

Minimum Standards for the Establishment and Remeasurement of Permanent Sample Plots in British Columbia

Revised: March 1999



FOREST PRODUCTIVITY COUNCIL OF BRITISH COLUMBIA

c/o BC Ministry of Forests Executive

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Preface

These standards set out the minimum criteria for establishing and measuring permanent sample plots (PSPs) in British Columbia.

The first growth plots in the province were established in the early 1920s in what is now the Vancouver Forest Region. Additional plots were subsequently located throughout the province and used to develop local and provincial yield tables.

The remeasurement results of PSPs are often difficult to aggregate and analyze because of the different measurement standards and procedures used to obtain the basic data. In addition, many data gaps become evident when the distribution of plots is examined by age, site index and stand density classes.

Growth and yield information, coupled with the forest inventory, is the base on which forest planning and investment strategy rest. With the province moving towards second-growth management, new approaches

and priorities, which take in to account the dynamics of the second crop, are being developed to cope with the emerging situation.

The Forest Productivity Council (FPC) provides recommendations on strategic, technical and budgetary direction to BC's chief forester for the development and implementation of a provincial forest productivity program. Composed of representatives of industry, academia and government, the council, in conjunction with regional growth and yield cooperatives, recommends forest productivity program needs and priorities based on a consensus of members.

These standards are voluntary, but their use in establishing and remeasuring PSPs for the purpose of determining growth and estimating future yield is highly recommended. They were developed by the Technical Advisory Committee, under the jurisdiction of the Forest Productivity Council of BC.

Minimum Standards Review Subcommittee (1999)

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Table of Contents

Preface.....	i
Minimum Standards Review Subcommittee 1999.....	i
Summary of Changes	iv
1. Scope.....	1
2. Plot Measure	2
2.1 Scope	2
2.2 Protection	2
2.3 Treatment	2
2.4 Access notes	2
2.5 Tie point.....	2
2.6 Tie line.....	2
2.7 Location.....	2
2.8 Plot centre and corners	3
2.9 Plot number	3
2.10 Ecological information	3
2.11 Plot size and shape.....	3
2.12 Plot identification.....	3
2.13 Plot site attributes	3
2.14 Measurement date	4
2.15 Measurement signature.....	4
2.16 Measurement schedule.....	4
2.17 Crown closure	4
2.18 Top height tree (even-aged stands).....	4
2.18 (a) Plot height (even-age stand)	4
2.19 Plot age (even-aged stands)	4
2.20 Leading species site index (even-aged stands).....	4
2.21 Plot status	4
2.22 Stand origin	4
2.23 Stand composition	5
2.24 Stem map	5
3. Tree Measures	6
3.1 Scope	6
3.2 Tagging and tallying.....	6
3.3 Breast height.....	6
3.4 Diameter	6
3.5 Species.....	7
3.6 Tree class	7
3.7 Decay indicators	7
3.8 Crown class	7
3.9 Live crown	7
3.10 Damage agents and severity.....	7
3.11 Tree heights.....	7
3.12 Breast height age.....	8
3.13 Radial increment.....	8
3.14 Stump measurements	8
3.15 Dead trees	8
4. Standards for Allowable non-sampling Measurement Error for Permanent Samples.....	9
5. Definitions	10
6. References.....	14

Table of Contents

Appendix 1. Standard Symbols and Computer Codes for Growth and Yield.....	15
Appendix 2. Names and Recommended Symbols of Tree Species in British Columbia.....	16
Appendix 3. Damage Agent and Condition Codes	19
Appendix 4. Damage Severity and mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples	22
Appendix 5. Minimum Data Collection Requirements for Ecosystem Field Forms (FS882).....	27
Appendix 6. Dead Tree Attributes.....	28

Summary of Changes

Characteristic	1995 Standard	1999 Standard	Implication
TIE LINE (2.6)			
Bearing	± 2 degrees of the true bearing	± 2 degrees of the true bearing	no change
Distance	± 2% of the true horizontal distance	± 2% of the true horizontal distance	no change
PLOT			
Centre or corners (2.8)	The plot centre of each circular plot, or the four corners of each square or rectangular plot, must be permanently marked. The centre stake of the circular plot must be stem mapped to three trees. Two of the diagonal corners of each square or rectangular plot must also be stem mapped to three trees. Any plot centre or corner stake missing at remeasurement must be re-located.	At establishment, the plot centre of each circular plot, or the four corners of each square or rectangular plot, must be permanently marked and relocatable in the event marker is lost or destroyed. The centre stake of the circular plot must be stem mapped to three living tagged trees. Any alternatives to stem mapping the centre or corners must ensure positional accuracy and be relocatable. Any plot centre or corner stake missing at remeasurement must be re-located. Plot reference trees that are dead or destroyed must be replaced.	the reference to stem mapping the centre of corners was removed as being a procedure
Radius	tolerance for in- or out-borderline trees are ±1% of plot radius	tolerance for in- or out-borderline trees are ± 0.5% of plot radius	general agreement that radius should be reduced to ± 0.5%
Size (2.11)	≥ 0.04 ha to provide approx. 50 crop trees at rotation	≥ 0.04 ha to provide approx. 50 crop trees at culmination	minor wording change, no impact
Sub-plot size	≥ 0.002 ha	≥ 0.002 ha	no change
Shape	circular, square or rectangular (rectangular plots not to exceed length:width ratio of 2:1)	circular, square or rectangular (rectangular plots not to exceed length:width ratio of 2:1)	no change
Rectangular plot side	± 10 cm of the true length	± 0.5%	changed to a percentage, no impact
Plot diagonals	± 20 cm of the true length	± 0.5%	tolerance should be reduced to ± 0.5% and change to % of length to be consistent with other standards
Protection (2.2)	20 m or top height buffer	≥ 50 m (or 100m for airborne treatments) unless on-site evaluation completed	the intent was to have field reconnaissance as the first course of action to weigh the potential influences upon the sample. Default values were increased to account for airborne treatments and pheromone baiting
Missed trees	no error within the established plot	no error	minor wording change, no impact
Crown closure (2.17)	± one 10% class for ground measures	± one 10% class	minor wording change, no impact
Slope (2.13)	± 5% of the true slope	± 5%	minor wording change, no impact
Aspect (2.13)	± 10 degrees of the true aspect	± 10 degrees	minor wording change, no impact
Elevation (2.13)	± 50 metres	± 50 metres	no change

