U.S. DEPARTMENT OF THE INTERIOR
Bureau of Land Management

Oregon/Washington State Office
P.O. Box 2965
Portland, Oregon 97204

BLM EcoSurvey
Field User Guide

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Background and Acknowledgements

The BLM EcoSurvey software has been operational since 2004. Detailed office user guides accompanied the release of this software, but there was no corresponding guide for use in the field. This guide is intended for field use with a handheld data recorder and follows the format of the 1995 Forest Survey Handbook that was developed for the previous Attebury Stand Exam Program.

INTRODUCTION AND OVERVIEW

Scope and Purpose of Field Guide

The BLM Forest EcoSurvey is a complete software package that includes a field data collection side with handheld data recorders and a reports and analysis side with office computers.

The scope of this field guide is to provide specific guidance on data entry into the handheld data recorder. The function of every key, button and field available to the user is described. The guide is organized to match the structure of the software as revealed on the data entry screens. This structure is covered in the next section.

Although there is some reference material included in the Appendix that will be helpful, it is not intended to be a detailed guide on how to accomplish a stand exam. It assumes that you have developed a design and plan for accomplishing your stand exam prior to going to the field.

Software Overview

This section introduces the overall organization of the handheld program and describes how to navigate through the menu screens.

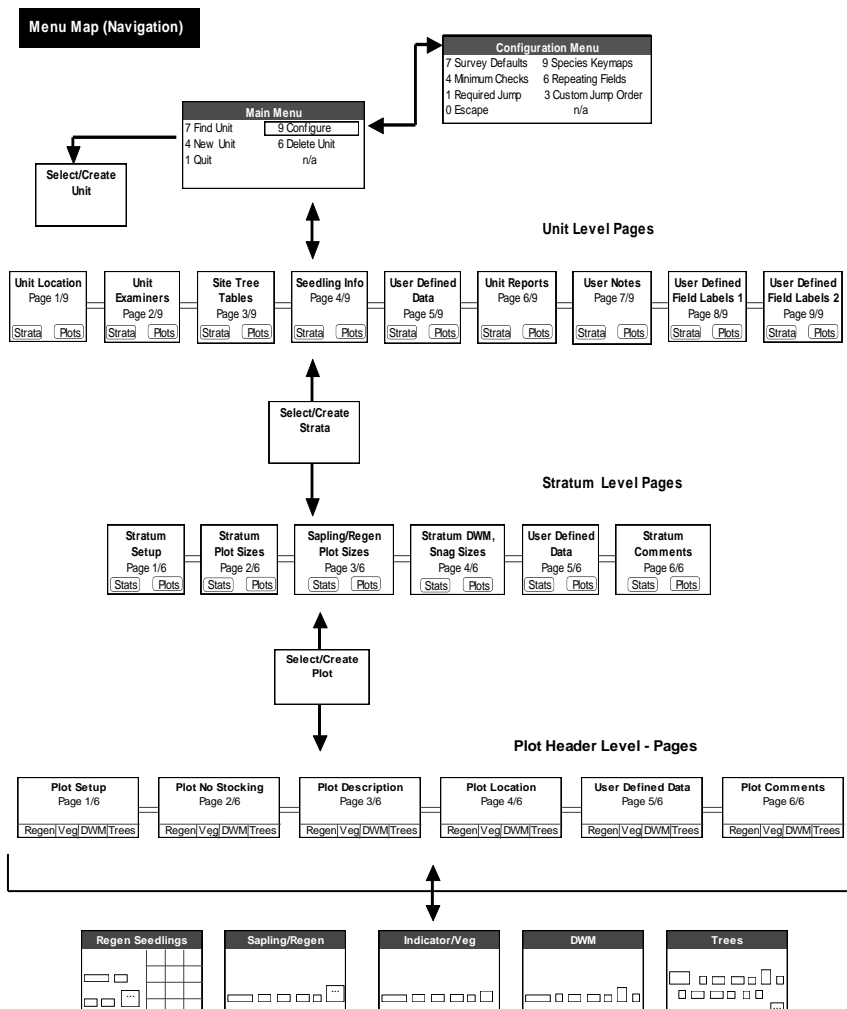Most menus in the handheld software are organized in a series of layers as shown in a diagram following this section. The layers are:
- Main Menu
- Configuration Menu
- Project
- Unit
- Strata
- Plot
- Piece (Seedlings, Saplings, Vegetation, DWM, and Trees)

Stand exams need both a project and unit assigned to keep the data organized. This guide will provide detailed instructions on completing and navigating through these layers.

Menu Map (Navigation)

Configuration Menu

7 Survey Defaults	9 Species Keymaps
4 Minimum Checks	6 Repeating Fields
1 Required Jump	3 Custom Jump Order
0 Escape	n/a

Main Menu

7 Find Unit	9 Configure
4 New Unit	6 Delete Unit
1 Quit	n/a

Select/Create Unit

Unit Level Pages

Unit Location Page 1/9	Unit Examiners Page 2/9	Site Tree Tables Page 3/9	Seedling Info Page 4/9	User Defined Data Page 5/9	Unit Reports Page 6/9	User Notes Page 7/9	User Defined Field Labels 1 Page 8/9	User Defined Field Labels 2 Page 9/9
Strata Plots	Strata Plots	Strata Plots	Strata Plots	Strata Plots	Strata Plots	Strata Plots	Strata Plots	Strata Plots

Select/Create Strata

Stratum Level Pages

Stratum Setup Page 1/6	Stratum Plot Sizes Page 2/6	Sapling/Regen Plot Sizes Page 3/6	Stratum DWM, Snag Sizes Page 4/6	User Defined Data Page 5/6	Stratum Comments Page 6/6
Stats Plots	Stats Plots	Stats Plots	Stats Plots	Stats Plots	Stats Plots

Select/Create Plot

Plot Header Level - Pages

Plot Setup Page 1/6	Plot No Stocking Page 2/6	Plot Description Page 3/6	Plot Location Page 4/6	User Defined Data Page 5/6	Plot Comments Page 6/6
Regen Veg DWM Trees	Regen Veg DWM Trees	Regen Veg DWM Trees	Regen Veg DWM Trees	Regen Veg DWM Trees	Regen Veg DWM Trees

Regen Seedlings	Sapling/Regen	Indicator/Veg	DWM	Trees

Navigation, Cursor Movement, and Use of Keys

Currently two handheld hardware platforms are supported – 1) the Juniper Systems Allegro and 2) the TDS Ranger. The keyboard functionality described below applies to the Allegro. The TDS Ranger keyboard operates differently and these differences will be pointed out later.

When a control is active it is said to have the "focus". When text boxes and pick lists have the "focus" the cursor is in them. A pop-up label may also appear . Command buttons have the focus when they are highlighted. When a button has the focus, you can select it by pressing the <Enter> key or <Spacebar> key.

Navigating through the screens and menu system can be done by one of two methods.
- The first method is to use a stylus to jump from field or menu option to another field or menu option. The screen is touch sensitive and beginning users will find touching the button or field they want to use easy. Use a stylus so that the screen does not get scratched.
- The second method is to use the keyboard which is much faster. Keystrokes are covered later.

As can be seen on the menu map, one type of navigation is moving between levels. Moving down levels is done by selecting labeled "buttons" appearing at the bottom of a page. Selecting these buttons moves to the lower level. Moving up levels is done by pressing the <Escape> key. Note that the Configuration Menu has an **[Escape]** button that also moves up a level.

The second type of navigation is moving sideways between pages on the same level of the menu map (Unit, Stratum, or Plot). <Blue>/<PgDn> moves forward, such as moving from page 1/7 to page 2/7. <PgDn> is the bottom of the round button on the Allegro, and<PgUp> is the top of the round button on the Allegro. <Blue>/<PgUp> moves backwards, such as from page 3/7 to page 2/7.

The most basic need is to input data. There are three methods of moving the cursor between fields and buttons. They are:
- Touch Screen, with a plastic or soft tipped stylus
- Tab key
- Enter Key (only on text boxes)

Right or left arrow on the round key on the Allegro moves the cursor one character at a time. However if the cursor is at the last character in a field, the cursor will move between fields.

Some fields are text boxes with pick lists. These can be identified by a downward pointing triangle. Items in the pick list can be selected with either a stylus or the keyboard. With the stylus, select the triangle, scroll up and down with the scroll

bar, and then make the appropriate choice. With the keyboard, activate the field with the <spacebar> key, and then use the up and down arrows to scroll through the lists.

When buttons have numbers, press the number instead of highlighting the button. Pressing the number is the same as highlighting the button and pressing <Spacebar>. When using the keyboard and a numbered button is highlighted, use arrows on the round key to move

.

between controls.

Buttons (box shaped controls) are activated by the <Spacebar> key while the <Enter> key only works on certain buttons.

Pressing the period key while in a text box sometimes brings up a help screen such as the species codes associated with a vegetation list. In the tree height field it brings up a tree height calculator

Summary of Keys		
Action	Allegro	Ranger
Move between pages on the same level [PGUP] and [PGDN] keys	[Blue] + [PGUP], [PGDN]	[ALT] + [PGUP], [PGDN]
Move down levels	Navigate to correct button using [Tab], then [Spacebar]	Navigate to correct button using [Tab], then [Spacebar]
Move up levels	[Esc]ape	[Esc]ape
Move between fields	[Tab] always works, [ENTER] usually works	[Tab] always works, [ENTER] usually works
Tree Height Calculator or Pick List, depending on field	[.] Period	[.] Period
Tools	[F3]	[*]
Selecting a button with a number on it	Number on button	Number on button

Validation Routines and Edit Checks

EcoSurvey has sophisticated error prevention methodology. Most of this depends on decisions made in the configuration and setup screens explained later in this guide Possible interactions with the error prevention methodology include:

- Confirmation of a valid code. Some fields having long validation lists will display an error symbol ???? if a code is invalid or misspelled.
- Errors displayed when exiting a plot. In these cases EcoSurvey will give you the option of accepting the error or going back to edit the data. Examples include:
  o A formula that determines if a height diameter ratio is reasonable.
  o Violation of certain "global" values, such as maximum values for merchantable trees, sub merchantable trees, and regeneration.
  o "Global" ranges, such as the range of acceptable values for down woody material.
  EcoSurvey compares each input value to these values to determine if the inputs are reasonable.
- Forced choice from a pick list. When a validation list is too long for a pick list, such as species, use a period key to pull up the lists and find the correct response.
- Controlled jump order. The cursor in EcoSurvey on the handheld only jumps into fields that are needed. The fields the cursor jumps to can be controlled by one of three methods:
  o Report driven jump order
  o Custom Jump Order
  o Tree rules
- Repeating fields feature. This feature allows certain fields to repeat the values from the previous entry.

Should you find that the error checking is not setup correctly, changing the configuration is explained later in the manual.

Date and Time

The date and time must be accurate in the handheld data collectors and the computer used for downloading. This information is used by EcoSurvey to merge data. For more information on setting the date and time on handhelds please refer to Appendix C (Hardware Operation).

Using Two Handhelds

When using two different data recorders on the same project, unit and stratum, both recorders must have different plot numbers. If not, the data will be viewed as duplicate data and oldest records will be eliminated. Start the plot numbering on one data recorder at 1 and on the other at a much higher number than the potential number

of plots. If the data has already
been collected with duplicate plot
numbers, refer to sections B-E of
"Copy and Combine" in the
EcoSurvey PC manual on how to fix
it.

MAIN MENU

The following screens are accessed from the main menu: All entries can be made either by tapping on the screen with a stylus or by using selected keyboard strokes.   See Software Operation for additional guidance.

1 – Quit

Allows you to exit the application.

3 – Delete Project

Select and highlight the project to be deleted from the list. Select the **[Delete]** button.

4 – New Unit

Select an existing Project from the drop down pick list.   If this is a new project, then type in a new Project Name (up to 20 alpha or numeric characters) in the Project Window. Type in a Unit designation (up to 10 alpha/numeric digits) in the Unit Window and then select the **[Create Unit]** button.

6 – Delete Unit

Select the project from the pick list and then highlight the unit to be deleted. Select the **[Select]** button.

7 – Find Unit

Select the project from the pick list and then highlight the unit wanted. Select the **[Select]** button.

9 - Configure

This button allows entry into the Configuration Menu explained in the next section.

Configuration Menu

Configuration settings allow faster data entry, create global edit checks and set data validation routines.

Configuration settings may be set directly on the handheld or may be set in the EcoSurvey PC program. It is highly recommended that users create their Configuration settings and Survey Defaults on the PC then transfer the settings to the handheld. This process insures that once your configuration settings are completed, the exact same settings may be transferred to other handhelds to maintain consistence in the data entry behavior. Configuration settings and Survey Defaults (Stratum Defaults) will be automatically copied into each new Unit and Stratum created on the handheld or PC.

See Forest Survey User Guides for

the handheld and PC for detailed instructions.

"Custom Report" from page 6/9 of the Unit Pages Level.

0 – Escape

Allows you to return to the previous menu

1 – Required Jump

Select the data entry levels where you want the cursor to follow the jump sequence determined by the selected reports from page 6/9 of the Unit Pages Level.

Checking or Unchecking the boxes affects validation when moving between levels (either going to a lower level or moving up a level). Checked boxes activate error checking and cursor jumping for fields that are missing required data. Conversely, unchecked boxes turn off edit checking and required cursor jump order. An unchecked box results in the cursor (focus) jumping through every field and virtual button in the level or data entry screen. Sometimes this is a desired jumping behavior, as might be the case in the ""Small Trees/Regen" data entry screen.

3 - Custom Jump Order

Selecting fields here will add to the jump order triggered by the selected reports from page 6/9 of the Unit Pages Level. To activate this feature you must also select

4 – Maximum Checks

Select the Maximum Range Checks for the fields displayed. The values entered will affect all new Units. Recording of data that exceed these values will trigger an error during the validation routines.

6 – Repeating Fields

Check the boxes for those fields you want to repeat to speed up data entry. When a new line of data is created, fields from the previous data line will be copied automatically to the new line of data.

7 – Survey Defaults

A complete survey design can be set here using all 6 pages of the stratum level. All new units will follow this default design. See Stratum Level Menu for details on how to complete the 6 pages.

9 – Species Keymaps

Numeric key pad assignments may be given to those species most frequently encountered for the following:

- Merchantable trees
- Down woody material
- Sub-merchantable trees (seedlings and saplings)

- Vegetation (indicator species)
  levels.

Check or uncheck the box to allow
the Species Keymap to appear
during data entry.

UNIT LEVEL

Access the Unit Level pages from the **Main Menu** via either the **[Find Unit]** or **[New Unit]** buttons.

Unit Pages Description

The Unit level consists of 9 pages. Move between the pages by using the [PgUp] [PgDn] key or by tapping on the [<] [>] buttons. Move between fields within a page by tapping on the screen with a stylus or by using the tab key. Use the space bar to activate a field and the arrow keys to navigate within a pick list. The [Esc] key will exit the unit.

1/9 Unit Location

[Project] and **[Unit ID]** should already be filled in.

[RMA] – Use the pick list to select the appropriate District/Master Unit/Resource Area code.

[Area] – Record total unit acres. Allows entries to the nearest 1/100 acre.

[MS] – Micro*Storm Unit. Record up to three numeric digits. This is the optional unit number from the Micro*Storms database.

[OI Key] – Record the five or 6 digit FOI Key Number from the FOI map layer. Only one OI Key is allowed per unit.

[Twp] – Record up to 4 alpha numeric digits for township. The first two digits are the whole township. The third digit is the directional quadrant; and the fourth digit is the fractional township. Use leading zeros for townships 1-9. Quadrant is either N for North or S for South. Fractional townships are entered as follows: ½ = 5; ¾ = 7. Examples: 29S or 05S5.

[Rge] - Record up to 4 alpha numeric digits for range. The first two digits are the whole range. The third digit is the directional quadrant; and the fourth digit is the fractional range. Use leading zeros for townships 1-9. Quadrant is either E for East or W for West. Fractional ranges are entered as follows: ½ = 5; ¾ = 7. Examples: 06E or 05E5

[Sec] – Record up to 2 numeric digits for section numbers (1-36).

2/9 Unit Examiners

[Examiner(s)] – Record up to four examiner names with up to eight alpha numeric characters each.

Note: Do not use commas in this field. Commas will cause the program to crash.

[Date(s)] – Dates can be entered by tapping with a stylus on the drop down calendar or by moving the cursor into the date field and using the arrow keys. The slashes (mm/dd/yy) are permanent. The left

and right arrows move between slashes and the up and down arrows will increment or decrement the numbers.

3/9 Site-Tree Tables

[Site Tree Table] – Select from the pick list the appropriate site tree table. See Appendix G for Site Tree Selection Rules.

[Site Potential Tree Height Table] – Select from the pick list the appropriate 100 year Site Table that will be used to calculate the Site Potential Tree Height.

4/9 Seedling Info

Seedlings by definition are trees less than 4 ½ feet high. They have no DBH. If you plan to collect seedling data and transfer this data to Micro*Storms, then this screen must be completed.

[Layer] – Record either 1 or 3. Layer one is always the top layer. In Micro*Storms there must always be a top layer. If there are no overstory trees then the seedling layer will always be layer one. Use layer 3 for seedlings only if there are overstory trees that will occupy layer one. Seedlings can never be in layer 2. This is reserved for trees in a layer between 1 and 3.

