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Bureau of Land Management

BLM FOREST ECOSYSTEM INVENTORY

October 1993

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By

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Adapted from

FOREST DATA COLLECTION AND SURVEY HANDBOOK

and

PACIFIC YEW INVENTORY FIELD INSTRUCTIONS FOR WESTERN OREGON

USDI

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Adapted from

FOREST DATA COLLECTION AND SUMMARY PROCEDURE

BY

PACIFIC SOUTHWEST REGION
FIELD INSTRUCTIONS
FOR WESTERN SPRUCE BUDWORM

1982

BLM
Forest Ecosystem Inventory

These instructions are divided into color-coded sections. The first page of each section lists the contents and page number of each item in the section.

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INTRODUCTION AND PLOT ESTABLISHMENT

STAND EXAM GOALS

These procedures provide a standard and consistent method of collecting information on various stands. BLM will use the information collected to check stand performance and current stand conditions. In addition, the information provides for the development of long-term treatment plans and site-specific treatments.

A key element of the stand exam process is the capability to collect, summarize, and store the information electronically. The stand exam process includes stand analysis and treatment criteria processes.

GUIDANCE FOR PROGRAM LEADERS

1. Overall use and need for stand exams

The stand exam system provides information on the stand conditions needed to support the management of a wide range of resources.

The annual number of acres that receive stand exams will depend on the age class distribution and the treatment planned.

2. Type of stand exams

The following are the types and purpose of stand exams:

a. Inventory exam - This exam determines the stand condition, updates the inventory, and projects future stand development and treatments.

b. Prescription exam - This exam determines the treatment needed to develop a specific prescription for the planned treatment. Conduct these exams at least three years before the implementation of the treatment. Prescription exams would be done as needed to support the timber sale plan and annual work plan.

c. Post-treatment exam - This exam checks the treatment results and updates the inventory. This exam is especially appropriate following commercial thinning or any other treatment that would affect the condition of the stand. Post-treatment exams would be done within one year of completion of the treatment.

3. Existing sources of stand information

a. Operations inventory - This source consists of typed polygons and acreage currently in the MICRO*STORMS database.

b. GIS Mapping - GIS maps display visual information on streams, roads, land surveys, and topography.

c. Photos - Use of available photos can help the stratification of OI units and reduce the within-stand variation in the exams.

d. Other - Other information is provided by old type maps, tree improvement records, and employees.

4. Stand exam boundaries

Determine the exact boundaries of the stands selected for examination. Stand exam boundaries are controlled by such factors as size, topographic features (broken terrain, steepness, aspect), and closeness of fit between operations inventory and the proposed exam area. Define the potential boundary to reduce variation within the stand.

5. Data analysis and treatment recommendation

Process the collected data and analyze the information before making treatment recommendations. A generated tree list can be electronically input into stand simulation models to project growth and future stand structure.

A commercial thinning analysis process has been developed that considers the biological and economic factors. The ranking of trees allows manipulation of the cut and leave trees within the program so that the stand can be modeled.

6. Information storage

Store the stand exam summary information and treatment recommendations in MICRO*STORMS.

7. Contract inspection

If the stand exam is conducted by a contractor, inspect all field work to insure compliance with the guidelines in the handbook.

EQUIPMENT CHECKLIST

- Field Instructions
- Aerial photos
- Photo pen (no grease pens)
- Azimuth hand compass (declination set)
- Pocket stereoscope
- 6" Rules divided into 1/20"
- Diameter tape
- 75-foot retractable tape
- Clinometer
- Relaskop
- Flagging
- First Aid kit
- Increment borer (6" and 16")
- Magnifying glass
- Pocket calculator
- Field data recorder
- Transportation map
- Stand exam map

MAPS and PHOTOS

Prior to going to the field, select aerial photos and maps that cover the stand exam area. On the photo, mark the perimeter of the exam, starting reference point, and if possible, survey grid lines and plot centers. Also identify any apparent strata or stand exam types.

All reference data should be marked on the aerial photo using an oil base

ink photo pen that will not smudge and is waterproof.

PHOTO SCALE, AZIMUTH, AND DISTANCE

Before establishing plots or grid line locations, the field crew should determine the true azimuth of the photo and the photo scale. Complete these two items prior to arriving at the first plot.

To determine the true azimuth between two points on the photo, it is necessary to first know the true azimuth of some baseline on the photos.

In developed areas, roads, fence lines, or cutting boundaries which are on section, quarter section, or forty lines can be used for obtaining ground distance and direction. These lines usually run in cardinal directions and can serve as baselines. However, their true azimuth should be checked on the ground before use as a baseline. In areas where such lines do not show on the photo, a base can be quickly established by taking a compass sight between two objects or along some other line visible on both the photo and the ground or map.

Photo scale is determined from the relation between the ground and photo distances. Ground distances can be obtained from maps (if accurate and detailed), land lines visible on photos, or by actually measuring the distance on the ground between two points which are easily located on the photo.

If a known distance cannot be obtained from visible land lines or from a map, it may be necessary to measure the distance between two objects on the ground which are also visible on the photo. If this is the case, lines shorter than 10 chains should be avoided if possible.

Compute the photo scale from the formula:

$$\text{Photo scale reciprocal} = \frac{\text{Map dist. x map scale reciprocal}}{\text{photo distance}}$$

Example:

Photo distance between two points = 3.05 inches
Map distance between same two points = 1.50 inches
Map scale reciprocal = 24,000

$$\text{Photo scale reciprocal} = \frac{1.50 \times 24{,}000}{3.05} = 11{,}803.28$$

Record scale on the back of the photo and round to nearest 1,000 (i.e., 1:12,000).

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), 6-digit stand exam number, distance, and azimuth to the first plot. Document the RP location on the stand exam map. When the stand plot line crosses a road, hang two strips of flagging with the above information written on the flagging.

ESTABLISHING PLOT CENTERS

Use a hand compass and string box (hip chain)/Topcon Range-finder or equivalent to locate plot centers. Establish the plot on the ground at the predetermined location. 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.

If the stand exams 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 remeasurement of the plots.

MAPPING

Map the plot number, plot location, azimuth, distance, and route of travel between plots and plot lines on each stand exam 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.

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.

NARRATIVE

Record any significant or unique features observed while doing the stand exam. 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:

1. Wet areas
2. Rocky areas
3. Landslide areas and potential landslide areas
4. Windthrown areas
5. Oversteepened areas
6. Old PCT areas
7. Road accessibility and logability, etc.
8. Road location information (draws, headwalls, ridges)
9. Wildlife information
10. Topographical description
11. Sensitive areas (cultural resources, botanical concerns)
12. Presence of laminated root rot (*Phelilnus weirii*)

The wildlife portion of the narrative should capture basic information about wildlife and habitat observations. Reference this information to the map where appropriate.

PLOT TYPES

The stand exam program uses the following types of plots:

The variable plot is a sampling system where each tree has its own plot size dependent on the diameter of the tree. (Bell-Dilworth, Log Scaling and Timber Cruising, 1990). In this system, a specified number of points are systematically established in an unbiased manner over the entire stand. Each point is sampled with a Relaskop or prism.

Measure plot: Sampling points at which DBH and height are measured. One site tree is selected and measured, and all specific site information is recorded.

Count plot: Sampling points at which BAF, stand and tree type, plot number, species, and tree count by species are recorded.

Fixed plots are used to inventory shrubs, herbs, and trees under 7 inches diameter breast height (DBH).

Primary fixed plot: The largest fixed-radius plot primarily used in conjunction with variable plots. The primary fixed plot is normally used to sample pre-merchantable sized trees.

Nested fixed plot: A fixed-radius plot of smaller size and having the same plot center as the primary fixed plot. Nested fixed plots are occasionally used to sample tree seedlings.

Transects are based on the planar intersection technique of sampling which involves the establishment of vertical sample planes of known length that traverse the area. Down material intersected by these planes is tallied and categorized when appropriate.

SAMPLING PROCEDURE

Plot locations will be on a grid system and will be distributed to cover the sampled stand. Grid size for determining distance between plots will vary as needed to systematically locate the specified number of plots. Maintain predetermined distances between plots and grid lines within a stand. The distance to stand boundaries from the first and last lines should be one-half the design interval between lines.

Use the following guidelines to determine the number of variable plots, fixed plots, and transects to establish:

1. Variable plots

   Stands less than 41 acres - a minimum of 5 measure plots and no count plots.

   Stands 41 acres to 100 acres - a minimum of 5 measured plots and 15 count plots.

Stands greater than 100 acres - a minimum of 1 count or measure plot per 5 acres.

Count plots will be regularly distributed along the grid lines and will not exceed a ratio of three count plots to one measure plot.

If a measure plot falls on a location with no Type 1 or Type 2 trees (see Item 17 for description of tree type), the measure plot becomes a count plot. When this circumstance occurs, the next plot taken will be a measured plot. Note such changes on the stand exam map.

2. Fixed plots

Establish fixed plots at each measure and count plot location.

3. Transects

Establish transects between each plot on the traversed grid line.

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DATA INPUT

MASTER SCREEN

The following is a description of the information to record on the handheld data recorder for each data field.

ITEM NO. 1 Project Name

Record the project name using up to 8 alphanumeric characters.

ITEM NO. 2 Date of Survey

Record a 6-digit code for the month, day, and year the stand exam is conducted.

Example: 071392 represents July 13, 1992.

ITEM NO. 3 RMA

Record a 3-digit code for identification of Master Unit and Resource Area in western Oregon as follows:

Master Unit	Resource Area	Code
Columbia	Tillamook	111
	Yamhill	112
Alsea-Rickreall	Yamhill	172
	Alsea	173
Clackamas-Molalla	Clackamas	144
Santiam River	Clackamas	184
	Santiam	185
Upper Willamette	McKenzie	231
	S. Valley	232
Siuslaw River	S. Valley	243
	Coast Range	244
South Umpqua	S. Douglas	344
Douglas	Mt. Scott	351
	Tyee	352
	S. Douglas	354
South Coast	Umpqua R.	453
	Tioga	454
	Myrtlewood	456
Josephine	Grants Pass	511
	Glendale	513
	Ashland	515
	Butte Falls	516
Jackson	Grants Pass	521
	Klamath	524
	Ashland	525
	Butte Falls	526
Klamath	Ashland	534
	Klamath	834
	K. Falls East	848
	Lakeview	858

ITEM NO. 4
Township

Record a 4-digit code 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.

> Record townships in whole numbers; that is, 2 or 29.

Quadrant is either **N** for **N**orth or **S** for **S**outh.

Fractional townships are entered as follows:

> 1/2 = 5
> 3/4 = 7

Examples: 29S or 5S5.

ITEM NO. 5
Range

Record a 4-digit code 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.

> Record ranges in whole numbers with leading zeros; that is, 2 or 12.

Quadrant is either **E** for **E**ast or **W** for **W**est.

Fractional ranges are entered as follows:

> 1/2 = 5
> 3/4 = 7

Examples: 2W or 12E7.

ITEM NO. 6
Section

Record a 2-digit code for the section number (01-36) indicating the plot location. Sections 1-9 require the leading zero.

ITEM NO. 7
Stand Exam Number

Record a 6-digit number for the stand exam. The number must not duplicate a previously assigned exam number. Numbers assigned to each district are as follows:

District	Beg. Exam #	District	Beg. Exam #
MEDFORD		***LAKEVIEW***	
Butte Falls	500000	Klamath Falls	100000
Ashland	530000	Warner Lakes	130000
Grants Pass	560000	Lost River	160000
Glendale	580000	High Desert	180000
COOS BAY		***PRINEVILLE***	
Myrtlewood	600000	Deschutes	200000
Tioga	630000	Central Oregon	230000
Umpqua River	660000		
ROSEBURG		***BURNS***	
Mount Scott	700000	Three Rivers	250000
Tyee	730000	Andrews	280000
South Douglas	760000		
SALEM		***VALE***	
Santiam	800000	Southern Malheur	300000
Clackamas	820000	Northern Malheur	330000
Alsea	840000	Baker	360000
Yamhill	860000		
Tillamook	880000		
EUGENE		***SPOKANE***	
Coast Range	900000	Border	400000
South Valley	930000	Wenatchee	450000
McKenzie	960000		

ITEM NO. 8
OI Key Number

Record the 6-digit OI key number for each OI unit included in the stand exam. A maximum of ten different entries are permitted.