Summary of Changes

Characteristic	1995 Standard	1999 Standard	Implication
Ecological information (2.10)	permanent plots must be classified and recorded to the Biogeoclimatic Ecosystem Classification (BEC) site series level. Classification must be conducted by qualified personnel according to Research Branch specifications	permanent plots must be classified and recorded to the Biogeoclimatic Ecosystem Classification (BEC) site series level. Classification must include information as per Appendix 5 (Research Branch specifications)	specifications now explicit, no impact.
TREE			
Tree species (3.5)	no error except birch, interior spruce and willow may be identified at the genus level	no error except birch, interior spruce and willow may be identified at the genus level	no change
Breast height (3.3)	± 5 cm of the true height	± 5 cm	minor wording change, no impact
DBH (3.4)	± 0.1 cm or 1%, whichever is greater	± 0.1 cm or 1%, whichever is greater	no change
Decay indicators (3.7)	± 1 or 10% of the actual number of external indicators checked, whichever is greater	± 1 or 10% of the actual number of external indicators checked, whichever is greater	no change
Total tree height (3.11)	± 2% of true height (for ht. pole ± 1% or 10 cm	± 2% or ± 20 cm of measured height whichever is greater (for ht. pole ± 1% or 10 cm	wording change, addition of ± 20 cm for instrument error
Breast height age (3.12)	± 2 years or 2%, whichever is greater	± 2 years or 2%, whichever is greater	no change
Crown class (3.8)	± one or 10% , whichever is greater, of all crown classes checked, whichever is greater	± one class or 10% of all crown classes checked, whichever is greater	no change
Live crown (3.9)	± one 10% class for the live crown	± one 10% class for the live crown	no change
Radial increment (3.13)	± 1 mm of the true increment	± 1 mm of the true measurement	minor wording change, no impact
Damage agent and severity (3.10)		new damage agent and severity codes	implement new damage agents and severity codes - January 1999
STUMP (3.14)	identified from last cutting by species and tree number and measured for stump height and diameter outside bark at stump height	Identified from last cutting by species and tree number and measured for stump height and outside bark diameter at stump height.	no change
DEAD TREES (3.15)	all standing dead trees within the plot must be tallied by species and 5 cm diameter classes	all standing dead trees equal to or greater than 10 cm tallied	additional cost per plot of \$29-39 per plot
STEM MAPPING (2.24)			
Bearing	± 2 degrees	± 2 degrees	no change
Distance	± 2% of the true horizontal distance	± 2%	minor wording change, no impact
LOCATION (2.7)			
Latitude	± 1 second	± 1 second	no change
Longitude	± 1 second	± 1 second	no change
UTM	N/A	± 20 metres	keep up with metric standards for mapping

1 Scope

The Forest Productivity Council will meet its vision by developing specific province-wide strategies to:

1. coordinate and improve liaison and technical transfer of measurement data, scientific concepts and operational procedures; and
2. develop a strategy and priorities for the establishment and maintenance of permanent sample plots and research installations to determine growth rates and to measure the long-term response to silvicultural systems.

These standards provide the *minimum* criteria for the establishment and remeasurement of natural and operationally treated permanent sample plots for the assessment of forest growth. Personnel are encouraged

to exceed the minimum requirements wherever practical. Research plots and growth and yield installations may improve on these standards to meet specific objectives. Some of these standards are admittedly arbitrary but are considered to be achievable and repeatable based on field practices.

These standards are intended for use by forestry personnel and agencies that cooperate with the Forest Productivity Council of British Columbia to establish and maintain a database of forest productivity measures for the forest lands of British Columbia.

All field measurements must conform to the metric system of measurement.

2 Plot Measure

2.1 Scope

Section 2 provides the minimum criteria and essential measurements required to describe a permanent sample plot. Current measurement standards are listed in Section 4.

2.2 Protection

[50 metres in general or 100 metres for airborne treatments unless site evaluation completed]

PSPs need to represent the natural (or managed) stand condition and hence should be protected from any activity that might influence the stand dynamics or tree growth. All plots, natural or treated, must have a surrounding Disturbance Free Zone (DFZ) that will provide protection to the sample.

An 'on-site' field inspection should determine the appropriate size for the DFZ. The person responsible for the plot must take into consideration the nature of the disturbance or silvicultural treatment. The plot needs to be protected from windthrow, increased light infiltration, increased or decreased down-slope water flow, or changes to the micro climate resulting from stand tending or harvesting activities adjacent to the sample. The recommended DFZ distance from the plot perimeter should be recorded as a part of the sample information.

When an on-site evaluation is not completed, the DFZ will be assigned a default distance of 50 metres for all activities except for airborne treatments (fertilizer, herbicides, or pesticides) or placement of pheromone baits for forest health trap trees in which case the DFZ is increased to 100 metres.

2.3 Treatment

When plots receive silvicultural treatments, the following must apply:

- For treatment response studies, plots must be established and measured before treatment in order to establish initial conditions.
- Following a thinning treatment, the residual stems must be verified.
- A zone of identical treatment must be established surrounding the plot to ensure the stand is homogeneous and not influenced by adjacent stands.

- A plot must be measured in the same dormant season in which it is treated.
- The type and date of treatment must be recorded.

2.4 Access notes

Routes and distances from an easy-to-find and unlikely-to-change starting point must be described in detail en route to the tie point. Features such as road junctions, creek or river crossings and bridges must be noted. The access notes must include a description of the tie point as well as the bearing and horizontal distance to all the samples or plots using the tie point.

A plot location sketch showing the tie point, the plot(s) and other significant topographic features must also be produced and updated if changes have occurred.

Changes in access must be updated and errors in the access notes must be corrected at remeasurement.

