	Description
0	This form was not used.
1	Data was collected, but not according to Brown's Protocol.
2	Data was collected according to Brown's Protocol.

Exam Purpose (exactly 2 characters) Required

Use one of the following codes to define the purpose of the exam. CSE exams default to “SE;” Inventory and Monitoring exams default to “IM.”

Code	Description
RE	Regeneration/Stocking - Surveys to determine stocking rates of individual areas and for certification of regeneration.
TH	Thinning Exam - certify thinning prescription accomplishment at the completion of thinning treatments.
ID	Insect & Disease Exams - verify types and severity of infestation as an aid in determining treatment needs.
TI	Tree Improvement - follow Tree Improvement treatments.
SE	Stand Exam - determine stand composition.
CI	Compartment Inventory
FL	Fuels Survey
FF	Fire and Fuels
KW	Kirtland Warbler - survey to determine Kirtland warbler habitat
MC	Marking Check

Stratum (maximum of 6 characters and/or numbers)

Record the current setting stratum. Refer to aerial photo typing or other stratification information done in conjunction with the examination. Refer to Regional or Forest direction for a list of strata definitions and codes.

Existing Vegetation Reference (maximum of 8 characters and/or numbers)

Record the dominant existing vegetation reference. Dominance is based on plurality of basal area. Existing vegetation reflects plant species currently present. See Appendix E for a complete list of existing vegetation reference codes.

Existing Vegetation (maximum of 8 characters and/or numbers)

Record the dominant existing vegetation code. Dominance is based on plurality of basal area. Existing vegetation reflects plant species currently present. See Appendix E for a complete list of existing vegetation codes.

Potential Vegetation Reference (maximum of 4 numbers)

This field is not used by Region 9 at this time.

Potential Vegetation (maximum of 8 characters and/or numbers)

Record the potential vegetation composition code. Potential vegetation is the plant community that would become established if all successional sequences were completed without interference by man and under the present climatic and edaphic conditions, including those created by man. See Appendix G for a complete list of potential vegetation codes.

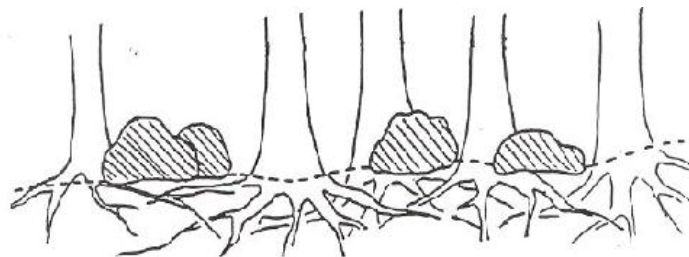
Structure (exactly 2 characters)

Record one of the following codes that best describe the overall structure of the setting. Structure is the distribution of tree size classes within the stand. Structure descriptions are as follows:

Code	Description
SS	Single story - A single even canopy characterizes the setting. The greatest number of trees is in a height class represented by the average height of the setting; there are substantially fewer trees in height classes above and below this mean.
TS	Two-storied - Two relatively even canopy levels can be recognized in the setting. The frequency distribution of trees by height class tends to be bimodal. Understory or overtopped trees are common. Neither canopy level is necessarily continuous or closed, but both canopy levels tend to be uniformly distributed across the setting (e.g., overstory with regenerated understory).
MS	Multi-storied - At least three height size classes are commonly represented in the setting. Generally, the canopy is broken and uneven although multiple canopy levels may be distinguishable. The various size classes tend to be uniformly distributed throughout the setting.
MO	Mosaic - At least two distinct height size classes are represented and these are not uniformly distributed, but are grouped in small repeating aggregations, or occur as stringers less than two chains wide, throughout the setting. Each size class aggregation is too small to be recognized and mapped as an individual setting.
UA	Unknown/un-assessable - A structure classification was attempted, but the stand did not fit into one of the pre-defined categories. Note in the remarks column the reason the stand could not be classified.

Capable Growing Area (maximum of 3 numbers)

Estimate the percent of the setting capable of supporting trees. Deduct areas such as roads, creeks, swamps, rock outcrops, unimproved dirt lanes, small streams, sites with standing or running water, a high water table, a rock outcropping, severe soil compaction (i.e. an old landing), or mass soil movement (slips, slides, or slumps) etc. For example, if an area contains 5% rock outcropping and 10% road, record a capable growing area of 85%. Accuracy Standard: ± 10 percent.



Example 1: Large, scattered boulders cover 25 percent of the setting. However, tree roots can fully utilize the space beneath the boulders. The boulders thus have no effect on potential tree stocking. Capable growing area is thus 100%.



Example 2: A swampy meadow covers 10% of the setting. Capable growing area is thus 90%.

Fuel Model (maximum of 2 numbers)

Record the predominant setting fuel model determined by the plurality of sample plot fuel model codes. Refer to Appendix N for a complete list of codes and descriptions.

Elevation (maximum of 5 numbers)

Record the median setting elevation, above mean sea level, in feet.

Accuracy Standard: ± 2 contour intervals.

Aspect (maximum of 3 numbers)

Record the predominant setting aspect in degrees, 0° to 360° . Record in true north (i.e., always set the declination on your compass). Aspect may be determined from contour maps. Aspect is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. Aspect is measured with a hand compass along the same direction used to determine slope.

- If aspect changes gradually across the setting, record an average aspect.
- If aspect changes across the setting but is predominately of one direction, code predominate direction, rather than the average.
- If the setting falls on or straddles a canyon bottom or narrow ridge top, code the aspect of the ridgeline or canyon bottom.
- If the setting falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

Examples are:

Code	Description
0	Flat
360	360°
72	72°
90	90°
999	Indeterminate/No predominant aspect/Undulating

Accuracy Standard: ± 45 degrees.

Slope (maximum of 3 numbers)

Record the angle of slope across the setting. Slope is determined by sighting the clinometer along a line parallel to the average incline (or decline). This angle is measured along the shortest pathway

down slope before the drainage direction changes. To measure Slope, Observer 1 should stand at the uphill edge and sight Observer 2, who stands at the downhill edge. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

- If slope changes gradually across the setting, record an average slope.
- If slope changes across the setting but the slope is predominately of one direction, code predominate slope percentage rather than the average.
- If the setting falls directly between two side hills, code the average slope of the side hill(s).
- If the setting falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

Accuracy Standard: ± 10 percent.

Slope Position (exactly 2 characters)

Record the position of the setting on the landscape. The definitions are from: Soil survey Staff. 1993. National Soil Survey Handbook (Title 430-VI) USDA Soil Conservation Service.

Code	Description
SU	Summit/Ridgetop/Plateau. The topographically highest hillslope position of a hillslope profile and exhibiting a nearly level surface.
SH	Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit.
BS	Backslope. The hillslope position that forms the steepest inclined surface and principle element of many hillslopes. In profile, backslopes are commonly steep, linear, and bounded by a convex shoulder above and descending to concave footslope. They may or may not include cliff segments. Backslopes are commonly erosional forms produced by mass movement and running water.
FS	Footslope. The hillslope position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. It is a transition zone between upslope sites of erosion and transport.
TS	Toeslope. The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hillslope continuum that grades to a valley bottom.
VB	Valley Bottom. Wide valley bottom beyond influence of toeslope.

Accuracy Standard: ± 1 class.

Acres (maximum of 4 numbers)

Record the total setting acres.

Radial Growth Interval (maximum of 2 numbers)

Record the time period used for measuring radial growth. The default is "10" years. If the tree age is less than the radial growth interval, record the tree age and DBH and leave the radial growth field blank. Values less than 1 are not allowed.

Radial Growth Interval #2 (maximum of 2 numbers)

Record the second time period for measuring radial growth if two radial growth measurements are taken. A default value of 0 years is assumed. If the tree age is less than the radial growth interval, record the tree age and DBH, and leave the radial growth field blank. Values less than 1 are not allowed.

Height Growth Interval (maximum of 2 numbers)

Record the time period associated with the height growth measurements. Only one time period can be used for each examination. The default is “5” years. If the tree age is less than the height growth interval, record the tree age and height and leave the height growth field blank. Values less than 1 are not allowed.

Fuel Photo Reference (maximum of 3 numbers)

Record the fuel photo reference code. The corresponding photo is recorded on the plot form in the “residual descriptive code.” Refer to Appendix H for a complete list of Fuel Photo references and codes.

Precision Protocol (maximum of 5 letters)

Use “CSE” in this field.

Examiner (maximum of 12 characters and/or numbers)

Record the individual(s) responsible for data collection. If the full name is longer than 12 characters, use only the last name.

Damage Category (maximum of 2 numbers)

Record damage seen within the setting that was not recorded as tree damage or plot history. See Appendix K for a complete list of damage category codes.

Accuracy Standard: No Errors if found in stand along transect and not represented in tree damage or plot history.

Damage Agent (maximum of 3 numbers)

Record the damage agent. See Appendix K for a complete list of all damage agent codes.

Accuracy Standard: Locally specified if found in setting along transect and not represented in tree damage or plot history.

Damage Severity (maximum of 3 characters and/or numbers)

Record the damage severity. See Appendix K for a complete list of all damage severity codes. Use the setting severity codes where indicated in Appendix K.

Accuracy Standard: Locally specified if found in setting and not represented in tree damage.

Species of Management Interest (maximum of 8 characters and/or numbers)

Record the “plant species of management interest” that occurs in the setting, but does not occur on any of the plots. Species of management interest may include noxious weeds, threatened, endangered, or sensitive plants, or management indicator species. Multiple species codes may be entered. The PDR allows 10 species per setting. Note the approximate location of these species in

the stand sketch notes. This is only an indication of the presence of a species of management interest. To determine the extent of the occurrence, another exam should be conducted.

Latitude/Longitude Datum (exactly 4 characters)

Datum is an essential coordinate system component. Datum should always be recorded whenever latitude and longitude are recorded. There are three valid datum values; NAD27, NAD83 and WGS84.

User Code (maximum of 4 characters and/or numbers)

The data entered in this field is not managed at a National level and is stored in a generically labeled field. Region 9 uses this field to record the setting Land Class field.

Sketch Map and Traverse Notes

Make a sketch of the setting showing the relative location of the plots. Record azimuth and distance for each transect. Include a North arrow and other notable features such as roads, trails, lakes, and creeks that will assist in relocating the plots. Label each feature. This map is not stored in the database.

Setting Remarks (maximum of 242 characters and/or numbers)

Record remarks about specific observations on overall setting conditions. Remarks should not repeat information provided elsewhere.

SAMPLE DESIGN

Complete one Sample Design Form for each setting. The accuracy standard is “No Errors” unless otherwise noted.

Portable Data Recorders

From the main menu, select: “**Setting Data**,” then “**Sample Design Form**.” Highlight the setting to edit the Sample Design Form, then select “Next.” Once an existing setting record is selected, the sample design associated with the setting can be defined. The top of the sample design screen contains tabs to access the sample design data for the tree, vegetation, surface cover, and down woody material forms.

Sample Design Form; Setting: 03 02 03 1234 0001

Tree									
Meth	ExpFac	Azm	NPlts	Cond.	SubFiltr	Var	MinV	MaxV	
BAF	40.00		5	---	ALL	DBH	5.00	999.99	
FRQ	300.00		5	---	ALL	DBH	0.01	4.99	
				OR	ALL	HGT	0.50	4.49	

Sample Method: Field 2

The buttons along the bottom of the screen have the following functions:

Button	Function
Help	Contains hints about adding, inserting, and deleting a row of data.
Restore	Delete all changes; restore to the original sample design that accompanied the software. A warning message is NOT displayed.
Back	Return to the Setting Insert/View screen.
Next	Jump to the Setting Damages screen. This button is only active when using the Setting Data Wizard.
Cancel	Delete all changes; restore all field selections to the original list that accompanied the software. A warning message is displayed.
Save	Save all changes.
Finish	Return to the main menu.

The accuracy standard for all fields is “No Errors” unless otherwise noted.

Sample Selection Method Type (exactly 3 characters) *Required*

Record the method used to select trees, shrubs, grasses, or down woody material. This field defines the **type** of each plot; fixed area plot (FRQ), variable radius plot (BAF), or a transect line (TRN).

Code	Description
FRQ	Frequency for fixed area plots or linear strip plots
BAF	Basal area factor for a variable radius plot
TRN	Fixed-length transect

Sample Expansion Factor (maximum of 6 numbers; may include one decimal) *Required*

This field corresponds to the Sample Selection Method Type, and converts tree or piece data to a per-acre basis. This field defines the **size** of each plot; the BAF used with the variable radius plot, the size of the fixed are plot, and the transect length.

Examples are:

Sample Selection Method Type	Expansion Factor	Description
FRQ	20	The inverse of a 1/20 th acre plot or strip area
FRQ	3	The inverse of a 1/3 rd acre plot or strip area
FRQ	.2	The inverse of a 5 acre plot or strip area
BAF	40	40 basal area factor
TRN	27	The horizontal length of a transect line to the nearest foot

Starting Azimuth (maximum of 3 numbers)

Record the starting azimuth. Azimuth is only used for transect lines (selection method type of “TRN”). This field defines the starting azimuth of the transect line on the **first** plot installed. Write in the remarks column if the azimuth will remain the same for all subsequent plots, or if it will rotate X degrees on each subsequent plot.

Subpopulation Filter (maximum of 8 characters)

Record the filter to define the sample subpopulation. This field is used to specify that only standing live, only standing dead, only stumps, only down, or both standing live and standing dead vegetation will be sampled. This field is not used for the surface cover form type. Use the following codes:

Code	Description
LIVE	Standing live
DEAD	Standing dead
ALL	Both standing live and standing dead
STUMPS	Stumps
DOWN	Both down live and down dead

Note: If down trees will be recorded on the tree form, a subpopulation value of “down” must be included in the sample design.

In rare cases, it is necessary to exclude specific species from the sample. In this case, enter the species code, a dash “-,” and a standing live (L), standing dead (D), or standing live and standing dead (A) flag in this field. Then, enter “SPP” in the subpopulation variable, and enter “999.9” in the subpopulation minimum value. Examples are:

Code	Description
POTR5-L	Exclude standing live aspen
PIPO-D	Exclude standing dead ponderosa pine
LAOC-A	Exclude both standing live and standing dead larch

In rare cases, it is necessary to exclude vegetation with specific damages from the sample. In this case, enter the damage category in this field. Then, enter “DMG” in the subpopulation variable, and enter “999.9” in the subpopulation minimum value. Examples are:

Code	Description
21	Root/butt diseases
11	Bark beetles

Selection Criteria Number (maximum of 2 numbers) Required

Record a sequential number, starting with “1,” for each line of data within a sample selection method. Do not reuse a number between sample selection methods. Vegetation must meet **one** of the sequentially numbered criteria in order to be sampled on the plot type. If two or more lines have the **same number**, they are considered a “**set**,” and vegetation must meet **all** the criteria in the set in order to be sampled by that selection method.

Example 1: On a variable radius plot, sample all live and dead trees which are **either** greater than 5.0 inches DBH **or** are greater than 3.0 inches DRC. This requires **two** different selection criteria numbers:

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TREE	BAF	20	ALL	1	DBH	5.0	999.9
				2	DRC	3.0	999.9

Example 2: On a 27-foot transect, sample down woody pieces that are greater than 12 inches at the intersection diameter **AND** are at least six feet long. This requires the **SAME** selection criteria number. This implies that **both** intersection diameter **and** piece length must be recorded in order for a piece of vegetation to meet these two criteria.

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
DNWDY	TRN	27	DOWN	1	DIA	12.0	999.9
				1	LGT	6	999.9

Example 3: If both of the above selection parameters were placed on the same sample design form it would look like the following:

Form Type	Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TREE	BAF	20	ALL	1	DBH	5.0	999.9
				2	DRC	3.0	999.9
DNWDY	TRN	27	DOWN	3	DIA	12.0	999.9
				3	LGT	6	999.9

The first two lines have **different** selection criteria numbers, hence a piece of vegetation would have to meet **either** one of the criteria to be sampled on the variable radius plot. The next two lines have the **same** selection criteria numbers, hence a piece of vegetation would have to meet **both** of the criteria to be sampled on the transect. This implies that **both** intersection diameter **and** piece length must be recorded in order for a piece of vegetation to meet these two criteria.

Subpopulation Variable (exactly 3 characters) Required

Record the characteristic used to define the sampled subpopulation. This field defines which characteristic of the vegetation will be measured to see if it meets the sample criteria. For example, "DBH" means the diameter at breast height. "LGT" refers to the length of the piece of vegetation.

Code	Description
DBH	Diameter at Breast Height
DRC	Diameter at Root Collar
HGT	Height
CVR	Percent Vegetation Species Cover
SVC	Percent Ground Surface Cover
LGT	Length
DIA	Diameter at Midpoint or Intersection
DMG	Tree Damage Category
SPP	Species

Subpopulation Minimum Value (maximum of 6 numbers; may include 2 decimals)**Required**

Record the minimum subpopulation value. The default is zero. For example, if the subpopulation variable is set at "DBH," this field defines the minimum DBH the vegetation must have in order to be sampled on the plot.

Subpopulation Maximum Value (maximum of 6 numbers; may include 2 decimals)**Required**

Record the maximum subpopulation value. The default is 999.9. For example, if the subpopulation variable is set at "LGT," this field defines the maximum length the vegetation must be in order to be sampled on the plot.

Example Designs for Measuring Large Trees

Example 1: Sample all (standing live and standing dead) trees 5.0" + DBH with a 40 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	40	ALL	1	DBH	5.0	999

Example 2: Sample live standing live trees 5.0" + DBH with a 30 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	30	LIVE	1	DBH	5.0	999

Example 3: Sample standing dead trees 10.0"+ DBH with a 10 BAF.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
BAF	10	DEAD	1	DBH	10	999

Example 4: Sample standing live trees 5.0"+ DBH or 3.0"+ DRC on a 10th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	10	LIVE	1	DBH	5	999
		LIVE	2	DRC	3	999

Example Designs for Measuring Small Trees

Example 1: Sample standing live and standing dead trees .1-4.9" DBH, also sample live trees .5'-4.4' in height on a 100th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	100	ALL	1	DBH	.1	4.9
		LIVE	2	HGT	.5	4.4

Example 2: Sample standing live trees 1.0-4.9" DBH or 1.0-2.9" DRC on a 50th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	50	LIVE	1	DBH	1.0	4.9
		LIVE	2	DRC	1.0	2.9

Example 3: Sample stumps 10.0"+ diameter at root collar on a 10th acre plot.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	10	STUMPS	1	DRC	10	999

Example 4: On a 300th acre plot; sample all (standing live and standing dead) trees 3.0-4.9" DBH EXCEPT aspen, sample standing live trees 0.1-2.9" DBH and .5-4.9' high EXCEPT aspen, and sample standing live aspen 1.0-4.9' in height.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	300	All	1	DBH	3	4.9
		POTR5-A	1	SPP	999	
		LIVE	2	DBH	0.1	2.9
		LIVE	2	HGT	.5	4.4
		POTR5-A	2	SPP	999	
		POTR5-L	3	HGT	1.0	4.9

Example Designs for Measuring Down Woody Material

Example 1: Use Brown's protocols. Using a 7' transect, record the number of pieces on each of the three intersection diameter classes (0.1-.24, .25-.99, and 1.0-2.9). Using a 27' transect, record information on all pieces 3.0"+ in intersection diameter.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
TRN	7	DOWN	1	DIA	0.1	.24
		DOWN	2	DIA	.25	.99
		DOWN	3	DIA	1.0	2.99
TRN	27	DOWN	4	DIA	3.0	999

Example 2: Using fuel photos, estimate per acre down material volume and weight values for three size classes.

Sample Selection Method	Sample Expansion Factor	Subpop. Filter	Selection Criteria Number	Subpop. Variable	Subpop. Minimum Value	Subpop. Maximum Value
FRQ	1	DOWN	1	DIA	.01	3.0
		DOWN	2	DIA	3.1	5.0
		DOWN	3	DIA	5.1	999

Sample Design Remarks (maximum of 242 characters and/or numbers)

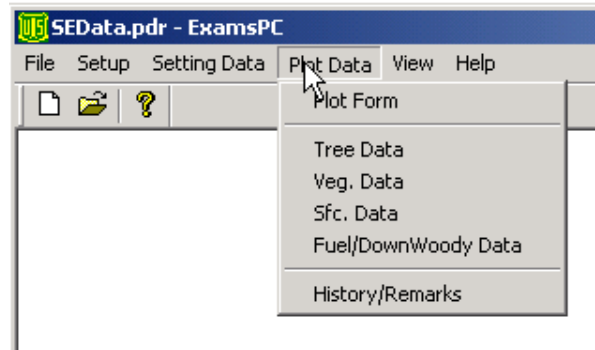
Record information about each line in the sample design form.

PLOT DATA

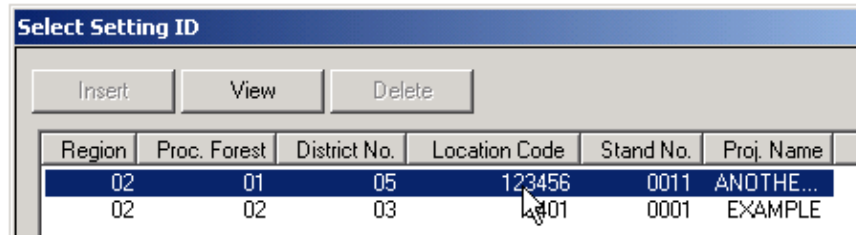
Record separate sets of plot data for each plot in the stand. The accuracy standard is “No Errors” unless otherwise noted.

Portable Data Recorders

From the main menu select: “Plot Data,” then “Plot Form.”



Select the appropriate setting, then select the “Next” button at the bottom of the screen.



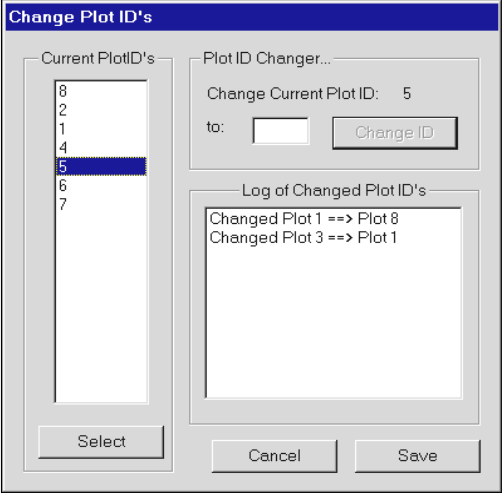
Plot Data Form for Setting: 0201051234560011							
Plot #	CaG%	Slp%	SP	*SV	*Elev	*ExistVeg	*PotVeg
1	95	5	FS	CV	5250	SAF202	202301
2 >>	90	10	FS	LL	5200	SRM102	292
3		0					
4		0					
5		0					
6		0					

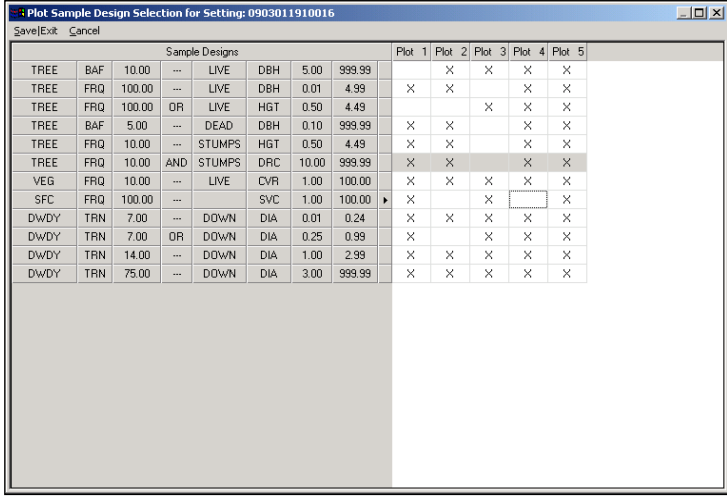
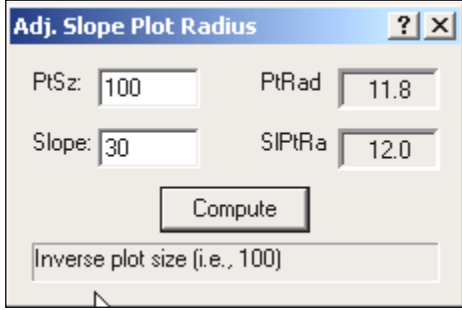
The plot number value (leftmost column) will increment by one as the keyboard’s **down arrow** key is used to highlight new rows of plot data. Only those plot data fields (selected during the Setup process) will be displayed on this screen.