[Total Age] – Record up to 2 numeric digits the average seedling

age of the unit. This is usually based on reforestation records and can be an estimate.

5/9 User Defined Data

These can be labeled in the Configuration Menu – Survey Defaults section or on pages 8 and 9 of the Unit Menu. Unit level labels appear on page 5.

[User Defined Alpha] – For a previously defined Alpha Label, record up to 10 alpha/numeric characters.

Note: Do not use commas in this field. Commas will cause the program to crash.

[User Defined Numeric] - For a previously defined Numeric Label, record up to 4 numeric digits to the nearest 1/10.

6/9 Unit Reports

This page allows the user to set the prompts and edit checks that will insure collection of data needed to generate specific reports. The Reports checked in this section will drive both the cursor jump order and edit checks at all levels of the program. If followed correctly it will provide improved efficiency and quality in data collection.

The Reports list has seven sections:

Custom Required Fields
Trees
Dead Wood
Understory
Regen
Export/Models
Micro*Storms Exports

When a specific report is selected the required fields will be subject to the guided cursor jump order and end of plot edit checks. The fields attached to each report except the "Custom Required Fields" are determined in the Tree Rules Page in the Administrator's PC Program. The default values in the Administrator's Program are designed to provide data for every field in a specific report.

The fields associated with the "Custom Required Fields" report are set in the Configuration Menu – Custom Jump Order section.

Any fields checked in "Custom Required Fields" are in addition to fields dictated by other checked reports. If no other reports are selected then only those dictated by the "Custom Required Fields" will be required if that report is checked.

7/9 Unit Notes

Any comments pertaining to the unit should be entered. There is no limit, but the line does not wrap. Use the **[Enter]** key to wrap a line.

8/9 User Defined Field Labels 1

User Defined Fields allow recording of data not otherwise captured in a standard field. The user can label these fields so they will display on the screen where the data can be entered. The data collected will be displayed in the reports but will not be used in any standard calculations.

Create paired alpha and numeric labels (up to 10 characters each) for the following levels:
Unit
Stratum
Plot
Trees

9/9 User Defined Field Labels 2

Create paired alpha and numeric labels (up to 10 characters each) for the following levels:

- DWM
- Veg/Indicator
- Seedlings
- Saplings

If you created User-defined labels in the Configuration Menu – Survey Default section, those labels will appear on pages 8 and 9. You can overwrite these labels on these pages and the changes will appear in the lower levels of the survey.

STRATA LEVEL

The following page screens are accessed from the **[Strata]** button at the bottom of the Unit Pages

Select a Stratum

The stratum level is the lowest level for statistical reporting. This means every unit must have at least one stratum. Each stratum must have an area. Whenever a new unit is created, the Select a Stratum screen will display this as Stratum "A". This stratum will also contain settings based on the stratum defaults set in the Configuration Menu.

Note: If the same survey design will be used over multiple units it is more efficient to make the settings in the Configuration Menu.

Enter the Stratum Setup screens by selecting **[Edit]** button. If there is more than one stratum on the list highlight the one you want to edit and then select the **[Edit]** button.

If you want to configure a new stratum then select the **[New]** button.

Stratum Pages Description

The Stratum level consists of 6 pages. Move between the pages by using the **[PgUp] [PgDn]** key or by tapping on the **[<] [>]** buttons. Move between fields within a page by tapping on the screen with a stylus or by using the tab key. Use the space bar to activate a field and the arrow keys to navigate within a pick list. The **[Esc]** key will move you back to the Select a Stratum page.

1/6 Stratum Setup

[Strata ID] – The stratum code that was automatically created can be edited by using the space bar, back space, delete key and key pad.

[Area ac] – Record total stratum acres. Allows entries to the nearest 1/100 acre.

Sampling method

The stratum is the basis for all statistical reporting. Each stratum can have a different sampling method and intensity. This first screen is designed for measuring merchantable size trees. The radio buttons **[VP], [radius],** and **[acres]** trigger a fixed or variable plot sampling design.

VP Sampling Method

[VP] – Select this if you are using a variable plot. Once selected then you must choose a Prism size and VP Sampling Method.

[Prism] - This label appears when **[VP]** is activated. It either wants the BAF to be used for VP1 and Ratio sampling methods, or the primary BAF used for the VP2 method. Entries can be made to 3 decimal places. The BAF is identical for every plot within a Stratum. Select a BAF that will result in an average of 4 to 8 trees per plot for the entire stand.

The choices in the pick list of the VP Sampling Method are now Ratio, VP2, or VP1.

[Ratio] – This allows you to select in the windows to the right a percentage of count trees to measure for either Age or Ht.
- **[Age Ratio]** - Record a whole number for the percentage of count trees desired to be measured for Age.
- **[Ht. Ratio]** – Record a whole number for the percentage of count trees desired to be measured for height.

[VP2] – This allows you to select in the window to the right a different BAF for selecting measure trees.
- **[Measure Prism] –** Record the BAF size to be used for selecting trees for additional measurement. This is usually larger than the BAF used for VP1. Entries can be made to 3 decimal places.

[VP1] – This is the default and is the traditional method of using one BAF and either counting or measuring all trees on the plot.

Fixed Plot Sampling Method

From the radio buttons select either **[radius]** or **[area]** if you want a fixed plot sampling method.

[radius] – Select this if you are using a fixed radius plot for measuring merchantable size trees.
- **[feet]** – This label appears and wants a recording of the plot radius in feet. Entries can be recorded to 3 decimal places.

[area] – Select this if you are using a fixed plot for measuring merchantable size trees and the size is determined by acres.
- **[Acres]** – This label appears and wants a recording of the plot size in acres. Entries can be recorded to 3 decimal places. This feature could be useful if you were doing a 100% cruise. The entire stratum then becomes the plot size.

2/6 Stratum Plot Sizes

[Vegetation Plot] – Record the size of the plot that will be used for collecting and recording understory non tree vegetation. Select either radius in feet or size in acres. Entries can be made to 3 decimal places.

[Seedling\Regen Plot] – Record the size of the plot that will be used for collecting and recording seedlings. Remember seedlings are by definition less than 4 ½ feet

high and have no DBH. Select either radius in feet or size in acres. Entries can be made to 3 decimal places.

[Min.Merch DBH(in.)] – Record the minimum merchantable DBH (nearest 1/10 inch) to be used in the survey. Trees less than this number are considered saplings and are recorded on a sapling plot.

[Default DWM Transect Len.] – Record the default transect length (nearest whole foot) to be used on each plot. This length can be overridden in the plot setup screen for individual plots.

3/6 Sapling/Regen Plot Setup

[Plot Size] – Three plot sizes are available for utilizing a nested plot design for saplings. If only one sapling plot is used, then enter the plot size in the first field. If you plan to use a nested plot design with saplings split into different DBH sizes, then define the maximum dbh for each size class. The plot sizes should be entered from the smallest dbh to the largest. When following the plot design used by ORGANON, the saplings will be split using these criteria during the export to ORGANON file creation. Record either plot radius in feet (nearest 1/10), or plot size in acres (nearest 1/10).

[Max Dbh] – Record the maximum dbh for the nested plot design (nearest 1/10 in). If only one plot

size is utilized, setting the maximum dbh is optional since the Min. Merch Dbh set on page 2/6 defines the maximum.

4/6 Stratum DWM, Snags Sizes

[Min. DWM Intersect] – Record to the nearest whole inch, the desired minimum diameter at point of intersection, of down woody material to be sampled.

[Min DWM Length] – Record to the nearest whole foot, the desired minimum length of down woody material to be sampled.

[Min. Snag DBH] – Record to the nearest whole inch, the desired minimum DBH of snags to be sampled.

[Min. Snag Length/Ht.] – Record to the nearest whole foot, the desired minimum height of snags to be sampled.

5/6 User Defined Data

These can be labeled in the Configuration Menu – Survey Defaults section or on pages 8 and 9 of the Unit Menu. Strata level labels appear on page 5.

[User Defined Alpha] – For a previously defined Alpha Label, record up to 10 alpha/numeric characters.

Note: Do not use commas in this field. Commas will cause the program to crash.

[User Defined Numeric] - For a previously defined Numeric Label, record up to 4 numeric digits to the nearest 1/10.

6/6 Stratum Comments

Any comments pertaining to the stratum should be entered. There is no limit, but the line does not wrap. Use the [Enter] key to wrap a line.

STATISTICS

Statistics can be obtained for each stratum providing you have at least two plots. This can help you decide whether you need to take additional plots. You must be in one of the stratum pages to obtain statistics.

[Statistics] – Select this button at the bottom of a stratum page. It will display basic statistical parameters for BA/ac; TPA; VBAR; CF Vol/ac; and Regen TPA.

Note: Volumes are gross values

PLOT LEVEL

The following pages are accessed from the [Plots] button at the bottom of the Strata Pages or Unit Pages.

Select a Plot

Enter the Select a Plot Screen by selecting the **[Plots]** button at the bottom of the Strata or Unit Pages.

Every stratum must have at least one plot. Whenever a stratum is created, the Select a Plot screen will display this as Plot "001". This number can be changed by the user. (See Plot Setup section below). The plot will also contain some settings based on the stratum defaults set in the Configuration Menu.

Enter the Plot Setup screens (plot headers) by selecting **[Edit]** button. The first plot created by the program for a new stratum must be edited before data entries can be made. If there is more than one plot on the list, highlight the one you want to edit and then select the **[Edit]** button.

If you want to add a new plot, then select the **[New]** button.

1/6 Plot Setup

[Plot #] – This number is automated and must not be duplicated within a stratum. If the

plot is new, the next sequential number is created from the plot list. The plot number can be changed or overwritten by the user. This will be necessary whenever two or more crews are working on the same unit.

[Stratum] – This is defaulted from the previous screen. The plot can be reassigned to a different stratum by the pick list.

[Shape] – The user can select Full, ½ or ¼. Use the ½ plot on the edge of unit and the ¼ plot in the corner of a unit. It is desirable to sample stands near the edges because they constitute a large part of the stand and will usually have more variation. The ½ plot feature can also be used on steep slopes to facilitate measurement.

Note: ½ and ¼ plots only apply to merchantable size trees on either variable or fixed plot. Understory regeneration (seedlings and saplings) and vegetation must have full fixed plots.

[Non Forest] – Applies to Regeneration Surveys only. Checking this box means the plot will not be used in calculating percent stocking or trees per acre. The user should consult the Regeneration Stocking Survey Manual for further guidance. This box has no effect on other surveys.

[Plot Type] – If your sample type is VP1, then select Measure or Count. Ignore this field for all other plot types as it will be locked in as

Measure. On fixed plots, all trees have full measurements. On Ratio and VP2 plots, there is a mixture of measure trees and count trees.

[DWM Transect Azimuth] – The azimuth is filled in by a random number generator. If for some reason you cannot follow this azimuth, then you can overwrite and record the azimuth that you followed. Be sure to document in the comments page the reason for this change.

[DWM Transect Tot Length] – This is the default value set in the Stratum Plot Size page. The user can overwrite this number if the length needs to be changed. An example would be a transect that has to stop at an impassable geographic feature such as a water body or cliff. Be sure to document the reason in the comments page.

2/6 Plot No Stocking

Note: It is important to check the following boxes if applicable. Failure to check these boxes when there are empty plots will indicate to the program that this plot was not installed and it will not be used in the calculations of density.

[Non Forest Plot] – This is linked to the **[Non Forest]** box on the previous page and if checked there it will also show up here. Checking the box on this page will also display on page 1.

[Trees Not Stocked] – Check this

box if the plot was installed and there are no merchantable trees on the plot.

[SubMerch / Regen Not Stocked] – Check this box if the plot was installed and there are no sub-merchantable trees on the plot.

[No Vegetation Present] – Check this box if the vegetation plot was installed and there was nothing present to record.

[No DWM Present] – Check this box if the down woody material transect was installed and there was nothing to record.

3/6 Plot Description

[Aspect] – Record the azimuth of the plot aspect to the nearest whole degree.

[Quadrant Aspect…] – This button accesses a tool that converts compass bearings to azimuth. Completing the boxes in this tool and selecting **[Done]** automatically converts the bearing into azimuth and writes it into the proper field.

[Slope %] – Record the slope of the plot to the nearest whole percent.

[Topog.] – Select from the pick list the appropriate topographic position. The descriptions of the codes are displayed as a long prompt as you move through the list. The following table describes this in more detail:

TOPOGRAPHIC CLASSIFICATION

Topography indicates the relationship of the plot location to adjacent **major** landforms. It is recommended that a 1/5th acre plot (52.7 ft. radius) be used to determine the topographic position. Record a topographic position code that typifies the physical geography of the plot survey area including the trees tallied via variable plot.

If a plot straddles a canyon bottom or narrow ridge top, but most of the area lies on one sidehill, code the topographic position of the sidehill.

CODE	TOPOGRAPHIC POSITION	SHAPE OF SLOPE
1	Ridgetop or mountain peak over 120 feet wide	Flat or rounded
2	Narrow ridgetop or peak less than 120 feet wide	Convex
3	Sidehill – Upper 1/3	Convex
4	Sidehill – Middle 1/3	No rounding
5	Sidehill – Lower 1/3	Concave
6	Canyon bottom less than 660 feet wide	Concave
7	Bench, terrace or dry flat	Flat
8	Broad alluvial flat greater than 660 feet wide	Flat
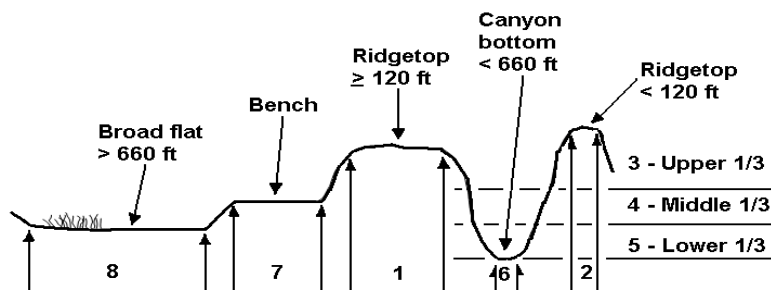
3/6 Plot Description, cont.

[Story % Canopy Cover] –
Definition: The proportion of
ground area directly covered by the
vertical projection of the tree crown
as a cylinder. (Aerial view).

The Micro*Storms database allows
the division of the trees (both
merchantable size and saplings and
seedlings) into three canopy layers.
Canopy Layer is a height grouping
classification assigned to trees
within a survey unit. One third
height difference between layers
determines when separate layers
are described. The data fields in
EcoSurvey are **[Over], [Middle]**
and **[Lower]**. The delineation of
the stand into these distinct canopy
layers is recorded at the plot level
but the determination of how many
layers to record is done at the stand
level. Canopy layer assessment
should be conducted during the
survey unit preview when
determining the appropriate BAF for
the survey unit.

Canopy Layers must always have a
top layer **(1)**. If two layers are
present then there must always be
a top **(1)** and bottom layer **(3)**. If
three layers are present then there
would be a top **(1)**, middle **(2)** and
bottom layer **(3)**.

The top and middle layers should
each comprise 10% or more of the
total canopy cover to qualify as a
layer. The bottom layer should
comprise 1% or more of the total
canopy cover to qualify as a layer.

See Appendix F, Canopy Layers,
for more details.

Once a determination of canopy
layers has been made for the stand,
then complete the following fields at
each plot:

[Over] – Record from plot center
the percent canopy cover to the
nearest whole percent of the top
layer of the stand.

[Middle] – Record from plot center
the percent canopy cover to the
nearest whole percent of the middle
layer of the stand.

[Lower] - Record from plot center
the percent canopy cover to the
nearest whole percent of the bottom
layer of the stand.

**[Total %Cover Resolved for
Overlap]** – Record the percent
canopy cover of merchantable trees
and saplings (regardless of layer) at
plot center to the nearest whole
percent. Include both hardwoods
and conifers in all layers and
resolve for any overlap so that the
total cannot exceed 100%.

*Note: When determining % canopy
cover, the recommended procedure
is to project a 1/5 acre circle (52.7 ft
radius) as a cylinder from plot
center and estimate the crown
cover of the different layers within
the cylinder.*

4/6 Plot Location

This screen is designed for entering spatial coordinates from GPS units or from a map. Future modifications of the software may allow direct entry to the handheld from a GPS unit.

[Datum] – Record up to 5 alpha/numeric characters that describe the Model of the Earth used in GIS applications. For our Region this will be North American Datum 1983 (NAD83).

[Zone] – Record the Universal Transverse Mercator (UTM) zone that applies to your geographic location.

[UTM North] – Record the UTM Northing from the map or GPS unit.

[UTM East] – Record the UTM Easting from the map or GPS unit.

[Elev.] – Record the plot elevation to the nearest foot.

[Latitude] – Record the plot latitude from the map or GPS unit in degrees (0-179), minutes (0-59), and seconds (0.0 to 59.99).

[Longitude] – Record the plot longitude from the map or GPS unit in degrees (0-179), minutes (0-59), and seconds (0.0 to 59.99).

5/6 User Defined Data

These can be labeled in the

Configuration Menu – Survey Defaults section or on pages 8 and 9 of the Unit Menu. Plot level labels appear on page 5.

[User Defined Alpha] – For a previously defined Alpha Label, record up to 10 alpha/numeric characters.

Note: Do not use commas in this field. Commas will cause the program to crash.

[User Defined Numeric] - For a previously defined Numeric Label, record up to 4 numeric digits to the nearest 1/10.