2.5 Tie point

A well-marked tie point containing the plot identification, bearing and horizontal distance must be established for each plot. An aerial photo tie point or GPS coordinate must be established and recorded.

The tie point must be maintained at each remeasurement. If the tie point has been destroyed, a new one must be established and marked and the new bearing and horizontal distance to the sample must be recorded.

2.6 Tie line

[bearing: ± 2 degrees of the true bearing or distance: $\pm 2\%$ of the true horizontal distance]

A well-marked (painted and/or flagged) line must be established and maintained between all plots in a stand and between the tie point and the first plot.

The tie line must be maintained at each remeasurement.

2.7 Location

[latitude and longitude recorded to ± 1 second or UTM recorded to ± 20 m]

2 Plot Measure

Each established plot must be located and identified on a forest cover map having a scale of 1:20 000.

The plot location(s) must be recorded in degrees, minutes and seconds of latitude and longitude or for UTM coordinates, UTM zone and datum.

The type of administrative unit (TFL, TSA, Woodlot, Private, Park, Indian Reserve, etc.) must be recorded for each plot.

2.8 Plot centre and corners

[the centre stake of circular plots and at least two of the diagonal corners of square or rectangular plots must be stem mapped to three living tagged trees]

At establishment, the plot centre of each circular plot, and the four corners of each square or rectangular plot, must be permanently marked and relocatable in the event the marker is lost or destroyed. The centre stake of the circular plot must be stem mapped to three living tagged trees.

Any alternatives to stem mapping the centre or corners must ensure positional accuracy and be relocatable.

Any plot centre or corner stake missing at remeasurement must be re-located. Plot reference trees that are dead or destroyed must be replaced.

2.9 Plot number

Permanent plots must receive a unique plot number indicating Forest Inventory Region, Forest Inventory Compartment, Installation (for multiple samples), Sample and Plot.

2.10 Ecological information

Permanent plots must be classified and recorded to the Biogeoclimatic Ecosystem Classification (BEC) site series level. Classification must include information as per Appendix 5.

2.11 Plot size and shape

Plot size

[≥ 0.04 ha to provide approx. 50 crop trees at culmination]

Plots must be at least 0.04 ha in size and should contain a sufficient number of stems to provide approximately 50 crop trees per plot at culmination age.

Sub-plot size

[≥ 0.002 ha]

Sub-plots ≥ 0.002 ha must be established to allow the measurement and recording of stems ≥ 0.3 m in height but having a DBH less than the plot tagging limit.

Shape

[circular, square or rectangular (rectangular plots must not exceed a length:width ratio of 2:1)]

The plot must be square, circular or rectangular and must be coded and recorded as per Appendix 1. Rectangular plots must not exceed a length:width ratio of 2:1.

Dimensions

[radius, rectangular plot sides or plot diagonals $\pm 0.5\%$ of the recorded horizontal distance]

The plot dimensions (e.g., radius, diagonals and length of sides) must be measured and recorded as horizontal distance.

2.12 Plot identification

Each established plot must be identified with a permanent marker containing the plot number (as per Section 2.9), sample type, date of establishment and administrator for the sample.

Markers must be maintained and, if necessary, replaced at each remeasurement.

2.13 Plot site attributes

Slope

[$\pm 5\%$]

The average plot slope must be recorded to the nearest percent.

2 Plot Measure

Slope position

The slope position must be coded and recorded as per Appendix 1.

Aspect

[± 10 degrees]

The plot aspect must be recorded in an azimuth bearing to the nearest 5 degrees. Zero is used to indicate that the plot is flat and 360 degrees indicates a north aspect.

Elevation

[± 50 metres]

The elevation must be recorded to the nearest 50 m.

2.14 Measurement date

The date of plot measurement must be recorded.

2.15 Measurement signature

Each field crew member must sign and date the field measurements and, if applicable, the contractor must be noted.

2.16 Measurement schedule

Plots must be measured at least every 10 years. All plots should be measured in the dormant season, considered to be from September 1 to April 30. Local forestry personnel will decide whether trees are dormant or growing.

Only under extenuating circumstances are plots to be measured during the growing season. If it is necessary to do so, the following additional information must be determined:

- partial-year DBH growth
- average amount of flush
- percent DBH growth compared to the previous year
- measurement to top of last whorl to discount current partial growth.

2.17 Crown closure

[± one 10% class]

On the plot, the crown closure of trees equal to or greater than the DBH tagging limit must be estimated and recorded to the nearest 10% for each canopy layer.

Any veteran component must be estimated and recorded to the nearest 1%.

2.18 Top height tree (even-aged stands)

[Top Height 1998]

The height of the largest DBH tree within a 0.01 ha plot shall be measured to the nearest 0.1 m.

2.18 (a) Plot height (even-age stand)

[± 2% or 20 cm, whichever is greater]

Mean height of the leading species site trees must be calculated and recorded to the nearest 0.1 m.

2.19 Plot age (even-aged stands)

[± 2 years or 2%, whichever is greater]

Mean age (at breast height) of the leading species site trees must be calculated and recorded in years for each plot.

2.20 Leading species site index (even-aged stands)

The site index (at breast height age 50) of the leading species using the plot mean age and height, must be calculated and recorded. The reference for the site index curve must be cited.

2.21 Plot status

The status of the plot must be assessed and, if found to be damaged, the degree of damage must be recorded. Plot status must be coded and recorded as per Appendix 1.

2.22 Stand origin

The primary origin of the stand must be determined, coded and recorded as per Appendix 1.

2 Plot Measure

2.23 Stand composition

Structure

The stand structure must be assessed, coded and recorded as per Appendix 1.

Plot and stand comparison

The composition of the plot must be compared to the stand, coded and recorded as per Appendix 1.

Veteran component

The presence or absence of veterans within the plot must be assessed, coded and recorded as per Appendix 1.

2.24 Stem map

[bearing: ± 2 degrees; distance $\pm 2\%$]

Plots that have been stem mapped must be identified with a code Y and the method used must be coded as per Appendix 1.