ITEM NO. 9
Examiner

Record the name or initials of the individual conducting the stand exam. Limit is 8 alphanumeric characters.

ITEM NO. 10
Stand/Strata Acres

Record as 1, 2, or 3 digits, the number of whole acres examined. The program allows the stand to be divided into three separate stands or substrata, each with its separate reports. For multiple stands or strata, acres must be recorded for each part.

ITEM NO. 11
Basal Area Factor

For variable plots, record the 2-digit number of the Basal Area Factor (BAF) used. The BAF must be identical for every entry within a stand.

Use a BAF that results in an average of 6-10 trees per plot for the entire stand.

ITEM NO. 12
Transect Length

Record to the nearest foot the total length of each transect for each strata or stand.

ITEM NO. 13
Primary Fixed Plot Size

For each strata or stand, record the size of the fixed plot as a **decimal.** Common sizes are:

Plot Size (acre)	Decimal Plot Size	Radius (foot)
1/4	.25	58.9
1/5	.20	52.7
1/10	.10	37.2
1/20	.05	26.3
1/50	.02	16.7
1/100	.01	11.8
1/250	.004	7.4

ITEM NO. 14
Nested Fixed Plot Size

Record the size of the nested fixed plot as a **decimal** as shown under Item No. 13.

ITEM NO. 15
Vegetation Plot Size

Record the size of the vegetation plot in **feet** as shown under Item No. 13.

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VARIABLE, FIXED PLOT, AND TRANSECT DETAIL SCREEN

ITEM NO. 16 Tree Number

Trees will be numbered in order proceeding clockwise around the plot. Tree numbers are automatically recorded in the program on both measure and count plots. When two or more trees are in the same azimuth line, the tree closest to plot center will be given the smaller number.

If trees are numbered with paint, mark the tree at eye level on the side of the tree facing plot center.

ITEM NO. 17 Plot Factor

This item has multiple functions. It identifies the prism factor for variable plots, the size of the fixed plots or nested fixed plots, and the total transect length.

The Prism Factor (PF) can be recorded as a number (i.e., 40) or as a reference to the Master Screen (i.e., B1). The program will repeat the value for each tree and plot until changed. When entering a new strata, the PF may be changed.

For primary fixed plots, enter the size of the plot as a decimal or enter F_1. For nested fixed plots or a secondary nested plot, enter the size of the plot as a decimal or enter F_2 or F_3. The F_1, F_2, and F_3 codes reference the Master Screen.

For transect length, enter the length in feet or enter as referenced to the Master Screen (i.e., T_1, T_2, or T_3).

ITEM NO. 18 Stand Type and Tree Type

Record a 2-digit code for each tree on measure and count plots as follows.

First digit - Stand Type

The stand type number (1, 2, or 3) is used to distinguish different stands or strata on a grid line. This option allows the stand data to be processed based on stand type or strata.

Second digit - Tree Type

Record each tree on the measure and count plots as follows:

Code	Description
1	Conifer leave tree
2	Conifer cut tree
3	
4	Hardwood tree live
5	Dead tree (standing)
6	Dead tree (down)

ITEM NO. 19
Plot Number

Record up to a 3-digit number for all measure and count plots. When conducting transects, leave Item No. 18 blank.

ITEM NO. 20
Tree Species

Record tree species as a 3-digit code for all trees tallied.

Code	Softwoods
202	Douglas-fir
211	Redwood
	TRUE FIRS:
011	Pacific silver fir
015	White fir
017	Grand fir
019	Subalpine fir
020	Calif. red fir
021	Shasta red fir
022	Noble fir
	SPRUCE-HEMLOCK:
092	Brewer spruce
093	Englemann spruce
098	Sitka spruce
263	Western hemlock
264	Mt. hemlock
	PINES:
101	Whitebark pine
103	Knobcone pine
108	Lodgepole pine
116	Jeffrey pine
117	Sugar pine
119	W. white pine
122	Ponderosa pine
	CEDAR-LARCH:
073	Western larch
041	Port-Orford-cedar
042	Alaska-cedar
081	Incense-cedar
242	W. redcedar
050	Cypress
060	All junipers
231	Pacific yew

Code	Hardwoods
312	Bigleaf maple
351	Red alder
352	White alder
361	Pacific madrone
431	Golden chinkapin
492	Pacific dogwood
510	Eucalyptus
542	Oregon ash
631	Tanoak
660	Apple
746	Quaking aspen
747	Black cottonwood
760	Cherry
805	Canyon live oak
815	Oregon white oak
818	Calif. black oak
821	Calif. white oak
920	Willow
981	Oregon myrtle
999	All other hardwoods

The following species may occasionally attain tree size, but are considered understory vegetation and will be tallied as vegetation species (Item No. 35):

Cascara buckthorn (*Rhamnus purshiana*)
Vine maple (*Acer circinatum*)
Mountain maple (*Acer glabrum*)
Douglas maple (*Acer glabrum douglasii*)
Indian plum (*Osmaronia cerasiformis*)
Ocean spray (*Holodiscus discolor*)
Hazel (*Corylus spp.*)
Mountain ash (*Sorbus spp.*)
Sitka alder (*Alnus sinuata*)
Elderberry (*Sambucus spp.*)
Manzanita (*Arctostaphylos spp.*)
Ninebark (*Physocarpus spp.*)
Mountain mahogany (*Cercocarpus spp.*)
Ceanothus (*Ceanothus spp.*)
Red or water birch (*Betula occidentalis*)
Silktassel tree (*Garrya spp.*)
Rhododendron (*Rhododendron spp.*)
Poison-oak (*Toxicodendron spp.*)
Chokecherry and Klamath plum (*Prunis spp., except P. emarginata*)
Service berry (*Amelanchier spp.*)
Mockorange (*Philadelphus spp.*)
Arrowwood or moosewood (*Viburnum spp.*)
Creek and redstem dogwoods 2 (*Cornus spp., except C. nuttallii*)
Hawthorn (*Crataegus*)

ITEM NO. 21 Diameter Breast Height or Tree Count

Measure Plot:

Record DBH on all measure plots. DBH may be recorded to the nearest tenth inch. For recording tenths, the decimal must be entered.

Count Plot:

Record the number of trees counted in each type/species category. The entry is a 2-digit number preceded with a dash. **(Example:** -05 for 5 trees).

ITEM NO. 22 Form Point

No entry is required. Form point is the point on the bole where trees are determined to be IN or OUT.

ITEM NO. 23
Form Factor

Record a 2-digit code for all Type 1 (leave) trees and all Type 2 (cut) trees on all measured plots. Do not record form factor for other tree types.

Form factor is the ratio of diameter outside bark at 17 ft. (above ground height) to diameter outside bark (DOB) at 4.5 ft. above ground height (DBH).

Determine form factor by one of the following methods:

1. Measure DBH with a tape. Measure diameter at 17 ft. with a Relaskop. Divide DOB 17 ft. by DOB at DBH (see Appendix D, page D-4).

2. Count the number of Relaskop bars at DBH and at 17 ft. Divide the number of bars at 17 ft. by the number of bars at DBH. No distance measure is required.

   Use a minimum of 8 bars at DBH on the Relaskop when collecting form factor (see Appendix D - Use of Relaskop).

3. Distance yourself from the tree until you are reading 18 bars at DBH with the Relaskop. Then read the number of bars at 17 ft. above ground level. Take the number of bars found at 17 ft. and reference the bars column of the form factor chart below; then read across to the corresponding form factor.

(18 Bars at DBH)

Bars at 17 ft.	Form Factor
17.5	97
17.0	94
16.5	92
16.0	89
15.5	86
15.0	83
14.5	81
14.0	78
13.5	75
13.0	72
12.5	69

ITEM NO. 24
Top Diameter Fraction

No entry is required. Top diameter fraction is the ratio of diameter outside the bark at some point on the upper bole to the diameter outside the bark at form point.

ITEM NO. 25
Total Height

Measure and record the total height to the nearest foot of each Type 1 and Type 2 tree. For all other trees on the measure plots, estimate total height to the nearest foot.

The total height of broken top trees will be estimated by projecting the tree bole upward and estimating the total tree height relative to the height of the surrounding measured trees.

ITEM NO. 26
Crown Ratio

Crown ratio is that portion of the normal tree bole that supports green, live foliage that is effectively contributing to tree growth. It is expressed as a percentage of total tree height. Normal tree bole includes dead or broken top portions of the bole.

For trees of uneven crown length, ocularly transfer lower branches on the longer side to fill holes in the upper portion until a full, even crown is generated.

Record a 1-digit code for all live trees (Tree Type 1 through 4) 7.0 inch DBH or larger on all measure plots. Use the following codes:

Percent	Code	Percent	Code
1-10	1	51-60	6
11-20	2	61-70	7
21-30	3	71-80	8
31-40	4	81+	9
41-50	5		

ITEM NO. 27
Crown Class

Record a 1-digit code for all live trees 7.0 inch DBH or larger on the measure plots for Tree Types 1 through 4.

Code

1 **Open grown** - Trees with crowns that have received light from above and all sides throughout most of their life, particularly during the early development period. The trees have not been influenced by other trees as to form or crown shape.

2 **Dominant** - Trees with crowns extending above the general level of the crown canopy and receiving full light from above and partly from the side. This includes larger than average trees in the stand, and with crowns dense, comparatively wide and long, but possibly somewhat crowded on the sides.

3 **Codominant** - Trees with crowns forming the general level of the crown canopy and receiving full light from above but comparatively little from the sides. This includes trees with medium-size crowns partially crowded on the sides.

4 **Intermediate** - Trees shorter than dominants or codominants, with crowns below or barely reaching into the main canopy formed by dominant and codominant trees.

These trees receive a little direct light from above and none from the sides. The trees are usually with small crowns crowded on the sides.

5 **Overtopped** - Trees with crowns entirely below the general level of the canopy, receiving no direct

light from either above or from the sides.

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 includes primarily those trees seriously affected by direct competition with adjacent trees.

In two-story or multistory stands, crown class for each tree is judged in the context of its **immediate environment** of crown competition. For example, a dominant tree is a tree that stands significantly 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 shorter than the dominant but still be receiving full light from above and partly from the side. **In its own immediate environment, record such a tree as dominant.** The same principles apply to two-storied stands. Only understory trees immediately next to the overstory tree will be assigned subordinate crown classes. When the overstory consists of scattered veterans standing above many younger trees, a considerable portion of the understory trees will be classified as dominant or codominant.

Crown class, as used here, is a classification of competition for light aimed at separating trees that can grow freely from those that cannot.

In uneven-aged stands of tolerant species (in which the trees are not in small even-aged groups), trees in the intermediate crown position in the stand and with medium-sized crowns will be considered comparable to codominants of even-aged stands and coded as such.

Tolerant species include grand and white fir in ponderosa pine stands; Englemann spruce in true fir stands; and hemlock and western red cedar in Douglas-fir stands.

ITEM NO. 28
Tree Rank

Rank all live conifer trees on all measure plots according to the value of the tree to the stand. Tree Rank is based upon basal area, spacing, crown class, crown ratio, and damage. The highest quality tree is ranked number 1; the second, number 2; etc. If there are more than nine trees in the plot, continue ranking the remaining trees with 9's.

ITEM NO. 29
Plot Crown Closure

For every plot, estimate the percent of crown closure. Record as follows, a 1-digit code on the first line of every plot.

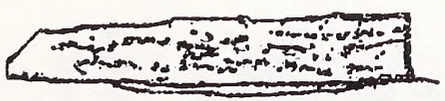
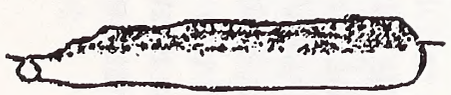
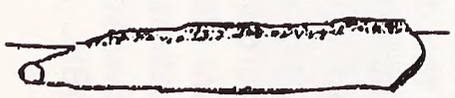
Percent	Code	Percent	Code
1-10	1	51-60	6
11-20	2	61-70	7
21-30	3	72-80	8
31-40	4	80+	9
41-50	5		

ITEM NO. 30
Dead Trees

Record a 2-digit code as follows:

Code	Description	
First Digit		
1	Standing dead	Salvageable
2	Standing dead	Nonsalvageable
3	Down	Salvageable
4	Down	Nonsalvageable
Second Digit		
1	Down log class or snag stage	
2	Down log class or snag stage	
3	Down log class or snag stage	
4	Down log class or snag stage	
5	Down log class or snag stage	

When a salvageable windthrow (Tree Type 6) occurs on or near the plot, measure the distance to DBH as it lays to determine if it is IN or OUT. If the DBH is within the limiting distance, number the windthrow and make a percent damage deduction under Item No. 32. If the determination is made that the windthrow is OUT, mark an X on the tree at DBH.