6/6 Plot Comments

Any comments pertaining to the plot should be entered. There is no limit, but the line does not wrap. The user needs to use the **[Enter]** key to wrap a line.

Tools Key [F3]

The Configuration Menu can be accessed directly via the **[F3]** key on any of the Plot Header Pages. This is especially helpful to allow turning on or off the quick key map graphic that appears on the piece level screens.

On the TDS Ranger the Configuration Menu is accessed via the **[*]** key.

TREES

Before starting the field data collection, it is highly recommended that the user visit the Configuration Menu, the Unit Reports (page 6/9) and the Stratum level pages of the Handheld to confirm the configuration that was previously set up in the office.

The purpose of completing the configuration is to allow the user to utilize the power of the software to simplify data collection and to insure that the needed data is collected. Key points to consider are:
- Setting the species key map and repeating fields will speed data entry.
- Setting the maximum checks and selecting the desired reports will allow the end of plot edit checks.
- Selecting the desired reports will establish the jump order of the cursor.

The tree screen is accessed from the **[Tree]** button at the bottom of the Plot Header Pages.

The tree data entry screen consists of one screen and two extra windows accessible via buttons on the main screen. The two windows are: Extra Data and Tree Flags. The screen and windows are used to record all tree data and measurements and to access tools that will help in those measurements

Cursor Movement on the Tree Screen

Keyboard. The Cursor/focus moves in a circle via **[TAB]** and **[ENTER]** keys and passes through all buttons and "required fields". A required field is denoted by a dark highlight surrounding the field. Utilizing the keyboard entry allows the user to take advantage of the cursor jump order as specified by the required fields. The required fields are determined by:
- User selected Reports and Export Models – as checked in the Unit Reports (page 6/9) of the Handheld Unit Menu.
- User denoted Site Tree ("S") Flag – declaring tree as a site tree.
- User denoted Age Tree ("A") Flag.
- User denoted Height Tree ("H") Flag.

Note: *The user can override the validation cursor control and have the cursor pass through every field by turning off the control in Main Menu – Configuration – Required Jump – Trees.*

Touch Screen. The user can access any field by touching the screen with a stylus.

Tree Data Entry

[Tree #] – This number is automated and will be sequential. The first tree on each plot is number 001. The top line on the

tree screen, the label line, includes the total number of trees and the tree number currently being edited. As you scroll up or down with the arrow keys, the tree or record count reflects your position among all the trees listed in the plot. Scrolling down past the last tree will automatically create a new tree record.

Tree Flags

To access the Tree Flags Window, use the tab key or touch screen to move cursor onto the **[Tree #]** and either press the space bar or tap the "button" field on the screen.

Tree flags are used for handheld statistical calculations, determining the cursor jump order and validation of tree data. It is important to understand their function before proceeding with tree data entry. The codes all appear in the Tree Flag Code Window, which is accessible via the Tree Flag Button (tree number button).

The sampling method determines how the tree flags are assigned:
- VP Ratio sampling   The Height ("H") and Age ("A") Tree Flags are assigned by the computer, which can be overridden (rejected) by the user.
- VP1 sampling and Fixed Plot. The computer assigns an "H" to every tree - the user assigns the "A" flag manually.
- VP2 sampling (Big BAF). The user has to assign both "H" and

"A" flags manually.

Some flags may not be accessible depending on the sampling method and the data on the tree. After the tree flags are applied, the tree flags appear next to the tree number for easy reference.

Basic Tree Flags:

The Basic Tree Flags that drive cursor movement and validation are:

H – "Height" - Requires dbh, ht (a VBAR tree), and the required fields designated by the Reports selected in the Unit Pages section.
A – "Breast Ht. Age" - Requires breast ht. age and radial growth (if required by export model).
S – "Site Tree" – Requires dbh, ht., and breast height age.

Note: Unless the tree has one of the above designations, there will be no end of plot validation checks and the cursor will not jump into the specific fields that are required by the selected Reports and Export Growth Models. Trees without an "S", "H", or "A" flag become count trees. The cursor jump order and validation on Count trees is limited to species, Cut/Leave, Standing/Fallen, Dead/Live, DBH and Canopy layer.

Table Driven cursor jump and validation rules

The fields that are required for "S",

"H", and "A" flags and count trees
are determined by the tree rules
table that lists required fields for
each Report and Export Model by
flag assignments. The table can be
amended or changed by an office
district data administrator and the
resulting validation rules
downloaded to the handhelds. A
custom jump order by tree flag or
tree type (tree, sapling, regen) can
also be set.

Note: *Any Tree Rules changes*
must be completed using the
EcoSurvey Administrators program.

The following are the definitions/comments about all the flags found in the tree flag window.

Flag	Quick Key	Description
S = Site	7	Assigned manually
o or **old** =Young/Old	8	Assigned manually. If old an "o" appears next to the species code in previous trees. On the button an "old' is displayed
IN or **OUT** In/Out	9	Assigned manually for site trees off the plot. Out trees are not included in calculations. A Site Tree can be Out and will be used for Growth Models, but not in volume calculations.
I Interest	0	Assigned manually. Similar to a user-defined field. Used to flag a tree of interest to the user. There are no special calculations for these trees, but they will be displayed in the Complete Tree List Report.
Not VBAR	. (period)	Assigned manually. Used in cases where trees with a dbh and ht should not be used in volume or statistical calculations.
A Age (Breast Ht. Age)	4	See " Basic Tree **Flags**", in previous section.
rA BH Age Reject	5	Used in Ratio Sampling and is assigned manually. The computer selects the "A" tree. If this tree is not suitable the tree must be rejected.
fA BH Age Force	6	Used in Ratio sampling and is assigned manually. The computer selects the "A" tree. Use this flag for additional "A" trees.
H Height	1	See " Basic Tree **Flags**", in previous section.
rH Height Reject	2	Used in Ratio Sampling and is assigned manually. The computer selects the "H" tree. If this tree is not suitable the tree must be rejected
fH Height Force	3	Used in Ratio sampling and is assigned manually. The computer selects the "H" tree. Use this flag for additional "H" trees.

Sample Types, Methods and Tree Flags

Following is a description of sample types with comments on data entry procedures.

Sample Method	Comments about Flags
Fixed Plot Or 100%	**Every plot is a Measure Plot** • Computer assigns an "H" Flag to every tree (every tree is a VBAR tree). When **[↓]** is pressed an "H" appears. • Assign "A" trees manually. "A" trees mean that Breast Ht. Age is required and radial growth is required if an Export Model requires it.
VP (1 prism or VP1)	**Measure Plot** • Computer assigns an "H" flag to every tree. When **[↓]** is pressed an "H" appears. • Assign "A" trees manually. **Count Plot** • No "H" or "A" assignments • Tree count can be by species only or species with Cut or Leave, Standing/Fallen, Dead/Live • Press **[↓]** to make a count
Big BAF (2 prism or VP2)	**Mixed Plot - all plots have count and Measure trees** • User assigns both "H" and "A" flags manually. • Trees without an "H" or "A" are considered a count tree and are used accordingly for statistical reporting.
Ratio Cruise	**Mixed Plot - all plots have count and Measure trees** • Computer assigns "A" and "H" flags automatically. User can override (reject) using flags if trees don't qualify. User can force trees into "A" and "H" trees. • Trees having no "A" or "H" are considered count trees for statistical reporting *(unless there is "good" data on the count tree – such would be the case if the count tree has dbh and height data).*

Special note when using the Ratio method:

The computer selects the "H" and "A" trees "blindly". The computer doesn't know that a tree is dead, down, leaning, small or large. When the selection is made the H and/or A flag appears on the screen. This selection may not be a desirable or applicable selection. If the computer selected tree for age is dead, or the selected tree for height is down, then the tree must be rejected in the Tree Flag screen by checking the box **[A.Reject 5]** or **[Ht.Reject 2]**. This will free the toggles for dead and down and the rest of the appropriate tree entries can be made.

Tree Data Entry Continued

[Species] – species can be recorded in three ways:

1. If the Species Key Maps have been configured, enter the appropriate number. Escaping back to the plot level and using function key [F3] allows access to the Species Key Maps. A box can be checked to show the key map during data entry.

2. If the species code is not known, all of the codes can be accessed by pressing the [.] key. Scrolling through this list and selecting the appropriate code with the [Enter] key will automatically place this code in the correct field.

3. Enter the appropriate species codes or BLM alias code. Note: The shortened BLM alias codes are assigned at the District level and are recorded in the BLM Veg. Codes tab of the Administrators Program.

Note: As the code is being typed the long prompt will display the tree name. If a code is mistyped or not on the list the long prompt will display - ???.

[Cut/Leave] – This is a toggle switch that can be changed from Cut ("C") to Leave ("L") by tapping on the screen or using the space bar. Whether a tree should be a cut or leave is a judgment call of the examiner and will depend on the directions given for the exam. The first tree line will have the Cut/Leave as a "?". The field can be ignored if a Cut/Leave Report was not requested in the Unit Reports (page 6/9) of the Handheld Unit Menu.

[Standing/Fallen] - Use the toggle switch to change the field to the position of the tree - Standing ("S") or Fallen ("F"). A fallen tree is a tree no longer supported by the strength of its own roots and leaning at an angle of 45 degrees or more from vertical. Whether a fallen tree is "in" or "out" of the plot is determined by where the butt of the tree lays. The original position of the tree is disregarded. For a variable plot, the limiting distance is to the point of DBH from plot center.

[Dead/Live] – Use the toggle switch to change the field to the proper description – Dead ("D") or Live ("L").

[DBH] – Record the diameter at breast height to the nearest 1/10 inch.

[Ht.] – Record the total height of the tree to the nearest foot. If you want an accurate volume estimate of broken top trees, then reconstruct the tree and estimate the original ht. See the More Screen below for entering height to a broken top.

Special Tree Data Entry using the Tree Height Calculator:

The tree height calculator can be accessed when the cursor is in the Height field by pressing the [.] key. This tool will calculate both the tree height and crown ratio based on distance and angles. The calculated height and crown ratio can be automatically entered into the appropriate fields. The following fields are completed in the tree height calculator:

[Slope%] – Record the percent slope (to the nearest whole percent) from your standing position to the tree's DBH. Note: Downhill slopes must be recorded as a minus slope (-10%) to calculate correctly.

[Dist.] – Record the distance (to the nearest 1/10 foot) from the tree to your standing position.

[Ht. DBH] – Record the height (to

the nearest 1/10 foot) to the spot on the tree where the distance is measured from (usually DBH).

[Cwn %] – Record the percent slope (to the nearest whole percent) to the bottom of the live crown.

[Top %] – Record the percent slope (to the nearest whole percent) to the total top of the tree.

As the cursor moves through the fields the tree height is calculated and appears in the upper right. To automatically place the height and crown ratio values into the tree screen click **[Ok]**. To ignore the values and not update the tree fields press the **[Esc]** key.

Tree Data Entry Continued

[G-5yr] and [10-yr] – Measure radial growth in 20th's of an inch from an increment core bored at DBH on the uphill side of the tree and at right angle to the core. Record the distance in whole numbers of 20th's (example: record a distance of $18/20^{th}$'s as 18 or a distance of 1.5 inches as 30). See Appendix "E" Age and Growth for more details.

[B.Age] – Measure breast height age from an increment core bored at DBH and at a right angle to the bole. Bore the tree such that the increment passes through and beyond the center of the tree. Beginning inside the phloem and the outer edge of the first dark ring

(end of last years fall wood), count the number of dark rings from the outer end of the wood core to the center of the tree and record the total breast height age.

See Appendix "E" (Age and Growth) for details on how to determine the age of a tree when the tree is too large to reach the center with an increment borer.

[%Ded] – Record the percent volume loss (to the nearest whole percent) of the tree due to defect. Defect is recorded on trees measured for height.

[DC] – Record the decay class (1-5) for dead trees either standing or fallen. Once a number is entered a short description of the decay class will be displayed if the cursor is placed at the beginning of the number. See Appendix "H" (Snag Decay Classes) for more details

[Dmg] – Record the damage code as one or two digits on trees measured for height. Typing in a code will display a long prompt of the code description. If no damage is present enter "0" (No Damage). If the damage code is not known, all of the codes can be accessed by pressing the **[.]** key. Scrolling through this list and selecting the appropriate code with the **[Enter]** key will automatically place this code in the correct field. See Appendix "J" (Damage Type and Severity Codes) for more details

[Sev] – Record the severity code as one digit. Each damage code has

unique severity codes that are linked. When the cursor is in this field a long prompt will display the associated severity codes with a brief description. See Appendix "J" (Damage Type and Severity Codes) for more details.

[CL] – Record the appropriate canopy layer (1, 2 or 3) for the tree being measured.

Canopy Layers for individual trees need to match the plot level determination on page 3 of the plot header for **[Story % Canopy Cover].**

Layer 1 – Topmost layer of defined crown class trees in a stand or survey unit comprising 10 % or more of the total crown closure of the stand or survey unit. Every unit must have a top layer.

Layer 2 – A layer of defined crown class trees that are on the average less than 2/3 the average height of the topmost layer (Layer 1) and comprise greater than 10% of the total crown closure. Trees would only be assigned to Layer 2 when three layers are present. If only two layers are present then trees in this layer would be assigned as the bottom Layer 3.

Layer 3 – In a two or three layered stand, a layer of defined crown class trees that comprise greater that 1% of the total crown closure that are on the average less than 1/3 the height of the next higher layer (Layer 1 or 2).

See Appendix "F" (Canopy Layers) for more details.

[CW] – Record the crown width to the nearest foot. This is the diameter of the crown as projected horizontal to the ground. The number recorded should be an average of two measurements at right angles to each other.

[CR] - Record actual percent crown ratio to the nearest whole percent. Crown ratio is that portion of the bole that supports live foliage that is effectively contributing to tree growth. It is expressed as a percentage of total tree height. For trees of uneven crown ratio length, visually transfer lower branches on the longer side to fill in the upper portion until a full even crown is generated.

[CC] – Record a 1-digit code for Crown Class on live trees. The Crown Class Codes are as follows:

1- <u>Open Grown</u> - Trees with crowns which have received light from above and all sides throughout most of their life, particularly during the early development period, and which have not been and are not likely to be influenced as to form or crown shape by other trees.

2 - <u>Dominant</u> – Trees with crowns extending above the general level of the main canopy of even-aged stands or, in uneven-aged stands, above the crowns of the tree's neighbors and receiving full light from above and partial light from the sides.

3 - <u>Codominant</u> – Trees with crowns forming the general level of the main canopy in even-aged stands or, in uneven-aged stands, the main canopy of the tree's immediate neighbors, receiving full light from above and comparatively little from the sides.

4 - <u>Intermediate</u> – Trees with crowns extending into the lower portion of the main canopy of even-aged stands or, in uneven-aged stands, into the lower portion of the canopy formed by the tree's immediate neighbors, but shorter in height than the codominants and receiving little direct light from above and none from the sides.

5 – <u>Overtopped</u> (suppressed) – Trees with crowns completely overtopped by the crowns of one or more neighboring trees and entirely below the general level of the canopy. Trees receive no direct light from either above or from the sides.

6 - <u>Pre-Dominant</u> (emergent) – Trees with crowns completely above the general level of the main canopy, receiving full light from above and from all sides. These are generally overstory trees remaining from an earlier stand.

In multiple-aged stands or even-aged stands with understory trees of younger age classes, direct application of the above definitions is often difficult. The classification into intermediate and overtopped crown classes is intended to include primarily trees seriously affected by

direct competition with adjacent trees.

As a general rule, in two-story or multistory stands, crown class for each tree must be judged in the context of its immediate environment, that is, in terms of crown competition. For example, a dominant tree is a tree which generally stands head and shoulders above all other trees in the vicinity. However, there may be a young vigorous tree nearby but not overtopped by a large dominant tree. The smaller tree may be considerably shorter than the dominant but still receiving full light from above and partly from the side. In its own immediate environment, it is dominant and should be recorded as such. The same principles apply to two-storied stands. Only understory trees immediately adjacent to the overstory tree shall be assigned subordinate crown classes. In cases where the overstory consists of scattered veterans standing above larger numbers of younger trees, a considerable portion of the understory trees shall be classified as dominant or codominant. Crown class, as used here, is essentially a classification of competition for light and is aimed at separating trees that are in a position to grow freely from those that are not.

More Screens

Access the more button by moving the cursor to the […] button and pressing the space bar or tapping on the screen. This screen allows entry of extra data for each tree line.

[Form Factor] – Record a two digit whole number expressed in a percent if form factor is measured. This measurement is optional and used when Behres volume equation is selected. See Appendix "K" (Use of the Speigel-Relaskop) for more details.

[Double Bark Thickness 10th in.] — Record the measured bark thickness (to 1/10 inch) times two. This measurement is optional and used when the Flewelling/Ingy volume equation is selected.

[Ht. To Broken Top (ft)] – Record the height to the top of the break to the nearest foot. Use this field if you have entered a reconstructed total height of a broken top tree on the previous screen. If accurate snag heights are desired for the Snag Report, it is critical that this field be completed. The Tree Height Calculator can also be accessed by pressing the **[.]** key.

User Alpha] – If you created user defined labels in the Configuration Menu – Survey Default section or in the Unit pages section, then record up to 10 alpha/numeric characters.

Note: Do not use commas in this field. Commas will cause the program to crash.

[User Numeric] - If you created user defined labels in the

Configuration Menu – Survey Default section or in the Unit pages section, then record up to 4 numeric only digits to the nearest 1/10.