3 Tree Measures

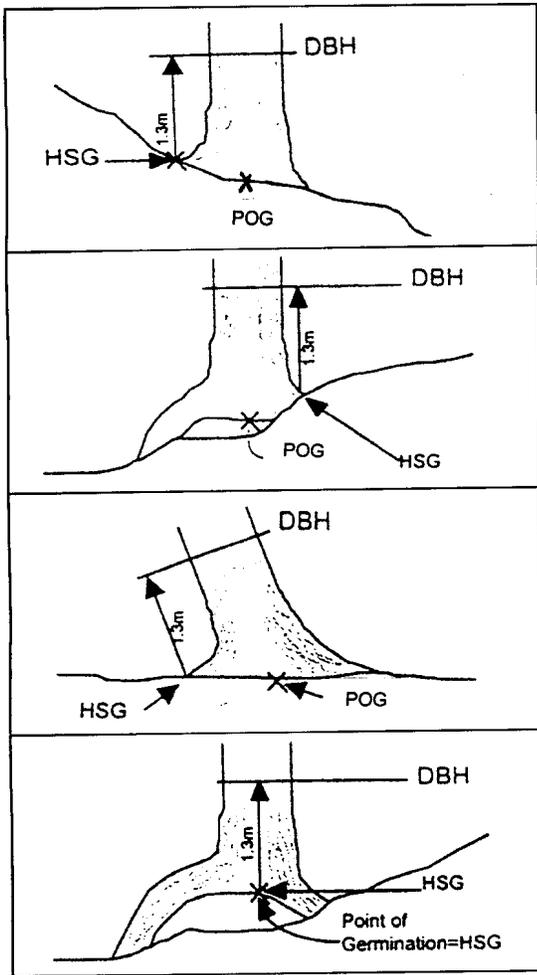


FIGURE 2. DBH in relation to high side ground (HSG).

3.5 Species

[no error except birch, interior spruce and willow may be identified at the genus level]

Trees must be identified as to species; however, birch, interior spruce and willow may be identified at the genus level (see Appendix 2).

3.6 Tree class

[no error]

The tree class of each tree must be recorded and coded as per Appendix 1.

3.7 Decay indicators

[± 1 or 10% of the actual number of external indicators checked, whichever is greater]

Indicators must be recorded and coded according to their location on the tree: lower third of the total tree height, middle third of the total tree height, upper third of the total tree height or combinations of the three as per Appendix 1.

3.8 Crown class

[± one class or 10% of all crown classes checked, whichever is greater]

Each live tree must be assigned a crown class and coded as per Appendix 1.

3.9 Live crown

[± one 10% class for the live crown]

The proportion of live crown must be estimated to the nearest 10% as a percentage of the total tree height.

3.10 Damage agents and severity

[as per Appendix 3 and 4]

Pest or damaging agent incidence and severity must be determined for each tree and recorded as per Appendices 3 and 4.

3.11 Tree heights

[± 2% or 20 cm of measured height whichever is greater (for ht. pole ± 1% or 10 cm)]

All tree heights must be determined and rounded to the nearest 0.1 m.

Top height (1998) is the height of the largest diameter tree on a 0.01 ha plot, providing the tree is suitable. Suitable trees are trees which provide heights and ages that can be validly used to estimate site index. This means that the top height tree must be healthy, not have a broken or damaged top, and not have its height growth affected by a competitor (within and/or external to the plot). The tree should not be a residual left from previous logging. If the largest diameter tree does not

3 Tree Measures

meet these criteria then no top height sample is taken (a “null” plot). The largest diameter tree is selected regardless of species. In some cases, such as mixed species stands, where the top height tree is not suitable in the 0.01 ha plot, an alternative tree may be selected but this height will be termed “site height”.

Additional height measurements must be obtained for all major species, and height-diameter curves obtained for each species on the plot. The curves are derived from the site trees and additional trees that cover the diameter range at the time of measurement.

Pure and mixed species stands

In pure stands (leading species > 80% basal area), site trees shall be measured for the leading species. In mixed species stands (leading species ≤ 80% basal area), site trees can be measured for as many species as desired. However, as a minimum in mixed stands, site trees shall be measured for the two most prominent species by basal area.

Number of site trees per plot

The number of site trees to be measured for each major species shall be spatially distributed based on the ratio of 1 tree per 0.01 hectare plot size, (e.g., 4 site trees for a minimum plot size of 0.04 ha to a maximum of 10 site trees for plots ≥ 0.1 ha).

Additional tree heights

A minimum of 15 additional trees (if present) per plot must be measured for height, covering the range in diameters down to the sub-plot DBH tagging limit.

Minor and scattered species

A minimum of 15 trees (if present) for each minor and scattered species within the plot must be measured for height, covering the entire range in diameters down to the sub-plot DBH tagging limit.

Veterans

A minimum of one height measurement is required for each veteran species within the plot. All other veterans shall have their heights estimated.

3.12 Breast height age

[± 2 years or 2%, whichever is greater]

Simple structure (even-aged, single layer)

Breast height ages must be taken on the top height tree as well as the site trees of the leading two major species.

At least one age is required for each veteran species.

Complex structure (uneven-aged)

Breast height ages must be taken on the top height tree, the site trees as well as two additional trees from the younger portion of the stand for the leading two major species.

One age is required for each veteran species.

3.13 Radial increment

A 10-year and 20-year radial increment at breast height must be taken on all trees measured for age.

3.14 Stump measurements

[identify species, height and outside bark diameter]

In assessing stands under partial cutting regimes, all stumps from the last cutting must be identified as to species and tree number, and measured for stump height and outside bark diameter at stump height.

3.15 Dead trees

[all standing dead trees equal to or larger than 10 cm tallied]

At plot establishment, all standing dead trees, equal to or greater than 10 cm DBH must be measured as per Appendix 6.

At remeasurement, all standing dead trees and trees that are down and died since the last measurement must be measured as per Appendix 6.