To **insert** a new plot anywhere on the form, press the keyboard’s **Insert** key, or navigate to the last plot (i.e., last line) on the form and press the keyboard’s **down arrow** key.

To **delete** an existing plot anywhere on the form, press the keyboard’s **Delete** key. You will be asked if you want to delete that particular plot.

The buttons along the bottom of the screen have the following functions:

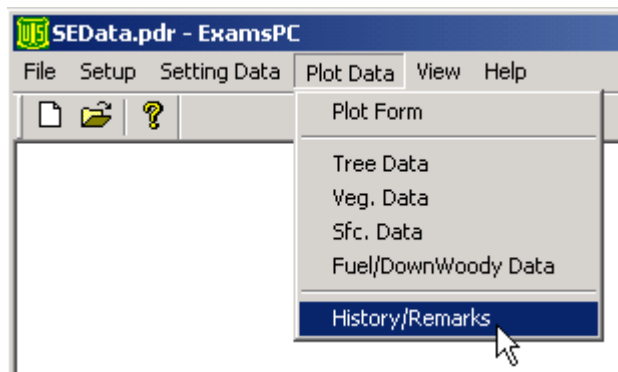
Button	Function
Help	Contains hints about each plot data field.
Options: Change Plot ID's	<p>Changes Plot ID Numbers.</p> <p>Select the Plot ID number you want to change under “Current PlotID's” on the left. Type in a new Plot ID number in the “Plot ID Changer” box, then click “Change ID.” Do this for all Plot ID numbers you want changed. When finished, click “Save.”</p> 
Options: Insert Record	<p>Inserts a new plot record to the bottom of the form.</p> <p>This can also be done by pressing the keyboard Insert key, or navigating to the last plot (i.e., last line) on the form and pressing the keyboard's down arrow key.</p>
Options: Delete Record	<p>Deletes an existing plot from anywhere on the form.</p> <p>OR, press the keyboard's Delete key. You will be asked if you want to delete that particular plot.</p>

Button	Function
<p>Options: Sample Design(s) by Plot</p>	<p>Allows you to select specific portions of the sample design(s) for the data you want (or don't want).</p> <p>Simply locate the portion of the sample design from the left-hand (grayed area) side of the form, and then locate the "Plot ID" number. Select the box where the sample design portion and Plot ID number intersect. An 'X' inside the intersecting box denotes that data will be taken for that portion of the sample design and corresponding Plot ID number. Upon completion, click "Save Exit."</p> 
<p>Options: Adj. Slope Radius Plot</p>	<p>Computes the adjusted slope plot radius.</p> <p>Enter the inverse of the plot size such as a 10 for a 1/10th acre plot. Enter the slope, in percent. Select the "Compute" button. The computed "PtRad" field contains the plot radius without a slope correction, and the "SIPtRa" field contains the plot radius with a slope correction.</p> 

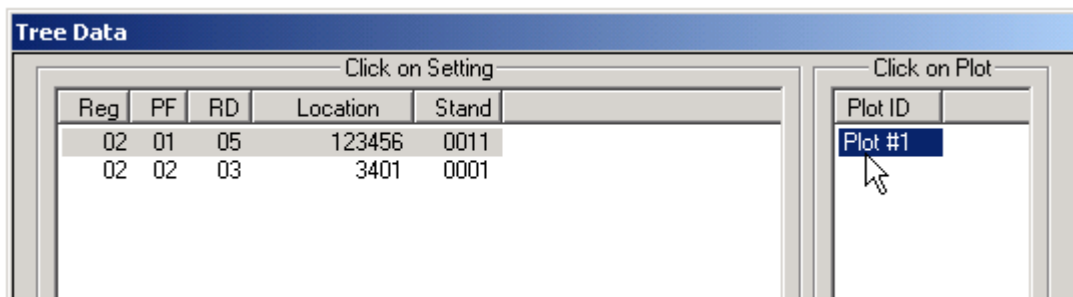
Button	Function
Latitude and Longitude	<p>To automatically populate the Plot Latitude and Longitude fields from a GPS receiver:</p> <ol style="list-style-type: none"> 1. Make sure the plot latitude and longitude fields are selected in “Setup/Field Selections.” 2. Make sure the correct communication port was set as the default in “Setup/User Definitions.” 3. Highlight the plot latitude field. 4. Select the pull-down list arrow 5. Select “Input Form” <div data-bbox="743 604 1117 829" style="text-align: center;"> </div> <ol style="list-style-type: none"> 6. Select the “Get GPS” (only available in Exams CE).

Plot History and Plot Remarks

From the main menu, select **“Plot Data”** and then select **“History/Remarks.”**



Select the setting ID and plot number for the plot history and remarks. Then select the **“Next”** button at the bottom of the screen.



Enter the plot history and plot history year. Use the down arrow to access a new line of data. Enter the plot remarks, up to 242 characters. The remarks will be changed to all upper case letters.

Plot History/Remarks; Setting: 03020312340001 Plot: 0001	
History	Year
04	1960
11	1985

Plot Remarks
FIRE WOOD CUTTING
SAW SOME ELK

The buttons along the bottom of the screen have the following function:

Button	Function
Help	Contains hints about the history and remarks fields.
Back	Return to the select setting ID screen.
Next	Inactive from this screen.
Cancel	Delete all changes; restore all field values to the original values that accompanied the software. A warning message is displayed.
Save	Save all changes.
Finish	Return to the main menu.

The accuracy standard is “No Errors” unless otherwise noted.

Plot Number (maximum of 3 numbers) Required

Record plot number for each sample plot within a setting. Plots do not have to be numbered consecutively. The total number of plots should equal the number of plots on the Sample Design Form.

Use a global positioning system (GPS) unit to determine the plot latitude and longitude of all plots. Collect at least 180 GPS readings at plot center, which will then be averaged by the GPS unit. Each individual reading should have an error of less than 70 ft if possible (the error of all the averaged readings is far less). Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable readings (180 readings at error < 70 ft) cannot be obtained, try again before leaving the plot center.

Plot Latitude (exactly 8 numbers)

Record the plot latitude as measured by a Global Positioning System (GPS). All latitude values must be positive (North assumed). Degrees must be from 18-71 inclusive, minutes must be from 0-59 inclusive and seconds must be from 0-59.99 inclusive.

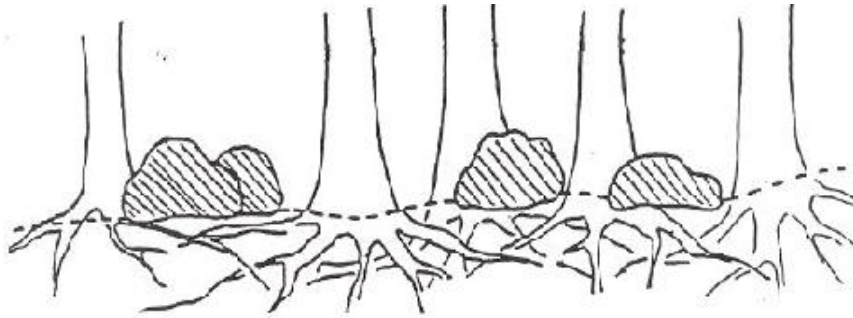
Plot Longitude (exactly 8 numbers)

Record the plot longitude as measured by a Global Positioning System (GPS). All longitude values must be positive (West assumed). Degrees must be from 44-172 inclusive, minutes must be from 0-59 inclusive and seconds must be from 0-59.99 inclusive.

Capable Growing Area Percent (maximum of 3 numbers)

Estimate the percent of the plot area capable of supporting trees. Deduct areas such as roads, creeks, swamps, rock outcrops, unimproved dirt lanes, small streams, sites with standing or running water, a high water table, a rock outcropping, severe soil compaction (i.e., an old landing), or mass soil movement (slips, slides, or slumps), etc. For example, if an area contains 5% rock outcropping and 10% road, record a capable growing area of 85%.

Accuracy Standard: ± 10 percent



Example 1: Large, scattered boulders cover 25 percent of the plot. However, tree roots can fully utilize the space beneath the boulders. The boulders thus have no effect on potential tree stocking. Capable growing area is thus 100%.



Example 2: A swampy meadow covers 10% of the plot. Capable growing area is thus 90%.

Plot Aspect (maximum of 3 numbers)

Record the predominant plot aspect in degrees, 0° to 360°. Record in true north (i.e. always set the declination on your compass). Aspect may be determined from contour maps. Aspect is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. Aspect is measured with a hand compass along the same direction used to determine slope.

- If aspect changes gradually across the plot, record an average aspect.
- If aspect changes across the plot but is predominately of one direction, code predominate aspect, rather than the average.
- If the plot falls on or straddles a canyon bottom or narrow ridge top, code the aspect of the ridgeline or canyon bottom.

- If the plot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.
- Use a code of zero for flat
- Use a code of 999 for indeterminate, predominant, or undulating

Examples are:

Code	Description
0	Flat
360	360°
72	72°
90	90°
999	Indeterminate/No predominant aspect/Undulating

Accuracy Standard: ± 45 degrees.

Plot Slope (maximum of 3 numbers)

Record the angle of slope across the plot. Slope is determined by sighting the clinometer along a line parallel to the average incline (or decline). This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure Slope, Observer 1 should stand at the uphill edge and sight Observer 2, who stands at the downhill edge. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer.

- If slope changes gradually across the plot, record an average slope.
- If slope changes across the plot but the slope is predominately of one direction, code predominate slope percentage rather than the average.
- If the slope falls directly between two side hills, code the average slope of the side hill(s).
- If the slope falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill.

Accuracy Standard: ± 10 percent.

Slope Position (exactly 2 characters)

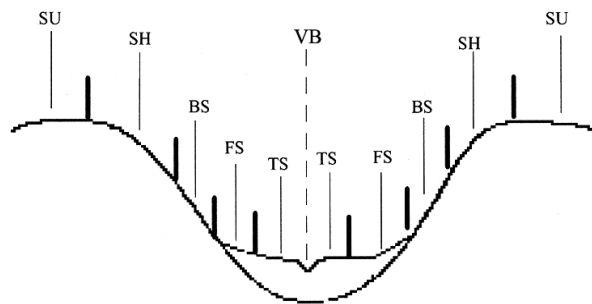
Record the plot position on the landscape. Slope position definitions are from: National Soil Survey Handbook (Title 430-VI). USDA Soil Conservation Service, 1993.

Code	Description
SU	Summit/Ridgetop/Plateau. The topographically highest hillslope position of a hillslope profile and exhibiting a nearly level surface.
SH	Shoulder. The hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone from backslope to summit.
BS	Backslope. The hillslope position that forms the steepest inclined surface and principal element of many hillslopes. In profile, backslopes are commonly steep, linear, and bounded by a convex shoulder above and descending to concave footslope. They may or may not include cliff segments. Backslopes are commonly erosional forms produced by mass movement and running water.

Slope Position (cont.)

Code	Description
FS	Footslope. The hillslope position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. It is a transition zone between upslope sites of erosion and transport.
TS	Toeslope. The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley bottom.
VB	Valley Bottom. Wide valley bottom beyond influence of toeslope.

Accuracy Standards: ± 1 Class



Slope Position

Slope Horizontal Shape (exactly 2 characters)

Record the micro-site horizontal shape of the plot. The horizontal shape is oriented across the slope, perpendicular to the vertical shape, or roughly parallel to the contours of the landforms. It goes from side-slope to side-slope. Use 1/10-acre plot for ocular estimate. Valid codes are the same as Slope Vertical Shape defined below.

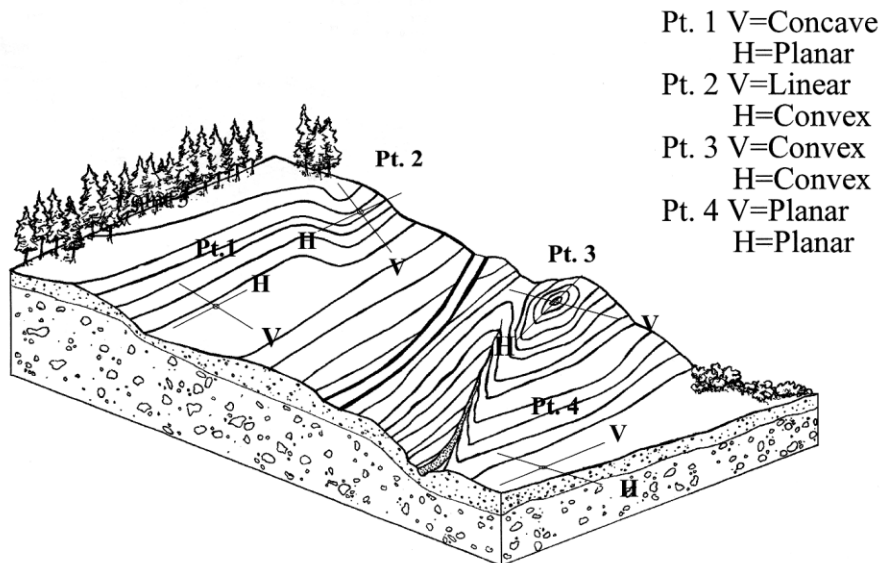
Slope Vertical Shape (exactly 2 characters)

Record the micro-site vertical shape of the plot. The vertical shape lies perpendicular to the contours, going from up-slope to down-slope, regardless of the slope percentage. See previous graphic for examples (size 1/10 acre ocular estimate). Note: At hilltops and depression bottoms, all directions are perpendicular to the contours and no direction is parallel. While the above definitions of horizontal and vertical shape really do not apply at these locations, both shapes are considered convex on hilltops and concave in depression bottoms, and their specific direction is irrelevant.

Code	Description
BR	Broken. Cliffs, knobs, and/or benches interspersed with steeper slopes generally characterized by sharp, irregular breaks. A marked variation of topography, or an irregular and rough piece of ground.
CC	Concave. The gradient decreases down the slope. Runoff tends to decelerate as it moves down the slope, and if it is loaded with sediment the water tends to deposit the sediment on the lower parts of the slope. The soil on the lower part of the slope also tends to dispose of water less rapidly than the soil above it.

Slope Vertical Shape (cont.)

Code	Description
CV	Convex. The gradient increases down the slope and runoff tends to accelerate as it flows down the slope. Soil on the lower part of the slope tends to dispose of water by runoff more rapidly than the soil above it. The soil on the lower part of a convex slope is subject to greater erosion than that on the higher parts.
LL	Linear or Planar. Substantially a straight line when seen in profile at right angles to the contours. The gradient does not increase or decrease significantly with distance (level or little relief).
PA	Patterned. A general term for any ground surface exhibiting a discernibly ordered, more-or-less symmetrical, morphological pattern of ground (i.e. micro relief of hummock and swales of several feet).
UN	Undulating. One or more low relief ridges or knolls and draws within the plot area.
UA	Unable to Assess.



Vertical and Horizontal Slope Illustrations

Plot Elevation (maximum of 5 numbers)

Record the median setting elevation, above mean sea level, in feet.

Accuracy Standard: ± 2 contour intervals on provided maps

Plot Existing Vegetation Composition Type (maximum of 8 characters and/or numbers)

Record the dominant existing vegetation composition. Dominance is based on plurality of basal area. Existing vegetation reflects plant species currently present. See Appendix E for a complete list of existing vegetation composition codes.

Plot Potential Vegetation (maximum of 8 characters and/or numbers)

Record the potential vegetation composition code. Potential vegetation is the plant community that would become established if all successional sequences were completed without interference by man and under the present climatic and edaphic conditions, including those created by man. See Appendix G for a complete list of potential vegetation codes. It is assumed that the potential vegetation reference code for the plot is the same as that referenced for the setting.

Accuracy Standards: Accurate to series, understory union, and Forest or District specified phases (three possible discrepancies).

Fuel Model (maximum of 2 numbers)

Record the fuel model that best describes the plot. Refer to Appendix N for a complete list of codes and descriptions.

Residue Descriptive Code (maximum of 15 characters and/or numbers)

Record the residue descriptive code or photo number of the photo that best represents the residue in the plot. This field is only recorded when a photo series for estimating fire behavior is used to determine Fuel Model. Refer to Appendix H for a complete list of Fuel Photo references and codes.

Distance to Seed Wall (maximum of 3 numbers)

Record the distance, in feet, from the plot center to the boundary of an adjoining stand where there are seed-producing trees, or a seed wall. Typically, this value is recorded where most of the overstory has been removed or destroyed within the last 20 years. If the distance is over 999 feet, record a value of 999. Accuracy Standards: ± 100 feet

Plot History (maximum of 2 numbers)

Record the activities that occurred on, or affected the plot. Multiple codes may be entered if more than one event is observed. For each additional event, record the plot number and history code on the next consecutive line.

Code	Description	Code	Description
1	Site Preparation	14	Mining
2	Artificial Regeneration	15	Clear cut
3	Natural Regeneration	16	Heavy partial cut ($\geq 20\%$ removed)
4	Stand Improvement	17	Light partial cut ($< 20\%$ removed)
5	Tree cutting	18	Firewood or local use cut
6	Fire	19	Incidental cut
7	Other Silvicultural Treatments	20	Pre-commercial thin
8	Other Human Disturbance	21	Improvement cut
9	Natural Disturbance	22	Planting throughout the stand
10	Land Clearing	23	Planting within non-stocked holes in the stand
11	Insect/Disease outbreak	24	Under-planting
12	Animal Damage	25	Clean and release
13	Type Conversion	26	Chaining

Plot History Date (exactly 4 numbers)

Record the 4-digit year in which a disturbance/activity occurred based on field observations. If a history code is entered, a date is required.

Accuracy Standards: Nearest decade.

User Code (maximum of 4 characters and/or numbers)

The data entered in this field is not managed at a National level and is stored in a generically labeled field. Check with your Region and Forest for specific instructions on using this field.

Plot Remarks (maximum of 255 characters and/or numbers)

Enter remarks relevant to the plot.

WITNESS TREE/NAVIGATION FORM

From the main Inventory and Monitoring menu, select **Plot Data/Witness Tree/Navigation**.

Only the settings that specified that down woody data will be collected on the exam level of the Setting form, will show up for selection. Select the setting ID and plot number to enter/edit down-woody data and select **Next** at the bottom of the screen.

Proc. Reg	Proc. For	District	Location Code	Stand No.	Date
01	02	04	123456789	9999	07/14/2011

- Plot #1
- Plot #2
- Plot #3
- Plot #4
- Plot #5

When you click on a plot number, the following screen automatically displays:

*Mon. Type	*Wit. Type	TagID	Species	DBHDRC	Diam.	*Azm	*Dist	Remarks	Travi

Navigation Information (from last Plot)

*Plot Navigated From: []

*Azimuth from Navigation Plot: []

*Distance from Navigation Plot: []

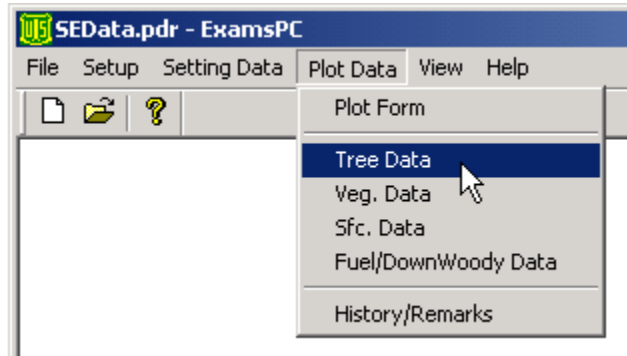
In this screen, click on either the Witness Tree Information or Navigation Information radio button, and enter the corresponding data. Required fields are marked with an asterisk (*). Then click on the Save button. When you are finished, click on Return to go back to the main screen.

TREE DATA

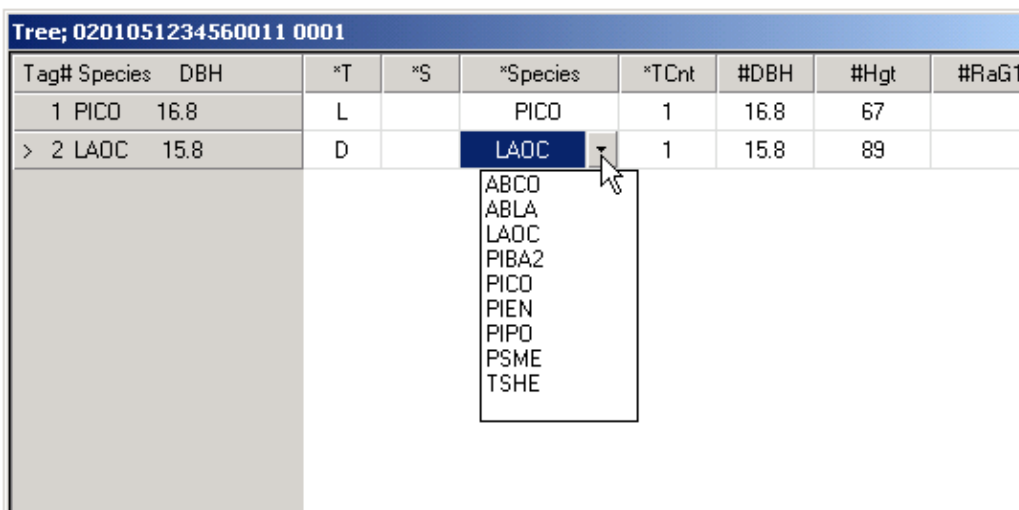
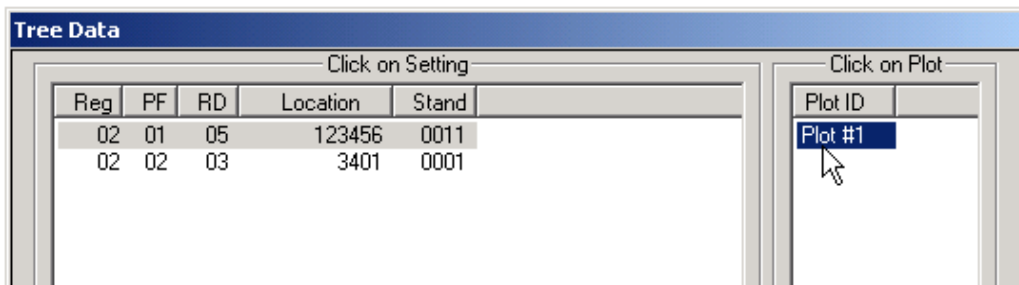
Data are not recorded if the plot does not contain trees or off-plot site trees. The accuracy standard is “No Errors” unless otherwise noted

Portable Data Recorders

From the main menu enter “Plot Data,” then “Tree Data.”