There are numerous tools available from the main entry screen of the Trees Menu. Access the Tools Menu with the function key **[F3]** or the **[*]** key.

[7 Delete] – The tree being deleted must be the tree being edited. The entire tree line will be deleted. Confirm Yes or No before deleting.

[4 Insert] – The tree to be inserted will create a new line above the tree currently in the edit line. It will be numbered with the next sequential number from the total list of trees, not the next number following where it is inserted. Confirm Yes or No before inserting.

[1 Renumber] – The tree to be renumbered must be the tree being edited. Enter the new number in the space provided. Confirm by moving to the renumber button and pressing on the space bar or tapping on the screen. The display of tree lines on the screen will not be reordered by their numbers, but will stay in the sequence that trees are entered.

[9 In/Out Tree] – This tool can be used for (1) determining whether a borderline tree is "IN" or "OUT", and (2) converting slope distance to horizontal distance.

Borderline Tree.

The borderline tree calculator uses the BAF and the tree DBH to calculate the critical distance to either the face or center of the tree. If the tree is farther than the critical distance it is considered an "OUT" tree. The BAF and DBH are pre-filled from the tree line from the tree screen. The BAF and DBH can be edited by the user. **The critical distance is always to the center of the tree.** The user can select with the radio button whether to measure to the face or to the center. If the slope distance and % slope to the face of the tree are entered, the calculation will automatically correct for slope and to the center of the tree. Press the **[Calc I/O]** button once values are entered. The display will show horizontal distance, critical distance and either "IN" or "OUT".

The calculation is not stored, nor is any tree automatically toggled to "OUT" or "IN". This is strictly a calculator.

Horizontal Distance.

This tool can also be used to calculate a horizontal distance from slope distance and percent slope. Ignore the BAF. Enter the slope distance and percent slope in the space provided. Press the **[Calc [I/O]** button. The horizontal distance will appear in the lower left corner of the display.

[6 User Data] – If you created user defined labels in the Configuration Menu – Survey Default section or in the Unit pages section, then record up to 10 alpha/numeric characters and up to 4 numeric only digits to the nearest 1/10 in the appropriate windows. These are the same fields accessed with the more **[…]** button. The alpha field is on the left and the numeric field is on the right.

Note: Do not use commas in this alpha/numeric field. Commas will cause the program to crash.

[3 Plot Notes] – Any notes pertaining to the plot should be entered. There is no limit, but the line does not wrap. Use the **[Enter]** key to wrap a line. This is the same screen accessed from page 6 of the Plot Header pages.

DOWN WOODY MATERIAL

For detailed Down Woody Material tally instructions, see Appendix "I" (Down Woody Material).

Before starting the field data collection, it is highly recommended that the user visit the Configuration Menu, the Unit Reports (page 6/9) and the Stratum level pages of the Handheld to confirm the configuration that was previously set up in the office.

The purpose of completing the configuration is to allow the user to utilize the power of the software to simplify data collection and to insure that the needed data is collected. Key points to consider are:

- Setting the species key map and repeating fields will speed data entry.
- Setting the maximum checks and selecting the desired reports will allow the end of plot edit checks.
- Selecting the desired reports will establish the jump order of the cursor.

DWM default values should be set for the following:

- Species Key Map
- Repeating Fields
- Required Jump Order
- Maximum Checks
- Default DWM Transect Length
- Minimum Intersect Diameter
- Minimum Length.

The DWM screen is accessed from the **[DWM]** button at the bottom of the Plot Header Pages.

DWM Data Entry

[Species] – Enter tree species or select species from the drop down list by pressing the "Period" Key while curser is in this block.

[DC] = Decay Class - Record the appropriate 1-5 Decay Class Code for all DWM. Refer to Appendix "I" (Down Wood Material) for descriptions of required decay class codes.

[Int.] = Intersect Diameter – Record the diameter of the DWM to the nearest inch measured perpendicular to the axis of the bole at the point of intersection with the transect line.

[End1] = End 1 Diameter – Record the small or large end diameter of the DWM to the nearest inch. (**Do not use "0"** for the small end diameter, entry must be at least 1 inch or larger.)

[Len.] = Log Length – Record the length of the DWM to the nearest foot.

[End 2] = End 2 Diameter – Record the other end diameter of the DWM to the nearest inch.

[OL] = DWM Overlap Y/N – Toggle to "OL N" for no overlap. Use "OL Y" for overlap yes, only when two

tallied DWM segments overlap for their entire length. "OL Y" should rarely be used.

[% Slp] = Piece % Slope – Record the slope angle of the DWM piece measured from horizontal to the nearest whole percent (%).

[S. Dist to Pce:] = Slope Distance to Piece – Record the distance to the nearest whole foot from plot center to the point of intersect with each tallied DWM.

[Trans Azim:] = Transect Azimuth – Record the transect azimuth to the nearest whole degree to each tallied DWM.

Tools Menu (F3)

There are numerous tools available from the main entry screen of the DWM Menu. Access the Tools Menu with the function key **[F3]** or the **[*]** key.

[7 Delete] – The piece being deleted must be the piece being edited. The entire piece will be deleted. Confirm Yes or No before deleting.

[4 Insert] – The piece to be

inserted will create a new line above the piece currently in the edit line. Confirm Yes or No before inserting.

[1 Renumber] – Not applicable for DWM material since the sequential numbers are not displayed on the screen and they are not listed on any reports

[9 In/Out Tree] – Not applicable to DWM

[6 User Data] – If you created user defined labels in the Configuration Menu – Survey Default section or in the Unit pages section, then record up to 10 alpha/numeric characters and up to 4 numeric only digits to the nearest 1/10 in the appropriate windows. The alpha field is on the left and the numeric field is on the right.

Note: *Do not use commas in this alpha/numeric field. Commas will cause the program to crash.*

[3 Plot Notes] – Any notes pertaining to the plot should be entered. There is no limit, but the line does not wrap. Use the **[Enter]** key to wrap a line. This is the same screen accessed from page 6 of the Plot Header pages.

VEGETATION

Before starting the field data collection, it is highly recommended that the user visit the Configuration Menu, the Unit Reports (page 6/9) and the Stratum level pages of the Handheld to confirm the configuration that was previously set up in the office.

The purpose of completing the configuration is to allow the user to utilize the power of the software to simplify data collection and to insure that the needed data is collected. Key points to consider are:

- Setting the species key map and repeating fields will speed data entry.
- Setting the maximum checks and selecting the desired reports will allow the end of plot edit checks.
- Selecting the desired reports will establish the jump order of the cursor.

Vegetation default values should be set for the following:
- Species Key Map
- Required Jump Order
- Maximum Checks
- Vegetation Plot Size

The Vegetation screen is accessed from the [Veg] button at the bottom of the Plot Header Pages.

Vegetation Data Entry

[Species] - Enter vegetation species or select species from drop down list by pressing the "Period" Key while curser is in this block.

[Ave. Ht] – Enter the vegetation species average height in feet above ground to the nearest whole foot for the species located on the vegetation fixed plot. Record species less than 1 foot as "1". If a species occurs in two distinctly different layers, the user has the option of entering the species twice with the appropriate heights.

[%Cover] – Enter the percent cover to the nearest whole percent for the species located on the vegetation fixed plot.

A procedure for determining cover percent:

- Visually divide the plot into four quadrants
- Each quadrant represents 25 percent. Visually estimate the percent of the quadrant that is covered by a given species. Cover is the crown width projected vertically to the ground. If the species enters the plot cylinder by overhang, it is also counted.
- Complete this procedure for each quadrant.
- Average the cover estimate for each of the four quadrants.
- Use the following chart as a guide

PERCENT COVER ESTIMATION GUIDE
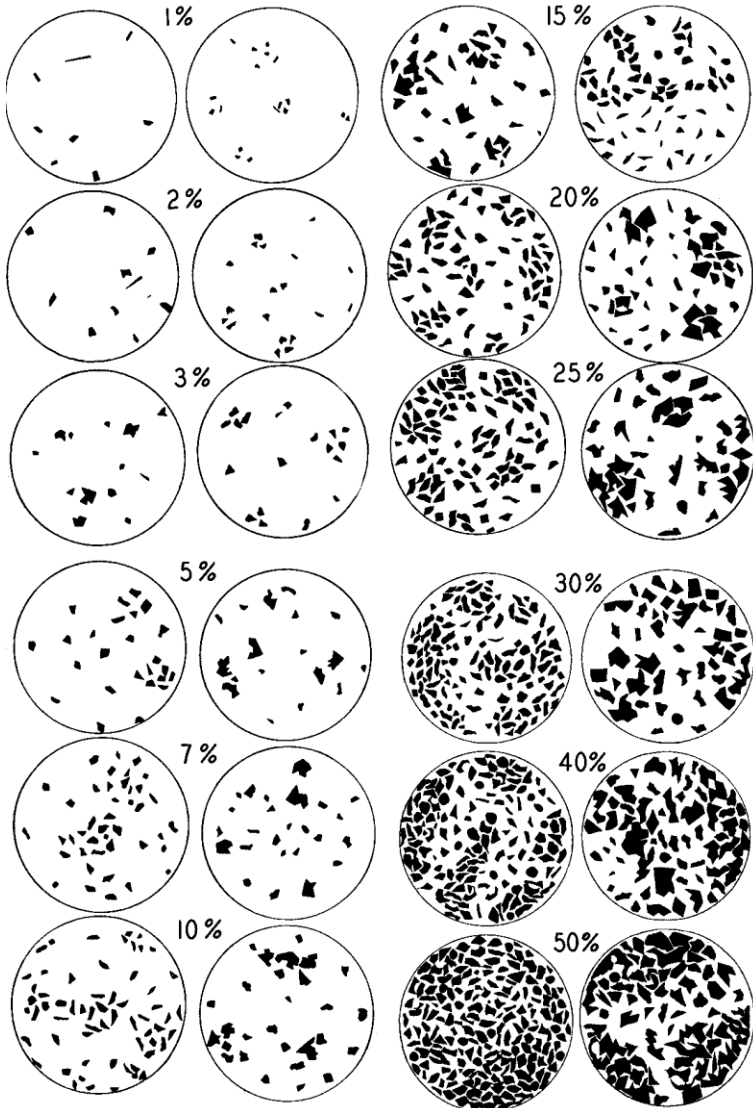
Vegetation Data Entry, cont.

[Trace] – Check this box if the species percent cover is less that one percent.

[User] – Tab or Enter to the User box then press space bar to access User Defined Data for each vegetation species if needed.

[User Defined Alpha] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 10 alpha/numeric characters.

Note: Do not use commas in this alpha/numeric field. Commas will cause the program to crash.

[User Defined Numeric] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 4 numeric only digits to the nearest 1/10.

Tools Menu (F3)

There are numerous tools available from the main entry screen of the Veg Menu. Access the Tools Menu with the function key **[F3]** or the **[*]** key.

[7 Delete] – The piece being deleted must be the piece being edited. The entire data set for the piece will be deleted. Confirm Yes or No before deleting.

[4 Insert] – The piece to be inserted will create a new line above the piece currently in the edit line. Confirm Yes or No before inserting.

[1 Renumber] – Not applicable since the sequential numbers are not displayed on the screen and they are not listed on any reports

[9 In/Out Tree] – Not applicable.

[6 User Data] – If you created user defined labels in the Configuration Menu – Survey Default section or in the Unit pages section, then record up to 10 alpha/numeric characters and up to 4 numeric only digits to the nearest 1/10 in the appropriate windows. These are the same fields accessed with the **[User]** button from the veg data entry screen. The alpha field is on the left and the numeric field is on the right.

Note: Do not use commas in this alpha/numeric field. Commas will cause the program to crash.

[3 Plot Notes] – Any notes pertaining to the plot should be entered. There is no limit, but the line does not wrap. Use the **[Enter]** key to wrap a line. This is the same screen accessed from page 6 of the Plot Header pages.

REGEN

Before starting the field data collection, it is highly recommended that the user visit the Configuration Menu, the Unit Reports (page 6/9) and the Stratum level pages of the Handheld to confirm the configuration that was previously set up in the office.

The purpose of completing the configuration is to allow the user to utilize the power of the software to simplify data collection and to insure that the needed data is collected. Key points to consider are:

- Setting the species key map and repeating fields will speed data entry.
- Setting the maximum checks and selecting the desired reports will allow the end of plot edit checks.
- Selecting the desired reports will establish the jump order of the cursor.

Regen/Submerch default values should be set for the following:

- Species Key Map
- Repeat Fields
- Required Jump Order
- Maximum Checks
- Seedling/Regen Plot Size
- Nested Sapling Plot Sizes.

Trees recorded for Regen surveys will be either seedlings and/or saplings and are always below the minimum merchantable DBH set in the configuration menu or Strata setup pages. Regen surveys can be considered understory when recorded as part of a merch tree stand exam or they can be independent stand alone surveys on young plantations. The data collection is the same for both types of surveys.

2/6 – Plot No Stocking

If no seedlings or saplings exist on the plot, navigate to page 2/6 of the plot pages (Plot Not Stocking). *Enter a check mark in the box preceding "SubMerch/Regen Not Stocked" field.*

Regeneration Surveys

The regeneration surveys are divided into two data entry types: 1) Saplings (having a diameter), and 2) Seedlings (less that 4.5 high). Saplings will have individual tree lines and seedlings will have tree counts by species.

The following screens are accessed from the **[Regen]** button at the bottom of the Plot Pages.

Regen Seedlings

Enter the Regen Seedlings Screen by selecting the **[7 Seedlings (<4.5ft)]** button after selecting the **[Regen]** button at the bottom of the Plot Pages. Seedlings by definition for this software application are trees less than 4.5 feet in height

and have no DBH.

The message bar at the top of the screen shows plot size and tree line number being edited.

There are two ways to enter data:

1. Manual Data Entry line by line

[Species] – Record the Species Code by entering a number from the species key map or the appropriate alpha code. As the code is being typed the long prompt will display the tree name. If the code is mistyped the long prompt displays a ??? Add a new species by using the down arrow on the central key pad. The old records will scroll up. You can go back to them by using the up arrow.

Species code help: [.] – To see a valid species code list press the **[.Period]** key. Selecting a species from this list will automatically fill the species in the proper field.

[Stem Count] – Record the number of seedlings on the plot of that particular species.

2. Dot Tally using touch screen

Enter both the **[Species]** and tree **[Stem Count]** by touching the species code button on the display grid. The display button grid species codes are defaulted from the Configure Species Key Maps for Submerch. You can change these by escaping back to the plot pages and pressing the **[F3]** key. On the TDS Ranger press the **[*]** key.

Each press of the species code grid button increments the count by one. As each new species is counted the previous species count scrolls above. The count can be decremented by one by pressing the +- toggle button located on the grid, then pressing the species code grid button.

Other Entries

[Tools] – Use this button to delete a tree line, access user defined data, and enter plot notes. You can also access the tool bar with the **[F3]** function key.

[Ht] – Record the average height in feet of all the seedlings on the plot.

[%CR] – Record the average crown ratio percent of all the seedlings on the plot.

[…] – Use this button access the Seedling More page.

Seedling More Page

[Avg. Leader] – Record the average leader length of all the seedlings on the plot.

[Interfering Condition] – This button accesses the Interfering Conditions Page. Check the boxes for the interfering conditions that apply on this plot. More than one box can be checked.

[Dist 1] – Record the distance to the nearest foot of the nearest suitable tree from the plot center.

[Dist 2] – Record the distance to the nearest foot to the nearest neighbor to the tree selected by Dist 1. The Dist 1 tree becomes the new plot center and its nearest neighbor is determined by excluding from examination that ½ of the plot that is closest to the original plot center.

Note: Dist 1 and Dist 2 measurements are optional and are used for calculating the C-statistic, an index of spatial arrangement of suitable tree species. For further information see the BLM's Regeneration Stocking Survey Manual – 5705.

[User Defined Alpha] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 10 alpha/numeric characters.

Note: Do not use commas in this alpha/numeric field. Commas will cause the program to crash.

[User Defined Numeric] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 4 numeric only digits to the nearest 1/10.

Regen Saplings

Enter the Sapling/Regen Screen by selecting the **[4 Saplings (>4.5ft)]** button after selecting the **[Regen]** button at the bottom of the Plot Pages. Saplings by definition are trees greater than 4.5 feet in height and have a DBH less than the minimum merchantable DBH selected in the Stratum Plot Sizes screen.

The message bar at the top of the screen shows maximum DBH, plot size and tree line number being edited.

If multiple plot sizes for saplings are used as in the nested plot design for ORGANON, then the plot size on the title bar is not used. The nested plot sizes are recognized internally. Saplings entered on this screen are separated by dbh classes and their associated plot sizes in the reporting phase of the PC program.

[Species] – Record the Species Code by entering a number from the species key map or the appropriate alpha code. As the code is being typed the long prompt will display the tree name. If the code is mistyped the long prompt displays a ??? Add a new species by using the down arrow on the central key pad. The old records will scroll up. You can go back to them by using the up arrow.

Species code help: [.] – To see a valid species code list press the **[.Period]** key. Selecting a species from this list will automatically fill the species in the proper field.

[DBH] – Record DBH to the nearest 1/10 inch.

[Ht.] – Record the sapling height to the nearest 1/10 foot.

[%CR] – Record crown ratio to the nearest whole percent.

[Ldr.] – Record leader length to the nearest whole inch.