Diameter must be measured for all trees that have died since the last measurement. If the tree cannot be located, it will be presumed missing

4 Standards for Allowable Non-sampling Measurement Error for Permanent Samples

The standards listed below are defined as the maximum allowable non-sampling error or variation in any measured quantity. Excessive error within a permanent plot will lead to its rejection.

Characteristic	Allowable Error
TIE LINE	
Bearing	± 2 degrees of the true bearing
Distance	± 2% of the true horizontal distance
PLOT	
Centre or corners	the centre stake of circular plots and at least two of the diagonal corners of square or rectangular plots must be stem mapped to three living tagged trees
Radius	tolerance for in- or out-borderline trees are ± 0.5% of plot radius
Size	≥ 0.04 ha to provide approx. 50 crop trees at culmination
Sub-plot size	≥ 0.002 ha
Shape	circular, square or rectangular (rectangular plots not to exceed length:width ratio of 2:1)
Protection	≥ 50 m (or 100 m for airborne treatments) unless on-site evaluation completed
Missed trees	no error
Crown closure	± one 10% class
Slope	± 5%
Aspect	± 10 degrees
Elevation	± 50 metres
Rectangular plot side	± 0.5%
Plot diagonals (2)	± 0.5%
Ecological information	classified and recorded to the BEC site series level and to include information as per Appendix 5
TREE	
Tree species	no error except birch, interior spruce and willow may be identified at the genus level
Breast height	± 5 cm
DBH	± 0.1 cm or 1%, whichever is greater
Decay indicators	± 1 or 10% of the actual number of external indicators checked, whichever is greater
Total tree height	± 2% or 20 cm of measured height whichever is greater (for ht. pole ± 1% or 10 cm)
Breast height age	± 2 years or 2%, whichever is greater
Crown class	± one class or 10% of all crown classes checked, whichever is greater
Live crown	± one 10% class for the live crown
Radial increment	± 1 mm of the true measurement
Pest injury	as per Appendix 3 and 4
STUMP	identify species, height and outside bark diameter
DEAD TREES	all standing dead trees equal to or larger than 10 cm tallied
STEM MAPPING	
Bearing	± 2 degrees
Distance	± 2%
LOCATION	
Latitude	± 1 second
Longitude	± 1 second
UTM	± 20 metres

5 Definitions

Access notes	a set of notes describing the route to a sample's tie point tree from an easily recognizable feature, giving distances and changes in direction.
Age class	any interval into which the age range of trees in a stand is divided for classification and use.
Age range	the difference between the minimum and maximum ages in a stand.
Aspect	the direction towards which a slope faces.
Azimuth bearing	a bearing based on the numbering of the compass scale from 0 to 360 degrees.
Basal area	(a) of a tree, the area in square metres of the cross section of the stem at breast height; and (b) of a forest stand or forest type, the area in square metres per hectare of the cross section at breast height of all trees measured to a specified diameter limit.
Biogeoclimatic ecosystem	a system of natural taxonomic classification of ecosystems that is widely used in British Columbia.
Blind conk	a pronounced swelling or depression around knots resulting from the tree's attempt to heal over an abortive conk or the point from which an old conk has dropped.
Breast height	the standard height, 1.3 m above ground level, at which the diameter of a standing tree is measured. On sloping ground, breast height must be measured on the uphill side of the tree.
Breast height age	the number of annual growth rings between the bark and the pith, as counted at breast height.
Buffer	a strip of variable width designed to cushion or shield a critical area (such as a PSP and its DFZ) from a nearby treatment or disturbance. Buffers vary in size and duration to reflect the nature of the treatment or disturbance and to ensure that the critical area is not affected in any way by the treatment or disturbance.
Conk	a large, protruding and firm sporophore of a wood-decaying (Basidiomycete) fungus formed on tree trunks, branches or stumps.
Crook	a defect in trees or logs, consisting of an abrupt bend. The defect results from the death or breakage of the main stem or portion of a tree fork.
Crown class	<p>a designation of trees in a forest with crowns of similar development and occupying similar position in the canopy. Crown classification applies to groups of trees. The following crown classes are recognized:</p> <p>Dominant: trees with crowns extending above the general level of the canopy and receiving full light above and partly from the sides. These trees are taller than the average trees in the stand and have crowns well developed but possibly somewhat crowded on the sides.</p> <p>Codominant: trees with crowns forming the general level of the canopy and receiving full light from above, but comparatively little from the sides. These trees usually have medium-sized crowns more or less crowded on the sides.</p> <p>Intermediate: trees shorter than those of the two preceding classes, with crowns either below or extending into the canopy formed by codominant and dominant trees. These trees receive little direct light from above and none from the sides, and usually have small crowns considerably crowded on the sides.</p> <p>Suppressed: trees with crowns entirely below the general level of the crown cover, receiving no direct light either from above or from the sides.</p>