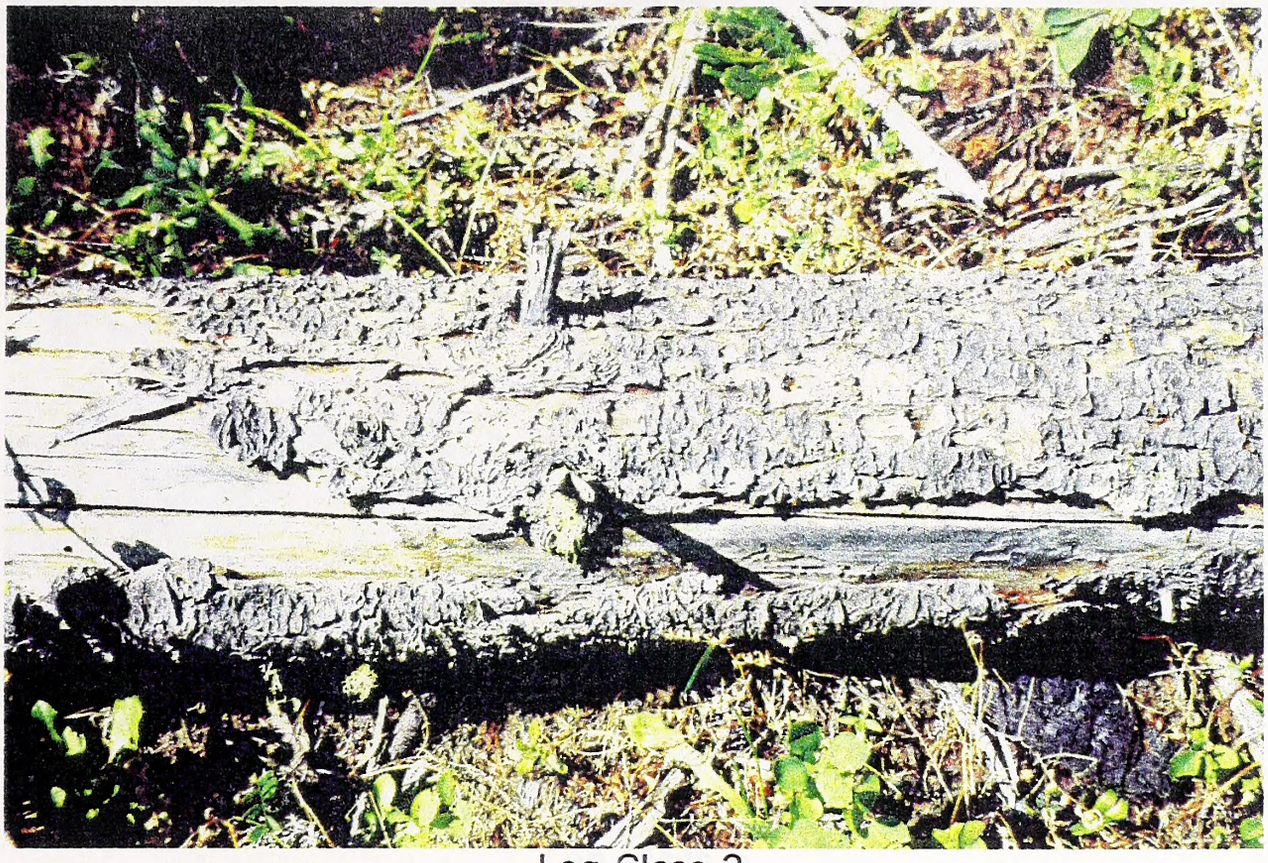
LOG CHARACTERISTICS						
Log Decomposition Class	Bark	Twigs < 3 cm (1.18 in)	Texture	Shape	Color of wood	Portion of log on ground
 Log class 1	intact	present	intact	round	original color	log elevated on support points
 Log class 2	intact	absent	intact to partly soft	round	original color	log elevated on support points but sagging slightly
 Log class 3	trace	absent	hard, large pieces	round	original color to faded	log is sagging near ground
 Log class 4	absent	absent	small, soft, blocky pieces	round to oval	light brown to faded brown or yellowish	all of log on ground
 Log class 5	absent	absent	soft and powdery	oval	faded to light yellow or gray	all of log on ground

Snag Characteristics	Snag Decomposition Class				
	1	2	3	4	5 1/
Limbs and branches	All present	Few limbs, no fine branches	Limb stubs only	Few or no stubs	None
Top	Pointed	Broken			
Diameter, broken top	- - - - Increasing at decreasing rate - - - -				
Height	- - - - Decreasing at decreasing rate - - - -				
Bark remaining %	100	- - - - Variable - - - -			20
Sapwood presence	Intact	- - - - Sloughing - - - -			Gone
Sapwood condition	Sound, incipient decay, hard, original color	Advanced decay, fibrous, firm to soft, light brown	Fibrous, soft, light to reddish brown	Cubical, soft, reddish to dark brown	
Heartwood condition	Sound, hard, original color	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown	Advanced decay at base. Sloughing from upper bole, fibrous to cubical, soft, dark reddish brown	Sloughing, cubical, soft, dark brown; or, fibrous, very soft, dark reddish brown, encased in hardened shell
Estimated age at which snags reach a deterioration state:					
3.6-7.2 in. DBH 2/	0-4	5-8	9-16	17	Fallen
7.6-18.8 in. DBH 3/	0-5	6-13	14-29	30-60	>60
>18.8 in. DBH 4/	0-6	7-18	19-50	51-125	>125

1/ Mostly remnant snags.
2/ Characteristic in Douglas-fir forests 80 years old; mean DBH 5.4 ± 1.2 in.
3/ Characteristic in Douglas-fir forests 80-200 years old; mean DBH 12.8 ± 2.8 in.
4/ Characteristic in Douglas-fir forests 200 years old; mean DBH 38.8 ± 16.4 in.

Log Class 1

Log Class 2



Log Class 3

Log Class 4

Log Class 5

ITEM NO. 31
Damage/Death Type

Record a 2-digit code for all trees on all measure plots.

Damage Codes - Use codes other than 00 when something is wrong with the tree that (a) will prevent it from living to maturity, or surviving 10 more years if already mature; or (b) will prevent it from producing marketable products (straight logs of minimum or greater dimensions); or (c) will reduce or has seriously reduced quality of the tree's products (such as may result from lightning strike, excessive lean, etc.); or (d) will result in growth loss.

Cause of Death - Record the primary cause of death even when two or more causes may be evident. Thus, a tree killed by windthrow but showing evidence of root rot is coded 20.

Damage	Damage Code	Death Code
No serious damaging agent	**00**	--
Insects	--	**10**
Bark beetles	11	--
Defoliators	12	--
Balsam wooly aphids	13	--
Sitka spruce weevil	14	--
Spruce budworm	15	--
Disease	--	**20**
White pine blister rust	21	--
Other rust cankers on main bole	22	--
Other conks on limb or ground near tree	23	--
Phellinus pini conks	24	--
Echinodontium tinctorium conks	25	--
Phaeolus schweinitzii conks	26	--
Other diseases and rot	27	--
Phytophthora lateralis	28	--
Phellinus weirii	29	--
Fire damage	**31**	**30**
Animal damage	**41**	**40**
Weather damage	--	**50**
Lightning	51	--
Wind	52	--
Other	53	--
Suppression	--	**60**
Suppressed seedlings or saplings	69	--
Other damage	--	**70**
Natural mechanical injury	71	--
Top out, dead, or spike top	72	--
Forked top or multiple stem	73	--
Deformed top above merchantable height	74	--
Needles or leaves short, sparse, or off-color	75	--
Excessive lean over 15°	77	--
Sound cull forked tree	78	--
Killed in cultural operation	--	**80**
Power equipment damage	81	--
Cutting damage	83	--
Chemical damage	84	--
Bark stripped (yew)	85	--
Killed outright in logging, but not cut down	--	**90**
Excessive deformity will not produce minimum log	91	--
Hardwood clump	99	--

Record only serious insect damage. Nearly any tree in the woods will have insects on it at one time or another, but the mere presence of insects does not indicate the tree is seriously damaged. Use the following guide in rating serious insect damage for codes 11 through 15.

Code 11 - Bark beetle in Douglas-fir
Needles turning yellow or red over most of tree (tree is dying). Boring dust in bark crevices is conspicuous. Black pitch streaks in bark over much of bole indicates older damage.

Bark beetle in pines
Needles turning yellow to red over most of tree. Small red pitch tubes (less than 1/4 inch in diameter) common. Reddish boring dust in bark flakes and crevices, or around base of tree.

Ips beetle in ponderosa and sugar pine
Tops killed in immature trees. (In some cases, especially in dense stands of saplings, *Ips* beetles may kill every tree in a small area.)

Code 12 - Defoliators include:
On pines - needleminers, sawflies, and pandora moth.

On other conifers - tussock moths, sawflies, pine tip moths, pine needle sheathminers, lodgepole needleminers.

Entire crown more than 25% defoliated. Top 1/3 of crown more than 50% defoliated or discolored. Leader deformed or killed. Current foliage with more than 25% of tips discolored or more than 25% of needles missing. Many branches with no new shoot growth.

Code any damage on hemlock and grand fir.

Code 13 - Balsam wooly aphid
Wooly material or dirty-white encrustation on bark or slight thinning of crown.

Code any Balsam wooly aphid infestation on all true firs.

On subalpine fir: Trees dying from top down, needles turning bright red. Wooly material or dirty-white encrustation on bark.

On Pacific silver fir: Bell-shaped tops. Foliage thin. Individual branches fading throughout crown. Large branch gouts (knob-like swelling on twig ends).

On grand fir: Flattened umbrella tops. Thinning of old needles. New foliage growth reduced. Internodal branches dead or dying. Severe pitching on mainstem.

Code 14 - Sitka spruce weevil
Sitka spruce: Usually attacks trees 6 to 60 feet high. Leaders showing current weevil activity begin to droop in August and often turn brown. Usually one or more side branches assume dominance.

Record old damage which has resulted in serious crooks or deformities if it is weevil caused.

The mere presence of attack on trees 18 feet or taller reflects significant growth loss. Significant deformity on smaller trees also indicates serious growth loss.

Continued attack results in a multi-topped tree and formation of cross-grained wood with multiple piths. Two to three attacks cause serious loss in height growth.

Code 15 - Spruce budworm
Use same criteria for coding as for other defoliators. Spruce budworm is not common west of the Cascades.

Code 21 - White pine blister rust
This disease attacks all Northwest five-needle pines; that is, white pine, whitebark pine, sugar pine. Code this item when any evidence of the disease is found.

The following symptoms may be in evidence in infected trees.
Discolored areas of bark, the outer edges of the discolorations yellowish to orange or shallow blisters on the bark, which may exude a sticky substance; or the **characteristic spindle-shaped swelling of the stem or branches** accompanied by scaly lesions and black pycnial scars; copious resin exudation from ruptured bark in area of infection.

Code 22 - Other rust cankers of the main bole
Code only those cankers that deform the bole, cause open wounds, or threaten to girdle the tree.
Lodgepole pine is often infested with *Peridermium harknessii* "hip cankers" that sometimes kill the tree.

Code 23 - Other conks on bole or limb or ground near base of tree
Use the decay estimation guide in Appendix I for identifying conks (fungus sporophores), as well as in determining the percent cull caused by the fungus.

Code 24 - *Phellinus pini* conks
White speck rot. Use the decay estimation guide in Appendix I.

Code 25 - *Echinodontium tinctorium* conks
Indian paint fungus. Use the decay estimation guide in Appendix I.

Code 26 - *Phaeolus schwienitzii*
Red brown butt rot. Use the decay estimation guide in Appendix I.

Code 27 - Other diseases and rot
In immature trees, code any disease which appears to threaten the tree's chance of developing into a desirable tree at maturity because of top-killing deformity, or decay of bole, or serious reduction of tree vigor. In mature trees, code infections that seriously jeopardize the tree's chance of surviving 10 years.