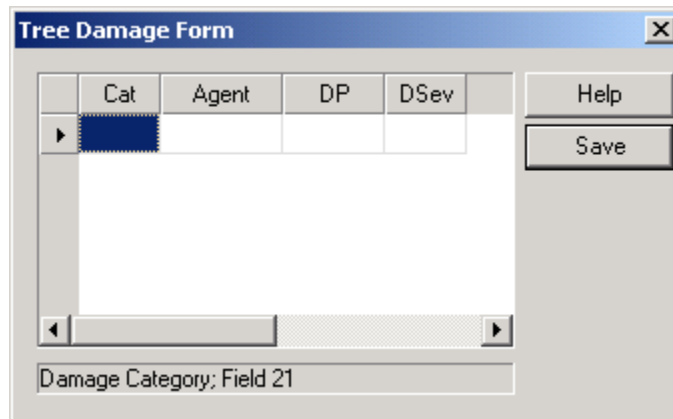
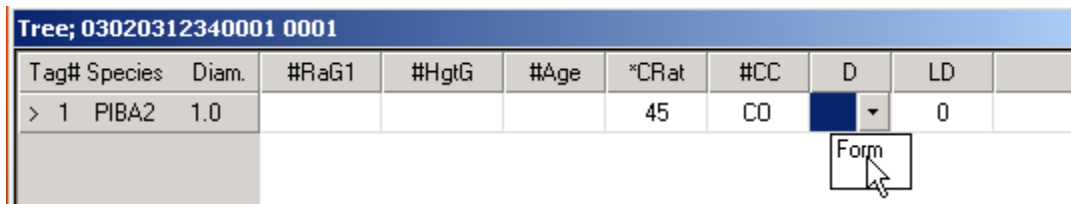


Only the settings that specified that tree data will be collected on the exam level will show up for selection. Select the setting ID and plot number for the tree data.



To insert a new line of tree data, use the down arrow. The tag ID will automatically increment. The tag ID, species, and diameter of each tree will be placed on the left hand part of the screen and frozen. The right hand section of the screen can be scrolled to access other data fields. Only the tree data fields selected during the set up process will be displayed on this screen. Refer to Chapter 3, Section 5 in the CSE User Guide, for detailed information about the tree data fields.

Tree damages are entered from the field labeled “D.” This field has a pull down menu called “Form” that will access the tree damage form.

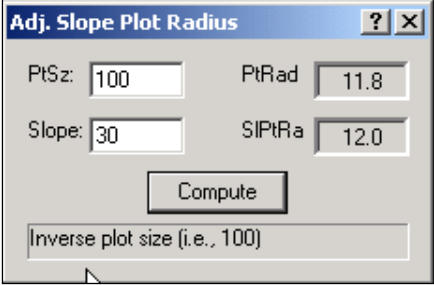
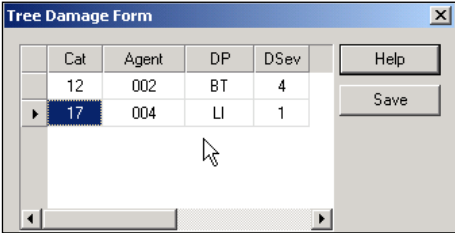


Use the “Help” or the “?” button to access the codes and descriptions for the tree damage fields.

The buttons along the bottom of the screen have the following function:

Button	Function
Help	Explanations of the codes in each pull down list.
Options: In/Out	A calculator to determine if a tree is IN or OUT if a plot, based on BAF, tree DBH, slope, and distance to the tree.

A screenshot of a calculator dialog box titled 'In/Out Tree Form'. It has input fields for BAF (40.00), DBH (15.8), Slope% (0), and SDist (0.0). It also has input fields for LDist (21.1) and LSDist (21.1). A 'Tree is:' field is set to 'IN!'. There is a 'Compute' button and a text field at the bottom that says 'Go measure that puppy !!!'.

Button	Function
Options: Adj. Slope Radius Plot	<p>Adjusted slope plot radius calculator. Enter the inverse of the plot size such as a 10 for a 1/10th acre plot. Enter the slope, in percent. Select the “Compute” button. The computed “PtRad” field contains the plot radius without a slope correction, and the “SIPtRa” field contains the plot radius with a slope correction.</p> 
Options: Large Tree Age	Under construction.
Options Sample Design	Displays the Sample Design for Tree Data (screenshot unavailable).
Options Damage Form	<p>Access a form to enter multiple damages for each tree. Use the down arrow to enter a new line of damage data.</p> 
Options: Insert Record	<p>Inserts a new plot record to the bottom of the form. This can also be done by pressing the keyboard Insert key, or navigating to the last plot (i.e., last line) on the form and pressing the keyboard’s down arrow key.</p>
Options: Delete Record	<p>Deletes an existing plot from anywhere on the form. OR, press the keyboard’s Delete key. You’ll be asked if you want to delete that particular plot.</p>
Back	Return to the previous screen to select another setting ID or another plot.
Cancel	Delete all changes; restore all field selections to the original list that accompanied the software. A warning message is displayed.
Save	Save all changes.
Finish	Return to the main menu.

Tag ID (maximum of 4 numbers)

Record a number, unique within each plot, for each tree record. On each plot, start with ‘1’ and increment one number for each tree record. The tag ID, in conjunction with the plot number, uniquely identifies each line of tree data in a setting.

Tree Status (exactly 1 character) Required

Code	Description
L	Live - includes all standing trees that have at least one green point of growth. This includes deciduous trees that have lost their foliage for the season, and trees that have recently lost their leaves to defoliators, but will re-flush.
D	Dead - standing trees 4.5 feet or taller, without a green point of growth. Note: many of the tree fields are not used if the tree is a dead tree. If dead trees are recorded, a snag decay class is required for extensive and intensive exam levels.
S	Stump - woody base of a tree left in the ground less than 4.5 feet tall. Note: many tree form fields are not used for stumps.
X	Down dead - includes all dead trees that have their main stem lying on the ground, or are supported by branch wood. A tree is considered down if it is not self-supporting. Record any broken trees as one tree. If down dead trees are recorded, a log decay class is required for extensive and intensive exam levels. Only trees in decay class 1 or 2 should be recorded here.
Y	Down live - Includes all live trees that have their main stem lying on the ground or are supported by branch wood. A tree is considered down if it is not self-supporting. Record any broken trees as one tree.

Tree Class (exactly 2 characters)

Code	Tree Class	Live	Species	Vigor	Damages or Snag Decay Class
DE	Desirable	Y	Commercial	- Relatively vigorous for its age, as evidenced by past growth rate and/or crown condition	- No defects that will reduce merchantable sawlog yields - No damaging agent that affects growth or survival
AC	Acceptable	Y	Commercial	- Relatively non-vigorous for its age as evidenced by slow past growth and/or poor crown condition. - Still retains the potential to grow and accumulate net merchantable volume	- Has some minor defects which will reduce, but not totally exclude, merchantable sawlog yields - May possess damaging agents in minor amounts that will not affect survival of the tree for the next 10 years
UA	Un-acceptable	Y	Commercial	- Expected to die within next 10 years - Not accumulating net volume growth; deteriorating more rapidly than growing - If relieved of competition, it would not release and accumulate net merchantable volume	- Has a severe rating for any damaging agent - Does or will meet minimum merchantability standards
RF	Rough	Y	Non-commercial for sawlog yields	- Smaller than the minimum size for sawlog merchantability - Presently does not contain a merchantable live sawlog	- Not expected to yield any sawlog products because of severe damage other than rot - Principle defects are physical defects, including trees culled for multiple forks

Tree Class (cont.)

Code	Tree Class	Live	Species	Vigor	Damages or Snag Decay Class
RN	Rotten	Y	Any	- Presently does not contain a merchantable live sawlog - Smaller than the minimum size for sawlog merchantability	- Principle defect is rot - Not expected to yield any sawlog products because of severe damage by rot
SV	Salvable dead	N	Any	- Contains at least one merchantable sawlog	- At least 25% sound
US	Non-salvable dead	N	Non-commercial	- Does not contain at least one merchantable sawlog	- Less than 25% sound
GS	Growing Stock	Y			

Site/Growth Trees (exactly 1 character)

Record if a tree is a Site or Growth Sample Tree. If tree is neither, leave blank.

Code	Description
G	Growth Sample Tree
S	Site Tree on Plot
F	Site Tree off Plot
B	Both a growth sample tree and an on-plot site tree

Site Tree (S) - A site tree is a tree for which age and height are measured to determine site index and yield capacity for a tree. Some site index tables may require collection of additional data, for example, some Grand fir site index tables also require crown ratio data. Site trees have never experienced any overstory competition or damage that would have reduced height growth during any period of their life. Freedom from height growth suppression is the single most important selection criteria for site trees. A number of descriptive guidelines may be used to indicate this condition. Site trees must be of a species for which site index relationships have been studied. The number of site trees per setting should reflect the setting variation and possible management objective. Productive capability can also be estimated from potential vegetation classification. Following is a summary of site tree selection criteria.

Site Tree Selection Criteria

- Freedom from height growth suppression
 - Choose dominants or co-dominants depending on the specific site index curves used.
 - No evidence of top damage, past or present.
 - No damage that could influence height growth.
 - No pronounced period of radial growth suppression.
- Select trees from a locally defined species list. Species preference is based on the quality of the associated site index-yield study.
- Similar age class, preferably middle-aged, avoiding old growth and young age classes. Typically > 50 years and < 120 years.
- Select at least one site tree from the sample trees tallied for each sample plot when the sample trees meet site tree criteria.

If none of the trees on the plot meet the above criteria, select the nearest off-plot tree that does meet the criteria. Use code "S" to designate site trees located on the plot. Use code "F" to designate

off-plot site trees. If no on-plot or off-plot trees meet site tree criteria, do not select a site tree for the plot.

Growth Sample Trees (GST) - A growth sample tree is a tree for which age, growth (radial or height), and height are measured. These GST measurements are the minimum needed to calibrate Forest Vegetation Simulation (FVS) routines for obtaining additional vegetation data.

If only one tree species is expected to be present in the stand, one large (≥ 3.0 " DBH) GST and one small (< 3.0 " DBH) GST will be measured on each plot. Measure the first live standing tree, both large and small, when moving clockwise from north.

If more than one tree species is expected to be present in the stand, two large (≥ 3.0 " DBH) GST's and two small (< 3.0 " DBH) GST's will be measured on each plot. The first live standing tree, both large and small, of each species encountered moving clockwise from north, will be measured until two trees of different species are assessed, i.e., four total per plot in a multi-species stand.

This minimum GST data collection may not provide sufficient trees for FVS calibration in multiple tree species stands, in stands with fewer than five plots, or where the stand exam is needed for a particular resource management question. Therefore, Regional or Forest project standards may result in requirements for additional GST sampling.

If age cannot be determined due to rot, select the next tree as GST. If the tree has a missing or dead top, select the next tree as GST.

Tree Species (maximum of 8 characters and/or numbers) Required

Record the species of every sampled tree. If the species cannot be determined in the field, measure the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to your local biologist for identification. Temporarily use one of the 2 generic codes, 2TE, or 2TD and make a note to correct the species code later.

Examples:

ABGR	Grand fir (<i>Abies grandis</i>)
JUOS	Utah juniper (<i>Juniperus osteosperma</i>)
PIPOS	Ponderosa pine (<i>Pinus ponderosa</i> var. <i>scopulorum</i>)
2TREE	Tree
2TE	Tree, evergreen
2TD	Tree, deciduous

Tree Count (maximum of 3 numbers)

Record the number of sampled trees represented by each line of tree data. Record growth sample trees and site trees individually. Trees with the same tree status and species, and a DBH/DRC less than 5.0 inches (not a GST or Site tree), may be grouped by height classes. One height grouping method is:

- <0.5 feet
- 0.5 - 4.9 feet
- 5 - 12.9 feet
- 13 - 18.9 feet
- 19+ feet

Record trees ≥ 5.0 " DBH/DRC individually for intensive and extensive examinations. Trees may be recorded in groups for quick plot examinations. One possible grouping is tree status, species, and 2" diameter classes. Any seedling forked above ground is counted as one tree.

The height grouping reflects age class distribution. Distinguishing characteristics other than tree status, species, and height may warrant further grouping or individual tree recording. Such characteristics include age, crown ratio, crown class, or tree damage.

Select the median tree to sample tree characteristics, such as DBH, height, etc.

Height Range	Diameter Range	Actual Trees on Point	Missed Tree Tolerance
*All	All	0	0 trees
≤ 0.5 feet		1 - 5	± 2 trees
≤ 0.5 feet		6+	$\pm 50\%$
> 0.5 feet	< 0.5 inches	1-5	± 1 tree
> 0.5 feet	< 0.5 inches	6+	$\pm 20\%$
All	.5" - Breakpoint DBH	1-5	± 1 tree
All	.5" - Breakpoint DBH	6+	$\pm 10\%$
All	Breakpoint DBH +	1+	0 trees

**When contracting exams, there is zero tolerance for recording a tree when none are actually present in any of the above size classes. The recording of a fixed plot tree when none are present will result in a single discrepancy. The recording of a variable plot tree when none are present will result in an unacceptable unit.*

Number of Stems (maximum of 3 numbers)

Record the number of stems for DRC measured species. This is a required field if the diameter of trees is measured at the root collar.

DBH/DRC (maximum of 3 numbers; may include one decimal)

Unless one of the special situations described below is encountered, measure Diameter at Breast Height (DBH) at 4.5 ft above the ground line on the uphill side of the tree. Measure Diameter at Root Collar (DRC) species at the root collar. DO NOT record a DBH or DRC of zero. Select the median tree to record the DBH/DRC for grouped trees.

Code	Description
.3	0.3 inches diameter
9.5	9.5 inches diameter
18.7	18.76 inches diameter

- For intensive exams, record to the nearest 0.1 inch.
- For extensive exams, record to the nearest inch.
- For quick plot exams, record to the nearest 2-inch class.

DBH

DBH is outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. To determine breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line. If a dead tree (snag) is missing bark, measure the DBH without the bark and record that measurement.

Forked tree: In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates above or below 4.5 feet.

Trees forked below 4.5 feet are treated as distinctly separate trees. DBH is measured for each stem at 4.5 ft above the ground.

Trees forked at or above 4.5 feet count as one tree. If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. For multi-stemmed woodland species, treat all new sprouts as part of the same new tree.

Tree with irregularities at DBH: On trees with swellings, bumps, depressions, and branches at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form. If this is not possible, because of the vertical extent of the irregularity, then adjust the DBH measurement to better reflect the diameter of a regular bole.

Tree on slope: Measure diameter at 4.5 ft from the ground along the bole on the uphill side of the tree.

Leaning tree: Measure diameter at 4.5 ft from the ground along the bole.

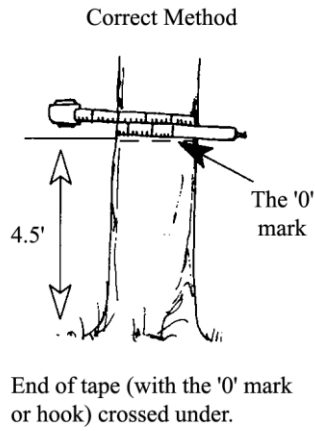
Turpentine tree: Usually in the Southwest. The tree is scarred to collect sap, mostly for naval products. A "turpentine face" is a result of this scarring. On trees with turpentine face extending above 4.5 ft, estimate the diameter at 10.0 ft above the ground and multiply by 1.1 to estimate DBH outside bark.

Independent trees that grow together: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees.

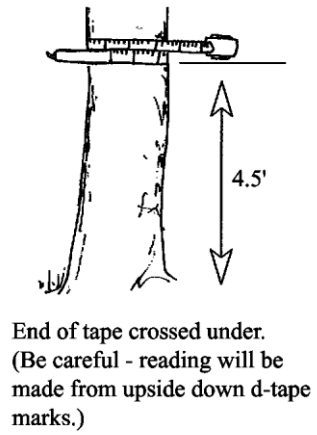
Missing wood or bark: If 50% or more of the circumference of the bole is intact, reconstruct the diameter at DBH.

Diameter on stump: Use a logger's tape, cloth tape, or ruler to measure the longest and shortest axis across the top of the stump. Record the diameter as the average of the two measurements.

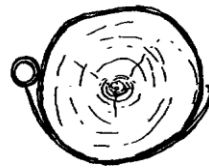
Proper Use of a Diameter Tape



Optional method if left handed



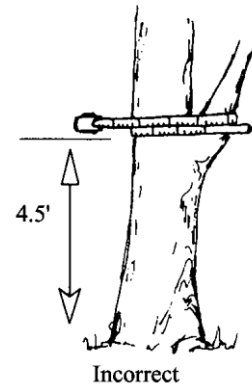
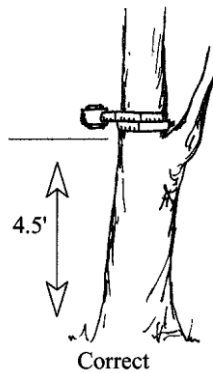
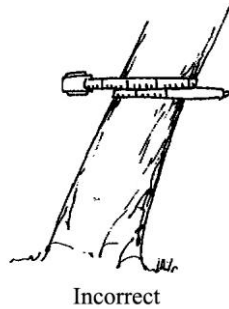
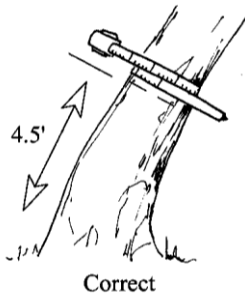
Press the tape firmly against the tree. Do not pull it out at a tangent to the tree at the point of measurement.



Correct



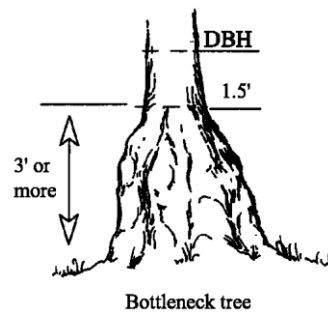
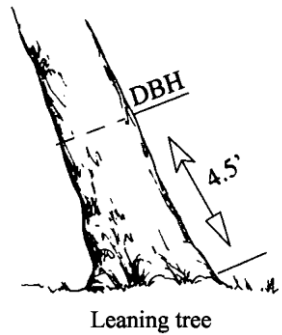
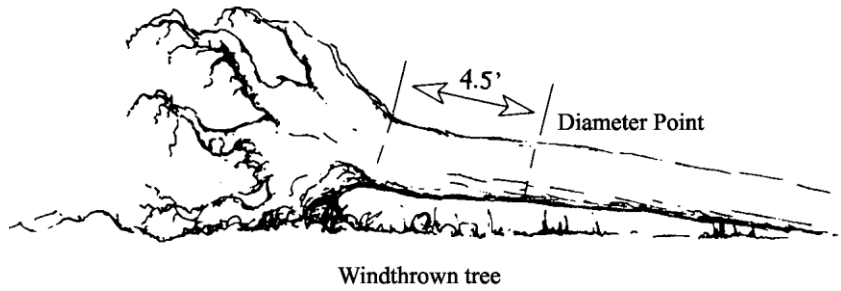
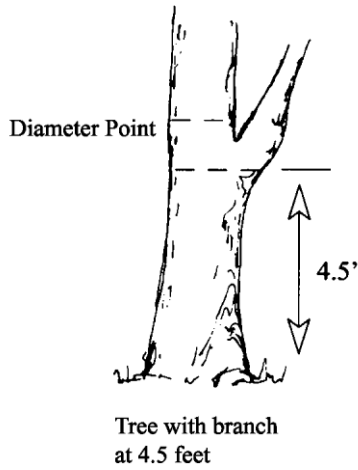
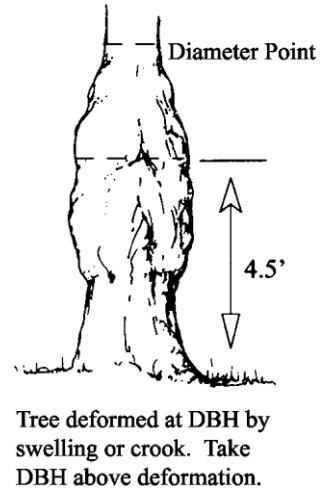
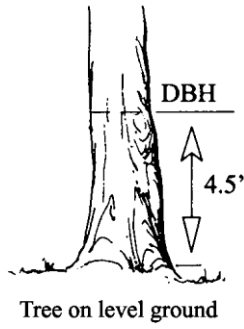
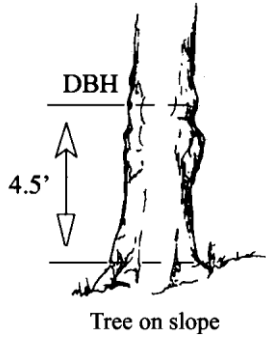
Incorrect



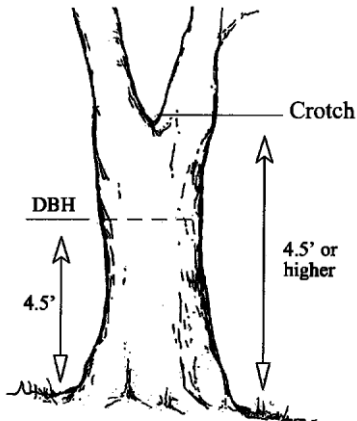
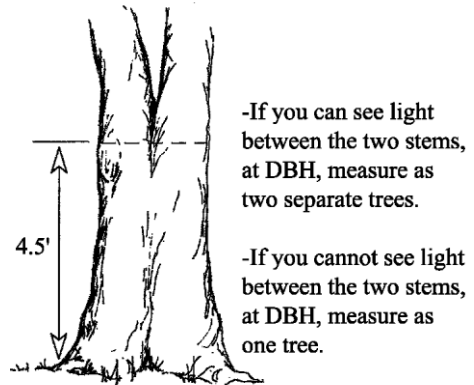
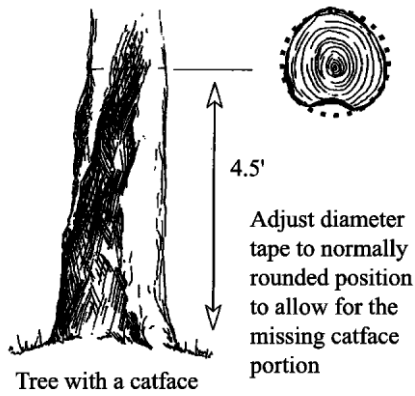
Tape must be at right angles to lean of tree.

Do not place tape at abnormal location on bole of tree.

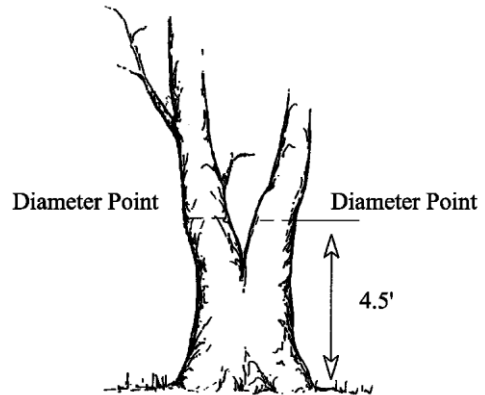
Point of Measurement for DBH



Point of Measurement for DBH (cont.)

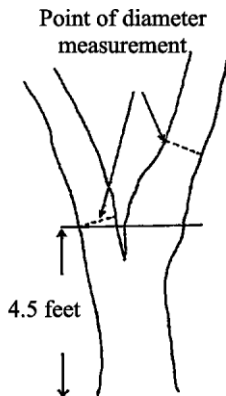


Tree forked at 4.5 feet or higher. Record as one tree and consider only the main fork. Take DBH below the swell of the fork.



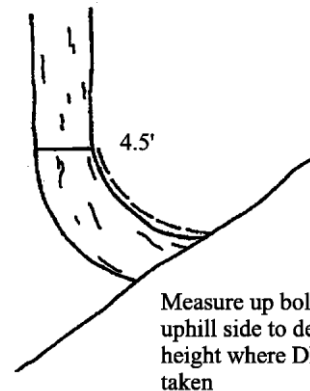
Tree forked below 4.5 feet. Record each fork that is "in" as a separate tree. Measure diameter at 4.5 feet.

Point of Measurement for DBH (cont.)

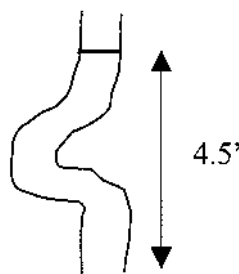


Measuring abnormal diameters on forked trees

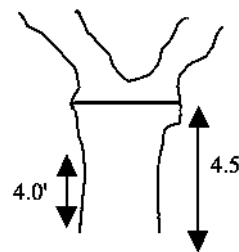
Diameter on abnormal fork



Diameter on pistol butt tree



DBH measurement for a pistol butt shaped tree



Tree forked at DBH. Unable to get a DBH tape through crotch. Take DBH below the swell of the fork.