5 Definitions

	Understory: trees clearly of a much younger age class than the stand as a whole in even-aged stands.
	Veteran: in even-aged stands, the occasional large stem of a much older age class (≥ 40 years) than the stand as a whole; a living remnant of a former stand.
Crown closure	the percentage of ground area covered by the vertically projected tree crown areas.
DBH tagging limit	the minimum diameter at breast height to which trees are to be recorded and measured. For plots the limit is 4.0 cm or lower. For sub-plots the limit is 2.0 cm or lower.
Decay indicator	external abnormalities signifying the possible presence of decay in trees. The eight indicators of decay are: conk, blind conk, scar, fork or crook, frost crack, mistletoe, rotten branch and dead or broken top.
Disturbance free zone (DFZ)	a determined area around a PSP that may interact biologically and abiotically with the PSP through root and crown contacts, water and nutrient exchange, light transmission, etc., and that acts to protect the PSP from surrounding disturbances.
Dormant season	the season of no or minimal tree growth, generally from September 1 to April 30.
Dwarf mistletoe	a parasitic flowering plant in the genus <i>Arceuthobium</i> (family Loranthaceae), which has no apparent leaves and occurs only on the above-ground parts of one or more coniferous species.
Elevation	the position of a given point above the mean sea level.
Even-aged	a forest, stand or forest type in which relatively small age differences exist between individual trees. The difference in breast height age for the trees in the main canopy should be less than 20 years.
Fork	a point on the tree trunk where it splits into two or more distinct stems. It is the result of two or more leaders continuing to grow.
Frost crack	a radial split along the grain in the stem and branches of a tree, normally as a result of internal stresses set up by freezing temperatures. Such cracks may open to the surface or remain internal. Frost crack is an indicator of a hidden defect that is due to the entry of wood-destroying fungi.
Global Positioning System (GPS)	the U.S. Department of Defense Global Positioning System is a constellation of 24 satellites orbiting the earth at a very high altitude. GPS satellites transmit signals that allow one to determine, with great accuracy, the locations of GPS receivers. The receivers can be fixed on the Earth, in moving vehicles, aircraft, or in low-Earth orbiting satellites. GPS is used in air, land and sea navigation, mapping, surveying and other applications where precise positioning is necessary.
High side	the highest point of mineral soil or a humus layer around the base of the tree, no lower than the point of germination. Breast height is 1.3 m above high side measured parallel to the tree bole.
Installation	a group of two or more samples such as a control or treatment pair.
Layer	a horizontal stratum or layer in a plant community and in a forest, appearing as one or more canopies. The following layer classes are recognized: Single-layered: a forest having one story (the main layer). Multi-layered: a forest having two or more stories.
Leading species	the primary species based on whole stem volume, stem count or basal area.

5 Definitions

Live crown	the uninterrupted crown (including one-sided crowns) from the highest living point to the lowest live branch. A crown is considered to be uninterrupted if gaps in the continuous live crown are < 2 m in length. Forks originating below breast height and epicormic branches are not considered part of the crown.
Major species	a species that contributes 20% or more by volume to a stand.
Minor species	a species that contributes 10–19% by volume to a stand.
Permanent sample plot (PSP)	an area with fixed boundaries within a forest stand, used to collect information related to forest growth and yield.
Pest incidence	the absence or presence of a pest on an individual tree.
Pest severity	the quantity of pest damage on an individual tree. Severity is described and measured on relative scales for each major pest group and for some individual species (see Appendix 4).
Pith	the small cylinder of primary tissue of a stem or branch around which the annual rings form, and usually darker in colour than the surrounding wood. It is Year 0 when tree age is being counted.
Plot	a subset of a sample.
Plot age	the average breast height age of the site trees of the leading species.
Plot centre	the physical centre of a PSP, usually marked with a stake and a cairn. In circular plots, it is the origin of measurements that determines the perimeter of the plot.
PSP matrix	a multidimensional matrix to categorize PSPs having similar characteristics. The matrix currently considers geographic region, treatment type, species, age class, site class and stand density class.
Radial increment	the increase in the inside bark radius of a tree stem during a given period.
Reference point	a point identified on the ground or on a photograph, which can be reasonably expected to be permanent, used as an aid in the location of a sample tie point.
Sample	the unit that contains the entire sample population. A sample may consist of one or more plots.
Sapling	a young tree having a diameter at breast height > 1 cm and less than the smallest merchantable diameter.
Scar	an injury caused by external forces that have exposed the heartwood or sapwood of the tree to attack by wood-destroying fungi.
Scattered species	a species that contributes less than 10% by volume to a stand.
Site association	a group of biologically equivalent sites that have similar vegetation and productivity potential.
Site index	an expression of the forest site quality of a stand, at a specified age, based on a particular height (e.g., top height).
Site series	a site association specific to the level of biogeoclimatic variant. Permanent sample plots must be classified to the site series level.
Site tree	a dominant or codominant tree with both an age and height suitable for estimating site index.
Slope position	the relative position within a water catchment profile.

5 Definitions

Stand density	a quantitative measure of tree cover on an area, expressed as live stems per hectare or according to Wilson's spacing factor.
Stem map	a map showing the location of the germination point of each tagged tree on a plot in relation to a fixed point.
Tie line	a marked line, painted and/or flagged, on trees and other objects between the tie point and a plot, as well as between plots.
Tie point	a feature easily recognised on the ground and on aerial photographs, used as a reference point indicating the start of a tie line that leads to a PSP.
Timber supply area (TSA)	an area of the province created by the Ministry of Forests for the analysis, planning and management of timber resources.
Top height (1998)	top height is the height of the largest diameter tree on a 0.01 ha plot, providing the tree is suitable. Suitable trees are trees which provide heights and ages that can be validly used to estimate site index. This means that the top height tree must be healthy, not have a broken or damaged top, and not have its height growth affected by a competitor. The tree should not be a residual left from previous logging. If the largest diameter tree does not meet these criteria then no top height sample is taken (a "null" plot). The largest diameter tree is selected regardless of species.
Total age	the number of years elapsed since the germination of the seed or the budding of the sprout or root sucker.
Tree farm licence (TFL)	a privately managed sustained yield unit consisting of Crown and private forest lands.
Universal transverse mercator (UTM)	a universal globally defined map projection and plane coordinate system based on a series of 60 zones world-wide, each covering 6 degrees of longitude in a north-south strip. UTM uses a cylindrical surface that intersects the earth along two lines parallel to a meridian of longitude called the central meridian. UTM values are generally recorded in metres.
Wilson's spacing factor	a measure of stand density used to define the PSP matrix. It is calculated as the average spacing between trees, divided by the stand's average height of the site trees. The quotient is expressed as a percent. For square spacing, Wilson's spacing factor is derived as follows: $\left(\frac{\sqrt{\frac{10000}{N}}}{H} \right) 100$ where, H = average height of the site trees N = live trees per hectare
Zone of identical treatment	a buffer surrounding the plot to ensure that the stand is homogenous and not influenced by adjacent stands or treatments.