Examples of other disease and rot:
- Needle blights, wilts, and rusts
- Dry rot associated with sunscalds and mechanical damage
- Needle cast
- Scabs and leaf galls
- Diebacks

Code 28 - *Phytophthora lateralis* Port Orford cedar root rot
Primarily on Port Orford cedar but may also occur on Pacific yew.

Code 29 - ***Phellinus weirii***
Laminated root rot
Primarily in Douglas-fir, also hemlock and true fir. Circular openings in forest with trees jackstrawed. Uprooted trees, many of the roots only stubs, stubs often brittle. White mycelia with fine brown hairs that can be seen with hand lens on the bark of roots. Wood covered with small pits. **Wood appears layered and peels off like separating pieces of paper.** If stumps, the rot often appears in a crescent or half-moon pattern and laminated around edge of stump. Trees in center of infection with sparse or off-color crowns often show presence of disease in roots. In seedling/sapling stands, check stumps of previous stand for presence of *Phellinus weirii* as sign of cause, if seedling/saplings appear to be dying.

Code 31 - **Fire damage**
In coding fire damage, ignore basal scars unless they have killed the cambium on 1/2 or more of the bole circumference, or the cull due to large fire scars is enough to reduce quality of product or to reduce growth.

When foliage is killed by fire, do not code fire damage unless the fire-killed foliage reaches into upper 1/3 of crown. Ground fires may kill foliage on lower branches without seriously damaging tree.

Code 41 - **Animal damage**
Code animal damage for trees when 1/2 or more of the bole circumference has been girdled. Also code animal damage when browsing has seriously decimated seedlings or saplings so they will probably not develop into desirable trees. Includes browsed Pacific yew trees.

Code 51 - **Lightning**
Code only damage in immature trees which will reduce quality at maturity or will prevent mature trees from surviving 10 years.

Code 52 - **Wind**
Code only when partial uprooting by wind will prevent the tree from surviving 10 years.

Code 53 - **Other Weather**
Code only damage caused by obvious snowbreak or damage caused by sunscald which will prevent the tree from surviving 10 years.

Code 69 - **Live suppressed seedling or sapling**
Suppressed understory trees are common in old-growth stands but may occur in second-growth timber, or even as residual trees after logging. Suppressed trees are usually characterized by extremely short or nonexistent internodes; twisted, gnarled stems; short flat crowns of live needles forming "umbrella-shaped" trees; or an extreme sparseness of foliage.

Code 71 - **Natural mechanical damage**
Code damage in immature trees that will reduce quality at maturity or will prevent mature trees from living 10 years. Broken limbs in crown caused by other trees falling into them, or boles 1/2 or more girdled by mechanical actions such as the

rubbing action of trees in the wind, boulders rolling against bole, will be considered here.

Code 72 - Top out or top dead (Spike top)
Code for immature trees. Do not code for a mature tree unless more than 10 feet of top is dead or broken out.

Code 73 - Forked top or multiple stem
Ignore small double leaders in tall trees but code all major forks or multiple stems. Do not code forks above merchantable height (top diameter) in mature trees.

Code 74 - Deformed top above merchantable height
In immature trees, code only when damage will reduce quality of product at maturity. Do not code for mature trees.

Code 75 - Needles or leaves noticeably short, sparse, or off-color
Ignore minor chlorosis or general redbelting of trees due to frost conditions (when the needle tips of trees in a large area are tinged). If defoliators are causing sparseness of foliage, code damage as 12, not 75; and if the needles are off-color because of beetle or a disease attack and it can be identified as such, code according to the insect or disease attacking tree. If the insect or pathogen cannot be identified, use Code 75.

Code 77 - Excessive lean more than 15 degrees from vertical
Code for all trees having this defect regardless of age or size unless a more serious damaging agent is present.

Code 78 - Sound cull forked tree
A hardwood tree that forks within the first 8-foot log or a conifer that forks with the first 12-foot log, the main fork of which forks again within 8 or 12 feet, respectively.

Code 81 - Power equipment damage
Code as for natural mechanical damage. Includes damage caused by powered equipment such as logging cables or tractor skidding.

Code 83 - Cutting damage
Code damage by saw or axe that girdles 1/2 of the tree or will prevent the tree from surviving 10 years.

Code 84 - Chemical damage
Code damage by chemicals that kills more than 25% of entire crown or 50% of top 1/3 of crown.

Code 85 - Bark stripped
Record for Pacific yew trees only. Includes partial or total removal of bark.

Code 91 - Excessive deformity
Code for abnormally squatty trees with abnormal taper, or trees that are severely twisted or gnarled. These trees will not produce a 16-foot log if a conifer, or an 8-foot log if a hardwood.

Code 99 - Hardwood clump
Code when tree starts from a clump that has three or more stems originating from same root system.

This may occur either through stump sprouts or forking. Record only the largest tree within the clump if the trees are less than 7.0 inch DBH. Otherwise, record all trees 7.0 inch DBH and larger.

ITEM NO. 32
Damage Severity

Record a 1-digit code indicating the percent of volume loss in dead or damaged trees. Severity is recorded on measure plots only.

Code	Percent Volume Loss
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81+

ITEM NO. 33
Site Tree

Select one site tree on each measure plot. Site trees should be dominate or co-dominate trees. If no suitable tree is found on the plot, select a suitable site tree off the plot.

Code as follows:

1 equals site tree on plot
2 equals site tree off plot

In addition to the measurements required for Type 1 trees, record the last 10 years radial increment and breast height age.

ITEM NO. 34
Breast Height Age

Record as a 3-digit number, the age at breast height, for each site tree.

Breast height ages for other trees on the plot are optional.

When determining the age of a tree that has a radius greater than the length of an increment borer, use the following procedure:

Bore into the tree as far as possible, extract the core, and count the rings. Measure the diameter of the tree and divide by two, then subtract the bark thickness. This gives the radius of the wood part of the tree. Measure the length of the core and subtract from the radius of wood to determine how much longer the core would have to be to reach the pith. Count the number of rings in the inner 2 inches and extrapolate to the center. Add this to the ring count on the extracted core.

Example: Determine the age of a Douglas-fir 58.6 inches DBH, having bark thickness of 2 inches when a core 14 inches long has 95 rings and the inner 2 inches has 9 rings.

58.6" ÷ 2	=	29.3" (radius of wood & bark)
29.3"-2.0"	=	27.3" (radius of wood)
27.3"-14.0"	=	13.3" (short of reaching center)
9 ÷ 2"	=	4.5 rings per inch
4.5x13.3	=	59.8 or 60 rings
95 + 60	=	155 years old at breast height

ITEM NO. 35
Radial Growth

If collecting data for use in Organon or Hann-Scrivani site determinations, record radial growth for the last five years of growth. Otherwise, radial growth is recorded for a ten-year period.

Record five or ten-year radial growth for all site trees and each 2-inch diameter class for each species on each measure plot.

If encountering more than one tree of the same species per diameter class on a plot, measure the first tree met.

Measure radial growth from an increment core bored immediately below the point of DBH measurement and at right angles to the bole. Count the number of rings in from the outer end of the wood core for the five or ten-year period and mark the point. Using a ruler graduated to 1/20 inch, measure and record as a 2-digit code.

Examples: 6/20, code **6**; 21/20, code **21**.

TABLE OF CONTENTS

VEGETATION DETAIL SCREEN

Information recorded on this screen is used to describe the ground cover and physiographic class of the plot.

ITEM NO. 36
Plot Number

Record up to a 3-digit plot number for all measure and count plots. The default value is the overstory plot number (Item No. 19).

ITEM NO. 37
Plot Size

Record the size of the vegetation plot in feet. The default value is the primary fixed plot size (Item No. 13).

ITEM NO. 38
Stand or Strata

Record the stand or strata number (1, 2, or 3) in which the plot occurs.

ITEM NO. 39
Layer

Record each species of vegetation present in each structural layer of the ground cover. Structural layers are defined and coded as follows:

Code	Description
1	< 6 inches
2	6 inches to 1-1/2 feet
3	1-1/2 to 3 feet
4	3 to 6 feet
5	above 6 feet but below the tree canopy

ITEM NO. 40
Vegetation Species

Each district will determine the level of detail required for understory vegetation identification. Identified understory species data needs should meet specific requirements identified in the RMP and other documents. Include such species as those listed as Special Forest Products, Special Status Species, habitat and community indicator species, noxious weeds, and those which are found in the USDA Forest Service publications listed below.

Use the species codes in the USDA Soil Conservation Service's (SCS) National List of Scientific Plant Names, 1992.

To help with field identification, use the following publications:

1. Major Indicator Shrubs and Herbs on National Forests of Western Oregon and Southwestern Washington (R6-TM-TP-009-89).

2. Key Species for Plant Association on the Rogue River, Siskiyou and Umpqua National Forests (R6-TM-TP-009-89).

3. Major Indicator Shrubs and Herbs on National Forests of Eastern Oregon (R6-TM-190-1985).

4. Sensitive Plants of the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests (R6-WAM-TP-040-92).

5. Principal Indicator Species of Forested Plant Associations on National Forests of Northeastern Oregon and Southeastern Washington (USDA-Forest Service, Pacific Northwest Region, 1988).

6. Indicator Species of Forested Plant Associations on National Forests of Northwestern Washington (R6-MBS-TP-041-1992).

7. Major Indicator Shrubs and Herbs on National Forests of Eastern Washington (R6-TM-TP-304-87).

Enter the SCS alpha character code for each species. Do not record tree species listed in Item No. 20.

Sample codes:

Code	Vegetation Species
RUBUS	Blackberry
PTAQ	Bracken fern
RHAMN	Cascara
CEANO	Ceanothus
CORNU	Creek or redstem dogwood
SAMBU	Elderberry
GRAMA	Grass (all species)
CORYL	Hazel
VACCI	Huckleberry
ARCTO	Manzanita
HOLOD	Ocean spray
BERBE	Oregon grape
TODI	Poison oak
RHMA	Rhododendron
GASH	Salal
RUSP	Salmonberry
CYSC	Scotch broom
POMU	Sword fern
RUPA	Thimbleberry
ACCI	Vine maple

ITEM NO. 41
Average Height

Record the average height in feet, of the vegetation by species. Record species less than 1 foot as 1.

ITEM NO. 42
Cover Percent

Record as a 1-digit code the percent of vegetation cover by species.

Percent	Code
0-10	1
11-20	2
21-30	3
31-40	4
41-50	5
51-60	6
61-70	7
71-80	8
81+	9

The procedure for determining percent cover is as follows:

1. Start at center.

2. Visually divide the plot into 4 quadrants.

3. Each quadrant represents 25%. Visually estimate the percent of the quadrant that is covered by a given competing species. Cover is the crown width projected vertically to the ground. If the species enters the plot cylinder by overhanging, it is also counted.

4. Complete this procedure for each quadrant.

5. Add the 4 quadrants to determine total cover by species and divide by 4.

6. Round to the nearest 10% and enter the corresponding 1-digit code.

Example:

	Salal	Hazel
Quad 1	10%	10%
Quad 2	50%	40%
Quad 3	70%	20%
Quad 4	60%	10%
Total ÷ 4	47% (round to 50)	20%
	code 5	code 2

ITEM NO. 43 Special Forest Products Quality

The following species are commonly sold as special forest products:

Common Special Forest Products
Sword fern
Salal
Oregon grape
Evergreen huckleberry
Beargrass
Princess pine
Moss
Cascara (bark)
Mushrooms:
Morel
King botetus
Chanterelle

Quality is a subjective measure of the value of a product on the open market. Products that are small, shriveled, discolored, or lack sufficient numbers may not be as desirable and, therefore, would bring the seller a lesser price.