[Age] and **[Lyr]** – The total age and layer fields defines the Micro*Storm canopy layer that the sapling resides in. Use these fields if you plan to export the survey to Micro*Storms. At least one age for each layer in the survey is required. Total age can be estimated by counting whorls, or if the tree is large enough, by boring the tree and adding the estimated number of years to breast height.

[F3] – Use this button to access the Tools menu. This will allow you to delete a tree line, insert a tree line, renumber the tree lines, access user defined data, and enter plot notes. (On the TDS Ranger press the **[*]** key.)

[…] – Use this button to access the Sapling More page.

Sapling More Page

[Interfering Condition] – This button accesses the Interfering Conditions Page. Check the boxes for the interfering conditions that apply to the sapling. More than one box can be checked.

[Dist 1] – Record the distance to the nearest foot of the nearest suitable tree from the plot center.

[Dist 2] – Record the distance to the nearest foot of the nearest neighbor to the tree selected by Dist 1. The Dist 1 tree becomes the new plot center and its nearest neighbor is determined by excluding from examination that ½ of the plot that is closest to the original plot center.

Note: Dist 1 and Dist 2 measurements are optional and are used for calculating the C-statistic, an index of spatial arrangement of suitable tree species. For further information see the BLM's Regeneration Stocking Survey Manual – 5705.

[G-5y] and **[G-10y]** – Measure radial growth in 20th's of an inch from an increment core bored at DBH on the uphill side of the tree and at right angle to the core. Record the distance in whole numbers of 20th's (example: record a distance of $18/20^{th}$'s as 18 or a distance of 1.5 inches as 30). See Appendix "E" (Age and Growth) for more details.

[User Defined Alpha] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 10 alpha/numeric characters.

Note: Do not use commas in this alpha/numeric field. Commas will cause the program to crash.

[User Defined Numeric] - If you created User-defined labels in the Configuration Menu – Survey Default section or in the Unit Pages section, then record up to 4 numeric only digits to the nearest 1/10.

APPENDIX A - DEFINITIONS

Age Tree - A live tree assigned with the tree flag "A" that requires total breast height age, 5 year, and 10 year radial growth measurement data.

Basal Area Factor (BAF) - A factor used in variable plots that makes it possible to convert stem count per plot to basal area per acre. (Refer to: Appendix "K" for a complete list of BAF's on the American Scale Relaskop)

Bole - The main stem or trunk of a tree.

Borderline Tree - A tree which is difficult to judge as being "in" or "out" of the variable plot because it is located at a distance from plot center which is nearly equal to the plot radius for a tree of its diameter.

Breast Height (BH) – A measured point which is 54 inches (4.5 ft) above ground level on the uphill side of the bole.

Breast Height Age – The age of a tree measured with an increment borer at Breast Height.

Canopy Cover – The proportion of ground area directly covered by the vertical projection of the tree crown as a cylinder. (Aerial view)

Canopy Layer - A relative height grouping classification for trees based upon one third incremental differences.

Coarse Woody Debris (CWD) – Same as Down Woody Material (DWM). Dead and down pieces of wood.

Count Plot – Sampling points when count plots are separate from measure plots. Minimum required data is tree count. Other measurements are optional

Count Tree – A tree for which only limited data is required. When ratio sample is selected, this is a tally tree with no tree flag assigned by the Handheld.

Cover Percent -Visual percent cover by a given species. (The live crown or foliage width projected vertically to the ground.)

Crown Class - A description of the relative position of the tree crown with respect to competing trees which surround it that are competing for sunlight with the subject tree.

Crown Ratio - The percent of live crown in relation to total tree height. Compensate for abnormal voids within the crown or missing branches on one side of the crown by visually redistributing branches of uneven crowns to attain a full even crown distribution

Crown Width – The average horizontal crown diameter for live trees.

Cut Tree – A tree that would be removed from a stand to be commercially thinned. Determined by treatment objectives.

Damage – Damage agents including insects, disease and physical injury.

Damage Severity – A severity ranking for the damage agent.

Dead Tree – A tree no longer alive or growing. A tree devoid of viable meristematic tissue, live foliage, lives branches or live buds. A tree with one or more live branches would be classified as a Live tree.

Decay Class – A numerical scale (1-5) that rates the decomposition characteristics of dead standing trees and down woody material.

Deduction Percent – The percent of volume loss due to defect. This estimate is the basis for all gross to net volume adjustments in the reports.

Diameter at Breast Height (DBH) – The outside bark diameter of the tree bole measured at a breast height.

Dominant Species - The species most often observed in a particular stand or Survey Unit.

Double Bark Thickness – The thickness of bark at DBH measured to the nearest 1/10th of an inch. The main reason to measure bark thickness is to verify whether the assumed bark thickness from the volume equation is correct. Actual bark thickness may be assigned to individual trees. Double Bark Thickness is the thickness of bark at DBH multiplied by two.

Down Woody Material (DWM) – Dead and down pieces of wood that are intercepted by the transect sample plane and meet the minimum length and diameter requirements. (Example: Minimum length is 8 feet in length and a minimum intercept diameter is 5 inches.) Includes dead tree boles, limbs, and other pieces that have been severed from their original source of growth or uprooted. DWM includes uprooted tree and shrub boles and any stems or branches attached to them. DWM does not include: standing trees, stumps, or shrubs, dead foliage, bark, or other non-woody pieces that are not an integral part of a bole or limb, roots or main bole below the root collar. (Bark attached to a portion of a piece is an integral part.)

DWM Transect Intercept Distance - The slope distance measured in feet from plot center to the point where the DWM transect first intercepts the DWM piece. (i.e. measured from plot center to the inner edge of the piece not to the center of the piece)

DWM Transect Azimuth – The azimuth of the transect sample plane.

Fallen Tree – A tree no longer primarily supported by the strength

of its own roots and leaning at an angle of 45 degrees or more measured from vertical

Fixed Plot – A designated area where measurements of material are made. Plots can be circular or rectangle. Circular plots have their radius in feet measured horizontally from the plot center. Square or rectangular plots require their sizes expressed in acres.

Form Factor – The ratio of the bole diameter outside the bark at 16 feet above stump height to the diameter outside the bark at DBH.

HDCP – Handheld Data Collection Program. Used as data filename extension on survey data files downloaded from the handheld application.

HHPC – Handheld Personal Computer. A handheld personal computer used to collect, store and down load forest survey data.

Height Tree – This is a tally tree assigned with tree flag "H" for 100% and the three types of VP sampling. In VP Ratio sampling the "H" is assigned automatically by the handheld according to a user defined ratio percent.

Height to Break- The height measurement for a standing tree with a broken or missing top, measured from the ground to point on the bole were the break occurred.

"In" Tree – A tree whose DBH is

large enough to subtend the fixed critical angle of a Relaskop, angle gauge, or wedge prism as measured from plot center on a variable plot. Additionally, a tree having 50 percent or more of its bole (measured at ground level) within a fixed plot boundary. Trees meeting this criterion shall compose the set of tally trees for each plot.

Leave Tree - A tree that would be left in a stand to be commercially thinned. Determined by treatment objectives.

Limiting Distance – A calculated distance used to determine whether a borderline tree is truly "in" or "out" of the variable plot.

Measure Plot - Sampling points at which species, DBH and Height for each tree is required when measure plots are at a separate location from count plots.

Measure Tree – A tally tree including Height, Age, and Site trees which require measurement and classification data in addition to that required by a Count Tree.

Minimum Merchantable Diameter – The minimum DBH tallied for merchantable trees. These trees are normally tallied on the variable plot.

Non Forest site – A definable site or area within a Survey Unit or stand 1/5 acre or larger in size not capable of maintaining at least 10 percent stocking of forest trees and those sites which have been

converted to non forest uses. Examples are rock outcrops, roads, rock pits, utility corridors, etc.

Old Growth Tree – Large tree typically 200 years old or older with thick deeply furrowed bark.

"Out" Tree - A tree not meeting the requirements for an "in" tree.

Prism Factor – Same as Basal Area Factor.

Radial Growth – Radial growth increment for the last five and ten years of annual growth to the nearest 1/20th of an inch.

Ratio Sampling – A variable plot sample system whereby a percentage of the tally trees are selected for specific measurements. (Example: 50% of the total trees are selected as Height trees for height measurement and 10% of the total trees are selected as Age trees for age measurement.)

Reference Point (RP) – A point accurately locatable on a Project Area Map or aerial photo used to establish an on the ground point of access to a particular group of plots.

Representative - The likeness or sameness of an area of a stand to the surrounding area.

Salvageable –A salvageable tree is a tree that has at least one 16 foot log, of which one-third must be sound wood.

Sapling – A tree species normally tallied within a fixed radius plot that is 4.5 feet tall or taller and has a DBH that is less than the minimum merchantable tree diameter.

Seedling – A tree species tallied with a fixed plot and is less than 4.5 feet tall.

Standing Tree – A live tree rooted in the ground and continuing to grow. A dead tree primarily supported by its roots and leaning at an angle of 45 degree or less measured from vertical.

Site Tree – Trees used for site determination. These user selected trees have diameter breast height, breast height age and height measurements.

Strata – Strata are the reporting unit used by the EcoSurvey report calculations. Sample plot design such as variable plot, fixed plot, and down woody material transect length are set at the stratum level. Each stratum should include area in acres.

Survey Unit – The survey unit is generally a stand of similar characteristics such as tree species, diameter, height, stocking etc. The basis for determining a survey unit should be the existing stand delineation (FOI polygon) from the Forest Operations Inventory theme.

Tally Tree - Those trees determined to be "In" trees within the variable plot or fixed plot.

Type (Stand) - A unit area having trees of similar characteristics.

Tree Flags - Attributes assigned to an individual tally tree either by the handheld software or by the examiner that indicate the measured data collected or required for the individual tree. In the case of Ratio sampling, the tree flags are randomly assigned to the trees by the handheld computer, but can be over ridden or changed by the examiner. Trees may have more than one tree flag assigned. (Example: HA, HrA, S Out, fA, etc.)

Vegetation – The tally of vegetation on fixed plots may include all or part of the following life forms: Trees, shrubs, herbs, grasses and noxious weeds. Stand alone vegetation surveys may include all of the life forms listed. Stand exams that incorporate the tally of vegetation may be designed to collect indicator species for the determination of plant association or simply tally the major shrub life forms for silvicultural purposes.

STAND EXAM FIELD PROCEDURES

Equipment Checklist

A possible checklist for equipment to bring to the field includes:

Field instructions
Aerial photographs
Photo pen
Transportation map
Survey unit map
First aid kit
Flagging
Field data recorder
Hand compass (check declination at http://www.ngdc.noaa.gov/)
Pocket stereoscope
6" Ruler divided into 1/20"
Diameter tape
Loggers tape
Clinometer
Relaskop
Increment borer
Magnifying glass
Pocket calculator
Densiometer or Moosehorn
Geographic Positioning System
Laser range finder

Modify this list to meet your needs

Sampling Intensity

The degree of accuracy desired determines the sampling intensity. If you know the variability of the stand, i.e. coefficient of variation, then you can use standard statistical methods to determine the number of plots and the number of measure trees need to meet your desired sampling error.

Lacking prior knowledge of the stand, then use the following guide based on size of the unit:

Acres	No of Plots
0-12	1 per 3 ac
12-30	1 per 4 ac
30-50	1 per 5 ac
50-80	1 per 6 ac
80-110	1 per 7 ac
110-150	1 per 8 ac
150+	1 per 10 ac

Also, a reliable sample should have at least 3 plots and 25 measure trees.

Marking Plot Reference

Locate a photo identifiable starting reference point (RP) for each stand by setting the RP on the ground with two strips of flagging.

Write with an indelible marker on the RP flagging, the date (day/month/ year), initials of the examiner(s), stand exam unit number, distance, and azimuth to the first plot. Document the RP location on the stand exam map.

Moving To and Between Plots

Use a hand compass and string box (hip chain) or range-finder or

equivalent to locate plot centers. Establish the plot on the ground at the predetermined location.

Mark the route to and between plots with flagging to help in relocating the plots for inspection. Flags must be visible from flag to flag. When the stand plot line crosses a road, hang two strips of flagging with the above information written on the flagging.

If the surveys are conducted under contract, the following standards apply:

A maximum variation of 10 percent in distance between survey lines and between plots on a line will be accepted. Allow a maximum variation of 5 degrees from the stated azimuth of the plot line. An error in the location of plots and plot lines greater than this will make the survey unsatisfactory and will require relocation and re-measurement of the plots.

Establishing Plot Centers

As a minimum, mark plot centers with flagging. Hang additional flagging over the plot center, or as near as possible to the plot center. Write the plot number, examiner's initials, and date on the flagging. The plot center is the same for both the variable and fixed plots.

Mapping

Map the plot number, plot location,

azimuth, distance, and route of travel between plots and plot lines on each survey map. In addition, enter the date of survey, initial line azimuth, line spacing, and plot spacing on the map legend. Record any unique or significant features on the map. Examples: Wet or rocky areas, cliffs, cultural features, wildlife observations, past disturbances, road access, etc. If the map is too small to display this information, list the information clearly elsewhere.

Narrative

Record any significant or unique features observed while doing the survey. Complete the narrative for each stand and where applicable, reference comments to locations on the map. The following list is an example of features that must be included in the narrative:

Rocky ground
Landslides
Wind-thrown trees
Steep slopes
Previous treatment (PCT, commercial thin etc.)
Road accessibility
Wildlife use
Topographical features
Sensitive sites (cultural, botanical, wetlands etc.)
Topographical description
Disease and insects (Laminated root rot, pine beetle)

Appendix C - Hardware Operations

ALLEGRO HARDWARE OPERATION

Allegro Considerations

- Exiting the program transfers all data into permanent memory. This means when you are done using the Allegro for the day or you are changing batteries, to prevent memory loss exit the program.
- If the screen goes blank while in the middle of collecting data, change the batteries relatively soon. When the batteries get low, the Allegro automatically goes into suspend mode. That means all work is still available if batteries are swapped relatively quickly (see Battery Considerations below).
- Different models for which the program is designed are:
  - Field PC (also known as CE/DOS)
  - CE
  - CX

Display Considerations

- **Selecting display properties and appearance**
  - Select Start
  - Select Control Panel
  - Select Display

- Can adjust appearance, though *use caution*. Sometimes things on the screen can "disappear" when touching things are identical shades.
- The display property settings of the heater, backlight, and contrast can be set under the Options tab (older Field Allegros) or Control tab (newer CE and CX Allegros).
- **Display heater Auto and Off** – Only monochrome screens use heaters. The heater is needed for the display to work in below freezing weather. It is best to leave the heater on when cold since only minimal electricity can be saved by selecting off. It can take the Allegro six seconds for the display to appear after large differences in temperature.
- **Contrast Adjustment** – Self explanatory
- **Brightness Adjustment** – Adjust the brightness of the backlight
- **Adjusting Display Features** – Key Sequences
  - **Turning backlight on and off** – Gold + <F3> (has a light bulb icon above it).
  - **Increase Contrast** – Gold + <F3> (has a circle ¼ shaded above it)
  - **Decrease Contrast** – Gold + <F3> (has a circle ¾ shaded above it)
  - **Turning Touchscreen on and off** – Blue <BkSp> (Key also has TS on it for touchscreen).

This feature is useful in avoiding inadvertent selections while cleaning the screen and walking through the woods.

Battery Considerations

- Battery Life
  - o NiMH – 12- 20 hours
  - o Alkaline – 5-8 hours
- Checking battery status
  - o See section on Power Management
- Batteries are inexpensive compared to the cost of a survey. Keep extras around in case the storage capacity of the original battery decreases to the point it may not last a day in the field.
- Changing batteries
  - o If you have been actively using your Allegro:
    - ▪ Before changing the batteries on an Allegro CE, Select Start | Programs | Utilities | Save System (Allegro CX) or Save Registry (Allegro Field PC). This makes it possible to recover the Allegro CE in case anything goes wrong.
    - ▪ On all Allegros **change the batteries in less then five minutes! This will prevent all problems**! The program is backed up by a capacitor, which has a maximum life of 5 minutes. Failure to change batteries in a timely manner will result in the computer rebooting. Rebooting while collecting data can also cause the loss of data.

- o When inserting a new NiMH battery pack, you will be asked for the battery charge percentage and capacity. Failure to answer accurately will result in the battery gauge not working correctly.
- o If unsure of the battery level, but it has been over a day since the battery was charged, set the level to 10% then charge the battery.
- Storage – Keep Allegro Field PCs connected to a charger while in storage, even if the Allegros do not have a main battery in them.
- Lithium Battery
  - o Only the Allegro CE/DOS and Allegro CX have lithium batteries.
  - o If the lithium battery goes dead, replacement is very expensive.
  - o The way to preserve the lithium battery is to keep the main batteries charged or to store the Allegro connected to a trickle charger if the main battery is removed.
- Removing a battery from an Allegro CE and allowing the backup capacitor to go dead will result in the loss of calendar date and time. Long term storage resulting in a dead main battery will also cause this to happen.
- Charging batteries
  - o Batteries must be charged when the air temperature is between 32 and 104 degrees F.