6 References

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Appendix 1: Standard symbols and computer codes for growth and yield

Acceptable code	Description
Plot shape (2.11)	
C	Circular
R	Rectangular
S	Square
Slope position (2.13)	
c	Crest
u	Upper slope
m	Middle slope
l	Lower slope
t	Toe
d	Depression
f	Flat
Plot status (2.21)	
A	Active
D	Disturbed
I	Inactive, abandoned
L	Lost
X	Destroyed
Stand origin (2.22)	
C	Coppice
F	Fill-planted
G	Genetically improved
N	Natural
P	Planted
R	Residual stand
S	Seeded
Stand structure (2.23)	
C	Single layer, uneven-aged
S	Single layer, even-aged
M	Multi layers, even-aged
Z	Multi layers, uneven-aged

Acceptable code	Description
Plot and stand comparison (2.23)	
Y	Plot representative of stand
N	Plot not representative of stand
Veteran component (2.23)	
N	Veterans absent
Y	Veterans present
Stem map (2.24)	
G	Grid system
PM	Plane table and measured distances
PI	Plan table and intersecting lines
SC	Staff compass and polar coordinates
RP	Right angle prism
O	Other
Sub-plot tree classes (3.2)	
0	Trees 0.2 – 1.3 m in height
1	Trees to 1.9 m DBH (1 cm midpoint)
Tree class (3.6)	
1	No decay indicators present
2	One or more decay indicators present
3	Dead potential at remeasurement
4	Dead useless at remeasurement
5	Veteran
6	Unnatural mortality
Crown Class (3.8)	
1	Dominant
2	Codominant
3	Intermediate
4	Suppressed
5	Veteran
6	Understory

Appendix 2. Names and Recommended Symbols of Tree Species in British Columbia

Genus Symbol	Species Symbol	Common Name of Genus/Species	Scientific Name
D		Alder	<i>Alnus</i>
	Dg	Green and Sitka alder	<i>A. viridis</i>
	Dm	Mountain alder	<i>A. incana</i>
	Dr	Red alder	<i>A. rubra</i>
U		Apple	<i>Malus</i>
	Ua	Apple	<i>Malus pumila</i>
	Up	Pacific crab apple	<i>Malus fusca</i>
R		Arbutus	<i>Arbutus</i>
	Ra	Arbutus	<i>A. menziesii</i>
A		Aspen, Cottonwood or Poplar	<i>Populus</i>
	Ac	Poplar	<i>P. balsamifera</i>
	Acb	Balsam poplar	<i>P. b. ssp. balsamifera</i>
	Act	Black cottonwood	<i>P. b. ssp. trichocarpa</i>
	Ax	Hybrid poplars	<i>P. spp.</i>
	Ad	Southern cottonwood	<i>P. deltoides</i>
	At	Trembling aspen	<i>P. tremuloides</i>
B		Balsam	<i>Abies</i>
	Ba	Amabilis fir	<i>A. amabilis</i>
	Bl	Subalpine fir	<i>A. lasiocarpa</i>
	Bb	Balsam fir	<i>A. balsamea</i>
	Bg	Grand fir	<i>A. grandis</i>
	Bp	Noble fir	<i>A. procera</i>
	Bm	Shasta red fir	<i>A. magnifica var. shastensis</i>
	Bc	White fir	<i>A. concolor</i>
E		Birch	<i>Betula</i>
	Ea	Alaska paper birch	<i>B. neoalaskana</i>
	Exp	Alaska x paper birch hybrid	<i>B. x winteri</i>
	Ee	European birch	<i>B. pendula</i>
	Ep	Paper birch	<i>B. papyrifera</i>
	Es	Silver birch	<i>B. pubescens</i>
	Ew	Water birch	<i>B. occidentalis</i>
K		Cascara	<i>Rhamnus</i>
	Kc		<i>R. purshianus</i>
C		Cedar	<i>Thuja</i>
	Cw	Western red cedar	<i>T. plicata</i>
V		Cherry	<i>Prunus</i>
	Vb	Bitter cherry	<i>P. emarginata</i>
	Vv	Choke cherry	<i>P. virginiana</i>
	Vp	Pin cherry	<i>P. pennsylvanica</i>
	Vs	Sweet cherry	<i>P. avium</i>
F		Douglas-fir	<i>Pseudotsuga</i>
	Fd	Douglas-fir	<i>P. menziesii</i>
	Fdc	Coastal Douglas-fir	<i>P. menziesii var. menziesii</i>
	Fdi	Interior Douglas-fir	<i>P. menziesii var. glauca</i>

Appendix 2. Names and Recommended Symbols of Tree Species in British Columbia

Genus Symbol	Species Symbol	Common Name of Genus/Species	Scientific Name
H		Hemlock	<i>Tsuga</i>
	Hm	Mountain hemlock	<i>T. mertensiana</i>
	Hxm	Mountain x western hemlock hybrid	<i>T. mertensiana x heterophylla</i>
	Hw	Western hemlock	<i>T. heterophylla</i>
J		Juniper	<i>Juniperus</i>
	Jr	Rocky mountain juniper	<i>J. scopulorum</i>
L		Larch	<i>Larix</i>
	La	Alpine larch	<i>L. lyallii</i>
	Lt	Tamarack	<i>L. laricina</i>
	Lw	Western larch	<i>L. occidentalis</i>
M		Maple	<i>Acer</i>
	Mb	Bigleaf maple	<i>A. macrophyllum</i>
	Me	Box elder	<i>A. negundo</i>
	Mn	Norway maple	<i>A. platanoides</i>
	Ms	Sycamore	<i>A. pseudoplatanaus</i>
	Mv	Vine maple	<i>A. circinatum</i>
Q		Oak	<i>Quercus</i>
	Qe	English oak	<i>Q. robur</i>
	Qg	Garry oak	<i>Q. garryana</i>
		Other exotics	
	Oc	Coast redwood	<i>Sequoia sempervirens</i>
	Og	Common pear	<i>Pyrus communis</i>
	Od	European mountain-ash	<i>Sorbus aucuparia</i>
	Ob	Giant sequoia	<i>Sequoiadendron giganteum</i>
	Oa	Incense-cedar	<i>Calocedrus decurrens</i>
	Og	Oregon ash	<i>Fraaximus latifolia</i>
	Oe	Siberian elm	<i>Ulnus pumila</i>
P		Pine	<i>Pinus</i>
	Pj	Jack pine	<i>P. banksiana</i>
	Pf	Limber pine	<i>P. flexilis</i>
	Pl	Lodgepole pine	<i>P. contorta</i>
	Pli	Lodgepole pine	<i>P. contorta var. latifolia</i>
	Pxj	Lodgepole x jack pine hybrid	<i>P. x murraybanksiana</i>
	Pm	Monterey pine	<i>P. radiata</i>
	Py	Ponderosa pine	<i>P. ponderosa</i>
	Pr	Red pine	<i>P. resinosa</i>
	Plc	Shore pine	<i>P. contorta var. contorta</i>
	Ps	Sugar pine	<i>P. lambertiana</i>
	Pw	Western white pine	<i>P. monticola</i>
	Pa	Whitebark pine	<i>P. albicaulis</i>