For the above species, record quality as a 1-digit code:

Code
1 Excellent
2 Good
3 Poor

ITEM NO. 44
Physiographic Class

Physiographic class is used to describe the topographic features that most affect the management of the area the plot is on. Record as a 3-digit code on all plots. The first digit is for aspect, second for slope, and the third digit for topographic position, as follows:

Physiographic Class Codes

Code	Aspect	Code	Percent	Code	Topographic Position
0	Level	1	1-10	0	Headwall
1	N	2	11-20	1	Flat or rounded ridge ridgetop or mountain peak (2 or more chains wide)
2	NE	3	21-30		
3	E	4	31-40		
4	SE	5	41-50	2	Narrow ridgetop or peak (less than 2 chains wide)
5	S	6	51-60		
6	SW	7	61-70	3	Sidehill-upper one-third
7	W	8	71-80	4	Sidehill-middle one-third
8	NW	9	81-90	5	Sidehill-lower one-third
		9	91+	6	Canyon bottom (less than 10 chains wide)
				7	Bench or terrace
				8	Riparian zone
				9	Swamp or wet flat

APPENDICES

APPENDIX A

GLOSSARY

Basal Area Factor (BAF): A factor that makes it possible to convert stem count per acre to basal area per acre.

Bole: The main stem or trunk of a tree.

Borderline Tree: A tree that 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 limiting horizontal distance (Appendix F) for a given BAF.

Count Plot: Sampling points at which BAF, stand and tree type, plot number, species, and tree count by species and type are recorded.

Cover: The crown width of vegetation projected vertically to the ground.

Crown Class: A description of the relative position of the tree crown with respect to the competing trees which surround it.

Crown Ratio: The amount of live crown in relation to total tree height. Also referred to as Percent Live Crown.

Cut Tree: A tree that would be removed from a stand to be commercially thinned according to basal area guidelines, tree spacing, tree damage, or position in the tree crown. Also called a Type 2 tree.

Dead Tree: All dead (standing or down) trees of commercial species, 7.0 inch DBH or larger, 16 feet in height or larger, and one-third or more sound wood in a minimum 8-foot length.

Diameter at Breast Height (DBH): The diameter in inches of the tree bole outside the bark measured at a point 54 inches (4.5 feet) above ground level. On slopes less than 10 percent, the measurement will be taken on the face of the bole aligned with the plot center. On slopes equal to or exceeding 10 percent, the measurement will be taken on the uphill face of the bole.

Fixed Plot: A circular plot with a given radius measured horizontally from the plot center.

Form Factor: The ratio of the bole diameter outside the bark at 17 feet above stump height to the diameter outside the bark at DBH.

Form Point: The point on the bole where trees are determined to be IN or OUT.

In Tree: A tree whose diameter is large enough to subtend the fixed critical angle of the Relaskop being used in variable plot sampling. Additionally, a tree having 50 percent or more of its bole (measured at ground level) within the fixed plot boundary. Trees meeting this criteria will compose the set of tally trees for each plot.

Leave Tree: A tree that would be left in a stand commercially thinned according to basal area guidelines, tree spacing, tree damage, or position in the tree crown. Also called a Type 1 tree.

Limiting Distance: The horizontal distance from plot center to the center of the bole at the point of diameter measurement to determine whether a borderline tree is truly IN or OUT of the variable plot.

Measure Plot: Sampling points at which DBH and height are measured. One site tree is selected and measured, and all specific site information is recorded.

Out Tree: A tree not meeting the requirements for an IN tree.

Percent Cover: Visual percent cover by a given species.

Predominant Species: The species most often observed in a particular stand.

Reference Point (RP): A photo locatable point established on the ground as the access point to a particular group of plots.

Site Trees: Trees upon which measurements are taken to establish the relationship between tree age and tree height.

Tally Trees: Those trees determined to be in the plot and which are then recorded as required by recording procedures.

Tatum Aid: A summary of frequently used information pertinent to field procedures.

Type (Stand): An area having trees of similar characteristics (age/species/composition/density) from which the collected data will be analyzed as a single stand.

Type (Tree): Trees that have similar characteristics such as species, size, or type of treatment.

APPENDIX B

ACCURACY STANDARDS

DBH	±1 inch
Total tree height	±10 percent
Radial growth	±1/20 inch
Number of trees per plot	100 percent (no tolerance)
Age (DBH)	±10 percent
Species (over/understory)	100 percent correct
Crown ratio	±10 percent
Crown class	80 percent correct classification
Bole length	±5 percent of total bole length
Percent cover (understory)	±10 percent
Understory species height	±1 foot

APPENDIX C

DOWN LOG TALLY

Establishment and location of the transect samples

Transects will be located between each plot along the traverse grid line.

1. Define the location of the transect by stretching a tape along the traverse line. The sample plane is then visualized as passing along one edge of the tape. The tape must extend in a straight line and, once established, should not be moved until the tally for the transect has been completed.

2. Visualize the sample plane as passing along one edge of the tape and extending from the bottom of the litter layer to a height of six feet above the ground surface. Litter is the surface layer of the ground, which consists of vegetative debris that has not been incorporated into the duff or mineral soil through decomposition. The duff layer begins at the point where vegetative debris has noticeably begun to decompose.

3. Use the following procedures to identify down woody material which qualifies for tally. Start at the point marking the beginning of the transect and work along the tape the entire length of the transect.

Tally rules

Tally and record as part of the transect sample all pieces intersected by the sample plane that meet the following criteria:

1. Down, dead woody material consists of dead tree boles, limbs, and other woody pieces that have been severed from their original source of growth and have fallen to the ground. This includes uprooted tree boles and any stems or branches attached to them. It does not include:

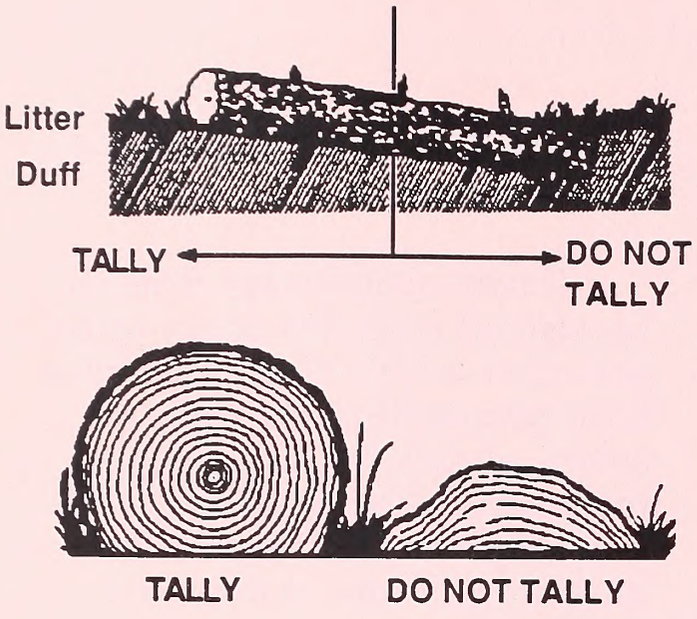
    a. Standing trees, stumps, or shrubs.

    b. Dead stems or branches attached to standing trees, stumps, or shrubs.

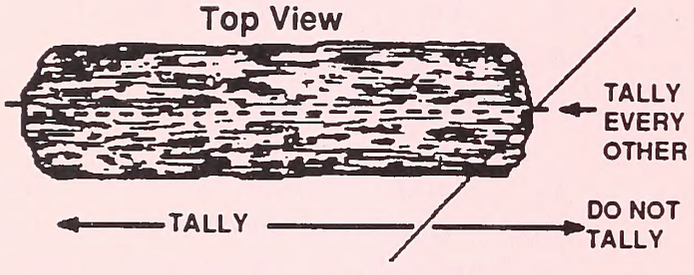
    c. Dead foliage, bark, or other non-woody pieces which are not an integral part of a bole or limb (i.e., bark attached to a portion of a down log would be tallied as part of that log).

2. Down woody material 5.0 inches in diameter or larger at the point where it is intersected by the sample plane and a minimum of 8 feet in length will be tallied.

3. Tally the 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.

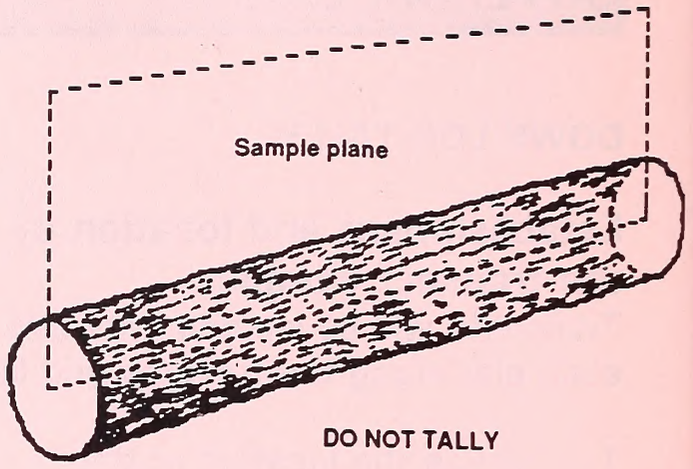


4. If the central axis is exactly crossed (at the end of a piece), count every other such intersection.

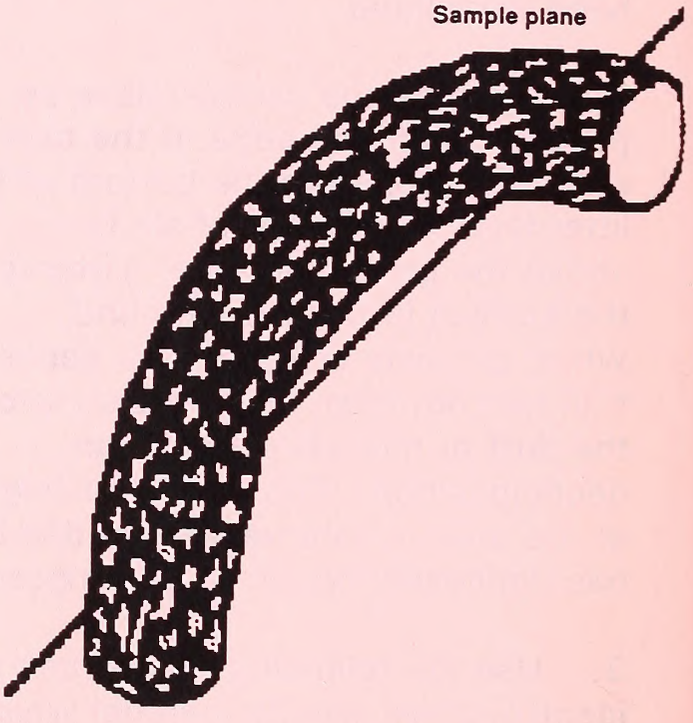


5. Material whose central axis is more than six feet above the ground surface at the point of plane intersection does not qualify for tally.

6. Do not tally the piece if the central longitudinal axis is exactly parallel to and coincides with the sample plane. This should rarely happen.



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



8. Tally wood slivers, chunks, and stumps left after logging if they meet the minimum size requirements.

9. Material can be tallied up to 6 feet from the ground.

Record species, diameter, length, and condition for all down woody pieces tallied. Use the detail screen to record transect data in the following fields:

Species - Item 20
Diameter breast height - Item 21
Total height - Item 25
Damage/death type - Item 31

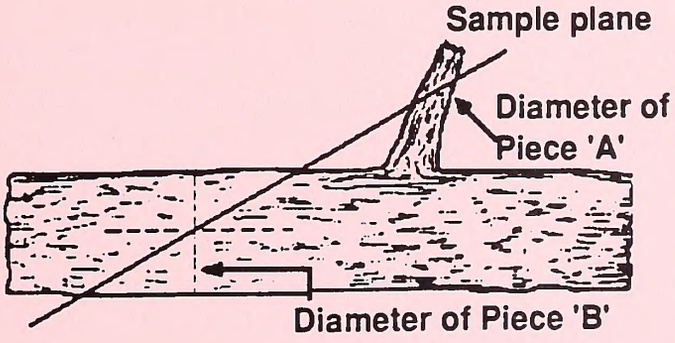
The stand exam program generates an ASCII file for input into a separate down log data processing program.

Species codes

Use the standard species codes from the tree species list located on page 12. When no tally occurs on the survey, record species as "888".