DRC

Diameter at Root Collar (DRC) is the diameter measured at the root collar or at the natural ground line, whichever is higher, outside the bark. Measure tree stems only, not branches. A stem generally grows in an upright position and contributes to the main structural support of a tree crown. If the diameter is measured at root collar, the number of stems is required.

DRC measured trees commonly have multiple stems. DRC-measured trees with stems clumped together and a unified crown and appearing to be from the same origin are treated as one tree. If necessary for diameter measurement, remove loose material on the ground but not mineral soil. For multi-stemmed DRC-measured trees with at least one stem ≥ 5.0 " at the root collar, DRC is computed as the square root of the sum of the squared stem diameters. For a single-stemmed tree, DRC is equal to the single diameter measured. For a multi-stemmed tree, DRC is calculated from the diameter measurements of all qualifying stems (≥ 1.5 " diameter and at least one foot in length).

Use the following formula to compute DRC. Record individual stem diameters in the tree form "REMARKS" column for future reference.

$$DRC = n \sqrt{\sum_{1}^n (\text{stem diameter})^2}$$

Example: Tree #1 has three qualifying stems; 5.9, 2.4, and 1.5

$$DRC = \sqrt{(5.9)^2 + (2.4)^2 + (1.5)^2} = 6.5$$

When DRC is impossible or extremely difficult to measure with a diameter tape (e.g., due to thorns, extreme limbs, packrat's nest), the stem(s) may be estimated to the nearest inch. Note "estimated DRC" in the tree form "REMARKS" column.

Accuracy Standards:

<.5 inch	No Errors
.5 inch - 13.9 inches	± 0.1 inch
14.0 inches - 23.9 inches	± 0.2 inch
24.0 inches - 34.9 inches	± 0.3 inch
35.0 + inches	± 0.5 inch
Borderline variable plot trees	± 1 inch (for the purpose of determining trees in or out)
Estimated DRC	± 1 inch

Point of Measurement for DRC



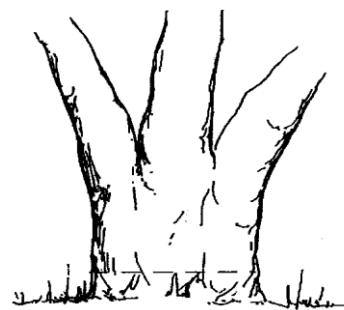
Measure at ground line when reasonable



Measure above butt swell



Excessive diameter below stems. Measure each stem and compute DRC



Multistemmed above diameter



Measure missing stem(s) and compute DRC



Multistemmed at or below ground. Measure each stem and compute DRC.

Height (maximum of 3 numbers)

Record tree height, in feet, from ground line on the uphill side to the uppermost tip. If the top is broken or missing, record the height to the break, and record the appropriate physical damage code. Tree heights are required for:

- Site Trees
- Growth Sample Trees
- Trees less than 4.5 feet tall. Does not apply to DRC species.
- All trees with broken or missing tops.

Additional tree heights should be measured and recorded when two adjacent sample trees of similar height can be viewed from the same vantage point, and when the height/diameter relationship of a particular tree seems atypical with respect to other trees of the same species.

Accuracy Standard: $\pm 10\%$
 $\pm 20\%$ for extensive and quick plot exams

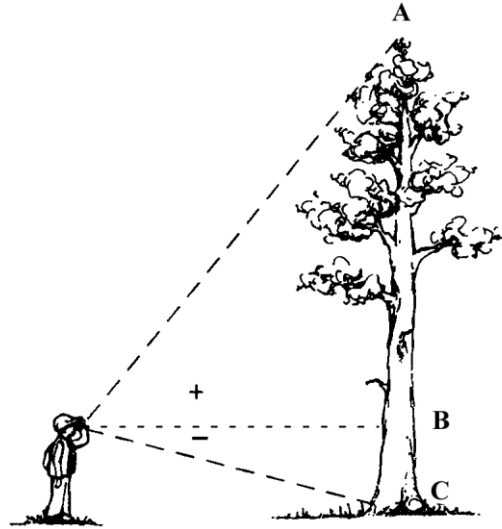
Examples:

0.5	0.5 feet tall
23	22.5 - 23.4 feet tall
151	150.5 - 151.4 feet tall

Note: Trees less than $\frac{1}{2}$ feet tall (0.5 feet) can be recorded to the nearest $\frac{1}{10}$ th foot. All trees over 0.5 feet are recorded to the nearest foot.

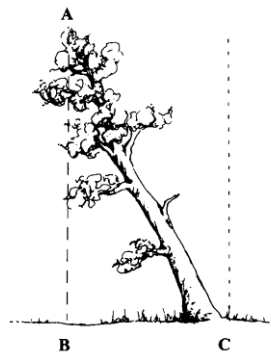
Total Tree Height

Measure from the base of the tree on the high ground side to the tip of the tree leader. Measure height from a point uphill or on the same contour line as the tree. Record total tree height to the nearest foot.



Leaning Trees

Trees leaning 25% (about 15°) or more from vertical require the following special height measuring technique.



Locate point on ground directly under tip of leaning tree. Measure height A B. Measure horizontal distance B C. Determine actual tree height (AC) using either the Pythagorean theory for right triangles where:

$$\text{Tree Height} = \sqrt{AB^2 + BC^2}$$

Example: Measured height (AB) = 120'
Horizontal distance (BC) = 40'

$$\text{Corrected tree height} = \sqrt{120^2 + 40^2} = 126.49$$

Or, use the following table:

Horizontal Distance - tip to center of bole at ground (B C)

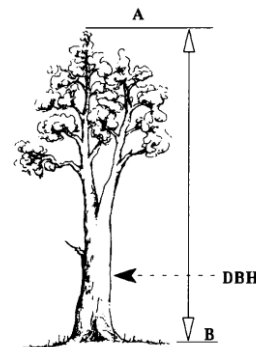
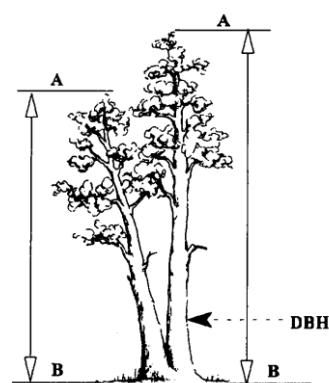
MS HT	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
40	40	41	43	45														
50	50	51	52	54	56													
60	60	61	62	63	65	67												
70		71	72	73	74	76	78											
80		81	81	82	84	86	87	89										
90		91	91	92	94	95	97	98	101									
100		101	101	102	103	104	106	108	110	112								
110			111	112	113	114	116	117	119	121	123							
120			121	122	123	124	125	126	128	130	132	134						
130			131	131	132	133	135	136	138	139	141	143	145					
140			141	141	142	143	144	146	147	149	150	152	154	157				
150			151	151	152	153	154	155	157	158	160	162	164	166	168			
160			161	161	162	163	164	165	166	168	169	171	173	175	177	179		
170			171	171	172	173	174	175	176	177	179	180	182	184	186	188	190	
180			181	181	182	183	183	184	176	187	188	190	191	193	195	197	199	201
190				191	192	192	193	194	195	196	198	200	201	203	204	206	208	210
200				201	202	202	203	204	205	206	208	209	211	212	214	215	217	219

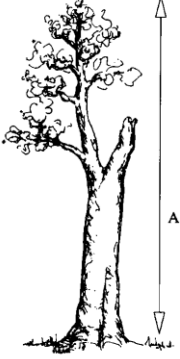
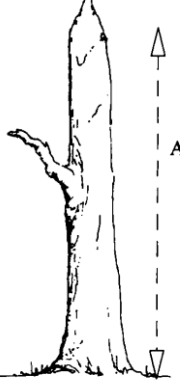
MS HT = (A B) Measured Height

Forked Trees

If tree forks below DBH, treat as two trees and measure height of each stem from base of tree to tip of tree.

If the fork crotch occurs at or above 4.5 feet on high ground side, the tree is treated as a single tree. Measure height of the tallest fork.



<p><u>Forked Tree with a Broken Top</u> The height of the tallest fork is measured and recorded in the "Total Height" field. Record a tree damage of "broken top."</p>	
<p><u>Trees with a Missing Top</u> Measure height of stub and record in the "Total Height" field. Record a tree damage of "missing top." If the tree is forked, measure the height of the stub of the dominant fork.</p>	

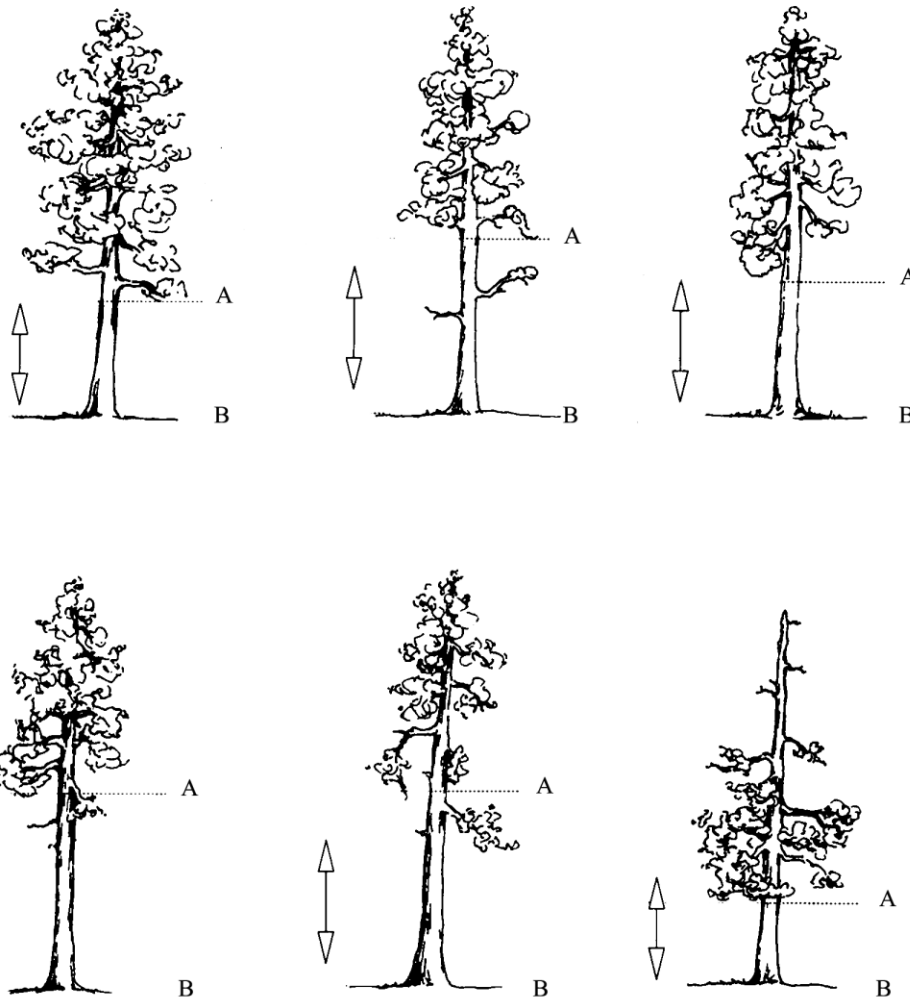
Height to Crown (maximum of 3 numbers)

Record crown height, in feet, on the uphill side of the tree, from the ground line to the base of the live crown (the lowest branch whorl with live branches in at least two quadrants exclusive of epicormic branches and whorls not continuous with the main crown).

Accuracy Standard: $\pm 10\%$

Examples:

- 1 0.1 - 1.4 feet. This includes crowns that touch the ground.
- 23 22.5 - 23.4 feet
- 151 150.5 - 151.4 feet



Measure the height from the base of the tree on the uphill side (B) to the base (A) of the live crown. Base of the live crown is the lowest branch whorl with live branches in at least two quadrants exclusive of epicormic branching and of whorls not continuous with the main crown.

Radial Growth (maximum of 2 numbers)

Record the radial growth increment for Growth Sample Trees ≥ 3.0 inches diameter for DBH measured species to the nearest $1/20^{\text{th}}$ of an inch. The default radial increment period is 10 years. Make the increment boring at breast height facing plot center. Measure the width of the outer complete annual increments up to the number of years equal to the growth period entered on the Setting form with a $1/20$ of an inch scale ruler. Enter radial growth using integers only. Accuracy Standard: $\pm 1/20$ inch

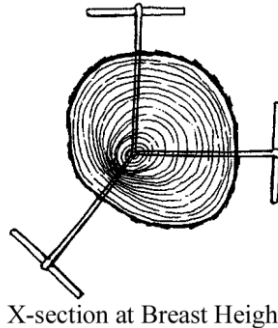
Examples:

6 6/20 radial growth (in 20th inch)
24 24/20 radial growth (in 20th inch)

1. Bore the tree just below the point of diameter measurement, on the side of the tree facing plot center to reduce bias in selecting the radial growth sampling cores. There can be considerable

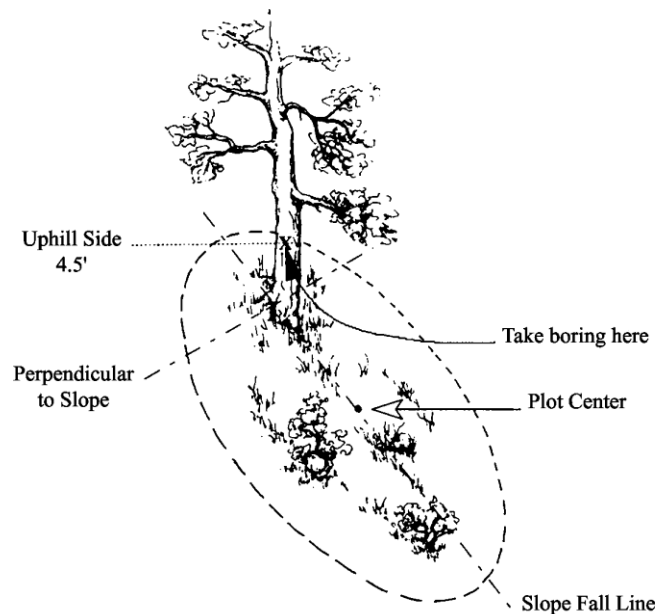
growth difference between the various areas of the same breast height X-section. Slope, aspect, influence from neighboring trees, etc., can affect the width of the growth rings in any given core area.

2. Count back 10 growth rings from the cambium end of the core.
3. Measure the length of this segment of the core to the nearest 1/20-inch to get radial increment. Enter this radial increment as the number of twentieths (e.g., 18/20 is recorded "18" and 27/20 is recorded "27").

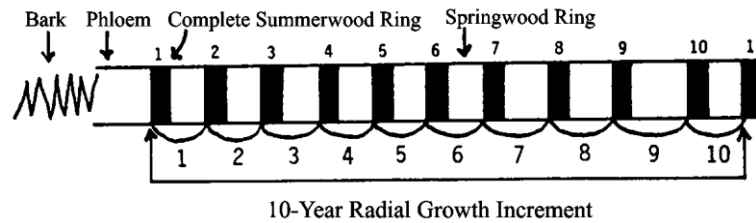


X-section at Breast Height

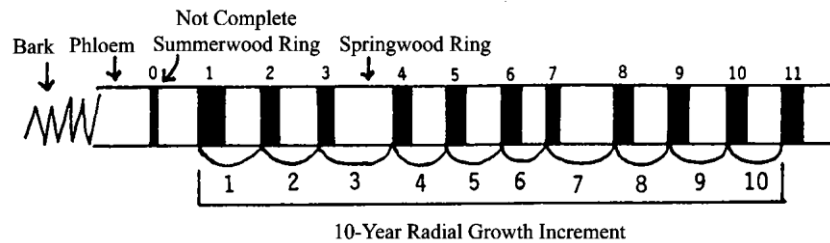
It may be difficult or impossible to obtain an increment boring at breast height on very steep slopes when the plot center is downhill from the tree. In this circumstance, obtain the core at breast height on a side of the tree perpendicular to the slope fall line.



The radial increment growth period is usually 10 years. The measurement is taken from the outside edge of the most current, complete summerwood (denser, dark-colored) ring to the outside edge of the eleventh summerwood ring, so that 10 complete annual increments are included. The last summerwood growth ring is considered complete by September 1 each year.



Example of a 10-year radial growth increment with the first summerwood ring – a complete growth ring.



Example of a 10-year radial growth increment with the first summerwood ring – not a complete growth ring.

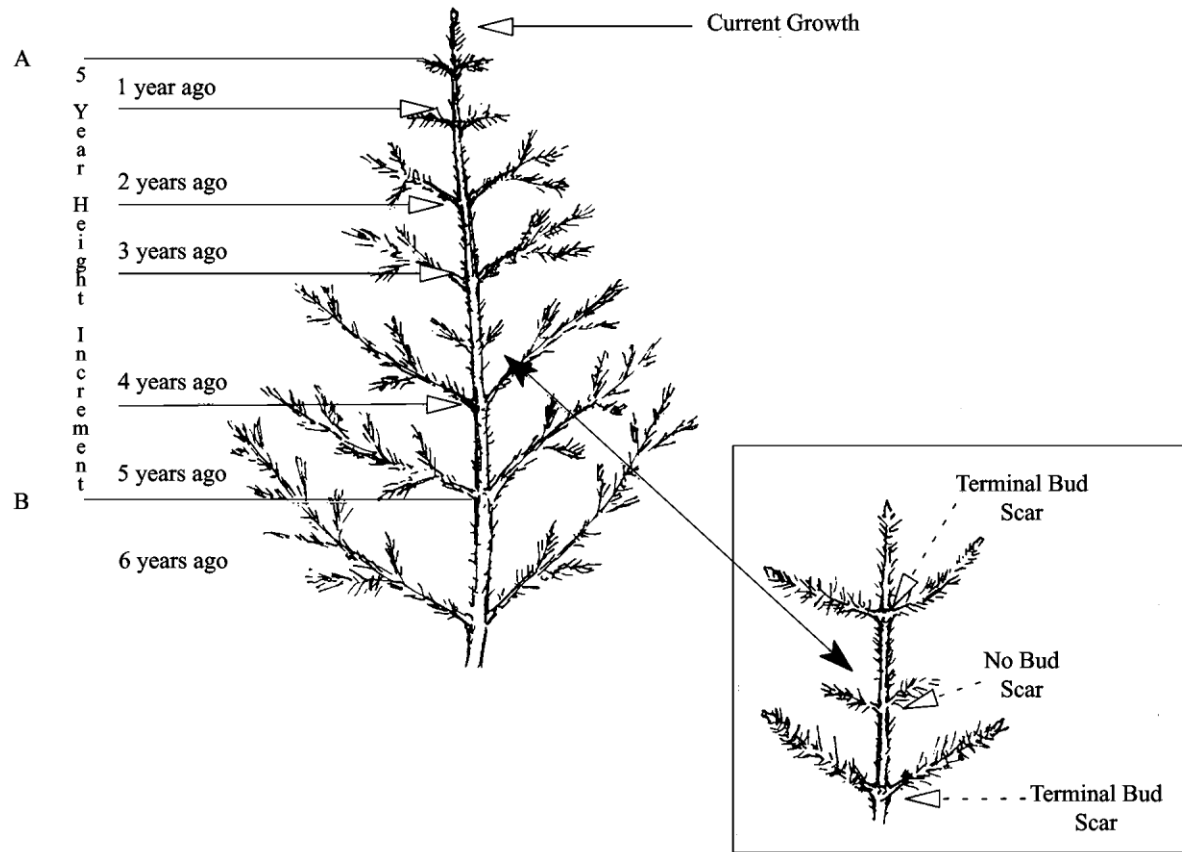
Note that the rulers above are 20th scale rulers.

Height Growth (maximum of 2 numbers; may include one decimal)

Record height growth, to the nearest 1/10th foot. Height growth is required for Growth Sample Trees less than 3.0 inches in diameter and greater than or equal to 5 years old. Measure the five most recent complete height increments of leader growth. The current terminal leader is excluded unless budset has occurred. Height increments are recognized by the presence of budscale scars on the nodes (except Western redcedar) or by dissecting the leader and counting annual rings with a hand lens. The default height growth period is 5 years.

Accuracy Standard:

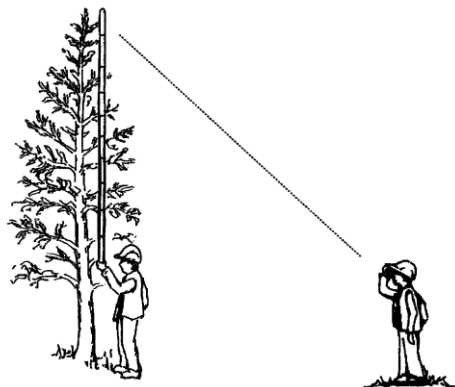
Tree height \geq 6 feet	\pm .5 feet
Tree height $<$ 6 feet	\pm 0.1 feet



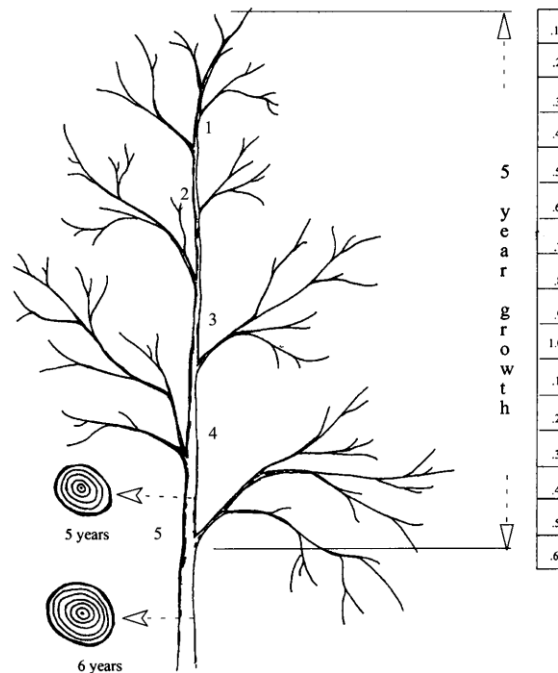
The 5-year Height Increment is between lines A and B.

Height Growth on Trees Taller than 10 Feet

One crewmember holds up the height pole to the top of the tree. The other crewmember uses binoculars to locate 5-year growth node and read the length on the height pole.



Using Destructive Sampling: Cut down the tree and measure the 5-year growth.



1. Cut at suspected internode between 5 and 6 years.
2. Cut between suspected internode between 4 and 5 years.
3. Measure at the 5th node.

Note: this graphic shows measuring to the top of the tree. If the measurement is taken during the spring or summer when the tree has a partial years flush of new growth, do NOT include the partial growth. Measure the 5 most recent COMPLETE increments of height growth.

Tree Age (maximum of 4 numbers)

Record the tree age in years. This is required for Growth Sample trees and Site Index trees.

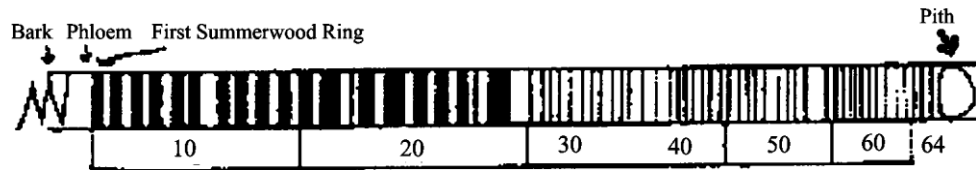
Record DBH age for trees 3.0 inches DBH and larger. Age is determined from an increment boring made at DBH and is the annual ring count to the pith of the tree. If age cannot be determined because of extensive heartrot, and this is a site tree, select another tree.

Record total age for trees less than 3.0 inches DBH. Total age is determined by counting branch whorls that represent annual height increments, or by severing the tree at the root collar and counting annual rings on the stump, or by taking an increment boring at the root collar. The most efficient and accurate method to use depends largely on the species and size of the sample tree.