Power Management

- To run the main power management center on all Allegros
- Select Start
  - o Select Settings
  - o Select Control Panel
  - o Select Power
    - Tells how much battery life is left.
    - Allows the user to set the length of time before the auto suspend feature is enabled.
- Battery Life Status
  - o All Allegros have 5 yellow LEDs under a long wedge on the top of the computer.
    - They move from left (0-10% charged and the beginning of the wedge) to right (fully charged, and the widest part of the wedge)
    - When only the left LED is lit, it will blink. This means you should immediately change the battery since main battery is almost dead.
  - o The Allegro CE/DOS machines give low battery warnings on the status bar.
  - o The Allegro CX machines have a little battery with a number on it on the status bar. The number tells how much battery life is left in a percentage.
- The battery life readings are only accurate in cases where the Allegro is used heavily and charged every day.

Miscellaneous

How to get out of DOS on an Allegro CE/DOS:
- Type WCE then <Enter> to load Windows CE again.

Other Key Combinations of Interest:
- Start Menu - Blue <Start>
- Special Characters – Blue <letter key with character)

TDS RANGER HARDWARE OPERATION

TDS Ranger Models

Different models for which the program is designed are:
- 200C
- 300/500X

Ranger Memory Considerations

- 200C – memory (data and program) is protected when program is installed onto Flashcard portion of memory. To ensure plots and units are saved securely exit program and return to desktop screen throughout the day, at the end of the day, and certainly before transferring data or files.
  - A RAM backup function on the 200C is available in Start – Control Panel – RAM Backup. This tool should not be needed if the EcoSurvey software is installed to the FlashDisk area of memory.

300/500X – Operating System MS Mobile 2005 offers protected memory for both RAM and Flash disk areas. During installation it is still wise to install in Flash disk area just in case. To ensure plots and units are saved securely exit program and return to desktop

screen throughout the day, at the end of the day, and certainly before transferring data or files.

Display Considerations

- **Selecting display properties and appearance:**
  - Select Start
  - Select Control Panel
  - Select Display
  - Can adjust appearance, though use caution. Sometimes things on the screen can "disappear" due to touching things being identical shades. A High – contrast white selection is available on both TDS Ranger models.
- **Display heater Auto and Off** – Rangers do not need heaters due to the color display technology used.
- **Contrast Adjustment** – None needed or available
- **Brightness Adjustment** – Backlight timer: Start – Control Panel – Display – Backlight (Auto On with key or touch)
- **Adjusting Display Features** – Key Sequences
  - **Turning Touchscreen on and off** – Tap touch screen.

Battery Considerations

- Battery Life
  - NiMH – 25 to 36 hours
- Checking battery status
  - 200C – Start – Control Panel – Power. A low power message

appears when the power supply is low.

- Ranger rechargeable lithium batteries should last a couple of years before replacement is needed. When the battery gets to the point where it doesn't make it through the day order another battery. Until the replacement battery arrives it can be charged during the day via an inverter plugged into a vehicle's cigarette lighter. The Ranger unit achieves 70% of its charge in the first hour of charging.
- Changing batteries
  - Both the 200 and 300/500X units have proprietary Battery packs:
    - Exit the EcoSurvey Software and return to the desktop screen.
    - Unscrew the battery pack and plug unit into charger. On the Ranger X units a green flashing lite indicates the unit is charging. A solid light indicates full charge.
  - There is no need to know battery levels in order to initiate charging on a Ranger.
  - 200C and 300/500X - When changing a battery pack you have about five minutes to keep from losing date and time. However, EcoSurvey data is protected regardless.
  - The 300/500X battery can be charged outside of the Ranger unit simply by plugging in the AC adapter into the battery unit directly.
- Storage – There is no need to keep Ranger units connected to a charger while in storage.

Power Management

- There are no special power management settings on the Ranger due to its intelligent power management logic. You can view power status via:
  - Select Start
  - Select Settings
  - Select Control Panel
  - Select Power
    - Displays battery charge level.
- Battery Life Status
  - Ranger 200C and 300X/500X– Start – Control Panel – Power.
    - Displays % power remaining as a progress bar
  - Ranger 300X/500X touch Power Battery icon when in the desktop screen to get main and backup battery power bar % status image.
- The battery life readings are fairly accurate.

Miscellaneous

Resetting the Handheld:
- Press and hold the [ON] key and follow instructions that appear on screen.

Screen Protectors:
The Rangers come with clear plastic screen protectors to protect the display from scratches. The screen protectors can be replaced by:
- Peeling off the old one,
- Peeling the back off the replacement protector film, then

- Lay the protector film on the display, and lastly
- Use a credit card to smooth the protector film and move any air bubbles to the edge.

Microphone and Speaker:
All Ranger handhelds have a microphone and speaker allowing you to be able to record voice notes, store them, and play them back for transcription or review.

APPENDIX D – DIAMETER MEASUREMENTS

Diameter Breast Height (DBH)

Tree diameters are measured at breast height or 4.5 feet above the ground. On slopes breast height is always measured on the uphill side of the tree. On leaning trees, breast height is 4.5 feet along the bole. On down trees, breast height is 4.5 feet along the bole starting at the root collar. On standing trees with roots above the ground, breast height is 4.5 feet above the root collar.

Diameter Irregularities at 4.5 Feet

When a bole form irregularity occurs at the normal DBH point, field crews will adjust the point of measurements and note the circumstances in remarks. For any DBH not measured at 4.5 feet due to an irregularity, note the height at which it was measured, and explain the reason in Remarks (i.e. "DBH at 5.3 - limb"). Measure diameters directly and do not attempt to compensate for missing bark and/or wood.

Major localized irregularities such as limbs, burls, scaring, and swelling will require that DBH be measured immediately above the irregularity at the point where it ceases to affect normal stem form.

If the irregularity extends a considerable distance up the bole but the stem form below the normal DBH point is unaffected, take diameter immediately below the irregularity as near to 4.5 feet above the ground as possible. Do not measure diameters less than 3.0 feet above the ground.

Non-localized irregularities such as lightning scars, cracks, seams, and logging scars sometimes extend over so much of the bole length that adjustment above or below is impossible or gives an unrealistic representation of tree size. In this circumstance, mark and measure DBH at the normal point 4.5 feet above the ground unless another major localized irregularity occurs there.

Butt swell that extends up the stem 4.5 feet or more will require that diameter be measured at a point immediately above the swell where the stem resumes normal form.

Trees Forked at or Above 4.5 Feet

If the open crotch of the fork is at or above 4.5 feet, record as single trees. Measure DBH immediately below any swelling but as near to the normal point as possible.
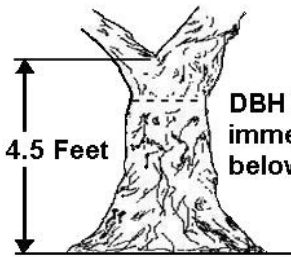
Forked at 4.5 Feet
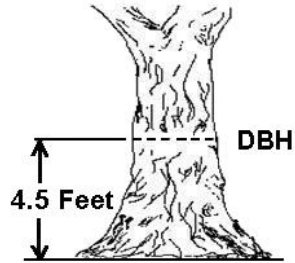
Forked higher than 4.5 Feet

Trees Forked Below 4.5 Feet

If the open crotch of the fork begins below 4.5 feet, record as two trees and measure and record stem diameters 2 feet above the beginning of the crotch. If the forks appear to be trees, which have grown together, refer instead to "Two trees growing together."
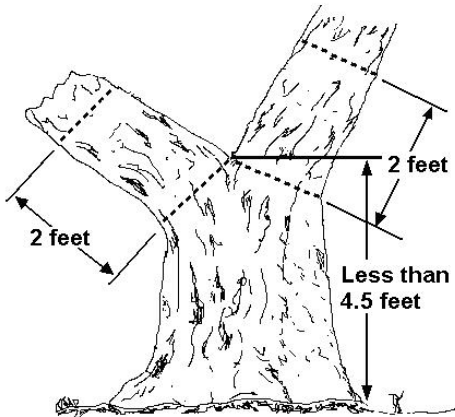
Forked below 4.5 feet

Two Trees Growing Together

Trees growing together sometimes give the appearance of a forked tree. This

situation can usually be recognized because of the seam, which develops where the two trees have joined. This seam should extend very close to the ground.

Trees which have grown together will be recorded as separate stems and DBH will be marked and measured at the normal point 4.5 feet up the stem. Determine DBH by driving in two nails opposite each other on the centerline of each bole's circumference. Measure the distance between the nails with a diameter tape and double it to determine DBH. Note the situation clearly in remarks.
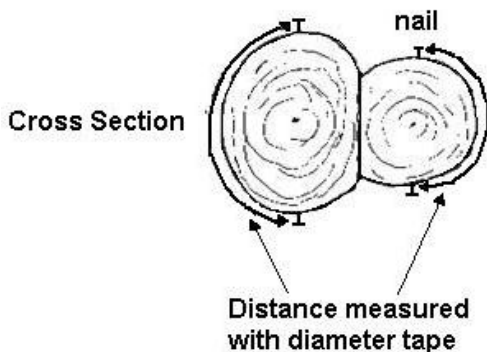
Broken or barber-chaired trees should have DBH marked and measured at the normal position, 4.5 feet up the bole. If the stem is broken below 4.5 feet, consider the upright portion a stump, the severed portion of the tree will be considered down woody material. If the stem is broken at or above 4.5 feet, measure the diameter at 4.5 feet.

Dead trees will have actual diameters recorded. Do not reconstruct diameter to account for missing bark or rotten wood. Record in the actual diameter present with no adjustments made for minor irregularities. When major deformities are present at 4.5 feet, adjust the measurement point as specified in the preceding examples.

Adjusting the Level of DBH Measurement

The objective is to obtain a measurement at a level 4.5 feet above the ground line on the uphill side of the tree. Accumulations of litter and debris will be

considered part of the ground line based on the extent to which they have
become incorporated into the soil. Exceptions to consider include:

- Recent debris such as limbs and small pieces of wood should be moved
  aside. Do not, however, dig down into the duff layer. Loose duff should
  be stepped on and compressed.

- Larger pieces should be compensated for if the tree base can still be
  recognized.

- Do not compensate when the debris accumulation has been in place for
  so long that it has become the new ground line.
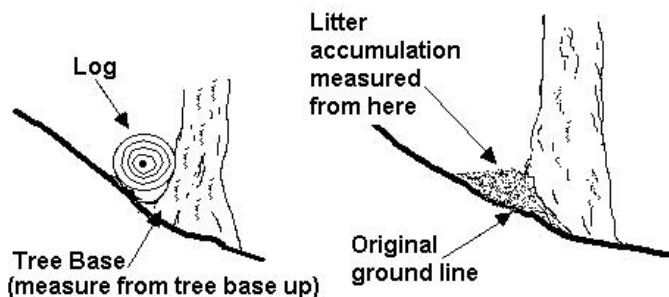
DBH Adjustment & Litter Considerations

APPENDIX E – AGE AND GROWTH

DETERMINING THE AGE OF A LARGE TREE

The following example and diagram explain how to determine the age of a large tree. Given a tree: 58.6 inches DBH, 2.0 inch bark thickness, 14.0 inch increment core with 110 total rings and 10 rings on the interior two inches of the core. Solve for age. Determine the radius of the tree at DBH (58.6"/2 = 29.3"). Subtract bark thickness to get wood radius at DBH (29.3" - 2.0" = 27.3). Find the remaining distance to the center of the tree (27.3 - 14.0" = 13.3). Calculate the average rings per inch (10 rings/2" = 5 rings/inch). Extrapolate the average rings per inch of missing core (5 rings/inch x 13.3" = 66.5 rings, round to 67). Add the actual ring count and the extrapolated ring total together to determine age (110 + 67 = 177 years age).
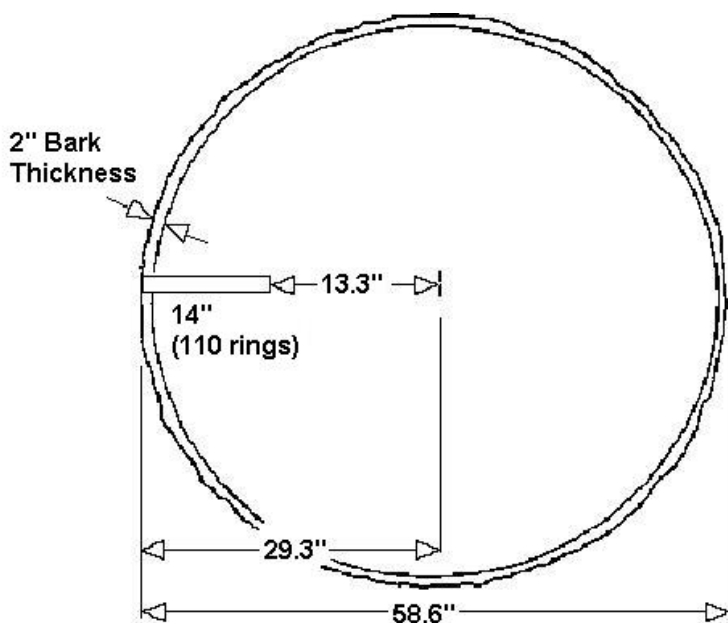
RADIAL GROWTH

When measuring radial growth do not include the bark, phloem (current years spring wood), or the current year's summer wood. Measure both 5-year and 10-year period beginning at the end of the 2nd years' spring wood and stopping at the beginning of the 5th years' and 10th years' fall wood. If BHA is less than 10 then do not record 10-year growth. Record the 5-year radial growth as usual.
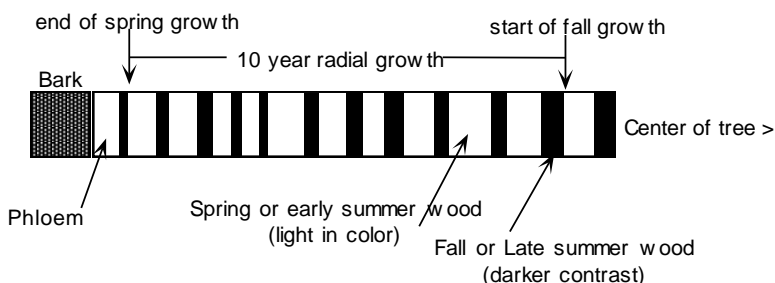
APPENDIX F – CANOPY LAYERS

The Micro*Storms database allows the division of the trees (merchantable size, saplings and seedlings) into three canopy layers.

Principles of Assigning Canopy Layer

Canopy Layer is a height grouping classification assigned to trees within a survey unit. Separate layers are described when there is at least a one third height difference between layers. Each stand can have up to three layers, where each layer can be analyzed or targeted for a specific silvicultural treatment. A dense even aged Douglas- fir stand may only have one layer while other stands may contain two or three layers depending upon past management or natural events.

When assigning canopy layers keep in mind:
- Canopy Layer designations are assessed on an overall survey unit or stand wide basis, not from plot by plot determination.
- Canopy Layer assessment should be conducted during the survey unit preview when

determining the appropriate BAF for the survey unit
- There must always be a top layer. If two layers are present then there must always be a top and bottom layer. If three layers are present then must be a top, middle and bottom layer.
- In stands that do not have one third height differences between crown classes, all trees are grouped into one layer and all trees are assigned to top Layer 1.
- In stands where one third height differences exist between crown classes and only two layers exist in the stand, trees are grouped into two layers, a top Layer 1 and a bottom Layer 3.
- In stands where one third height differences exist between crown classes and three layers exist in the stand, trees are grouped into three layers, a top Layer 1, a middle Layer 2, and a bottom Layer 3.
- Layers 1 and 2 must each comprise 10% or more of the total canopy cover to qualify as a layer. Layer 3 must comprise 1% of more of the total canopy cover to qualify as a layer.
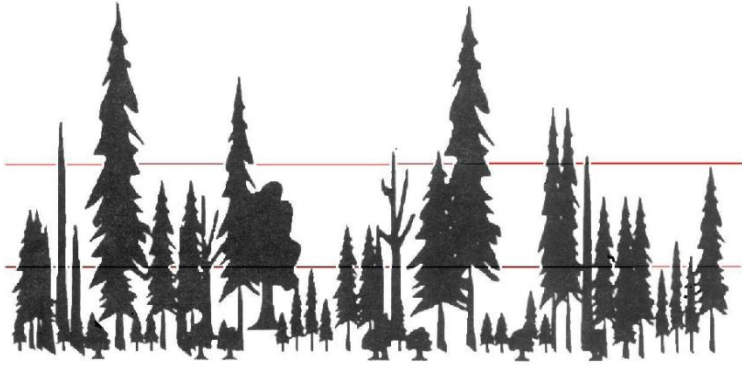
ONE LAYER STAND – Layer 1 Top
All trees and saplings are assigned to Layer 1 because 1/3 height difference is
present but sapling canopy cover is less than 1 percent.
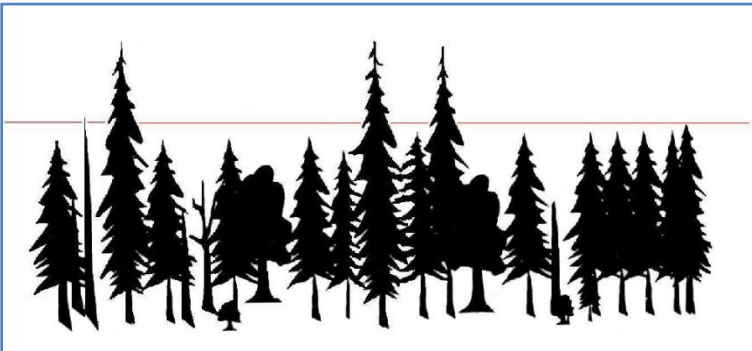
TWO LAYER STAND – Layer 1 Top and Layer 3 Bottom
Remnant trees are assigned to Layer 1 because 1/3 height difference is present
and canopy cover is 10 percent or greater. Remaining trees and saplings are
assigned to Layer 3 because combined canopy cover is 1 percent or greater
while the small sapling canopy cover by itself is less than 1 percent.