Diameter at point of plane intersection

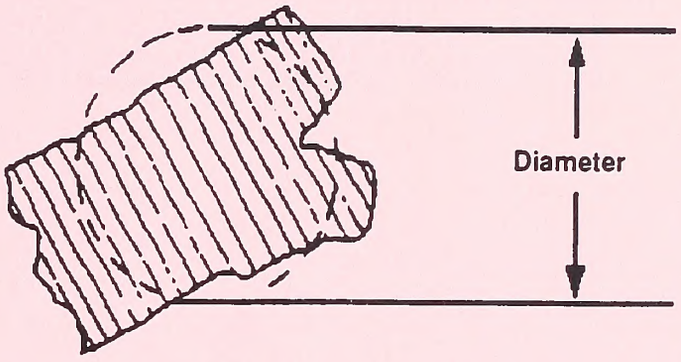
Determine and record the diameter of a qualifying piece at the point where its central longitudinal axis is intersected by the sample plane.



Measuring diameter at point of plane intersection

A diameter tape may be used to make this measurement. No adjustments in the point of measurement will be made for irregularities encountered at the intersection point.

Wood slabs and other noncircular pieces should be visually molded into cylinders in order to determine diameter as shown below:



Record diameter to the nearest inch in the Diameter Breast Height (Item No. 21) field.

Length

Record length to the nearest foot in the Total Height (Item No. 25) field.

Condition

Condition codes will be assigned based on the characteristics of the piece observed at the point of plane intersection. Record condition as a 1-digit code in the Damage/Death Type (Item No. 31) field. The following codes will be used based on these general characteristics:

Code	Bark	Limbs	Texture	Shape	Color of Wood	Portion on Ground
1 Sound	Intact	Present	Mostly sound	Round	Original color	Elevated on support points
2 Soft	Loose or missing	Mostly absent	Sapwood decay present	Round	Original to faded	All to mostly sagging
3 Rotten	Usually absent	Branch stubs loose	Interior decay present	Round to oval	Faded	All of piece on ground

APPENDIX D

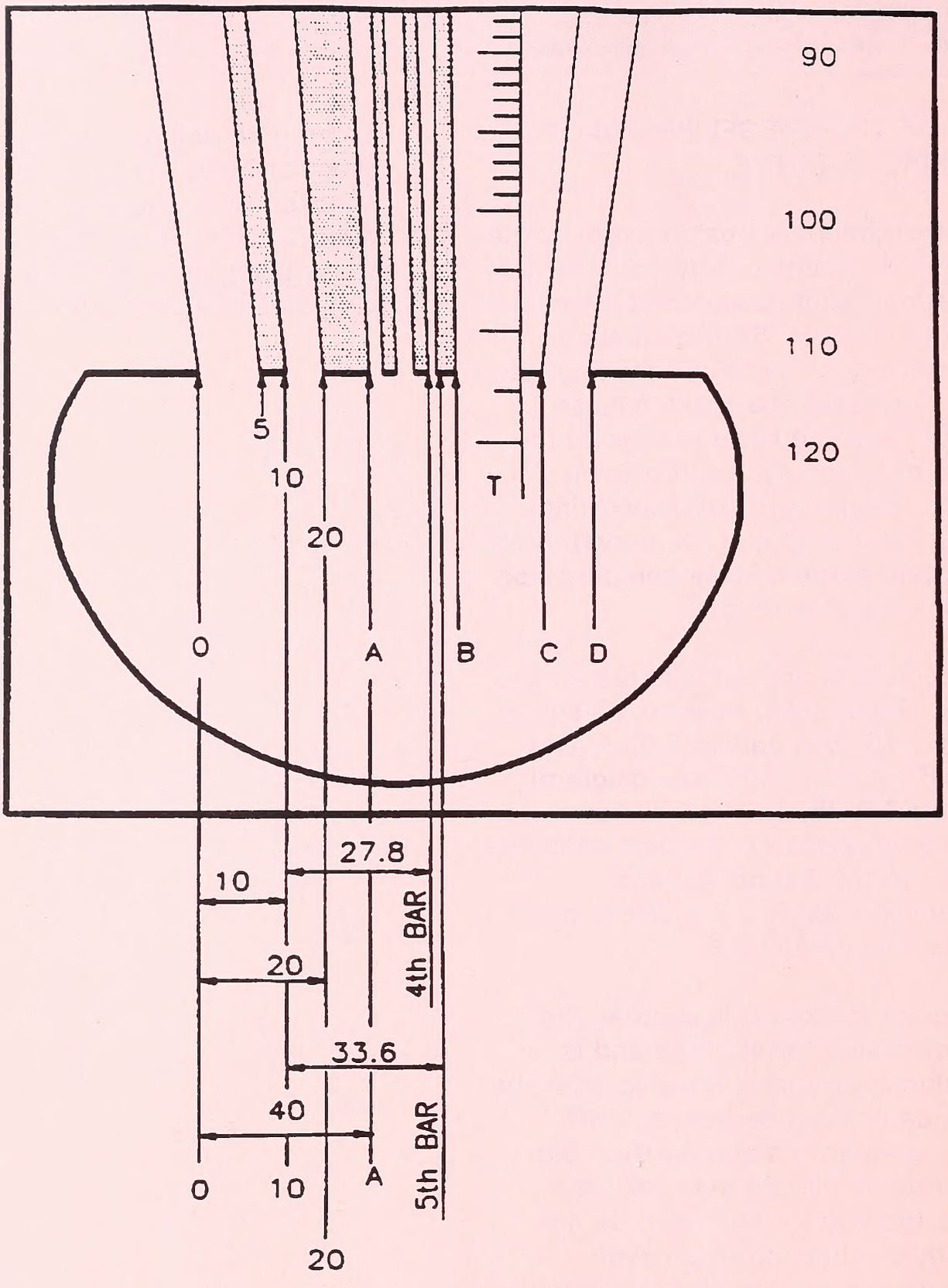
USE OF THE SPIEGEL-RELASKOP (AMERICAN SCALE)

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. In the Tatum Aid and Appendix F, BAFs 27.8, 33.6, and 40 have been added.

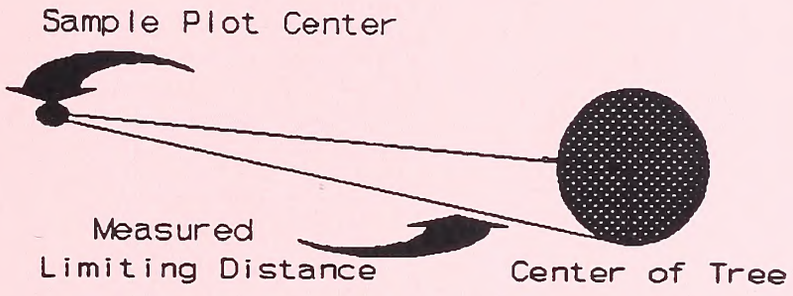
The edge marked 0 is used as the common side for all BAFs and is positioned so that it lines up with the left side of the tree bole at DBH. Trees greater in diameter than the projected angle are in or tallyable. Since the BAFs being used do not exactly correspond to an even number of bars, the observer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

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.

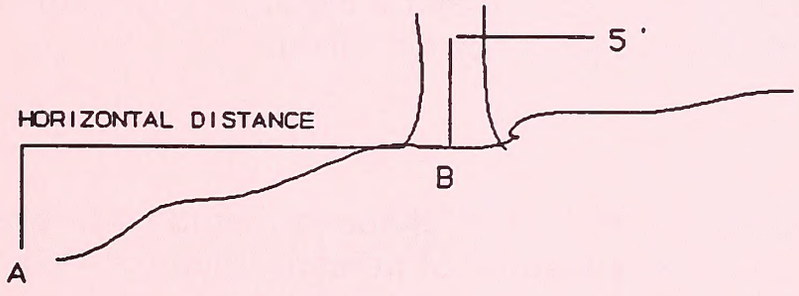

90
100
110
120
5
10
20
T
0
A
B
C
D
27.8
10
4th BAR
20
33.6
40
5th BAR
0
10
A
20

Determination of Limiting and Horizontal Distance

The limiting distance to all questionable trees must be checked with a tape. Hold the tape at DBH at the center of the tree, perpendicular to a line from the sample plot center to the tree.



Determine the limiting distance and compare it to the horizontal distance from point A to point B as illustrated below, and then compare to the tree's tabular limiting distance (Appendix F, Variable Radius Plot Limiting Horizontal Distances).

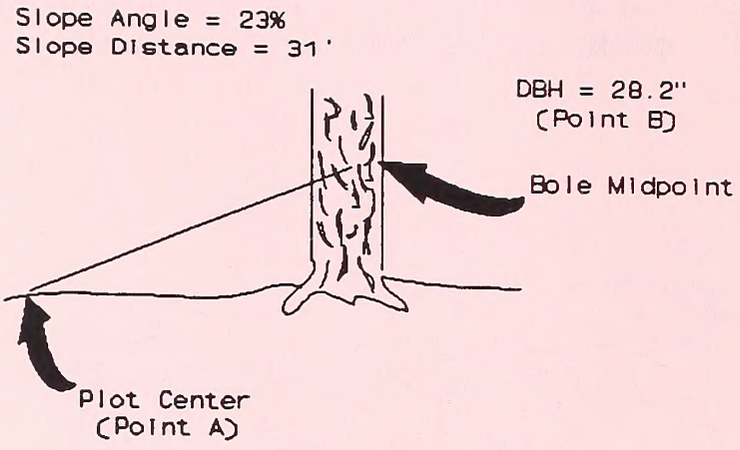


Plumb lines should be dropped to points A and B to ensure perpendicular measurements (2-4 ounce fishing sinkers on nylon cord make good plumb bobs).

To convert slope distance measurement to horizontal distance, measure the slope distance and slope angle from point A to point B as shown below.

Measure slope in percent and consult the slope tables (Appendix E) to determine the expansion factor reciprocal of that angle. Multiple the reciprocal times the measured slope distance to find the equivalent horizontal distance.

Example A:



From Appendix E, the expansion factor reciprocal for 23 percent slope = .974.

.975 x 31' (slope distance) - 30.2' (horizontal distance)

From limiting distance, Appendix F, the limiting distance for a tree 28.2 inches DBH is 27.4 feet using a BAF 80.

Therefore, since the computed horizontal distance is greater than the tabular limiting distance, this tree would not be tallied.

Example B:

If the angle of the slope from eye level above the stake to eye level on the tree bole is measured in degrees instead of percent, take the COS of the angle times the slope distance to find horizontal distance. Using the figure in Example A:

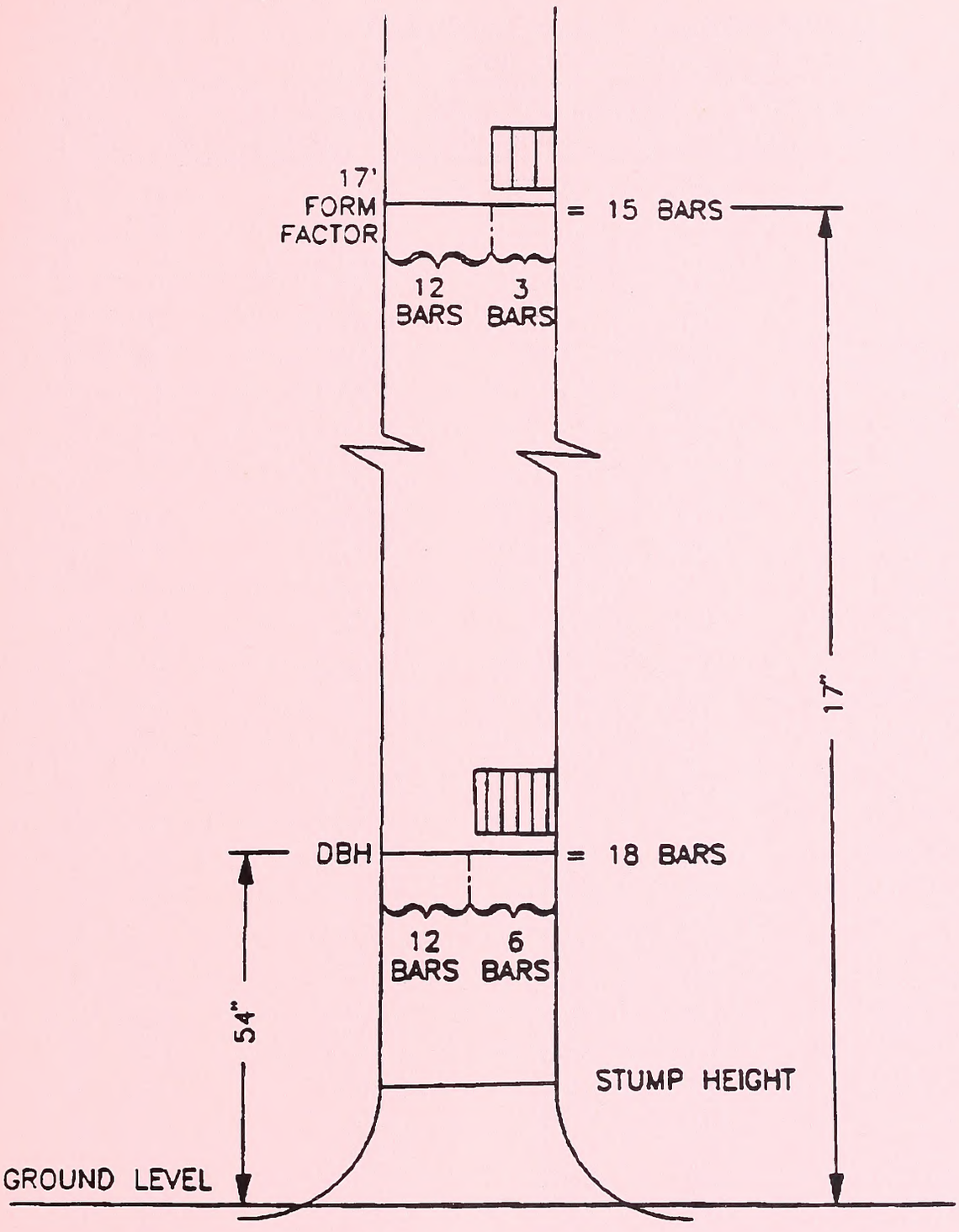
23% = 13°
COS 13° x 31' (slope distance) = 30.2' (horizontal distance)

So using either method, the tree is not tallied.