Accuracy Standard: $\pm 10\%$ for trees less than 299 years of age
 (Based on actual tree ring count at breast height for trees ≥ 3.0 " DBH, otherwise based on total age recorded.)
 $\pm 15\%$ for trees greater than 299 years of age

Age Measurements for Trees > 3 Inches DBH

For trees 3.0 inches DBH and larger, age is determined from an increment boring made at breast height. To reduce bias, the increment boring should be made at breast height facing plot center. Usually the boring for measuring radial growth is also used for age measurement. Age is counted from the most current summerwood ring to the pith of the tree. Record the age counted, do not add an estimate of the number of years to grow to breast height.



The ring count is 64 years, so record "64" for the tree age.

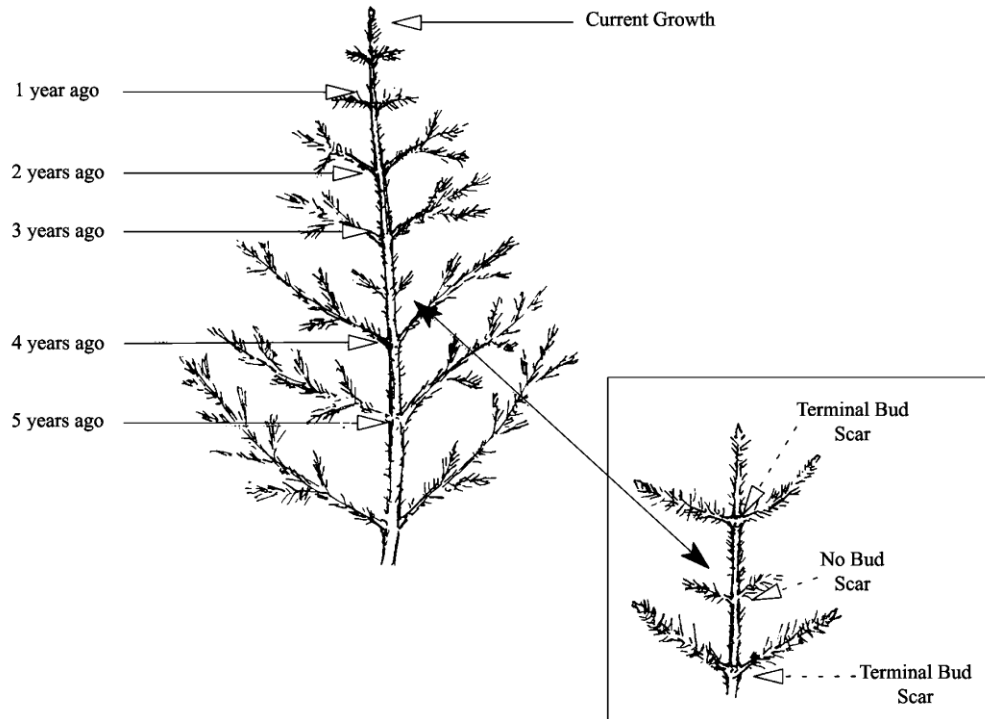
Age Measurements for Large Trees: When determining the age of a tree that has a radius greater than the length of the increment borer, bore into the tree as far as possible, extract core and count the rings. Measure the diameter of the tree and divide by two, then subtract the bark thickness. This gives the radius of the wood part of the tree. Measure the length of the core and subtract from the radius of the wood to determine how much longer the core would have to be to reach the pith. Count the number of rings in the innermost inch and extrapolate to the center.

Example: Determine the age of a 40-inch DBH tree having a bark thickness of 2.0 inches when a core 16 inches long has 200 rings and the innermost inch has 5 rings.

- | | |
|--------------------------------------|----------------------------------|
| 1. DBH / 2 | $40.0 / 2 = 20.0$ |
| 2. Bark thickness | 2 inches |
| 3. Difference | $20.0 - 2 = 18$ (radius of wood) |
| 4. Core length | 16 inches |
| 5. Radius of wood - core length | $18 - 16 = 2$ |
| 6. Number of rings (inner-most inch) | 5 |
| 7. Product (of #5 and #6 above) | $2 \times 5 = 10$ |
| 8. Number of rings on core + 10 (7) | $200 + 10 = 210$ Tree age |

Age Measurements for Trees < 3 Inches DBH - For trees less than 3.0 inches DBH, total tree age may be determined by counting branch whorls that represent annual height increments, by severing the tree at the root collar and counting annual rings, or by taking an increment boring at the root collar.

Counting Branch Whorls - Counting branch whorls to determine tree age should only be done on western white pine or other species where the distinction between annual branch whorls and false branch whorls can be clearly recognized. False branch whorls are recognized as whorls that have shorter branches and never have budscale scars at the node. The presence of budscale scars guarantees that the branch whorl represents an annual growth increment, but as a tree ages, budscale scars become masked by bark development. Western red cedar does not have budscale scars and false whorls are common, so counting branch whorls is never appropriate for cedar.



Cutting Tree at Root Collar to Count Annual Rings - Sample trees can be severed at the root collar in order to count annual rings. The root collar is the transition zone between the stem and the root and is recognized by the presence of a slight swelling.



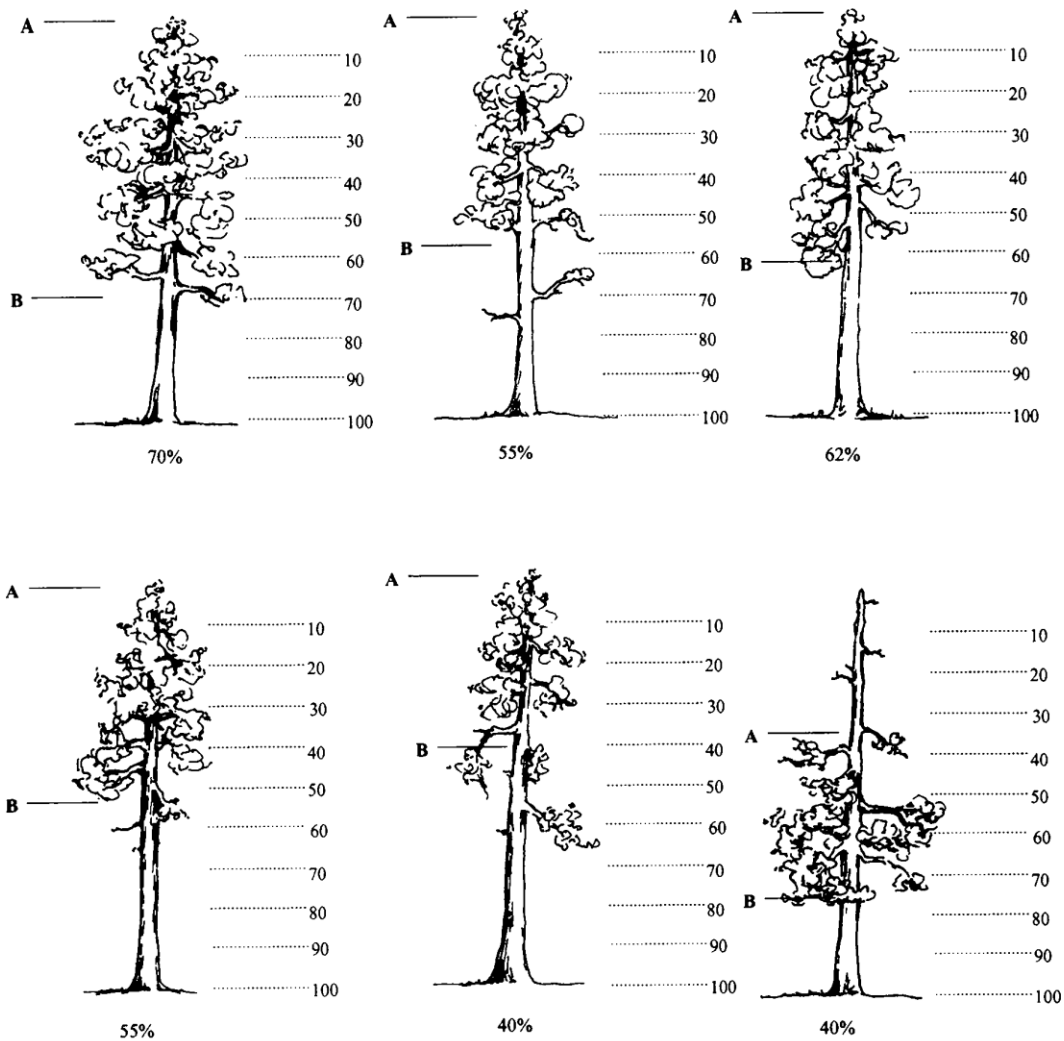
Increment Boring at Root Collar - Sample trees can be bored at the root collar to determine age. The same procedures for boring trees at breast height (see above) are used for boring trees at root collar.



Crown Ratio (maximum of 3 numbers)

Record crown ratio, in percent, as the length of the live crown divided by tree height. Live crown length is assessed from the uppermost live leader or branch to the lowest live branch. Visually adjust large openings in the crown or lopsided crowns by transferring lower branches to fill in the holes. Compressing the live crown length because the crown appears “sparse” or contains “unhealthy” foliage is not appropriate. Crown ratio is the portion of the tree bole supporting live, healthy foliage and is expressed as a percent of the actual tree height. The distance between A and B is the existing crown length.

Accuracy Standard: $\pm 10\%$ for intensive exams
 $\pm 20\%$ for extensive and quick plot exams



Crown Class (exactly 2 characters)

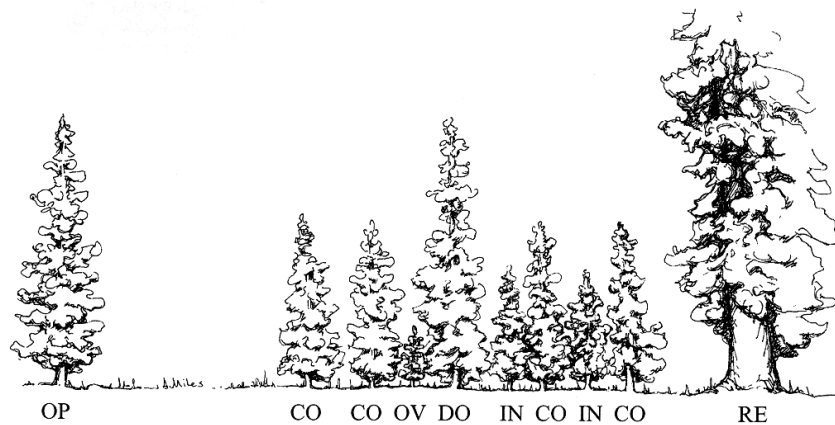
Record the crown class for all live trees. Crown class is the description of the relative position of the tree crown with respect to competing vegetation surrounding the tree. Crown classes are a useful descriptor of competitive status of trees in all structural types of stands. The Crown Class for each tree is determined in the context of competition for sunlight or moisture between the subject tree and its immediate environment, trees, or shrubs.

Classifications are more difficult to assign in uneven-aged stands or in plots where more than one stand is present. In these situations, classify the tree based on its immediate environment. Base your classification on how much light the tree's crown is receiving, not its position in the canopy. The intermediate and overtopped crown classes are meant to include trees seriously affected by direct competition with adjacent trees. For example, a young, vigorous tree that is considerably shorter than other trees in the stand but not overtopped by other trees, and receives full light from above and partly from the side, is classified as dominant. The same principle applies to two-storied stands: understory trees should only be assigned subordinate crown classes if they are adjacent to

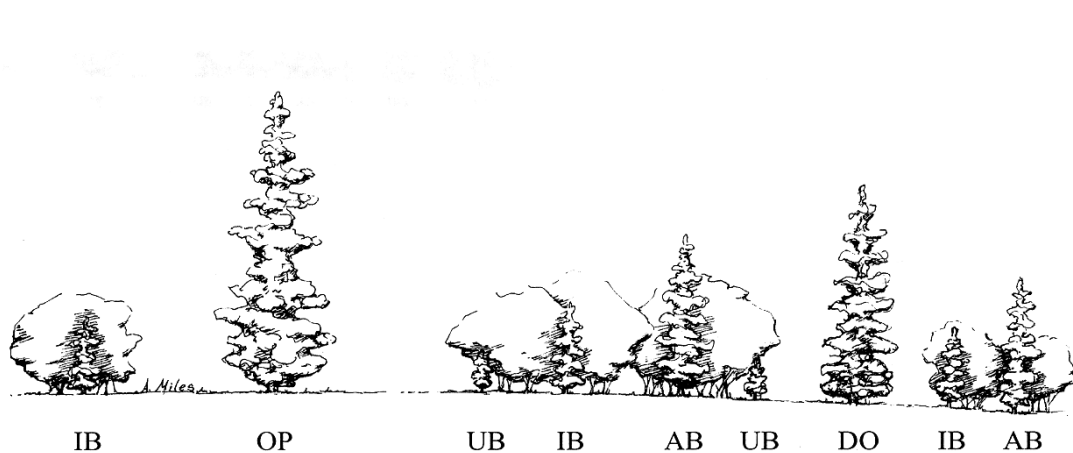
overtopping trees. In plots with scattered residual overstory trees over younger trees, a considerable portion of the understory trees will be classified as dominant or codominant.

Code	Name	Description
OP	Open-grown or Isolated	Tree crowns receive full light from above and from all sides. In even-aged stands, these trees have their crowns well above the general canopy.
DO	Dominant	Tree crowns receive full light from above and partly from the sides. Crowns extend above the general level of the crown cover of others of the same stratum and are not physically restricted from above, although possibly somewhat crowded by other trees on the sides. In even-aged stands, dominant trees rise somewhat above the general canopy.
CO	Codominant	Tree crowns receive full light from above, but comparatively little from the sides. Crowns form a general level of crown stratum, are not physically restricted from above and are crowded by other trees from the sides. In even-aged stands, codominants form the general canopy level.
IN	Intermediate	Tree crowns occupy a definitely subordinate position and are subject to strong lateral competition from crowns of dominants and codominants. They receive little direct light from above through small holes in the canopy, but no light from the sides.
OV	Overtopped	Tree crowns receive no direct light from above or from the sides and are entirely below the general level of dominant and codominant trees.
RE	Remnant	Trees that remain from a previous management activity or catastrophic event. The tree is significantly older than the surrounding vegetation. Remnant trees do not form a canopy layer and are usually isolated individuals or small clumps. This definition is from the Region 6 Inventory and Monitoring System field procedures for the Current Vegetation Survey.
AB	Leader Above Brush	The terminal leader of the tree is above the surrounding brush while the middle or lower crown may be within the brush canopy.
IB	Leader Within Brush	The terminal leader and upper crown of the tree is within the brush canopy.
UB	Leader Overtopped by Brush	The crown of the tree is completely overtopped by the surrounding brush. Brush cover crown classes only apply to isolated or dominant trees with brush competition; therefore, brush cover crown class codes are used as modifiers for open-grown or dominant trees. Competition from adjacent trees is more important than competition from shrubs if they both occur. Generally, brush cover crown codes are used in stands where overstory tree competition is absent.

Crown Class Illustration



Brush Cover Crown Class Illustration

**Crown Width (maximum of 3 numbers)**

Record the average crown width, in feet.

Crown width is the average of two measurements: 1) widest distance anywhere in the crown between the outer ends of two live branches (the drip line); and 2) the distance perpendicular to the widest measurement. Abnormally long branches sticking out beyond the edge of the crown are not used in establishing the extent of a crown.

A tree's widest crown measurement, if viewed from the air, is the diameter of a circle including all foliage. Measure it at the crown's widest point with a tape held by two crew people standing under opposite drip lines at the crown's edges. Make the second measurement at 90 degrees to the crown diameter at the widest point using the same procedures.

With shoulders parallel to the tape, determine drip line end points by looking up perpendicular to the tape and projecting where crown edge branch tips would hit the ground if they fell. Occasionally, a branch may protrude abnormally, but the lateral crown line is drawn across the portion of the branch, which includes the “normal outline” of the tree. It is helpful to use a device, such as a clinometer, that allows the observer to measure a line perpendicular to the ground. The clinometer should be used for training and to check estimates made during the operational field season. If you cannot see the crown edge from directly beneath the drip line, both observers should move an equal distance away from the tree and make your estimate. All measurements are rounded to the nearest foot. Crown width measurements or estimates can be used to compute crown volume and surface area.

Accuracy Standard: $\pm 10\%$ for intensive exams
 $\pm 20\%$ for extensive and quick plot exams

Wildlife Use (exactly 2 characters)

Record the stem characteristics that may indicate the presence of wildlife.

Code	Description
SC	Small cavities less than 3 inches in diameter
LC	Large cavities greater than 3 inches in diameter
LB	Loose bark
FH	Foraging holes/flaked bark: antler rubs, porcupine feeding
NE	Nest in tree and not in cavity
IB	Indiana Bat Habitat tree

Log/Snag Decay (exactly 1 number)

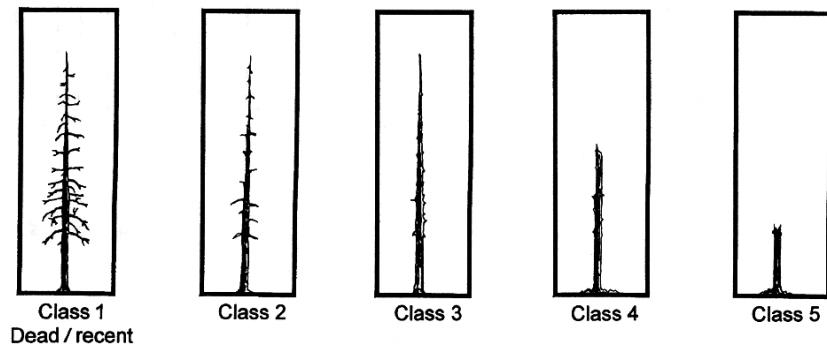
Record the condition of standing dead (snag) or down dead trees (log). The corresponding descriptions are adapted from “Wildlife Habitats in Managed Forests of the Blue Mountains of Oregon and Washington” by Jack Ward Thomas, Agriculture Handbook No. 553, USDA Forest Service, September 1979.

Snag Decay

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	≤ 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. 1/3	Mostly intact	>5 years
4	75% missing	Incipient to advanced	25%+	Few remain	Approx. 1/3 to 1/2	Losing form, soft	>5 years
5	75%+ missing	Advanced to crumbly	50%+ advanced	Absent	Approx. 1/2+	Form mostly lost	>5 years

* Implies recent mortality, within the last 5 years.

Snag Decay Classes

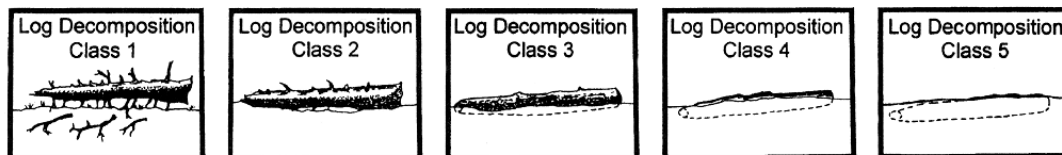


Log Decay

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

* Implies recent mortality, within the last 5 years.

** Only down trees in decay class 1 or 2 should be recorded on the tree form. Logs in decay classes 3-5 should be recorded on the down woody material form.



Cone Serotiny (exactly 1 number)

Record the open or closed condition of the majority of a tree's viable cones for Lodgepole pine and jack pine. Only consider the cones on the tree, not cones on the ground. Trees have closed cones (serotinous) if more than 50% of the cones are closed.

Code	Description
0	No Cones
1	Open/Opening Cones
2	Closed Cones
3	Intermediate - Both Open and Closed Cones

Damage Category (maximum of 2 numbers)

Record the damage category for both live and dead trees, based on physical evidence. Multiple damage categories may be recorded for each tree. See Appendix K for a complete listing of damage categories.

Damage Agent (maximum of 3 numbers)

Record the damage agent for each damage category. If the actual agent is not known, record an agent code of "000" for unknown agent within a category. See Appendix K for a complete listing of damage agents.

Tree Part (exactly 2 characters)

Record the tree part where the damage occurs. See Appendix K for a complete listing of tree parts.

Damage Severity (maximum of 5 characters and/or numbers)

Record the damage severity for each category. If category is recorded, severity is required. See Appendix K for a complete listing of damage severity codes.

Accuracy Standards

Category	Category Description	Tolerance
11	Bark Beetles	No misses on live trees with a severity of 2 or greater.
12	Defoliators	No misses on live trees with a severity of 3 or greater.
13-17	Other Insects	No misses of shoot moths or weevils on live trees.
21	Root/Butt Diseases	No misses on live trees with a severity of 2 or greater.
22	Stem Decays/Cankers	No misses on live trees with a severity of 3 or greater.
25	Foliage Diseases	No misses on Elytroderma on live trees.
41-42	Animal Damage	No misses on live trees with terminal leader damage or with greater than 1/4 of bole circumference affected.
50	Abiotic Damage	No misses on wind, snow, or ice bending, breakage, or bole cracks and frost damage to shoots on trees less than 1-inch diameter and lightning.
70	Human Damage	No misses on live trees for logging damage or fire if the damage affects greater than 1/4 of the bole circumference or if an open wound is in contact with the ground.

For Damage Agent 99, both "board foot volume loss" (code 013) and "cubic foot volume loss" (code 013) must be recorded to obtain net volume values, which reflect total defect. If these columns are NULL, net volume and gross volume will be the same.

Tree Remarks (maximum of 30 characters and/or numbers)

Record information that is unique to each tree.

User Code (maximum of 4 characters and/or numbers)

The data entered in this field is not managed at a National level and is stored in a generically labeled field. Check with your Region and Forest for specific instructions on using this field.

Treatment Option (maximum of 1 number)

Cut and leave treatment option. Legal values are 1-9. A "1" is automatically interpreted as "cut" in the Forest Vegetation Simulator (FVS) program.

Distance

The distance, in feet, of the tree from plot center. This field only allows positive values from 0.000 to 999.999.

Azimuth

The calculated direction (azimuth), in degrees, of the tree from plot center. This field only allows positive values from 0.000 to 999.999.

VEGETATION COMPOSITION AND SURFACE COVER

To insert a new line of cover data, use the down arrow. Only the vegetation data fields selected in the set up will be displayed on this screen.