THREE LAYER STAND – Layer 1 Top, Layer 2 Middle and Layer 3 Bottom
Remnant trees are assigned to Layer 1 because 1/3 height difference is present
and canopy cover is 10 percent or greater. Shorter trees and saplings are
assigned to Layer 2 because 1/3 height difference is present and canopy cover is
10 percent or greater. Smaller saplings and seedlings are assigned to Layer 3
because 1/3 height difference is present and canopy cover is 1 percent or
greater.

APPENDIX G – SITE TREE SELECTION RULES

The selection of the site trees is dependent upon which site index curve will be applied in a given area. Each BLM District Office should determine which site index curves are applicable on the District and which curves are preferred when there is a choice of curves.

Only one site index species can be selected for measurement within each stand or Unit. Select the species that is most appropriate for the site.

GENERIC RULES FOR ALL SITE INDEX CURVES:

Unless specifically stated in the species specific rules, select either dominant or co-dominant trees as your site index trees.

Dominant: Tree crowns receive full light from above and at least partial sunlight from the sides. Crowns extend above the general level of the canopy.

Co-dominant: Tree crowns receive full light from above and little from the side. Crowns usually form the general level of the canopy. **In addition use the following**

selection criteria:
- The tree has a normally formed bole and crown and is a tree having a central bole exhibiting physiological traits and development typical for that tree species, age and local environment.
- A site tree may have minor damage that does not affect height growth but cannot have any visible defect, evidence of suppression, or symptoms of interior rot.
- A tree must not be an open-grown tree, a "remnant tree" from a previous stand, or a tree joined at the base.

SPECIFIC SITE INDEX TREE SELECTION RULES:

WHBA – Western Hemlock Barnes

Primarily within the coastal fog-belt; may be applied to other Coast Range areas and west slopes of the Cascades Range.

- Dominant and co-dominant trees.
- Even-aged stands.
- BHA is 20 years or older.
- Apply to areas where 40% or more of total basal area is western hemlock.

Barnes, George H. Yield of Even-Aged Stands of Western Hemlock. USDA Forest Service Technical Bulletin No. 1273. September 1982.

DFCU – Douglas-fir Curtis

- Elevation greater than 3,000 feet
- Tallest dominant trees on the plot

Curtis, Robert O., Francis R. Herman, Donald J. DeMars. Height Growth and Site Index for Douglas-fir in High-Elevation Forests of the Oregon-Washington Cascades. Forest Science, Vol 20, No 4, pp. 307-315.

DFHS – Douglas-fir Hann/Scrivani

- Southwest Oregon
- Dominant crown class only.
- BHA Between 20 and 250 for either Douglas-fir or ponderosa pine.

Hann, David W., and John A. Scrivani. Dominant-Height-Growth and Site-Index Equations for Douglas-fir and Ponderosa Pine in Southwest Oregon. Oregon State University, Research Bulletin 59, February 1987.

DFKG – Douglas-fir Kings

- Younger Stands, low elevation not in SW Oregon
- Select trees within the category of trees that have the largest 20 percent DBH measurements on the plot.
- BHA between 30 and 130 years.

King, James, E. Site Index Curves for Douglas-fir in the Pacific Northwest. Weyerhaeuser Forestry Paper, No. 8 July 1966.

DFMC – Douglas-fir McCardle

- Elevation less than 3,000 feet
- Unmanaged stands
- Dominant and co-dominant trees.
- BHA older than the appropriate site curve at your location for younger stands.

McArdle, Richard, Walter H. Meyer, and Donald Bruce. The Yield of Douglas Fir in the Pacific Northwest. Technical bulletin No. 201. Revised October 1949, Slightly revised May 1961.

PPME – Ponderosa Pine Meyer

- Stands that are predominately ponderosa pine and or have Douglas-fir, white fir, or Sugar Pine as minor species.
- Managed or unmanaged even-aged stands
- Dominant and co-dominant trees.
- BHA older than 250 years.

Meyer, Walter. Yield of Even-Aged Stands of Ponderosa Pine. USDA Technical Bulletin No. 630, October 1938, Slightly revised April 1961.

WFSH – White Fir Schumacher

- Unmanaged even-aged stands
- Dominant Trees.
- BHA between 50 -150 years.

Schumacher, Francis X. Yield, Stand, and Volume Tables for White Fir in the California Pine Region. October 1926. University of California College of Agriculture Agricultural Experiment Station, Berkeley, California. Bulletin 407.

NFHE – Noble Fir Herman

- Unmanaged stands, mainly old growth
- Tallest dominant trees.

Herman, Francis R., Curtis, Robert O., DeMars, Donald J. Height Growth and Site Index Measurements for Noble Fir in High-Elevation Forests of the Oregon-Washington Cascades. USDA Forest Service Research Paper PNW-243 1978

SSME – Sitka Spruce Meyer

Primarily within the coastal fog-belt; may be applied to forests on inland areas.

- Pacific Northwest Coastal Fog Belt (Oregon & Washington)

- Fully stocked, even aged stands
- Dominant & co-dominant trees.

Meyer, Walter H. Yield of Even-Aged Stands of Sitka Spruce and Western Hemlock. Pacific Northwest Forest Experiment Station Forest Service Technical Bulletin No. 544 March, 1937

PPHS – Ponderosa Pine Hann/Scrivani

- Southwest Oregon
- Dominant crown class only.
- BHA Between 20 and 250 for either Douglas-fir or ponderosa pine.

Hann, David W., and John A. Scrivani. Dominant-Height-Growth and Site-Index Equations for Douglas-fir and Ponderosa Pine in Southwest Oregon. Oregon State University, Research Bulletin 59, February 1987.

RFSH – Red Fir Schumacher

- Even-aged, fully stocked, unmanaged stands
- Dominant trees.

Schumacher, Francis X. Yield, Stand and Volume Tables for Red Fir in California. August, 1928. University of California College of Agriculture Agricultural Experiment Station, Berkeley, California. Bulletin 456.

RAHC – Red Alder Harrington/Curtis

- Dominant and co-dominant trees.

Harrington, Constance A., and Rober O. Curtis. *Height Growth and Site Index Curves for Red Alder. USDA FS Pacific Northwest Research Station, Research Paper PNW-358, April 1986.*

PPBA – Ponderosa Pine Barrett

- Managed even-aged stands of ponderosa pine where relatively low density has permitted full height development.
- Tallest dominant trees on the plot

Barrett, *James W. Height Growth and Site Index Curves for Managed, Even-Aged Stands of Ponderosa Pine in the Pacific Northwest. USDA Forest Service Research Paper PNW-232 1978.*

APPENDIX H – SNAG DECAY CLASSES

Decay Class	1	2	3	4	5
Bark	Tight, intact	50% loose or missing	75% missing	75% missing	75% missing
Decay	Minor	None to advanced	Early stage of decay to advanced	Early stage of decay to advanced	to crumbly
Sapwood Decay	None to early stage of decay	None to early stage of decay	None to 25% decay	25% + decay	50% + advanced decay
Limbs	Mostly present	Small limbs	Few remain	Few remain	Absent
Top Breakage	May be present	May be present	1/3 may be missing	1/3 to ½ missing	½ + missing
Bole Form	Intact	Intact	Mostly intact	Loosing form, soft	Form mostly lost

Source: Natural Resource Inventory, Oregon/Washington Bureau of Land Management, Inventory and Monitoring System, Current Vegetation Survey Field Procedures; USDI Version BLM 4.4; 10/01/2007; 229 p.

APPENDIX I - DOWN WOODY MATERIAL

Definition

DWM includes downed, dead tree and shrub boles, large limbs, and other woody pieces that have been severed from their original source of growth or have been uprooted (no longer self-supported by their roots and leaning > 45 degrees from vertical). DWM includes uprooted tree and shrub boles and any stems or branches attached to them.

DWM does not include:
- Standing dead trees leaning 0 to 45 degrees from vertical (this is a snag), stumps that are rooted in the ground, or dead shrubs self supported by their roots.
- Dead foliage, bark, or other non-woody pieces that are not an integral part of a bole or limb. (Bark attached to a portion of a piece is an integral part).
- Roots or main bole below the root collar.

Line Transect Method

Lines of pre-determined length are established from the plot center. Down pieces meeting specified dimensions and conditions are tallied if their central axis is intersected by the line transect. The transect length must be measured on the horizontal and more than one transect may be established from a plot center. Debris piles created by direct human activity are not tallied by the transect, but are instead recorded in the plot notes.

Sampling Intensity

The arrangement and number of transects needed depends on the amount and distribution of the DWM, and on the desired accuracy of the estimate. Scattered and light amounts of DWM will likely require longer and/or greater numbers of transects. Upon analysis of the statistical results of the survey, the examiner may need to supplement the survey with additional transects in the stand.

Configuration and Setup

The stratum setup screen allows the user to establish the default transect length per plot, the minimum intersect diameter, and minimum piece length. These should be completed before collecting plot data.

Locating and Establishing Line Transects

Transects lines should begin at plot centers. The software will display a random starting azimuth for the first line. Additional lines can be at pre-determined angles from the starting azimuth. An example would be 200 feet of default transect length per plot established with four 50 foot transects from plot center. The first transect azimuth would be displayed by the software, the remaining three would be established at successive 90 degrees from the previous transect proceeding in a clockwise direction around the plot. If an individual piece crosses more than one transect, treat each crossing as an independent tally.

Tally Rules for Down Woody Material

Tally pieces of DWM that intersect the line and meet the following criteria:

1. The minimum piece size for length and intersect diameter determined earlier in the stratum set up pages.

2. Tally only DWM caused by natural events such as windthrow, fire and landslides. Human caused piles of debris from logging activities are usually not suitable for sampling with the line transect method. The user may want to record the size, shape and extent of slash piles or windrows in the plot comments page.

3. The intersect diameter should be measured at 90 degrees from the central axis of the bole.   Also note that in this example there would be two pieces recorded. The branch coming off the main log would be a separate tally, if it met the minimum intersect diameter and length.
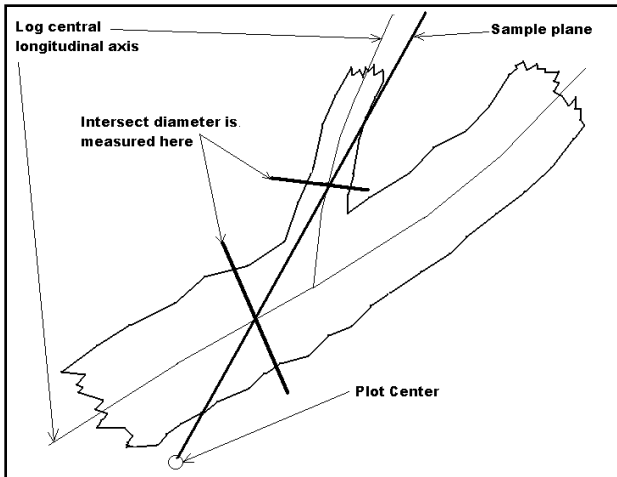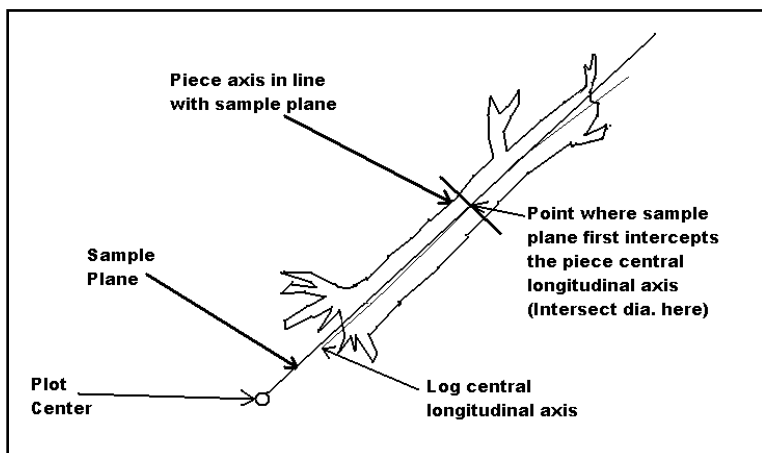

4. Tally a piece only if its central axis is intersected by the transect plane. The piece may be on the ground or suspended above ground at the point of intersect or elsewhere along the bole.
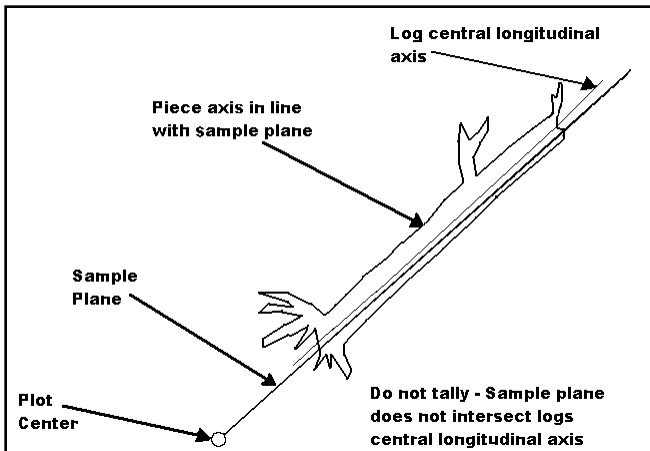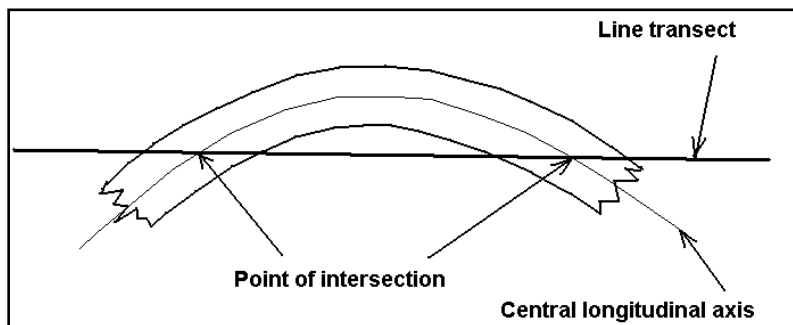
5. Tally a piece once if the central axis longitudinal axis of the piece falls directly in line only once with the transect sample plane.


6. If the central axis of the piece is intersected more than once, tally it each time it is intersected.

7. For a tally piece intercepted by more than one transect, tally the piece on each transect that it is intercepted.

8.   For a tally piece located directly at plot center, tally the piece on each transect taken from plot center. (Ex. If plot center falls directly on a piece of DWM and four transects are taken from plot center, then the piece would be tallied on each of the four transects.

9. Tally a piece only if the central longitudinal axis is intersected by the sample plane, and at that point, 50 percent or more of the piece is above the duff layer. A piece which is above the duff layer has distinct form and can definitely be distinguished from the ground.
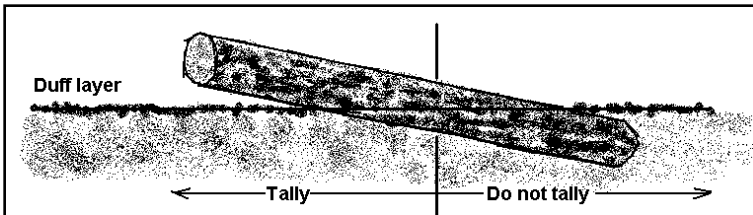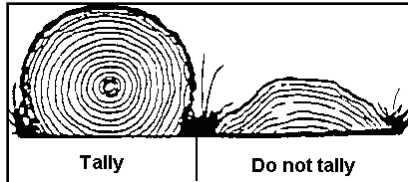

10. Tally uprooted snags and stumps that are leaning > 45 degrees from vertical and are no longer supported by roots. Snags or stumps that are leaning less than 45 degrees from vertical and/or are supported by roots are not counted.

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

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

(Cont. on next page)

13. When the transect crosses the forks or branches of one tree (i.e., two or more pieces that are connected), tally each qualifying piece separately. Each individual piece must meet the minimum diameter and length requirements in order to be tallied. In the case of forked trees, consider the largest of the two or more forks as the "main bole"; characteristics for this fork, such as length, should pertain to the entire main bole. For smaller forks or for branches connected to a main bole (even if the main bole is not a tally piece), characteristics (diameter, length & decay class) should pertain only to that portion of the piece up to the point where it attaches to the main bole.
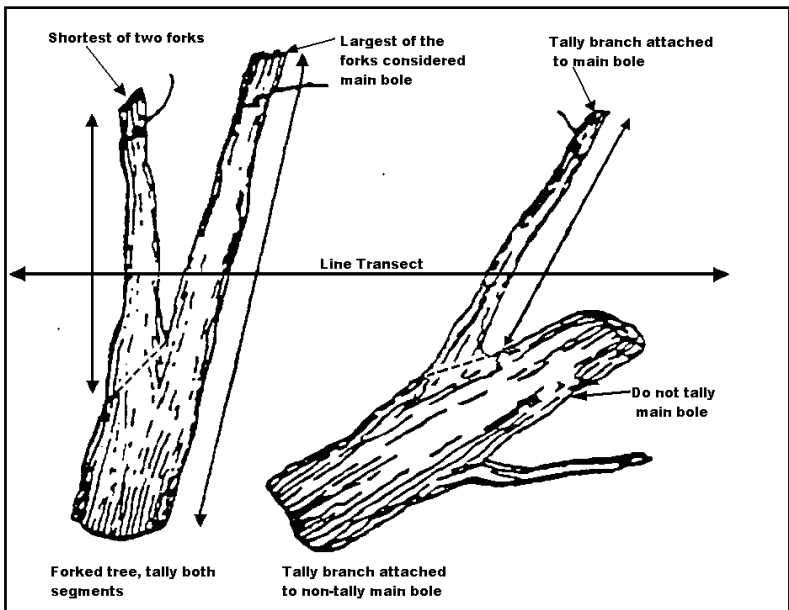
14. Each piece will have only one decay class. Do not kick apart or chop pieces to determine their decay class. The rating should reflect the decay class characteristics that best represent the majority of the log.