Determine Form Factor Using the Spiegel-Relaskop

The form factor is the percent relationship of diameter at 17 feet above ground level compared to diameter at DBH. This can be determined by counting the number of Relaskop bars at DBH and 17 feet and then dividing the DBH by D17H. A minimum of 8 bars on the Relaskop should be used when measuring form factor in this manner. This procedure is shown in the following illustration.

EXAMPLE FORM FACTOR



FORM FACTOR

$\frac{15 \text{ BARS}}{18 \text{ BARS}} = .83$

83 FF

APPENDIX E

TRAVERSE SLOPE ADJUSTMENT

(Use for adjustment along a traverse)

Slope (%)	Expansion Factor	Exp. Factor Reciprocal	Slope (%)	Expansion Factor	Exp. Factor Reciprocal
5	1.000	1.000	45	1.096	.912
6	1.002	.998	46	1.100	.909
7	1.002	.998	47	1.105	.905
8	1.003	.997	48	1.109	.902
9	1.004	.996	49	1.114	.898
10	1.005	.995	50	1.119	.894
11	1.006	.994	51	1.122	.891
12	1.007	.993	52	1.127	.887
13	1.008	.992	53	1.131	.884
14	1.010	.990	54	1.136	.880
15	1.011	.989	55	1.142	.876
16	1.013	.987	56	1.145	.873
17	1.014	.986	57	1.151	.869
18	1.016	.984	58	1.156	.865
19	1.018	.982	59	1.161	.861
20	1.019	.981	60	1.167	.857
21	1.021	.979	61	1.171	.854
22	1.024	.977	62	1.176	.850
23	1.026	.975	63	1.182	.846
24	1.029	.972	64	1.188	.842
25	1.031	.970	65	1.192	.839
26	1.033	.968	66	1.198	.835
27	1.036	.965	67	1.203	.831
28	1.038	.963	68	1.209	.827
29	1.042	.960	69	1.215	.823
30	1.044	.958	70	1.221	.819
31	1.047	.955	71	1.227	.815
32	1.050	.952	72	1.232	.812
33	1.053	.950	73	1.238	.808
34	1.056	.947	74	1.244	.804
35	1.059	.944	75	1.250	.800
36	1.063	.941	76	1.256	.796
37	1.066	.938	77	1.263	.792
38	1.070	.935	78	1.267	.789
39	1.073	.932	79	1.274	.785
40	1.078	.928	80	1.280	.781
41	1.081	.925	81	1.287	.777
42	1.085	.922	82	1.294	.773
43	1.088	.919	83	1.300	.769
44	1.093	.915	84	1.305	.766

Slope (%)	Expansion Factor	Exp. Factor Reciprocal	Slope (%)	Expansion Factor	Exp. Factor Reciprocal
85	1.312	.762	120	1.562	.640
86	1.319	.758	121	1.570	.637
87	1.325	.755	122	1.577	.634
88	1.332	.751	123	1.585	.631
89	1.339	.747	124	1.592	.628
90	1.346	.743	125	1.600	.625
91	1.351	.740	126	1.608	.622
92	1.359	.736	127	1.616	.619
93	1.366	.732	128	1.623	.616
94	1.372	.729	129	1.631	.613
95	1.379	.725	130	1.639	.610
96	1.387	.721	131	1.647	.607
97	1.393	.718	132	1.656	.604
98	1.401	.714	133	1.664	.601
99	1.406	.711	134	1.672	.598
100	1.414	.707	135	1.681	.595
101	1.420	.704	136	1.689	.592
102	1.429	.700	137	1.695	.590
103	1.435	.697	138	1.704	.587
104	1.443	.693	139	1.712	.584
105	1.449	.690	140	1.721	.581
106	1.458	.686	141	1.727	.579
107	1.464	.683	142	1.736	.576
108	1.473	.679	143	1.745	.573
109	1.479	.676	144	1.754	.570
110	1.486	.673	145	1.761	.568
111	1.495	.669	146	1.770	.565
112	1.501	.666	147	1.776	.563
113	1.508	.663	148	1.786	.560
114	1.517	.659	149	1.795	.557
115	1.524	.656	150	1.802	.555
116	1.531	.653			
117	1.538	.650			
118	1.546	.647			
119	1.555	.643			

DISTANCE CORRECTION:

a. Adjusted Slope Distance = Slope distance x % slope exp. factor
b. Horizontal Distance = Slope distance x exp. factor reciprocal
c. Horizontal Distance = Slope distance x Cos. of vertical angle

TREE HEIGHT CALCULATION:

a. Total Height = Horizontal distance x (upper % $\pm$ lower %)
b. Total Height = $Tan_1 \pm Tan_2$ x horizontal distance

APPENDIX F

VARIABLE RADIUS PLOT LIMITING HORIZONTAL DISTANCES

Horizontal Limiting Distance from plot center to the center of the bole at the point of diameter measurement.

Dia.	BAF 10	BAF 20	BAF 27.8	BAF 33.6	BAF 40
	Feet	Feet	Feet	Feet	Feet
4	11.0	7.8	6.6	6.0	5.5
5	13.8	9.7	8.3	7.6	6.9
6	16.5	11.7	10.0	9.1	8.2
7	19.3	13.6	11.6	10.6	9.6
8	22.0	15.6	13.3	12.1	11.0
9	24.8	17.5	14.9	13.6	12.4
10	27.5	19.4	16.7	15.1	13.8
11	30.3	21.4	18.3	16.6	15.1
12	33.0	23.3	19.9	18.1	16.5
13	35.8	25.3	21.6	19.6	17.9
14	38.5	27.2	23.3	21.1	19.2
15	41.3	29.2	24.9	22.7	20.6
16	44.0	31.1	26.7	24.2	22.0
17	46.7	33.1	28.3	25.7	23.4
18	49.5	35.0	29.9	27.2	24.8
19	52.3	36.9	31.6	28.7	26.1
20	55.0	38.9	33.3	30.2	27.5
21	57.8	40.8	34.9	31.7	28.9
22	60.5	42.8	36.6	33.2	30.2
23	63.3	44.7	38.3	34.8	31.6
24	66.0	46.7	39.9	36.3	33.0
25	68.8	48.6	41.6	37.8	34.4
26	71.5	50.6	43.3	39.3	35.8
27	74.3	52.5	45.0	40.8	37.1
28	77.0	54.4	46.6	42.3	38.5
29	79.8	56.4	48.3	43.8	39.9
30	82.5	58.3	50.0	45.3	41.3
31	85.3	60.3	51.6	46.8	42.6
32	88.0	62.2	53.3	48.4	44.0
33	90.8	64.2	54.9	49.9	45.4
34	93.5	66.1	56.6	51.4	46.8
35	96.3	68.1	58.3	52.9	48.1
36	99.0	70.0	59.9	54.4	49.5
37	101.8	71.9	61.6	55.9	50.9
38	104.5	73.9	63.3	57.4	52.3
39	107.3	75.8	64.9	58.9	53.6
40	110.0	77.8	66.6	60.4	55.0
	Plot radius factor = 2.75	Plot radius factor = 1.9445	Plot radius factor = 1.665	Plot radius factor = 1.511	Plot radius factor = 1.375
	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.

APPENDIX G

PERCENTAGE DISTRIBUTION OF TOTAL TREE VOLUME

BY 16-FOOT LOGS:

No. of Logs	Log Number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 log	100														
2	84	16													
3	59	34	7												
4	44	34	17	5											
5	37	29	19	12	3										
6	30	26	19	14	8	3									
7	26	22	19	14	11	6	2								
8	23	20	18	14	11	8	3	2							
9	21	17	16	13	11	9	7	4	2						
10	19	17	15	13	11	9	7	5	3	1					
11	17	15	14	12	11	9	7	6	5	3	1				
12	16	14	13	11	11	9	8	6	5	4	2	1			
13	15	13	12	11	10	9	8	7	5	4	3	2	1		
14	13	12	12	10	9	9	8	7	6	4	4	3	2	1	
15	12	12	11	10	9	9	8	7	6	5	4	3	2	1	1

BY 8-FOOT LOGS:

No. of Logs	Log Number											
	1	2	3	4	5	6	7	8	9	10	11	12
1 log	100											
2	55	45										
3	41	33	26									
4	33	28	22	17								
5	28	24	20	16	12							
6	25	22	18	15	12	8						
7	22	20	17	14	12	9	6					
8	20	18	16	14	11	9	7	5				
9	18	17	15	13	11	9	7	6	4			
10	17	16	14	12	10	9	8	6	5	3		
11	16	15	13	12	10	9	8	6	5	3	3	
12	15	14	13	12	10	9	8	6	5	3	3	2

SAMPLE TATUM AID

Card Item No. 3 - RMA

Master Unit	Resource Area	Code
Upper Willamette	McKenzie	231
	S. Valley	232
Siuslaw River	S. Valley	243
	Coast Range	244

Card Item No. 18 - Stand Type and Tree Type

Stand Type - 1st Digit
The type number will be used to distinguish between different stands on a given survey line(s). This option allows the stand data to be processed based on stand type.