Cover By Lifeform

Veg. Composition; Setting: 0102011234567891111_11/30/2004 Plot: 0001

Cover by Lifeform | Cover by Species and Layer | Cover by Species | Ground Surface Cover

Life Form	Layer	Code	Cvr%	Hgt	Diam	UseF	Remarks
	Total Veg.	TV	10				
Trees		TOT	20				
	Hgt >= 6.1 ft	TOV	30				
	Hgt < 6.1 ft	TSA	40				
Shrubs		TOS	50				
	Hgt >= 6.1 ft	ST	60				
	1.6 ft <= Hgt <= 6.0 ft	SM	70				
	Hgt < 1.6 ft	SL	80				
Forbs		TOF	90				
Graminoids		TOG	100				
Herbs		TOH					
Algae		TAL					
Lichen		TLC					
Fungus		TFU					
Woody Liana		TLI					
Woody Subshrub		TSS					
Herb. Vine		TVI					
Nonvasc. Plant		TNP					
Unknown		TIIN					

Total Vegetation (TV): Canopy Cover (%) (Required)

Help Options < Back Next > Cancel Save Return

Cover By Species and Layer

Veg. Composition; Setting: 0102011234567891111_11/30/2004 Plot: 0001

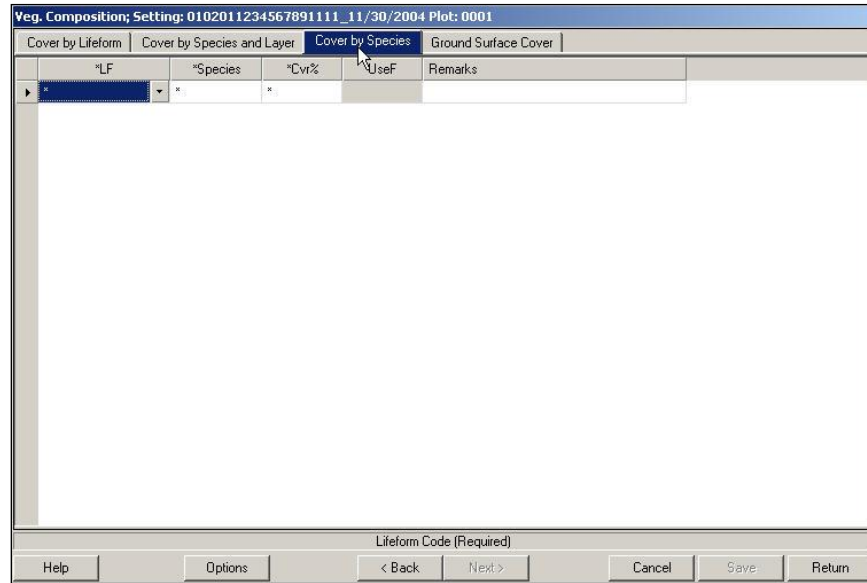
Cover by Lifeform | Cover by Species and Layer | Cover by Species | Ground Surface Cover

Life Form	Layer	Code	Species	*Cvr%	Hgt	Diam	Age	Maturity	Shrub Form	Use
Trees	>= 6.1 ft	DV		0.0						
"	"	DV		0.0						
"	"	DV		0.0						
	< 6.1 ft	RE		0.0						
"	"	RE		0.0						
"	"	RE		0.0						
Shrubs	>= 6.1 ft	ST		0.0						
"	"	ST		0.0						
"	"	ST		0.0						
	1.6 - 6.0 ft	SM		0.0						
"	"	SM		0.0						
"	"	SM		0.0						
	< 1.6 ft	SL		0.0						
"	"	SL		0.0						
"	"	SL		0.0						

Trees >= 6.1 ft.: Canopy Cover (%) (Required)

Help Options < Back Next > Cancel Save Return

Cover By Species



The buttons along the bottom of the Vegetation Composition form have the following function:

Button	Function																																			
Help	Explanations of valid codes for each field.																																			
Options Sample Design	Displays the Sample Design for Tree Data. <div data-bbox="527 1178 1276 1440" data-label="Table"> <table border="1"> <caption>View Sample Design</caption> <thead> <tr> <th>Meth</th> <th>ExpFac</th> <th>Cond.</th> <th>SubFiltr</th> <th>Var</th> <th>MinV</th> <th>MaxV</th> </tr> </thead> <tbody> <tr> <td>BAF</td> <td>40.00</td> <td>---</td> <td>LIVE</td> <td>DBH</td> <td>5.00</td> <td>999.99</td> </tr> <tr> <td>FRQ</td> <td>4.00</td> <td>---</td> <td>DEAD</td> <td>DBH</td> <td>8.00</td> <td>999.99</td> </tr> <tr> <td>FRQ</td> <td>300.00</td> <td>---</td> <td>ALL</td> <td>DBH</td> <td>0.10</td> <td>4.99</td> </tr> <tr> <td></td> <td></td> <td>OR</td> <td>ALL</td> <td>HGT</td> <td>0.50</td> <td>4.49</td> </tr> </tbody> </table> </div>	Meth	ExpFac	Cond.	SubFiltr	Var	MinV	MaxV	BAF	40.00	---	LIVE	DBH	5.00	999.99	FRQ	4.00	---	DEAD	DBH	8.00	999.99	FRQ	300.00	---	ALL	DBH	0.10	4.99			OR	ALL	HGT	0.50	4.49
Meth	ExpFac	Cond.	SubFiltr	Var	MinV	MaxV																														
BAF	40.00	---	LIVE	DBH	5.00	999.99																														
FRQ	4.00	---	DEAD	DBH	8.00	999.99																														
FRQ	300.00	---	ALL	DBH	0.10	4.99																														
		OR	ALL	HGT	0.50	4.49																														
Options Insert Record	Inserts a new tree record below the line that the cursor is positioned at. The Insert key has this same functionality.																																			
Options Delete Record	Deletes the tree record that the cursor is currently positioned on. The Delete key has this same functionality.																																			
Back	Return to the previous screen to select another setting ID or plot number and return to the Vegetation form.																																			
Cancel	Cancel all changes; return to main menu. A warning message is displayed.																																			
Save	Save all changes, remain in Vegetation form.																																			
Finish	If changes have been made, Save must be selected first, returns to main menu.																																			

Surface Cover Data

From the main menu select “**Plot Data/Veg. Composition|Ground Surface Cover Data**”

Only the settings that specified that surface cover data will be collected on the exam level in the Setting form will show up for selection. Select the setting ID and plot number to enter/edit surface cover data and select “**Next**” at the bottom of the screen.

The screenshot shows a window titled "Sfc. Data" with two panes. The left pane, labeled "Click on Setting", contains a table with columns: Reg, PF, RD, Location, and Stand. The right pane, labeled "Click on Plot", contains a list of plots from Plot #1 to Plot #10, with Plot #4 selected.

Reg	PF	RD	Location	Stand
01	10	04	0103	0001
01	14	01	2305	0006
01	14	01	2401	0046
01	14	01	2401	0047
01	14	01	2401	0056
01	14	01	2401	0057
01	14	01	2401	0059
01	14	01	2401	0063
01	14	01	2401	0064
01	14	01	2401	0070
01	14	01	2401	0200

The screenshot shows a window titled "Veg. Composition; Setting: 0102011234567891111_11/30/2004 Plot: 0001". It has four tabs: "Cover by Lifeform", "Cover by Species and Layer", "Cover by Species", and "Ground Surface Cover". The "Ground Surface Cover" tab is active. Below the tabs is a table with columns: *SurC, *Cvr%, and Remarks. At the bottom, there is a label "Surface Cover Code (Required)" and a row of buttons: Help, Options, < Back, Next >, Cancel, Save, and Return.

The optional Vegetation Composition protocol is used to collect ocular estimates of cover by lifeform and layers for trees, shrubs, forbs, and grass species within a fixed area. It provides a fast and practical sampling method to collect information on plant composition and structure to meet a variety of vegetation composition purposes.

There are four different levels of intensity that may be used to record vegetation composition.

Exam Level Code	Interested in Obtaining	Species to record	Subpop. Min.	Subpop. Max.	Form 1	Form 2	Form 3	Form 4
1	Quick estimate	Life form only	1%	100	Required	Optional	Optional	Optional
2	TES, NOX, and/or the dominant four species	Only specific species	User defined	100	Required	Required	Optional	Optional
3	All species	All species to a specified %	User defined	100	Required	Required	Optional	Optional
4	All species, including TES and NOX to trace	All species to a specified %, but species on a list to trace	User defined	100	Required	Required	Optional	Optional

Level 0 – Not Done: Vegetation Composition data was not collected.

Level 1 – Life Form: Individual species are not recorded. Percent cover is recorded by life form, and layers within the tree and shrub life forms. Only Form 1 is required, all other forms are optional.

Level 2 – List: Only species on a “list” are recorded, if they occur above the user specified minimum cover level. A list of species could include threatened, endangered, and sensitive (TES) species, noxious (NOX) species, invasive plants, management indicator species, the dominant four species, etc. If only the dominant four species are being recorded, enter “DOM4” in the Sample Design remarks field. The sample design subpopulation minimum value is set to the minimum cover percent a species must have to be recorded. To record all species on a list to a “trace” level, set the subpopulation minimum to 0.1%. A reference to the list is placed in the Sample Design Form remarks column. If only the dominant four species are being recorded, enter “Dom4” in the Sample Design Remarks field.

Level 3 – All Species: All species are recorded, if they occur above the user specified minimum cover level. The sample design subpopulation minimum value is set to the minimum cover percent a species must have to be recorded. To record all species to a “trace” level, set the subpopulation minimum to 0.1%.

Level 4 – All Species Plus a List: All species are recorded, if they occur above the user specified minimum cover level. In addition, any species on a “list” is recorded if it occurs at trace amounts. A list of species could include threatened, endangered, and sensitive (TES) species, noxious (NOX) species, invasive plants, management indicator species, the dominant four species, etc. The sample design subpopulation minimum value is set to the minimum cover percent a species must have to be recorded. A reference to the list is placed in the Sample Design form remarks column.

Plot Data

Plot Location: If tree and/or down woody material are being sampled, use the same plot center for the vegetation composition plots. Systematically space the plots equally across the site. If data other than vegetation composition is being collected, the order in which the data is collected may be important. Vegetation composition and down woody material data may be more accurate if collected prior to collecting tree data due to the effects of trampling.

Plot Size: Vegetation plots should be small enough to be efficient, large enough to include most of the species present within the setting, and must all be the same size within a setting. The sample design, plot size, and number of plots depend upon the purpose of the survey and the characteristics of the vegetation being sampled. Larger plots are better at capturing overstory and trace species. If surface cover plots are being installed, they should be the same size as the vegetation composition plots. Several common plot sizes are shown below. Plots smaller than 1/100th acre should not be used to sample vegetation composition.

Plot Size (acres)	Vegetation Types
1/100	Regeneration areas
1/50	Riparian shrubland, riparian herbland, alpine vegetation, grassland
1/10	Low-diversity forest, shrubland, grassland, riparian forest and woodland, riparian large shrubland. Good plot size for broad vegetation composition inventories.
1/5	Forests with widely spaced large trees
1/4	High-diversity forests
3/5	Old growth forests with very large trees

Plot Shape: Circular plots are easiest to install, but the actual plot shape (square, rectangular, or circular) can be decided upon on a setting-by-setting basis. For example, if sampling in riparian areas only, a long, narrow, rectangular plot may be appropriate. If square or rectangular plots are used, record the length and width of the plots in the sample design remarks field and include a sketch in the setting sketch: map. Like plot size, all plots must be the same shape within a setting to avoid bias.

Training: Conduct calibration of ocular estimates at the outset of the examination. Calibrate ocular estimates by using cover, line intercept transect methods, or other sampling. The accuracy of the data depends on the training and ability of the examiners. If species data are collected, examiners must be knowledgeable in plant identification. Plant identification skills are critical to accurately assess plant communities and categorize ocular estimates. Estimating canopy cover to the nearest 10% cover is relatively easy to learn. Quick comparisons of cover estimates can be made by independently estimating cover for a few species or life forms in a plot and comparing results. Repeat the process until all personnel produce acceptably similar results.

There are five different ways to measure vegetation composition. Each of these methods is discussed in detail below:

1. Total cover
2. Cover broken out by life form
3. Cover broken out by life form and layer
4. Cover broken out by layer and species
5. Cover broken out by species

Form 1: Total Cover and Cover by Lifeform

This form is required for all exam levels. It provides information on horizontal and vertical distribution and diversity of these attributes for all vegetation, by lifeform (grass, forb, shrub, tree) and by height classes for shrubs and trees. This information may be used for assigning plots to the upper levels of the Federal Government Data Classification (FGDC) Physiognomic Hierarchy, which is required by the Forest Service vegetation mapping protocol and is needed to crosswalk plots to NatureServe Alliances. The Forest Service vegetation mapping protocol also requires total vegetation cover for interpreting remotely sensed imagery and description of vegetation polygons. The FGDC Vegetation Classification Standard (1997) specifically requires total herbaceous cover.

Microscopic soil surface algae and fungi are difficult to evaluate. Hence, total vegetation cover does not typically include non-vascular plants. If you plan to enter values for the optional fields of “total fungus,” “total algae,” and “total non-vascular plant” cover, consult with your local ecologist for guidelines on collecting this data.

For the tree and shrub lifeforms, canopy cover is recorded by lifeform and by defined layers within those lifeforms. The canopy cover of these layers describes the horizontal structure of a setting in more detail. Predominant height is optional, and is used to describe the vertical structure. The optional tree diameters by layer can be used to further describe horizontal structure.

On this form, cover percent is always taken to the nearest 1%. White fields are required, lightly shaded fields are optional, and darkly shaded fields are not allowed.

Life Form	Layer	Layer Code	Canopy Cover (%)	Predom. Height	Predom. DBH or DRC	User Defined Data	Remarks
	Total Vegetation	TV		XXX	XXX		
Total Tree		TOT			XXX		
	Trees ≥ 6.1 TOV	TOV					
	Trees ≤ 6.0' TSA	TSA					
Total Shrub		TOS			XXX		
	Shrubs ≥ 6.1'	ST			XXX		
	Shrubs 1.6-6.0'	SM			XXX		
	Shrubs < 1.6'	SL			XXX		
Total Forbs		TOF		XXX	XXX		
Total Graminoids		TOG		XXX	XXX		
Total Herbs		TOH		XXX	XXX		

Total Cover and Cover by Lifeform (cont.)

Life Form	Layer	Layer Code	Canopy Cover (%)	Predom. Height	Predom. DBH or DRC	User Defined Data	Remarks
Total Algae		TAL		XXX	XXX		
Total Lichen		TLC		XXX	XXX		
Total Fungus		TFU		XXX	XXX		
Total Woody Liana		TLI		XXX	XXX		
Total Wood Subshrub		TSS		XXX	XXX		
Total Herbaceous Vine		TVI		XXX	XXX		
Total Nonvascular Plant		TNP		XXX	XXX		
Total Unknown		TUN		XXX	XXX		
Total all Vascular plants		TVP		XXX	XXX		

Form 2: Cover by Species and Layer

This form is required for exam levels 2-4. It describes the distribution of each tree and shrub species within the layers present in the setting. It can be used to describe the species composition and diversity found in the setting. It also provides the means to estimate habitat, biomass, forage availability, and forest ecosystem health. Cover of each tree species by layer can also be used for floristic analysis. The ages of each species within each layer can be used to describe seral tree species and successional pathways. Differences in seral trees and successional sequence may also be used to distinguish (classify) ecological types.

If an intensive level of the tree form is being used in addition to this vegetation form, the predominant height and predominate age need not be recorded. However, on the intensive tree level the ages are collected for growth sample trees and site trees, not for all trees. These trees are not representative of the entire stand and may give a biased estimate of the layer/species ages.

Only species that have a canopy cover above the minimum canopy cover percent recorded in the Sample Design Form, and species occurring on a list (Exam Level 2 or 4) are recorded. Only three species lines are shown for each life form/layer combination, additional lines may be necessary. White fields are required, lightly shaded fields are optional, and darkly shaded fields are not allowed.

Life Form	Layer	Layer Code	Species	Canopy Cover (%)	Predom. Height	Predom. DBH or DRC	Predom. Age	Maturity	Shrub Form	User Defined Data	Remarks	
Tree	≥ 6.1'	TOV							XXX			
		TOV							XXX			
		TOV								XXX		
	< 6.1'	TSA								XXX		
		TSA								XXX		
		TSA								XXX		
Shrub	≥ 6.1'	ST				XXX	XXX					
		ST				XXX	XXX					
		ST					XXX	XXX				
	1.6-6.0'	SM					XXX	XXX				
		SM					XXX	XXX				
		SM					XXX	XXX				
	< 6.1'	SL					XXX	XXX				
		SL					XXX	XXX				
		SL					XXX	XXX				
		SL					XXX	XXX				

Step	Direction
1	Record the canopy cover for each tree species over 6.1 feet tall.
2	Record optional height, DBH, age, and maturity data for each tree species over 6.1 feet tall.
3	Record the canopy cover for each tree species less than 6.1 feet tall.
4	Record optional height, DBH, age, and maturity data for each tree species less than 6.1 feet tall.
5	Record the canopy cover for each shrub species over 6.1 feet tall.
6	Record optional height, maturity, and shrub form data for each shrub species over 1.6 feet tall.
7	Record the canopy cover for each shrub species between 1.6 and 6.0 feet tall.
8	Record optional height, maturity, and shrub form data for each shrub species between 1.6 and 6.0 feet tall.
9	Record the canopy cover for each shrub species less than 1.6 feet tall.
10	Record optional height, maturity, and shrub form data for each shrub species less than 1.6 feet tall.

Form 3: Cover by Species

This form is optional for all exam levels. It describes the canopy cover of each plant species on the plot. The values for shrub, grass, and forb species are often used with tree species cover, by layer, for classification of PNV types. Total tree species cover is sometimes used for classification instead of cover by species by layer. If this data is used as part of a floristic classification process, specific plot level attributes, such as slope, aspect, and ground cover, must be collected in addition. Recommended additional plot attributes include slope position, landform, slope shape, plot history, and geologic parent material that can be recorded in the plot user-defined field or plot remarks.

All species that have a canopy cover above the minimum canopy cover percent recorded in the sample design form, and species occurring on a list (if using exam level 2 or 4) are recorded. Only three species lines are shown for each life form, additional lines may be necessary. White fields are required, shaded fields are optional.

Life Form	Species	Canopy Cover (%)	User Defined Data	Remarks
Tree				
Tree				
Tree				
Shrub				
Shrub				
Shrub				
Forb				
Forb				
Forb				
Graminoid				
Graminoid				
Graminoid				

Step	Directions
1	Record canopy cover for each tree species.
2	Record canopy cover for each shrub species.
3	Record canopy cover for each forb species.
4	Record canopy cover for each graminoid species.

Form 4: Ground Surface Cover

This form is optional for all exam levels. It is used to collect ground surface cover data that is not a specific PLANTS species. Ground surface cover data describes the ground surface. Interpretations regarding soil surface protection, erosion probability, organic matter contribution, and effects of use such as recreation, grazing, and mechanical activity can be made from this data.

White fields are required, shaded fields are optional. Total ground surface cover of all features **must equal 100%** (foliar canopy cover above the soil surface plane is not considered to be ground surface cover).

Ground Surface Cover Type	Cover (%)	Remarks

Life Form Definitions (exactly 2 characters) Required

These definitions are consistent across all of the NRIS modules, and are approved national codes.

Code	Description	Definition
TR	Woody Tree	Perennial, woody plant with a single stem (trunk), normally greater than 4 to 5 meters or 13 to 16 feet in height; under certain environmental conditions, some tree species may develop a multi-stemmed or short growth form (less than 4 meters or 13 feet in height).
SH	Woody Shrub	Perennial, multi-stemmed woody plant that is usually less than 4 to 5 meters or 13 to 16 feet in height. Shrubs typically have several stems arising from or near the ground, but may be taller than 5 meters or single-stemmed under certain environmental conditions.
FB	Herbaceous forb/herb	Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface.
GR	Herbaceous graminoid	Grass or grass-like plant, including grasses (Poaceae), sedges (Cyperaceae), rushes (Juncaceae), arrow-grasses (Juncaginaceae), and quillworts (Isoetes).
HB	Herbs	Combination of all graminoids and forbs. This is required for FGDC Vegetation Classification Standard (1997).
AL	Algae	A general name for the single-celled plant plankton, seaweeds, and their freshwater allies.
LC	Lichen	Organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in symbiotic association. Often attached to solid objects such as rocks or living or dead wood rather than soil.
FU	Fungus	A non-flowering plant of the kingdom Fungi, all lacking chlorophyll.
LI	Woody Liana	Climbing plant found in tropical forests with long, woody rope-like stems of anomalous anatomical structure.
SS	Woody Subshrub/half-shrub	Low-growing shrub usually under 0.5 meters or 1.5 feet tall (never exceeding 1 meter or 3 feet tall) at maturity.
VI	Herbaceous Vine	Twining/climbing plant with relatively long stems can be woody or herbaceous.
NP	Nonvascular plant	Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts. Always herbaceous, often attached to solid objects such as rocks or living or dead wood rather than soil.
UN	Unknown	Growth form is unknown.
VP	All vascular plants	

Species (maximum of 8 characters and/or numbers)

Record the plant species using the NRCS PLANTS database codes. Do not repeat species codes within a layer. Identify plants to species, if possible, otherwise identify to the genus level. Identification of vascular plants to the subspecies or variety level may be required for some projects. Certain projects may require only a listing of indicator of dominant species growing on the main substrate. Include plants if their crowns overhang the plot area, even though their root systems may not be within the plot area, except when sampling small narrow riparian communities. In such riparian communities, overhanging trees rooted outside the community (across an ecotone) should not be included in the species list.

Floristic classification requires accurate plant identification. Correct species identification is more important than accuracy in cover estimates. Overlooking or misidentifying a species is a more serious error than estimating cover as 5% when a measurement would show it to be 3%. It is vital that field employees are well qualified and/or trained in species identification, use of accepted scientific floras, and proper collection of unknown species for later identification. Any plant that cannot be identified to the species level should be collected for later identification.

Examples:

VAGL	<i>Vaccinium globulare</i>	Blue Huckleberry
CAGE2	<i>Carex geyeri</i>	Elk Sedge
AGROP2	<i>Agropyron spp.</i>	Wheatgrass

Accuracy Standards: No Error in species level identification for dominant, common, or community indicator plants.

Canopy Cover (maximum of 3 numbers; may include one decimal) Required

Canopy cover is "the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants. Small openings within the canopy are included (SRM 1989, NRCS 1997)". For woody plants, canopy cover is synonymous with crown cover (NRCS 1997, Helms 1998).

Do not include cover by a dead tree or shrub, or portion of a dead tree or shrub (that will not recover) in cover estimates. However, cover should be estimated for the current season's annual forb and graminoid species that have already died. Perennial forbs and graminoids may also appear dead, but are actually in an inactive for dormant stage – these plants should also be included in the cover estimates. If included in the sample design or exam level, use 0.1 as "trace" for items present but clearly less than 1 % cover.

Do not record species whose canopy does not intersect the plot. Information about species that occur outside the plot can be recorded in the plot remarks, but cannot be included in the plot data or used in data analysis. If sampling is consistently missing important species, then a larger plot size should be used throughout the entire sampling area.

Canopy cover can be estimated consistently by walking through the plot and counting the number of 1 % or 5% units present within the plot. Estimates should be crosschecked with other crewmembers for consistency, and will help account for overlap between layers within a life form or species, species within a layer, etc.

You may never enter a canopy cover value that is greater than 100%. However, if the canopy cover values for all species within a layer are totaled, and the sum may be greater than 100%. Likewise, if the canopy cover values for a species between all layers is totaled, the sum may be greater than 100%.

Accuracy Standards:

- ± 1 % for cover between 1-10%
- ± 5% for cover between 10%-30%
- ± 10% for cover over 30%

Predominant Height (maximum of 3 numbers)

The predominant height of trees and shrubs is optional on Form 2. This value is redundant if detailed tree data are collected on each plot. Record in feet to the nearest foot. Heights less than two feet can be recorded to the nearest 1/10th foot. Predominant height is the distance from the base of the plant on the high side at ground level to the tip of the plant. Determine predominant height by selecting a representative individual plant and estimating its height using a clinometer and/or measuring tape. Predominant height is optional for the life forms other than trees and shrubs. Predominant height for each species within each layer is useful, but optional. Maximum height allowed is 500.99 feet; minimum height allowed is 0.1 feet.

Accuracy Standards: ± 10% of height

Predominant Diameter (maximum of 3 numbers)

The predominant diameter for the tree (TR) lifeform is optional on Form 2. If tree data are collected on the tree form, this value is redundant, and can be more accurately computed from the Tree form data. Estimate diameter at either breast height (DBH) or at root collar (DRC) depending on the species. Record the predominant diameter to the nearest inch.

Valid values are 1-999

Predominant Age (maximum of 3 numbers)

The predominant age for tree lifeforms is optional on Form 2. If tree data are collected on the tree form, this value is redundant. Age data collected on the tree form, according to growth sample tree selection protocol, provides an unbiased and more accurate estimate of age. Record the age in years. Core samples may be used. Take a sample core(s) at the same height as the diameter, either DRC or DBH. Count the actual number of rings. If diameter and age are measured at DBH, do not add additional years for the plant to reach 4.5 feet.