Decay Classes

Decay Class	1	2	3	4	5
Bark	Intact	Intact	Trace	Absent	Absent
Twigs <1.18in	Present	Absent	Absent	Absent	Absent
Texture	Intact	Intact to partly soft	Hard, large pieces	Small, soft, blocky pieces	Soft, powdery
Shape	Round	Round	Round	Round to oval	Oval
Color of wood	Original	Original	Original to faded	Light brown to faded brown or DF may be red brown	Faded to light yellow or gray DF may be red brown to dark brown
Portion of log on ground	Log elevated on support points	Log elevated on support points but sagging slightly	Log is sagging near ground	All of log on ground	All of log on ground with greater than 50% above ground

Source: Brown, E.R. tech, ed, 1985. Management of Wildlife and Fish Habitats in Forests in Western Oregon and Washington, Part 1 – Chapter Narratives. Publ. R6-F and WL-192-1985. Portland, Or: U.S. Dept of Agriculture, Forest Service, Pacific Northwest Region: 173.

Log Class 1

Log Class 2

Log Class 3

Log Class 3

Log Class 4

Log Class 5

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
0	NO DAMAGE	None	
BARK BEETLES - For all Bark Beetles			
1	BARK BEETLES GENERAL	1-5	1 - Unsuccessful current attack
2	Mountain pine beetle (All Pinus)		2 - Successful current attack
3	Douglas-fir beetle (PSME)		3 - Last year's successful attack
4	Spruce beetle (Picea spp.)		4 - Older dead
5	Western pine beetle (PIPO)		5 - Top kill
6	Pine engraver (All Pinus spp.)		
7	Fir engraver (Abies spp.)		
8	Silver fir beetle (ABAM)		
9	Red turpentine beetle All Pinus		
26	Jeffery Pine beetle		
INSECTS - DEFOLIATING			
10	DEFOLIATING INSECTS GENERAL	1 - 3	Divide the crown into thirds. Rate each third separately based on the following percentages. Obtain a rating for the entire tree by adding the ratings for each third together.
11	Western blackheaded budworm		**1** = Up to 33% foliage missing
12	Pine butterfly		**2** = 34-66% foliage missing
13	Douglas fir tussock moth		**3** = 67-100% foliage missing
14	Larch casebearer		
15	West spruce/Modoc budworm		
16	Western hemlock looper		
17	Sawflies		
18	Needle and sheath miners		
19	Gypsy moth		

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
	INSECTS - OTHER		
20	INSECTS - OTHER GENERAL	1-2	1 - Bottlebrush or shortened leaders & 0-2 forks on tree stem, OR <20% of branches affected, OR <50% of bole with visible larval galleries.
21	Shoot moths		
22	Weevils		
23	Wood borers		2 - 3+ forks on tree stem, OR $\geq$20% of branches infected, OR terminal leader dead, OR $\geq$50% of bole with visible larval galleries.
24	Balsam woolly adelgid		
25	Sitka Spruce terminal beetle		
	MISTLETOE		
30	MISTLETOE (dwarf & leafy)	1 – 6	**DWARF (Arceuthobium spp.)** Rate al infected conifer species except juniper species, white fir in CA only, and incense cedar. Divide the crown into thirds. Rate each third separately based on the following percentages. Obtain a rating for the entire tree by adding the ratings for each third together. **1** = $\leq$1/2 the branches have visible infection **2** = > 1/2 the branches have visible infections.

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
30	MISTLETOE (dwarf & leafy)		**LEAFY** For all infected juniper species, white fir (CA only), incense cedar and oak trees.
		7	Branch infections <50% of crown involved
		8	Branch infections >50% of crown involved. Any occurrence on the bole.
SUDDEN OAK DEATH			
31	SUDDEN OAK DEATH		Tanoak, Coast Live Oak, Black Oak
		1	Bleeding present on bole
		2	Bleeding present on bole & adjacent mortality present.
		3	Laboratory confirmed Sudden Oak Death
PITCH CANKER (Pinus)			
32	PITCH CANKER (Pinus)	1	No bole canker & <10 infected branch tips
		2	No bole canker & <10 infected branch tips
		3	1 or more bole canker & <10 infected branch tips
		4	1 or more bole canker & >10 infected branch tips

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
WHITE PINE BLISTER RUST			
36	WHITE PINE BLISTER RUST	1	Branch infections located > 2' from bole.
		2	Branch infections located between 6" & 2" from bole.
		3	Bole or branch infections within 6"of bole.
STEM CANKER			
33	DIPOLDIA BLIGHT	1-2	1 - Branch infections, <50% of the crown infected.
40	STEM CANKER - GENERAL		
41	Western gall rust		2 - Branch infections, >50% of the crown infected.
42	Comandra blister rust		Any occurrence on the bole.
43	Stalactiform rust		
44	Atropellis canker		
45	Cytospora/Phomopsis		
STEM DECAY			
46	STEM DECAY GENERAL	1-4	1 = One conk on stem or at ground line
47	Red ring rot		2 = >2 conks separated by <16' on the bole
.	Rust red stringy rot		3 = >2 conks separated by >16' on the bole
49	Brown cubical butt rot		4 = No conks, visible decay in interior of bole

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
FOLIAR DISEASE			
55	FOLIAR DISEASE GENERAL	1-2	1 = <20% of foliage affected, or <20% of crown in brooms.
56	Rhabdocline (only PSME)		2 = >20% of foliage affected, or >20% of crown in brooms.
57	Elytroderma (only PIPO)		
58	Broom rusts (only Abies, Picea)		
59	Swiss needle cast (only PSME)		
ROOT DISEASE			
60	ROOT DISEASE GENERAL	1-2	1 = Suspect/Proximity Tree: Live tree within 30' of a tree, stump, snag or blowdown with identifiable root disease.
61	Annosus root disease		
62	Armillaria root disease		2 = Dead tree with signs or symptoms of root disease such as characteristic decay, stain in sapwood or cambium, ectotrophic mycelia, mycelial fans, OR live tree where positive identification can be made.
63	Black stain root disease		
65	Laminated root rot		
66	Port-Orford-cedar root disease		

	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
ANIMAL DAMAGE			
70	ANIMAL PHYSICAL GENERAL	1-2	1 = <20% of crown affected. Bole damage present on <1/2 of circumference
71	Mountain beaver		
72	Livestock		2 = >20% of crown affected. Bole damage present on >1/2 of the circumference.
73	Deer or elk		
74	Porcupines		
75	Pocket gophers, squirrels, mice, voles, rabbits, hares	1-2	1 = <20% of crown affected. Bole damage present on <1/2 of circumference
			2 = >20% of crown affected. Bole damage present on >1/2 of the circumference.
76	Beaver		
77	Bear		
78	Human (not logging)		
WEATHER DAMAGE			
80	WEATHER PHYSICAL GEN	1-2	1 = <20% of crown affected
81	Windthrow or wind breakage		2 = >20% of crown affected or any damage to the bole
82	Snow / ice bending or breakage		
83	Frost damage on shoots		
84	Winter desiccation		
85	Drought/heat moisture deficient		
86	Sun scald		
87	Lightning strike		

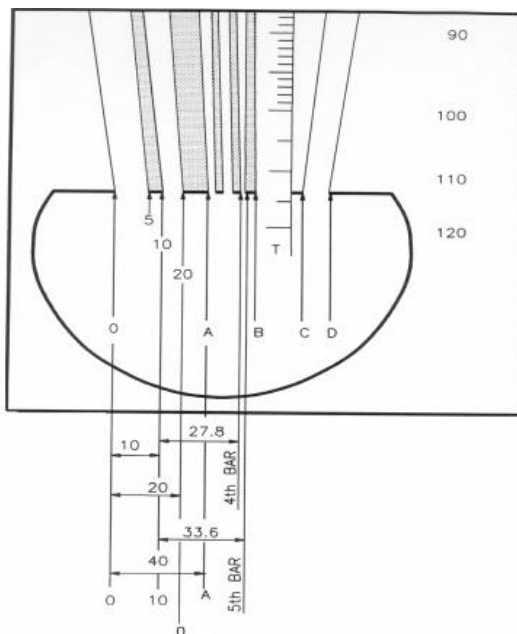|	DAMAGE DEFINITION	SEVERITY CODE	SEVERITY DESCRIPTION
PHYSICAL DAMAGE			
90	OTHER PHYSICAL DAMAGE	1-2	1 = <20% of crown affected
91	Logging		2 = ≥20% of crown affected or any damage to the bole
92	Fire: basal scars or heat		
93	Bad stock planting		
94	Air pollution or other chemicals		
PHYSICAL DEFECT			
95	OTHER PHYSICAL DEFECT	0	Severity is not rated
98	Fork, crook,lean, sweep		
99	Checks/bole cracks		
BROKEN/MISSING/DEAD TOP			
96	Broken/missing top	0-10	**1** = 1-10% of normal or original tree height dead or missing
97	Dead top		**2** = 11-20%
			3 = 21-30%
			4 = 31-40%
			5 = 41-50%
			6 = 51-60%
			7 = 61-70%
			8 = 71-80%
			9 = 81-90%
			10 = 91-100%

APPENDIX K - USE OF THE SPIEGEL-RELASKOP (AMERICAN SCALE)

The instrument is positioned over the sample plot center, and the measuring edge is aimed so as to cut the tree at DBH (54 inches above ground level). To take a reading, the user depresses the brake release button; and the scale rotates to the angle at which the instrument is tilted. Releasing this button brings the scale to a stop. The curvature of the scale automatically compensates for any slope in terrain.

Eighteen bars are represented on the scale. From the 0 edge to 10 equals 6 bars; 10 to A equals 6 bars; and A to B equals 6 bars (see diagram). Three BAFs (5, 10, and 20) are already imposed on the bottom of the scale.

The edge marked 0 is used as the common side for all BAFs and is positioned so that it lines up with the left side of the tree bole at DBH. Trees greater in diameter than the projected angle are in (tally trees). Since the BAFs being used do not exactly correspond to an even number of bars, the observer must use caution and check the limiting distance of all questionable trees with a tape.

Trees with oblong, egg-shaped, or irregular boles should always be checked with a tape whenever questionable. The irregular shape of these boles does not give a true image of tree diameter.

RELASKOP (AMERICAN SCALE)

The following figure and table display the many combinations of BAF available. Obviously some of these are not very useful and using some may be difficult in the field.

In the figure, the scales have been numbered consecutively from the left "0" which differs from the designations on the Relaskop itself. Therefore, the normal Relaskop designations of 5, 10, 20, a, b, c, and d correspond to the numbers 1, 2, 3, 4, 10, 11 and 12 respectively in the figure below.

The table below was developed from the known percentages (p) of width to horizontal distance for the twelve scales. PRFc and PRFf are the plot radius factors to the tree center and face respectively.

$$BAF = 1.089*p^2 \qquad PRF_c = 8.696226/BAF^{0.5} \qquad PRF_f = PRF_c - (1/24)$$

Scale	% (p)	BAF	PRFc	PRFf	Scale	% (p)	BAF	PRFc	PRFf
4 – 5	0.5050	0.28	16.5016	16.4600	1 – 5	4.4230	21.30	1.8841	1.8424
4 – 6	0.5050	0.28	16.5017	16.4600	2 – 7	4.5455	22.50	1.8333	1.7916
6 – 7	0.5050	0.28	16.5016	16.4600	3 – 10	4.8053	25.15	1.7342	1.6925
7 – 8	0.5051	0.28	16.4984	16.4567	1 – 6	4.9280	26.45	1.6910	1.6494
8 – 9	0.5050	0.28	16.5016	16.4600	2 – 8	5.0506	27.78	1.6500	1.6083
9 – 10	0.5050	0.28	16.5016	16.4600	1 – 7	5.4330	32.14	1.5338	1.4922
1 – 2	0.8875	0.86	9.3897	9.3480	2 – 9	5.5556	33.61	1.5000	1.4583
4 – 6	1.0100	1.11	8.2508	8.2092	1 – 8	5.9381	38.40	1.4034	1.3617
5 – 7	1.0100	1.11	8.2508	8.2092	0 – 4	6.0608	40.00	1.3750	1.3333
6 – 8	1.0101	1.11	8.2500	8.2083	2 – 10	6.0606	40.00	1.3750	1.3333
7 – 9	1.0101	1.11	8.2500	8.2083	10 – 11	6.0606	40.00	1.3750	1.3333
8 – 10	1.0100	1.11	8.2508	8.2092	1 – 9	6.4431	45.21	1.2934	1.2517
2 – 3	1.2553	1.72	6.6385	6.5968	0 – 5	6.5658	46.95	1.2692	1.2275
4 – 7	1.5150	2.50	5.5005	5.4589	1 – 10	6.9481	52.57	1.1994	1.1577
5 – 8	1.5151	2.50	5.5002	5.4585	8 – 11	7.0706	54.44	1.1786	1.1369
6 – 9	1.5151	2.50	5.5002	5.4585	0 – 6	7.0708	54.45	1.1786	1.1369
7 – 10	1.5151	2.50	5.5002	5.4585	0 – 7	7.5758	62.50	1.1000	1.0583
3 – 4	1.7752	3.43	4.6943	4.6526	7 – 11	7.5757	62.50	1.1000	1.0583
4 – 8	2.0201	4.44	4.1252	4.0835	0 – 8	8.0809	71.11	1.0312	0.9896
5 – 9	2.0201	4.44	4.1252	4.0835	6 – 11	8.0807	71.11	1.0313	0.9896
6 – 10	2.0201	4.44	4.1252	4.0835	5 – 11	8.5857	80.27	0.9706	0.9289
0 – 1	2.1428	5.00	3.8890	3.8473	0 – 9	8.5859	80.28	0.9706	0.9289
1 – 3	2.1428	5.00	3.8890	3.8473	0 – 10	9.0909	90.00	0.9167	0.8750
3 – 5	2.2802	5.66	3.6546	3.6130	4 – 11	9.0907	90.00	0.9167	0.8750
4 – 9	2.5251	6.94	3.3002	3.2585	10 – 12	9.0909	90.00	0.9167	0.8750
5 – 10	2.5251	6.94	3.3002	3.2585	9 – 12	9.5959	100.28	0.8684	0.8268
5 – 10	2.5251	6.94	3.3002	3.2585	8 – 12	10.1009	111.11	0.8250	0.7833
3 – 6	2.7852	8.45	2.9920	2.9503	7 – 12	10.6060	122.50	0.7857	0.7441

Scale	% (p)	BAF	PRFc	PRFf	Scale	% (p)	BAF	PRFc	PRFf
0 – 2	3.0303	10.00	2.7500	2.7083	3 – 11	10.8659	128.58	0.7669	0.7253
2 – 4	3.0305	10.00	2.7498	2.7082	6 – 12	11.1110	134.44	0.7500	0.7083
4 -10	3.0301	10.00	2.7502	2.7085	5 – 12	11.6160	146.94	0.7174	0.6757
11 – 12	3.0303	10.00	2.7500	2.7083	4 – 12	12.1210	159.99	0.6875	0.6458
3 – 7	3.2902	11.79	2.5328	2.4911	2 – 11	12.1212	160.00	0.6875	0.6458
2 – 5	3.5355	13.61	2.3570	2.3154	1 – 11	13.0087	184.29	0.6406	0.5989
3 – 8	3.7953	15.69	2.1957	2.1540	3 – 12	13.8962	210.29	0.5997	0.5580
1 – 4	3.9180	16.72	2.1269	2.0853	0 – 11	15.1515	250.00	0.5500	0.5083
2 – 6	4.0405	17.78	2.0625	2.0208	2 – 12	15.1515	250.00	0.5500	0.5083
0 – 3	4.2856	20.00	1.9445	1.9028	1 – 12	16.0390	280.14	0.5196	0.4779
3 – 9	4.3003	20.14	1.9378	1.8962	0 – 12	18.1818	360.00	0.4583	0.4167

Determine Form Factor Using the Spiegel-Relaskop

The form factor is the percent relationship of outside bark diameter at 16 feet above stump height compared to diameter at DBH (see example below where stump height is 1 foot). This can be determined by counting the number of Relaskop bars at DBH and at 16 feet above stump height and then dividing the bars at DBH by the bars at 16 feet above stump height. It is recommended that the surveyor adjust their distance from DBH to attain 18 bars at DBH. Stump height will determine the height at which form factor is taken. Large trees may have a stump height of 2 feet, therefore, form factor would be taken at 16 feet above stump height (18 feet above ground).