Tree Type - 2nd Digit
Record each tree on a measured plot as follows:

- Type 1 - Conifer leave tree
- Type 2 - Conifer cut tree
- Type 3 -
- Type 4 - Live hardwood tree
- Type 5 - Dead tree standing
- Type 6 - Dead tree down

Card Item No. 32 - Severity

Vol. Loss in %	Code
1-10	1
11-20	2
21-30	3
31-40	4
41-50	5
51-60	6
61-70	7
71-80	8
81+	9

Card Item No. 30 - Dead Trees

1st Digit

1 Standing salvageable
2 Standing nonsalvageable
3 Down salvageable
4 Down nonsalvageable

2nd Digit

1 log class/stage
2 log class/stage
3 log class/stage
4 log class/stage
5 log class/stage

Card Item No. 26- Crown Ratio

Percent	Code
0-10	1
11-20	2
21-30	3
31-40	4
41-50	5
51-60	6
61-70	7
71-80	8
81+	9

Card Item No. 27 - Crown Class

Code

1 Open grown
2 Dominant
3 Codominant
4 Intermediate
5 Overtopped

Card Item No. 39 - Vegetation Species

Code		Code	
RUBUS	Blackberry	BERBE	Oregon grape
PTAQ	Bracken Fern	TODI	Poison oak
RHAMN	Cascara	VAPA	Red-huckleberry
CEANO	Ceanothus	RHMA	Rhododendron
CORNU	Creek / redstem dogwood	GASH	Salal
SAMBU	Elderberry	RUSP	Salmonberry
VAOV2	Evergreen-huckleberry	CYSC	Scotchbroom
GRAMA	Grass (all species)	POMU	Sword fern
CORYL	Hazel	RUPA	Thimbleberry
ARCTO	Manzanita	ACCI	Vine maple
HOLOD	Ocean spray		

Card Item No. 44 - Physiographic Class

Code	Aspect	Code	Slope %	Code	Topographic Position
0	Level	1	0 to 10	0	Headwall
1	N	2	11 to 20	1	Flat or rounded ridge, ridgetop or mountain peak (2 or more chains wide)
2	NE	3	21 to 30		
3	E	4	31 to 40		
4	SE	5	41 to 50	2	Narrow ridgetop or peak (less than 2 chains wide)
5	S	6	51 to 60		
6	SW	7	61 to 70	3	Sidehill: upper one-third
7	W	8	71 to 80	4	Sidehill: middle one-third
8	NW	9	81+	5	Sidehill: lower one-third
				6	Canyon bottom (less than 10 chains wide)
				7	Bench or terrace
				8	Riparian zone
				9	Swamp or wet flat

Card Item No. 20 - Tree Species

Code	Softwoods
202	Douglas-Fir
	Pines
117	Sugar Pine
119	W. White Pine
122	Ponderosa Pine
	Hemlock
263	Western Hemlock
264	Mt. Hemlock

	True Firs
011	Pacific Silver Fir
015	White Fir
017	Grand Fir
022	Noble Fir
	Cedar
081	Incense-Cedar
242	W. Red Cedar
231	Pacific Yew
041	Port-Orford-Cedar

Code	Hardwoods
312	Bigleaf Maple
351	Red Alder
361	Pacific Madrone
431	Golden Chinkapin
492	Pacific Dogwood
747	Black Cottonwood
760	Cherry
815	Oregon White Oak
920	Willow
999	All other hardwoods

VARIABLE RADIUS PLOT LIMITING HORIZONTAL DISTANCES

Horizontal Limiting Distance from plot center to the center of the bole at the point of diameter measurement.

Dia.	BAF 10	BAF 20	BAF 27.8	BAF 33.6	BAF 40
	Feet	Feet	Feet	Feet	Feet
4	11.0	7.8	6.6	6.0	5.5
5	13.8	9.7	8.3	7.6	6.9
6	16.5	11.7	10.0	9.1	8.2
7	19.3	13.6	11.6	10.6	9.6
8	22.0	15.6	13.3	12.1	11.0
9	24.8	17.5	14.9	13.6	12.4
10	27.5	19.4	16.7	15.1	13.8
11	30.3	21.4	18.3	16.6	15.1
12	33.0	23.3	19.9	18.1	16.5
13	35.8	25.3	21.6	19.6	17.9
14	38.5	27.2	23.3	21.1	19.2
15	41.3	29.2	24.9	22.7	20.6
16	44.0	31.1	26.7	24.2	22.0
17	46.7	33.1	28.3	25.7	23.4
18	49.5	35.0	29.9	27.2	24.8
19	52.3	36.9	31.6	28.7	26.1
20	55.0	38.9	33.3	30.2	27.5
21	57.8	40.8	34.9	31.7	28.9
22	60.5	42.8	36.6	33.2	30.2
23	63.3	44.7	38.3	34.8	31.6
24	66.0	46.7	39.9	36.3	33.0
25	68.8	48.6	41.6	37.8	34.4
26	71.5	50.6	43.3	39.3	35.8
27	74.3	52.5	45.0	40.8	37.1
28	77.0	54.4	46.6	42.3	38.5
29	79.8	56.4	48.3	43.8	39.9
30	82.5	58.3	50.0	45.3	41.3
31	85.3	60.3	51.6	46.8	42.6
32	88.0	62.2	53.3	48.4	44.0
33	90.8	64.2	54.9	49.9	45.4
34	93.5	66.1	56.6	51.4	46.8
35	96.3	68.1	58.3	52.9	48.1
36	99.0	70.0	59.9	54.4	49.5
37	101.8	71.9	61.6	55.9	50.9
38	104.5	73.9	63.3	57.4	52.3
39	107.3	75.8	64.9	58.9	53.6
40	110.0	77.8	66.6	60.4	55.0
	Plot radius factor = 2.75	Plot radius factor = 1.9445	Plot radius factor = 1.665	Plot radius factor = 1.511	Plot radius factor = 1.375
	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.	Limiting dist. = PRF x Dia.

Damage	Damage Code	Death Code
No serious damaging agent	00	--
Insects	--	10
Bark beetles	11	--
Defoliators	12	--
Balsam wooly aphids	13	--
Sitka spruce weevil	14	--
Spruce budworm	15	--
Disease	--	20
White pine blister rust	21	--
Other rust cankers on main bole	22	--
Other conks on limb or ground near tree	23	--
Phellinus pini conks	24	--
Echinodontium tinctorium conks	25	--
Phaeolus schweinitzii conks	26	--
Other diseases and rot	27	--
Phytophthora lateralis	28	--
Phellinus weirii	29	--
Fire damage	31	30
Animal damage	41	40
Weather damage	--	50
Lightning	51	--
Wind	52	--
Other	53	--
Suppression	--	60
Suppressed seedlings or saplings	69	--
Other damage	--	70
Natural mechanical injury	71	--
Top out, dead, or spike top	72	--
Forked top or multiple stem	73	--
Deformed top above merchantable height	74	--
Needles or leaves short, sparse, or off-color	75	--
Excessive lean over 15°	77	--
Sound cull forked tree	78	--
Killed in cultural operation	--	80
Power equipment damage	81	--
Cutting damage	83	--
Chemical damage	84	--
Bark stripped (yew)	85	--
Killed outright in logging, but not cut down	--	90
Excessive deformity will not produce minimum log	91	--
Hardwood clump	99	--

APPENDIX I

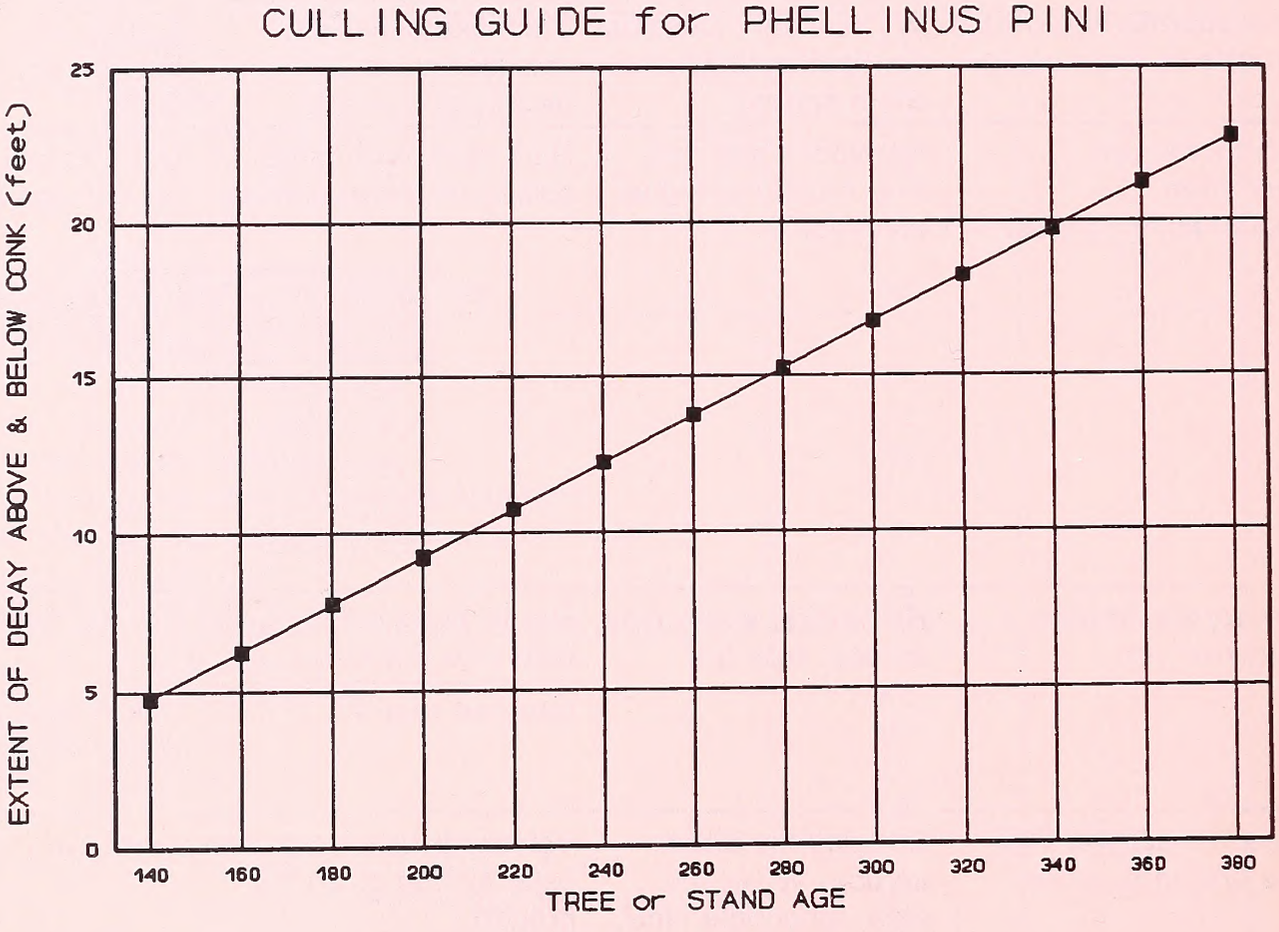
DECAY ESTIMATION GUIDE

Fungus	Tree	Visible Indicator	Deduction
Polyporus amarus (pecky cedar rot)	Incense cedar	Conk, shot hole cup	Cull entire tree
Fomitopsis pinicola (Red belt fungus)	Douglas-fir, hemlocks, W. larch, true firs	Conk mostly on dead trees or dead portions of trees	Cull 1 side of tree 6' below and 4' above each conk
Poria subacida (butt rot)	Hemlocks, W. white pine, Engelmann spruce, true firs, W. redcedar	Large butt scar or crust-like, white to buff conk, usually under root crotches	Cull 10' of 1 side log (8' in cedar)
Fomes robutus F. hartigii (concealed conk)	W. hemlock	Brown crust-like conk on undersurface of branch stub	Cull 16' of 1 side of tree only; if 2 opposite conks, cull entire 16' portion
Gandoderma applanatus (artist's or shelf conk)	W. hemlock, Douglas-fir, Pacific silver fir, Sitka spruce	Shelf-like conk--not common on live trees, usually at wounds	Cull 5' above and below infection point (scar)
Echinodontium tinctorium (Indian paint fungus)	Hemlocks and true firs; mostly at higher elevations	Dark conk with large spines on lower surface	Use the table below for cull deductions

DBH	Length Deduction (ft) Above	Below
5.0-10.9	18	13
11.0-18.9	18	13
19.0-26.9	20	18
27.0-34.9	20	21
35.0-42.9	20	22

Fomitopsis annosa (butt rot)	Hemlocks, white pine, spruce, true firs	Flat or bracket-like conk near root collar	Cull 16' of butt log
		Infected scar	Cull 4' above and below infection points
Phaeolus schweinitzii (red brown butt rot)	Douglas-fir, Sitka spruce, W. white pine, lodgepole pine, true firs	Velvety brown conk near base of tree or on the ground	Cull 8' of butt log
		Conk plus fir scar	Cull to 2' above top of scar or 8' of butt log

Fungus	Tree	Visible Indicator	Deduction
Fomitopsis cajanderi (top rot) subroseous	Douglas-fir, hemlocks	Small conk with rosy lower surfaces; broken top	Cull top 16' log
Fomitopsis officianalis (Quinine conk)	Douglas-fir, W. larch, ponderosa pine	Conk or rotten branch base	Cull 50% of tree volume
Phellinus igniarius or any other conk or fungus on hardwood trees	All hardwoods	Conk	Cull entire tree
Phellinus pini (white speck rot; conk rot) Dull gray or brown, perennial bracket-like or hoof-shaped conk	Douglas-fir under 140 years	Conk	No cull
	Douglas-fir over 140 years	Conk	Use the graph below showing extent of decay
		Swollen knots	Cull 1/2 distance figured for conks
	All pines	Conks	Cull 2' above and 4' below each conk



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