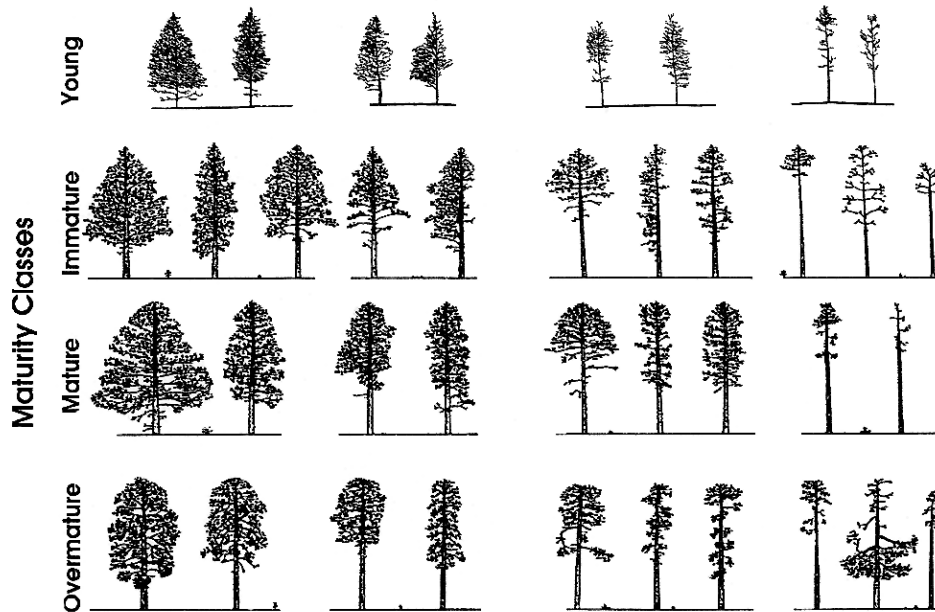
Maturity (maximum of 2 characters)

Tree maturity is optional on Form 2. Indicate relative maturity or physiological age, rather than actual age. Differences in site, elevation, moisture, and other environmental factors influence the age at which a tree reaches maturity. Trees generally reach maturity earlier on poor sites than on good sites. The maturity class descriptions are most related to conifer species. Look at stem form, bark color, and age to determine similar relationships for hardwoods. Maturity may be a substitute for boring trees to determine age.

Code	Tree Maturity Class	Description	Crowns	Branches	Bark
YO	Young	Tree appears young	Pointed	Distinct whorls, upturned, small in comparison with the main stem	Generally smooth and not platey
MA	Mature	Tree slightly showing age	Pyramidal or rounded, occasionally pointed	Flattened lower branches	Rough, somewhat platey or furrowed
DE	Overmature Or Decadent	Tree shows age	Flattened or rounded, but never pointed	Open, large, gnarled, or misshaped upper branches	Platey or deeply furrowed

Use the picture below to assist in determining maturity for conifer species. Recognize the change in crown shape from young to over-mature. As the tree matures, the top becomes flat, branches appear flat to drooping, giving a more cylindrical rather than conical shape, and branches become larger. For ponderosa pine, the amount of needles growing along the length of each branch decreases. In over-mature trees, the branches show tufts of needles at the ends.

Tree Maturity Classes



Shrub Form Class (maximum of 4 characters)

The shrub form class is optional on Form 2. Shrub form class is based on the availability of browse plants and the degree of hedging. These factors, along with age structure, can assist in determining the relative health of a browsed stand and can aid in evaluating trend. Availability represents the relative amount of twig growth that is within reach of grazing animals. Snow depth or duration has no bearing on availability. Hedging is the result of repeated utilization and is one of the factors that effects availability of shrubs. The general appearance of the plant is a primary criterion in determining degree of hedging.

Code	Abbreviation	Description
HIMV	Mostly/Highlined	Mostly available, highlined
HIUN	Unavail/highlined	Unavailable, highlined
LIAM	All/little	All available, little or no hedging
LIHE	Little or no hedging	2-year wood is relatively long/unaltered or slightly altered
LIPA	Partial/little	Partially available, little or no hedging
MOAV	All/moderate	All available, moderate hedging
MOHE	Moderately hedged	2 year wood is fairly long but altered from normal growth form
MOPA	Partial/moderate	Partially available, moderately hedged
SEHE	Severely hedged	2 year wood is relatively short and/or strongly altered
SEPA	Partial/severe	Partially available, severely hedged
SOAV	All/severely	All available, severely hedged

Remarks (maximum of 20 characters and/or numbers)

Enter optional notes about a species or layer record in Form 3 or 4. Use this space to record the scientific name of the species if the correct NRCS Plant Code is unknown.

User Code (maximum of 4 characters and/or numbers)

Enter an optional, locally defined code for this field. These codes will be stored in a generic FSVeg database field and will not be accessible via the nationally supported reports. Contact your Regional representative to determine the use, if any, for this field in your Region.

Ground Surface Cover Type (exactly 4 characters) Required

Record the major ground surface cover categories. Select ground cover categories that are visible when looking down. At times items will overlay each other. When this occurs the portions of each item that are viewed from above is what will be selected and recorded.

Code	Description	Definition
ROCKS		
ROCK	Rock	Relatively hard, naturally formed mineral or petrified matter >1/8 inch in dia. appearing on soil surface as small to large fragments or as rel. large bodies, cliffs, outcrops or peaks. Includes bedrock.
GRAV	Gravel (2-75 mm)	Rock fragments between 2 and 75 mm in diameter.
FIGR	Fine gravel (2-5 mm)	Rock fragments between 2 and 5 mm in diameter.
MEGR	Medium gravel (5-20 mm)	Rock fragments between 5 and 20 mm in diameter.
COGR	Course gravel (20-75 mm)	Rock fragments between 20 and 250 mm in diameter.
COBB	Cobbles (70-250 mm)	Rock fragments between 75 and 250 mm in diameter.
STON	Stones (round and flat)	
ROST	Round stone (250-600 mm)	Rock fragments between 250 and 600 mm in diameter.
BOUL	Boulders (round and flat)	Rock > 600 mm in diameter or length. Generic term for use when boulders are not differentiated by round and flat.
ROBO	Round Boulder (>600 mm)	Round Rock fragments >600 mm in diameter.
CHAN	Channers (2-150 mm long)	Long, thin rock fragments up to 150 mm in length, as determined by National Cooperative Soil Survey.
FLAG	Flag stones (150-380 mm long)	Flag Rock fragments 150-380 mm long.
FLBO	Flat boulders (>600 mm long)	Flat Rock fragments >600 mm long.
FLST	Flat Stone (380-600mm long)	Flat Rock fragments between 380 and 600 mm long.
BEDR	Bedrock	A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.
PAVE	Pavement	A natural concentration of closely packed and polished <u>stones</u> at the soil surface in a desert (may or may not be an erosional lag).
RROC	Rock fragments	Rock fragments >19.1 mm (3/4 inch) in diameter.
WATER, SNOW, AND ICE		
WATE	Water	Where the water table is above the ground surface during the growing season, such as streams, bogs, swamps, marshes and ponds (FIA definition).
TRIC	Transient Ice	Ice covering the surface; the ice will melt during the growing season.
TRSN	Transient Snow	Snow covering the surface; the snow will melt during the growing season.

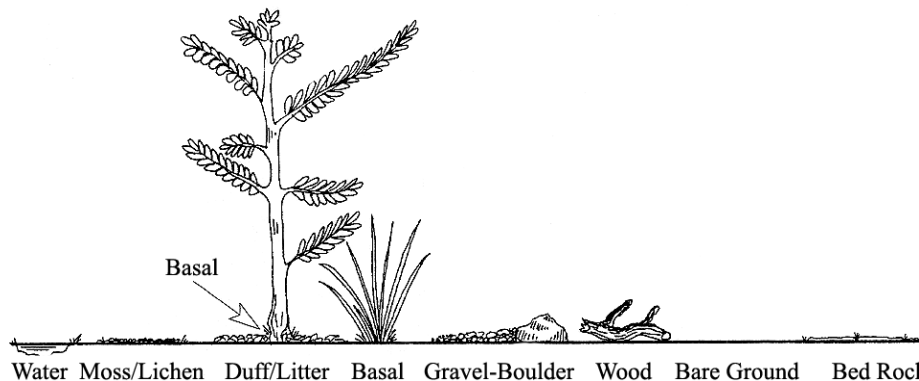
Ground Surface Cover Type (cont.)

Code	Description	Definition
WATER, SNOW, AND ICE (cont.)		
TRIS	Transient Ice and Snow	Surface area covered by ice and snow at the time of plot measurement, considered transient. For use when permanent ice and snow are not differentiated.
PEIC	Permanent Ice	Ice covering the surface. Does not melt during the growing season. The surface is ice-covered for the entire year (i.e., glaciers).
PESN	Permanent Snow	Snow covering the surface; does not melt during the growing season. The surface is snow-covered for the entire year.
PEIS	Permanent Ice and Snow	Surface area covered with ice and snow at the time of plot measurement, considered permanent. For use when permanent ice and snow are not differentiated.
WOODY PIECES		
WOOD	Wood	Woody material, slash and debris; any woody material, small and large woody debris, regardless of depth. Litter and non-continuous litter are not included (for example, scattered needles over soil is classified as BARE).
MOSS, LICHEN, FUNGI		
CRYP	Cryptogam	Thin, biotically dominated ground or surface crusts on soil in dry rangeland conditions, e.g. cryptogamic crust (algae, lichen, mosses or cyanobacteria).
CML	Cryptogams, mosses, and lichens	For situations where information is not further differentiated.
LICH	Lichen, fungi, algae	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.
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.
DUFF AND LITTER		
LITT	Litter and duff	Leaf and needle litter, 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 a BARE).
BASAL VEGETATION		
BAVE	Basal vegetation	Basal vegetation not differentiated by life form. For use when basal vegetation is not separated into more detailed codes (BAFO, etc.).
BATR	Basal tree	Basal (cross-sectional area at or near the ground level) cover of trees. (Definition adapted from definition of basal area in National Range & Pasture Handbook)
BASH	Basal shrub	Basal (cross-sectional area at or near the ground level) cover of shrubs.
BAFO	Basal Forb	Basal (cross-sectional area at or near the ground level) cover of forbs.
BAGR	Basal graminoid	Basal (cross-sectional area at or near the ground level) cover of grasses or grass-like plants.

Ground Surface Cover Type (cont.)

Code	Description	Definition
OTHER		
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).
BARR	Barren	Areas naturally devoid of vegetation, such as intermittent lakebeds and saline flats. Does not include areas denuded of vegetation.
DEVP	Developed surface (other than road), i.e., buildings or other structures	Surface area occupied or covered by any man-made structure other than a road, such as a building, dam, parking lot, electronic site/structure.
ROAD	Road	Improved roads, paved roads, gravel roads, improved dirt roads and off-road vehicle trails regularly maintained or in long-term continuing use. Generally constructed using machinery. Includes cutbanks and fills.
TEPH	Tephra Volcanic	A general term for all material formed by volcanic explosion or aerial expulsion (as opposed to flow) from volcanic vent.
UNKN	Unknown	Other covers not defined elsewhere.

Note: Basal Vegetation is the soil surface occupied by the live basal or root crown portion of vascular plants. This includes live trees. This is not the foliar cover of plants. Typical basal plant cover ranges between 3-7 percent; 15 percent is very high and rarely encountered.

Ground Surface Cover Categories**Ground Surface Cover Percent (maximum of 3 numbers; may include one decimal)*****Required***

Record the estimated percent ground cover at the soil surface plane for each ground surface cover type. Cover is defined as that portion of the horizontal surface layer intersected by ground surface features. Total ground surface cover of all features **must equal 100%** (foliar canopy cover above the soil surface plane is not considered to be ground surface cover).

Whether moss covering a rock is recorded as “moss” or “rock” depends on the exam objective. Record the code that describes the soil surface and meets the exam objective. Record moss that is growing directly on the soil surface as “moss.”

Code	Description
10	10%
18	18%
0.5	½ of 1%

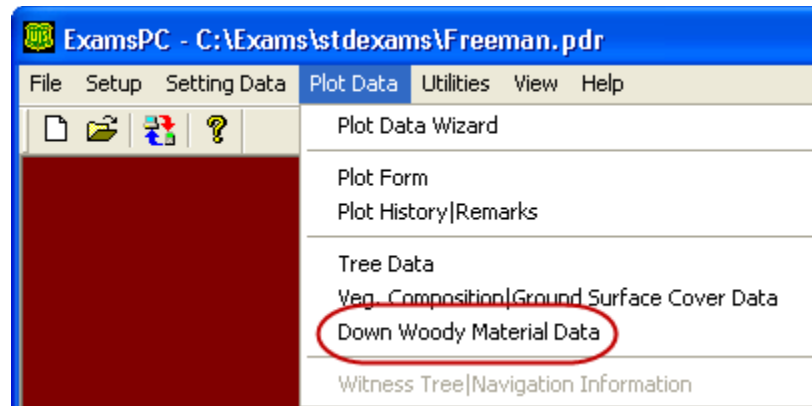
Accuracy Standards: ± 10 percent

DOWN WOODY MATERIAL

Downed woody material is the dead twigs, branches, stems, boles of trees, and brush that have fallen and lie on or above the ground. This data is used to provide quantitative estimates of downed woody material and duff. The accuracy standard is “No Errors” unless otherwise noted.

Portable Data Recorders

From the main menu, enter “**Plot Data,**” then “**Down Woody Material Data.**”



Only the settings that specified that down woody material data will be collected, on the exam level, will show up for selection. Select the setting ID and plot number for the surface cover data.

Down Woody Material

Click on Setting

Proc. Reg.	Proc. For.	District	Location Code	Stand No.	Date
02	01	01	ABCD	9999	03/15/2011

Click on Plot

Plot ID
Plot #1

Down Woody Material Data; Setting: 020101ABCD9999_03/15/2011 Plot: 0001

Brown's Survey

	Duf1	Duf2	FuD	Twig1	Twig2	Twig3	*Cnt	*Dec	*Diam	Len	Small	Large
▶							1					

To insert a new line of data, use the down arrow. Notice that only one line of information is available for the duff and twig measurements, but many lines are available for the large size pieces.

The buttons along the bottom of the screen have the following function:

Button	Function
Help	Explanations of valid codes for each field.
Back	Return to the previous screen to select another setting ID or plot number.
Cancel	Delete all changes; restore all field selections to the original list that accompanied the software. A warning message is displayed.
Save	Save all changes.
Finish	Return to the main menu.

For Down Woody Material, the examination level is set to one of the following on the setting form:

Code	Description
0	This form was not used.
1	Data was collected, but not according to Brown's Protocol.
2	Data was collected according to Brown's Protocol.

If down woody material data is collected, but **not** according to Brown's Protocol, there are three separate methods that data can be collected:

- 1A) Photo series
- 1B) Piece count on a fixed area plot
- 1C) Piece count on a transect

Each of these methods, and Brown's Protocol, will be discussed in detail.

1A) Photo Series

This method involves making visual comparisons between the on-site fuel condition and the conditions depicted on the photos. The Photo Series is intended to allow fast, easy and inexpensive quantifications of forest residues. Before using a particular Photo Series, become thoroughly familiar with the photo series book. To best understand how the photo series works, conduct several samples utilizing James K. Brown's Handbook for Inventorying Downed Woody Material. Hands-on sampling using the Brown method provides the ability to fine-tune ocular estimates. The photo series relies heavily on one's ability to visually compare the actual on the ground conditions against representative photos and its characteristics.

Enter the weight (tons/acre) and volume (MBF/acre) by size class by selecting the representative photo based on the instructions found within the photo series. Compare photos to best match the ground conditions being evaluated. Only the dead and downed woody material (twigs, stems, branches, and bolewood) from trees and shrubs is evaluated. Do not allow the live species in the sample are to skew the visual estimate. Since the photo series requires an interpolation of photos to actual conditions, it is helpful to begin by estimating mid size fuels first before moving to the finer fuels. The size classes used for this protocol are:

- 0.00 – 0.25
- 0.26 – 1.00
- 1.10 – 3.00
- 3.10 – 9.00
- 9.10 – 20.00
- 21.00+

Step 1: Enter the Sample Design Information

In the Exams sample design form, select the **Down Woody Material** tab. Set the Selection method to “**FRQ**” and the Expansion Factor (ExpFac) to “**1.00**” for 1 acre. Set the minimum and maximum intersection diameters to the different piece sizes that correspond with the photo series being used.

Default Sample Design Form								
Tree	Veg. Composition	Ground Surface Cover		Down Woody Material				
Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	Remarks
FRQ	1.00		---	DOWN	DIA	0.01	0.25	
			OR	DOWN	DIA	0.26	1.00	
			OR	DOWN	DIA	1.10	3.00	
			OR	DOWN	DIA	3.10	9.00	
			OR	DOWN	DIA	9.10	20.00	
			OR	DOWN	DIA	20.10	999.9	

Step 2: Enter the Down Woody Data

From the Exams plot menu, select **Down Woody Material** and enter the data for the duff, fuel depth, and weight and volume of each piece class.

Down Woody Material Data; Setting: 020101ABCD9999_03/15/2011 Plot: 0001									
Piece Count									
	Duf1	Duf2	FuD	*Cnt	Dec	*Diam	Len	Small	Large
	1.0	2.0	4.0						
▶				1	2	4.0	7.0		
				1	1	6.0			
				2	2	3.0			

First Duff and Second Duff (maximum of 2 numbers; may include one decimal)

Record the duff, in inches, to the nearest 0.1-inch. Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff layer is the start of the mineral soil.

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 where the depth is measured. Measure the duff along a transect that starts at plot center. Rotate the direction of the transect about 30 degrees from plot to plot. Record the transect direction in the remarks section. Take the first duff measurement at one foot from the sample plot center and record it in the “First Duff” column. Take the second duff at six feet from sample plot center and record it in the “Second Duff” column. When stumps, logs, and trees occur at the plot of measurement, offset one foot perpendicular to the right of the sampling plane. Measure through rotten logs when the central axis is in the duff layer.

Accuracy Standard: Plot average duff depth \pm 1/2 inch

First Litter

User-entered depth of first litter measurement.

Second Litter

User-entered depth of second litter measurement.

Fuel Depth (maximum of 2 numbers; may include one decimal)

This is the total vertical dead fuel depth, in inches, to the nearest whole inch. Take three equally spaced measurements, along the longest transect, and record the average depth. The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and includes litter, dead branches, and boles from trees, and dead material from shrubs, herbs, and grasses. Dead branches on trees, and dead stems and branches still attached to the ground (i.e. standing dead plants) are not included. Measure (to the nearest tenth inch) from the top of the duff layer to the highest dead particle above the point. On suspended logs, (e.g., spanning a ravine) enter the distance between the top of the duff layer and the top of the log.

Accuracy Standard: ± 20%

Volume (maximum of 8 numbers; may include one decimal) Required

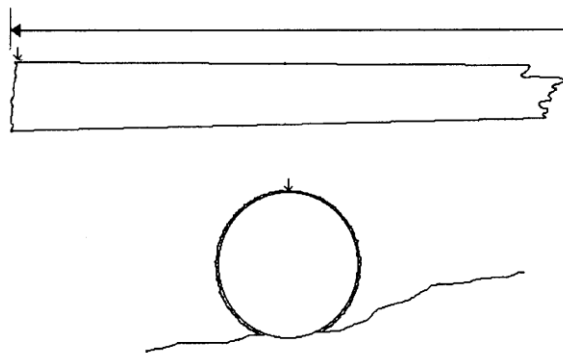
This is the average volume per acre in each diameter class as determined by the fuel photos.

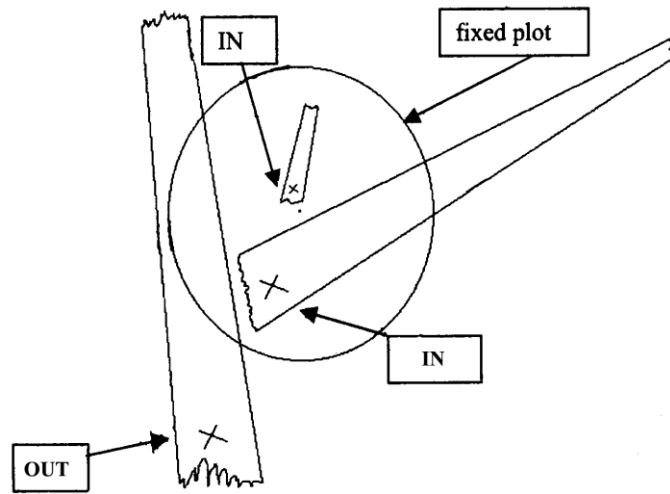
Weight (maximum of 5 numbers, may include one decimal place) Required

This is the average tons per acre in each diameter class as determined by the fuel photos.

1B) Piece Count on a Fixed Area Plot

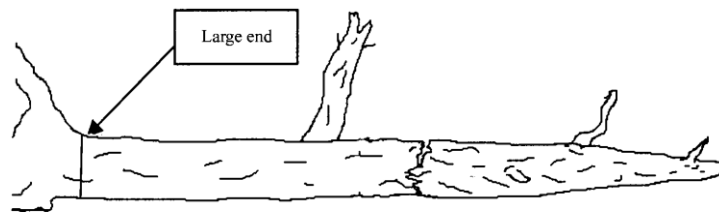
When collecting down woody data on a fixed area plot, the piece is tallied if the point on the upper most surface of the cylinder, the large end, is within the fixed area plot.





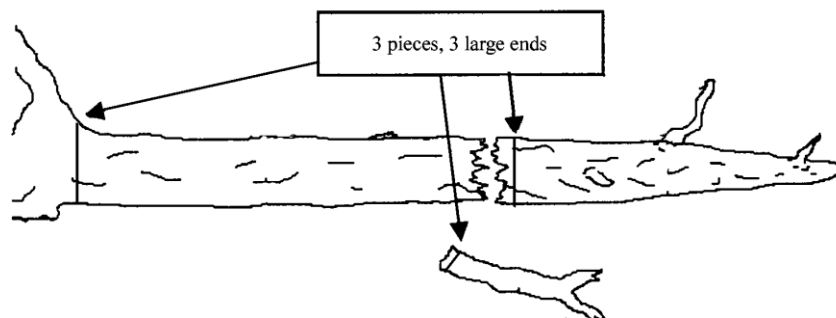
Position of large end of piece on the plot determines tally.

A down log may be broken into more than one piece. If a log is cracked, broken, or partially cut, but the two parts are still physically touching, then the log shall be considered one piece.

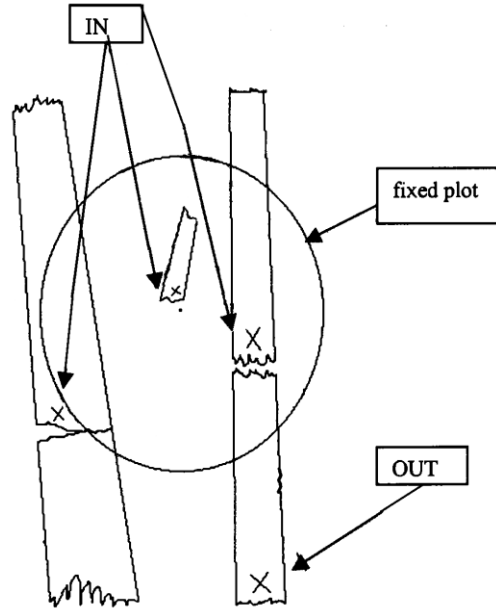


Large end on a one-piece log.

If the two or more parts are not physically touching, then they are considered separate pieces, each having their own large end. This may affect whether all parts of the down log are within the fixed radius plot.



Broken pieces not touching are measured separately.



Broken pieces have separate large ends that can affect which pieces are tallied

Step 1: Enter the Sample Design Information

In the Exams sample design form, select the **Down Woody Material** tab. Set the Selection method to **“FRQ”** and the Expansion Factor (ExpFac) to the inverse of the fixed acre plot size. Set the minimum intersection diameter to the smallest piece size to be tallied.

Sample Design Form(s); Setting: 02 01 01 ABCD 9999 03/15/2011

Tree	Veg. Composition	Ground Surface Cover	Down Woody Material (Piece Count)						Remarks
Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV		
TRN	27.00	45	---	DOWN	DIA	3.00	999.99		

Step 2: Enter the Down Woody Data

From the Exams plot menu, select **Down Woody Material** and enter the data for the duff and fuel depth. Then tally each piece in the fixed area plot larger than the minimum intersection diameter.

Down Woody Material Data; Setting: 020101ABCD9999_03/15/2011 Plot: 0001

Piece Count									
	Duf1	Duf2	FuD	*Cnt	Dec	*Diam	Len	Small	Large
	1.0	2.0	3.0						
				1	3	4.0	5.0		
				1		5.0	17.0		
				1		3.5	6.0		
				1		56.0	23.0		
				1		3.0	15.0		

First Duff and Second Duff (maximum of 2 numbers; may include one decimal)

This is the duff, in inches, to the nearest 0.1-inch. Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff layer is the start of the mineral soil.

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 where the depth is measured.

Take the first duff measurement at one foot from the sample plot center and record it in the "First Duff" column. Take the second duff at six feet from sample plot center and record it in the "Second Duff" column. When stumps, logs, and trees occur at the plot of measurement, offset one foot perpendicular to the right of the sampling plane. Measure through rotten logs when the central axis is in the duff layer.

Accuracy Standard: Plot average duff depth $\pm 1/2$ inch

First Litter

User-entered depth of first litter measurement.

Second Litter

User-entered depth of second litter measurement.

Fuel Depth (maximum of 2 numbers; may include one decimal)

This is the total vertical dead fuel depth, in inches, to the nearest whole inch. Take three equally spaced measurements, along the longest transect, and record the average depth. The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and includes litter, dead branches, and boles from trees, and dead material from shrubs, herbs, and grasses. Dead branches on trees, and dead stems and branches still attached to the ground (i.e., standing dead plants) are not included. Measure from the top of the duff layer to the highest dead particle above the point to the nearest tenth inch. On suspended logs, (e.g., spanning a ravine) enter the distance between the top of the duff layer and the top of the log.

Accuracy Standard: $\pm 20\%$

Piece Count (maximum of 3 numbers) Required

This is the number of large pieces (three inches or larger in diameter or as stated on the Sample Design form). Tally each decay class separately. If pieces are touching, it is considered one piece.

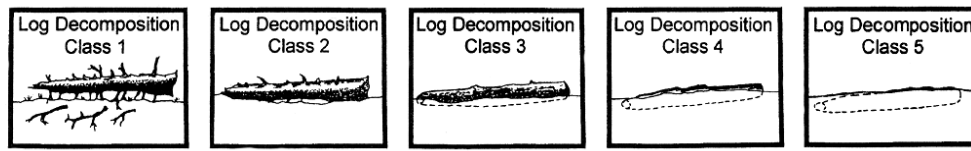
Accuracy Standard: No missed pieces.

Decay Class (exactly 1 number) Optional

This is the decay class (1-5) for the pieces three inches in diameter and larger.

Log Decay Class

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



Diameter (maximum of 3 numbers; may include one decimal) Optional

This is the diameter of each intersected piece three inches in diameter and larger.

Accuracy Standard: ± 1 inch

Diameter Large End (maximum of 3 numbers; may include one decimal) Optional

This is the large end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Diameter Small End (maximum of 3 numbers; may include one decimal) Optional

This is the small end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Piece Length (maximum of 3 numbers; may include one decimal) Optional

This is the piece length, in feet, of each piece three inches in diameter or larger. Record the diameter of the intersected piece.

Accuracy Standard: $\pm 20\%$

1C) Piece Count on a Transect

When collecting down woody data on a transect, the piece is tallied if the diameter of the piece that falls along the transect meets the “intersection diameter” criteria specified on the sample design.

Step 1: Enter the Sample Design Information

In the Exams sample design form, select the **Down Woody Material** tab. Set the Selection method to “TRN” and the Expansion Factor (ExpFac) to the length of the various transects you intend to use. Set the minimum and maximum intersection diameter for each transect length.

Sample Design Form(s); Setting: 02 01 01 ABCD 9999 03/15/2011								
Tree	Veg. Composition	Ground Surface Cover		Down Woody Material (Brown's Survey)				Remarks
Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinV	MaxV	
TRN	6.00		---	DOWN	DIA	0.01	0.24	
TRN	6.00	45	---	DOWN	DIA	0.25	0.99	
TRN	12.00		---	DOWN	DIA	1.00	2.99	
TRN	50.00		---	DOWN	DIA	3.00	999.99	

Step 2: Enter the Down Woody Data

From the Exams plot menu, select **Down Woody Material** and enter the data for the duff and fuel depth. Then tally each piece that intersects each transect and that meets the minimum and maximum diameter requirements for that transect.

Down Woody Material Data; Setting: 020101ABCD9999_03/15/2011 Plot: 0001									
Brown's Survey									
	Duf1	Duf2	FuD	Twg1	Twg2	Twg3	*Cnt	*Dec	*Diam
	1.0	2.0	4.0	13	18	5			
							1	2	4.0
							1	1	6.0
							2	1	3.0
							1	4	13.0

First Duff and Second Duff (maximum of 2 numbers; may include one decimal)

This is the duff, in inches, to the nearest 0.1-inch. Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff layer is the start of the mineral soil.

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 where the depth is measured.

Take the first duff measurement at one foot from the sample plot center and record it in the "First Duff" column. Take the second duff at six feet from sample plot center and record it in the "Second Duff" column. When stumps, logs, and trees occur at the plot of measurement, offset one foot perpendicular to the right of the sampling plane. Measure through rotten logs when the central axis is in the duff layer.

Accuracy Standard: Plot average duff depth $\pm 1/2$ inch

First Litter

User-entered depth of first litter measurement.

Second Litter

User-entered depth of second litter measurement.

Fuel Depth (maximum of 2 numbers; may include one decimal)

This is the total vertical dead fuel depth, in inches, to the nearest whole inch. Take three equally spaced measurements, along the longest transect, and record the average depth. The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and includes litter, dead branches, and boles from trees, and dead material from shrubs, herbs, and grasses. Dead branches on trees, and dead stems and branches still attached to the ground (i.e., standing dead plants) are not included. Measure from the top of the duff layer to the highest dead particle above the point to the nearest tenth inch. On suspended logs, (e.g., spanning a ravine) enter the distance between the top of the duff layer and the top of the log.

Accuracy Standard: ± 20%

Piece Count (maximum of 3 numbers) Required

This is the number of large pieces (three inches or larger in diameter or as stated on the Sample Design form). Tally each decay class separately. If pieces are touching, it is considered one piece.

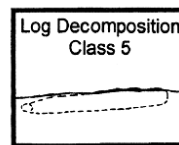
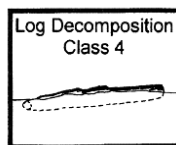
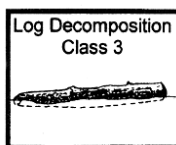
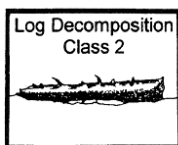
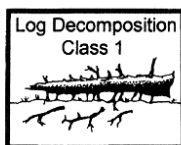
Accuracy Standard: No missed pieces.

Decay Class (exactly 1 number) Optional

This is the decay class (1-5) for the pieces three inches in diameter and larger.

Log Decay Class

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



Diameter (maximum of 3 numbers; may include one decimal) Optional

This is the diameter of each intersected piece three inches in diameter and larger.

Accuracy Standard: ± 1 inch

Diameter Large End (maximum of 3 numbers; may include one decimal) Optional

This is the large end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Diameter Small End (maximum of 3 numbers; may include one decimal) Optional

This is the small end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Piece Length (maximum of 3 numbers; may include one decimal) Optional

This is the piece length, in feet, of each piece three inches in diameter or larger. Record the diameter of the intersected piece.

Accuracy Standard: $\pm 20\%$

Method 2: Planar Intercept (Brown's Protocol)

Sampling Procedures

For average amounts of downed material, about 5 to 6 minutes per sample point is required for the measurements. More time is usually spent in traveling and locating sample points than in making the measurements. If only downed woody material is inventoried, a two-person crew can complete 20 to 40 plots per day, depending on how much material is present.

The Sampling Planes

The inventory is based on the planar intersect technique which has the same theoretical basis as the line intersect technique. The planar intersect technique involves counting intersections of woody pieces with vertical sampling planes that resemble guillotines dropped through the downed material. Review the following literature for more information:

- Brown, James K. 1974. *Handbook for inventorying downed woody material*. USDA For. Serv. Gen. Tech. Rep. INT-16, 24 p. Intermt. For. and Range Exp. Stn., Ogden, Utah.
- Brown, James K., and Peter J. Roussopoulos. 1974. *Eliminating biases in the planar intersect method for estimating volumes of small fuels*. For. Sci. 20(4): 350-356.
- Van Wagner, C. E. 1968. *The line intersect method in forest fuel sampling*. For. Sci. 14(1): 20-26.

Sampling Plane Height

The sampling plane height (vertical height) is undefined so that all intersections of dead down material are tallied regardless of their height above the ground. Tree boles are considered down if they lean greater than 45 degrees from the perpendicular. Sampling plane lengths vary by size and amount of downed woody material.

Sampling Plane Length

Length of sampling plane can be varied by users to obtain desired sampling precision. Generally, as fewer sample points are taken, sampling plane lengths should be longer to achieve desired sampling precision.

Sampling plane lengths are horizontal lengths. Slope distance will need to be adjusted to a horizontal distance. If a sampling plane extends beyond the border of the stand, truncate the plane at the stand boundary.

The table that follows suggests sampling plane lengths and number of sample points needed to obtain specified percent errors (standard error of estimate divided by the mean, expressed as percentage). These recommendations are based on average distributions of naturally fallen downed woody material sampled in the northern Rocky Mountains. The sampling plane lengths can vary from one-half of the table values for heavy fuels that are uniformly distributed to twice the table values for light and unevenly distributed fuels. For heavy slash, the sampling plane lengths recommended for naturally fallen fuels could be cut in half.

A standard error of estimate within 20 percent of the mean is often considered adequate for fuel appraisal. A smaller percent error may be desirable for planning utilization of downed woody material. Percent errors greater than 35 percent afford poor reliability. If sampling cannot provide at least this level of reliability, it may not be worthwhile.

Fuel Estimate

Decide whether an estimate of fuels is needed for an individual stand or for several stands together. If fuel quantities are believed to be similar in several stands, then a single estimate is appropriate for appraising fuels in these stands. This is often the case for several adjacent stands in a timber sale area. If fuel estimates are desired for individual stands, then choose a sampling plane length appropriate for the number of sample points planned for the stand. The same sampling plane length should be used throughout each stand or group of stands for which fuel estimates are sought.

Length of Sampling Plane for Percent Errors and Number of Sample Points

Diameter	Percent Error	Number of Sample Points							
		5	6	7	8	10	15	20	30
Sampling Plane Lengths in Feet									
0.1-1 inch	15	34	28	24	21	17	11	8	6
	20	19	16	14	12	10	6	8	4
	25	12	10	9	8	6	4	3	2
	30	8	7	6	5	4	3	2	2
	35	6	5	5	4	3	2	2	1
1-3 inches	15	85	70	60	55	45	30	22	14
	20	50	40	35	30	24	16	12	8
	25	30	25	22	20	16	10	8	5
	30	22	18	15	14	11	7	5	4
	35	16	13	11	10	8	5	4	3
3+ inches	15	380	315	270	235	190	125	95	65
	20	210	175	150	130	105	70	50	35
	25	140	115	100	90	70	50	35	25
	30	100	80	70	60	50	35	25	15
	35	70	60	50	45	35	25	18	12

Record each Sampling Plane Length once per setting, on the Sample Design form. For example, if the number of sample points is 20 and desired percent of error is 20%, then record:

- 8 – foot length for 0.1 – 1 inch class
- 12 – foot length for 1 – 3 inch class
- 50 – foot length for 3 + inch class

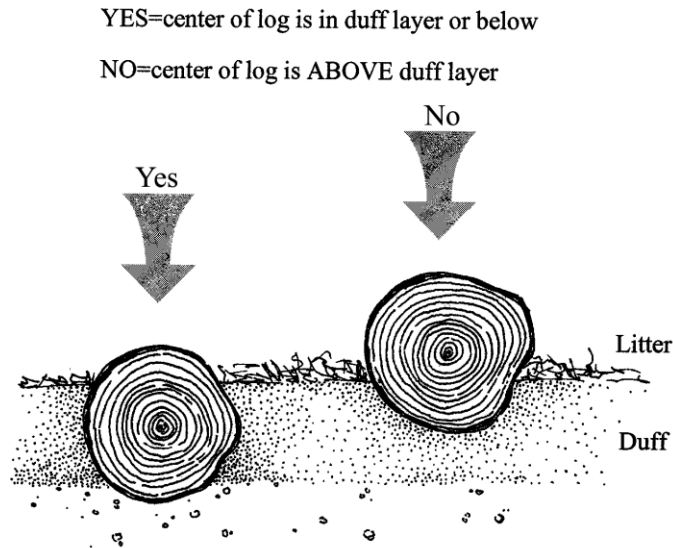
In medium fuel situations, these sampling planes should provide percent errors of about 20 percent with 20 sample points and 30 percent with 10 sample points.

Tally Rules for the Downed Fuel Inventory

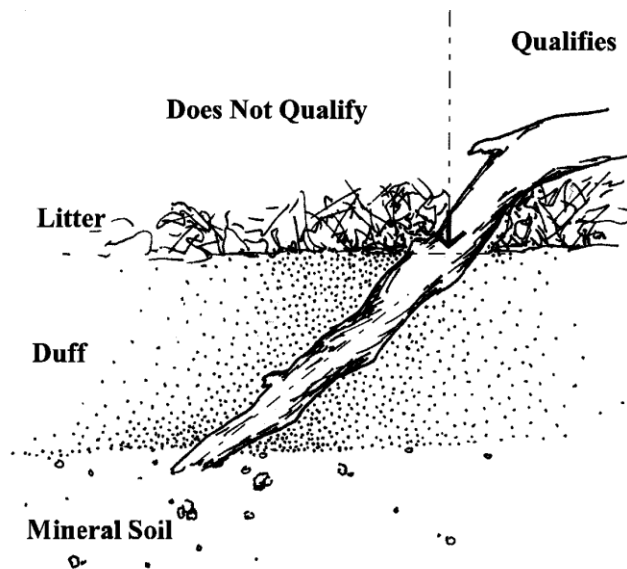
1. Particles qualifying for tally include downed, dead woody material (twigs, stems, branches, and bolewood) from trees and shrubs. Dead branches attached to boles of standing trees are omitted because they are not downed vegetation. Consider a particle “downed” if it has fallen to the ground, or is severed from its original source of growth. Cones, bark flakes, needles, leaves, grass, and forbs are not counted. Dead woody stems and branches still attached to standing brush and trees are not counted.
2. Twigs or branches lying in the litter layer and above are counted. However, they are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter).
3. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed. If the plane exactly intersects the central axis, tally every other such piece.
4. Don't tally any particle having a central axis that coincides perfectly with the sampling plane.
5. If the sampling plane intersects a curved piece more than once, tally each intersection.
6. Tally uprooted stumps and roots not encased in dirt. For tallying, consider uprooted stumps as tree boles or individual roots, depending on where the sampling planes intersect the stumps. Do not tally undisturbed stumps.
7. Tally all intersections of dead tree boles that lean greater than 45 degrees from the perpendicular regardless of the height of these intersections. Do not tally intersections of any standing dead trees that do not lean greater than 45 degrees from the perpendicular even if the point of intersection is within six feet of the ground.

Explanatory Figures

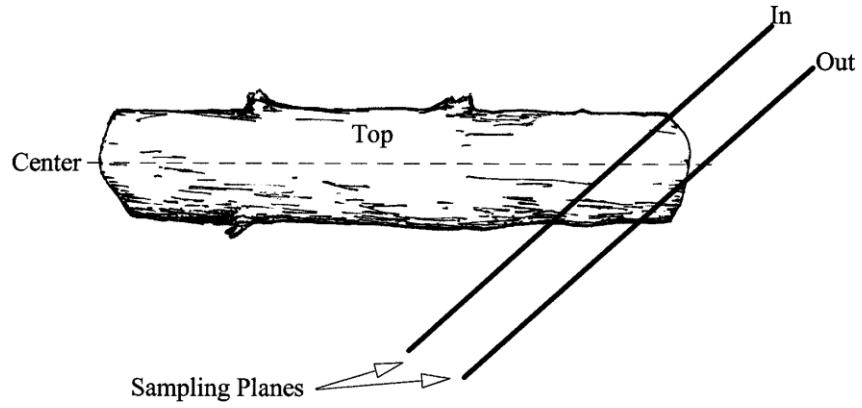
1. When stumps, logs, and trees occur at the point of duff measurement, offset one foot perpendicular to the right of the sampling plane. Measure through rotten logs whose central axis is in the duff layer.



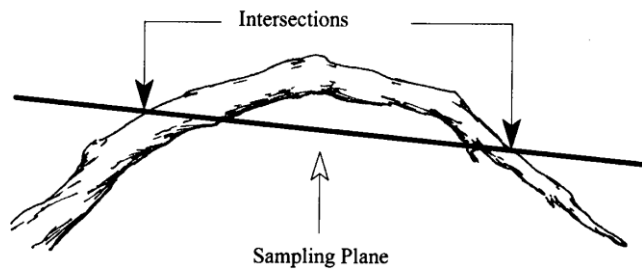
Twigs or branches lying in the litter layer and above are counted. They are not counted when the intersection between the central axis of the particle and the sampling plane lies in the duff (forest floor below the litter).



- a. If the sampling plane intersects the end of a piece, tally only if the central axis is crossed. If the plane exactly intersects the central axis, tally every other such piece.



- b. If the sampling plane intersects a curved piece more than once, tally each intersection.



Step 1: Enter the Sample Design Information

In the Exams sample design form, select the **Down Woody Material** tab. Set the Selection method to “TRN” and the Expansion Factor (ExpFac) to the various transect lengths for each fuel class (1, 10, 100, and 1000 hour fuel classes). Set the minimum and maximum intersection diameters to correspond with those of each fuel class.

Sample Design Form(s); Setting: 06 14 04 407 0114 09/05/2007							
Tree	Veg. Composition	Ground Surface Cover		Down Woody Material (Brown's Survey)			
Meth	ExpFac	Azm	Cond.	SubFiltr	Var	MinW	MaxW
TRN	7.00	45	---	DOWN	DIA	0.01	0.24
TRN	7.00	45	---	DOWN	DIA	0.25	0.99
TRN	7.00	45	---	DOWN	DIA	1.00	2.99
TRN	27.00	45	---	DOWN	DIA	3.00	999.99

Step 2: Enter the Down Woody Data

From the Exams plot menu, select **Down Woody Material** and enter the data for the duff, fuel depth and the first 3 fuel classes. Then tally each piece in the 1000 hour fuel class (3 inches and larger) separately.

Down Woody Material Data; Setting: 020101ABCD9999_03/15/2011 Plot: 0001									
Brown's Survey									
	Duf1	Duf2	FuD	Twg1	Twg2	Twg3	*Cnt	*Dec	*Diam
	1.0	2.0	4.0	13	18	5			
							1	2	4.0
							1	1	6.0
▶							2	1	3.0
							1	4	13.0

First Duff and Second Duff (maximum of 2 numbers; may include one decimal)

This is the duff, in inches, to the nearest 0.1-inch. Duff is the fermentation and humus layers of the forest floor. It does not include the freshly cast material in the litter layer. The top of the duff is where needles, leaves, and other castoff vegetative material have noticeably begun to decompose. Individual particles usually will be bound by fungal mycelium. When moss is present, the top of the duff is just below the green portion of the moss. The bottom of the duff layer is the start of the mineral soil.

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 where the depth is measured.

Measure the duff along a transect that starts at plot center. Rotate the direction of the transect about 30 degrees from plot to plot. Record the transect direction in the remarks section. Take the first duff measurement at one foot from the sample plot center and record it in the “First Duff” column. Take the second duff at six feet from sample plot center and record it in the “Second Duff” column.

When stumps, logs, and trees occur at the plot of measurement, offset one foot perpendicular to the right of the sampling plane. Measure through rotten logs when the central axis is in the duff layer.

Accuracy Standard: Plot average duff depth $\pm 1/2$ inch

First Litter

User-entered depth of first litter measurement.

Second Litter

User-entered depth of second litter measurement.

Fuel Depth (maximum of 2 numbers; may include one decimal)

This is the total vertical dead fuel depth, in inches, to the nearest whole inch. Take three equally spaced measurements, along the longest transect, and record the average depth. The fuel bed is the accumulation of dead, woody residue on the forest floor. It begins at the top of the duff layer and includes litter, dead branches, and boles from trees, and dead material from shrubs, herbs, and grasses. Dead branches on trees, and dead stems and branches still attached to the ground (i.e., standing dead plants) are not included. Measure from the top of the duff layer to the highest dead particle above the point to the nearest tenth inch. On suspended logs, (e.g., spanning a ravine) enter the distance between the top of the duff layer and the top of the log.

Accuracy Standard: $\pm 20\%$

Twig 1 (0 - .24) 1-hour fuels (maximum of 3 numbers) Required

This is the number of small twig intersections for each sampling plot. Small twigs are defined as pieces that have a cross section diameter of less than 1/4 inch at the point of intersection with the sampling plane. The horizontal length of the sampling plane for recording twig intersections is specified on the Sampling Criteria/Design form.

Accuracy Standard: $\pm 40\%$

Twig 2 (.25 - .99) 10-hour fuels (maximum of 3 numbers) Required

This is the number of large twig intersections for each sampling plot. Medium sized twigs are defined as pieces which have a cross section diameter of between .25 and .99 inches inclusive at the point of intersection with the sampling plane. The horizontal length of the sampling plane, being the same as that used for tallying small twigs, is specified on the Sampling Criteria/Design form.

Accuracy Standard: $\pm 30\%$

Twig 3 (1.0 - 2.99) 100-hour fuels (maximum of 3 numbers) Required

This is the number of branch intersections for each sampling plot. Large twigs 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. The length of the sampling plane for tallying branch intersections is specified on the Sampling Criteria/Design form.

Accuracy Standard: $\pm 20\%$

Piece Count (maximum of 3 numbers) Required

This is the number of large pieces (three inches or larger in diameter or as stated on the Sample Design form). Tally each decay class separately. If pieces are touching, it is considered one piece.

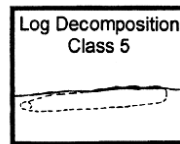
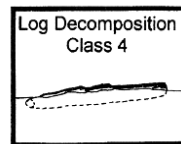
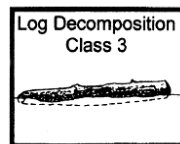
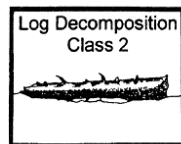
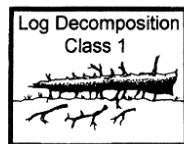
Accuracy Standard: No missed pieces.

Decay Class (exactly 1 number) Required

This is the decay class (1-5) for the pieces three inches in diameter and larger.

Log Decay Class

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

**Diameter (maximum of 3 numbers; may include one decimal) Required**

This is the diameter of each intersected piece three inches in diameter and larger.

Accuracy Standard: ± 1 inch

Diameter Large End (maximum of 3 numbers; may include one decimal) Optional

This is the large end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Diameter Small End (maximum of 3 numbers; may include one decimal) Optional

This is the small end diameter of the intersected piece.

Accuracy Standard: ± 1 inch

Piece Length (maximum of 3 numbers; may include one decimal) Optional

This is the piece length, in feet, of each piece three inches in diameter or larger. Record the diameter of each intersected piece three inches in diameter and larger. Piece length is useful data for wildlife specialists.

Accuracy Standard: $\pm 20\%$