Appendix 2. Names and Recommended Symbols of Tree Species in British Columbia

Genus Symbol	Species Symbol	Common Name of Genus/Species	Scientific Name
S		Spruce	<i>Picea</i>
	Sb	Black spruce	<i>P. mariana</i>
	Se	Engelmann spruce	<i>P. engelmannii</i>
	Sn	Norway spruce	<i>P. abies</i>
	Ss	Sitka spruce	<i>P. sitchensis</i>
	Sw	White spruce	<i>P. glauca</i>
	Sx	Spruce hybrid	<i>Picea cross</i>
	Sxw	Engelmann x white	<i>P. engelmannii x glauca</i>
	Sxl	Sitka x white	<i>P. x lutzii</i>
Sxs	Sitka x unknown hybrid	<i>P. sitchensis x ?</i>	
W		Willow	<i>Salix</i>
	Wb	Bebb's willow	<i>S. bebbiana</i>
	Wp	Pacific willow	<i>S. lucida</i>
	Wa	Peachleaf willow	<i>S. amygdaloides</i>
	Wd	Pussy willow	<i>S. discolor</i>
	Ws	Scouler's willow	<i>S. scouleriana</i>
	Wt	Sitka willow	<i>S. sitchensis</i>
T		Yew	<i>Taxus</i>
	Tw	Western yew	<i>Taxus brevifolia</i>
	Xc	Unknown Conifer	
	Zc	Other Conifer	
	Xh	Unknown Hardwood	
	Zh	Other Hardwood	

BC Ministry of Forests, Research Branch. "The BC Tree Code List" Version 4.1, 1999.

Appendix 3. Damage Agent and Condition Codes

Code	Definition	Code	Definition
A	Animal damage	CVR	PI cone borer (<i>Eucosma recissoriana</i>)
AB	Bear	CYC	Sx seed midge (<i>Mayetiola carpophaga</i>)
AC	Cattle	CYP	Py seedworm (<i>Cydia piperana</i>)
AD	Deer	CYS	Sx seedworm (<i>Cydia strobilella</i>)
AE	Elk	CYT	Cw cone midge (<i>Mayetiola thujae</i>)
AH	Hare or rabbit	CYX	seedworms (<i>Cydia spp.</i>)
AM	Moose	D	Diseases
AP	Porcupine	DB	Broom rust
AS	Squirrel	DBF	fir broom rust (<i>Melampsorella caryophyllacearum</i>)
AV	Vole	DBS	spruce broom rust (<i>Chrysomyxa arctostaphyli</i>)
AX	Birds	DD	Stem rot
AZ	Beaver	DDB	birch trunk rot (<i>Fomes fomentarius</i>)
C	Cone and seed insects	DDD	sulfur fungus (<i>Laetiporus sulphureus</i>)
CAH	cone resin midge (<i>Asynapta hopkinsi</i>)	DDE	rust red stringy rot (<i>Echindontium tinctorium</i>)
CBC	Fd cone moth (<i>Barbara colfaxiana</i>)	DDF	brown crumbly rot (<i>Fomitopsis pinicola</i>)
CBX	fir cone moth (<i>Barbara sp.</i>)	DDH	hardwood trunk rot (<i>Phellinus ignarius</i>)
CCP	(<i>Camptomyia pseudotsugae</i>)	DDO	cedar brown pocket rot (<i>Poria sericeomollis</i>)
CDC	Sx cone gall midge (<i>Dasineura canadensis</i>)	DDP	red ring rot (<i>Phellinus pini</i>)
CDD	fir seed midge (<i>Dasineura abiesemia</i>)	DDQ	quinine conk rot (<i>Fomitopsis officinalis</i>)
CDR	Sx cone axis midge (<i>Dasineura rachiphaga</i>)	DDS	schweinitz butt rot (<i>Phaeolus schweinitzii</i>)
CDX	Dasineura midges (<i>Dasineura spp.</i>)	DDT	aspen trunk rot (<i>Phellinus tremulae</i>)
CEA	fir cone maggot (<i>Earomyia abietum</i>)	DF	Foliage disease
CEB	(<i>Earomyia barbara</i>)	DFA	western pine aster rust (<i>Coleosporium asterum</i>)
CEQ	(<i>Earomyia aquilonia</i>)	DFC	large-spored spruce-labrador tea rust (<i>Chrysomyxa ledicola</i>)
CEX	Earomyia maggots (<i>Earomyia spp.</i>)	DFD	spruce needle cast (<i>Lirula macrospora</i>)
CFP	Fd cone beetle (<i>Ernobius punctulatus</i>)	DFE	elytroderma needle cast (<i>Elytroderma deformans</i>)
CHX	budworms (<i>Choristoneura spp.</i>)	DFH	larch needle cast (<i>Hypodermella laricis</i>)
CIA	fir coneworm (<i>Dioryctria abietivorella</i>)	DFL	pine needle cast (<i>Lophodermella concolor</i>)
CIP	Fd coneworm (<i>Dioryctria psuedotsugella</i>)	DFM	larch needle blight (<i>Meria laricis</i>)
CIR	Sx coneworm (<i>Dioryctria reniculelloides</i>)	DFP	fir fireweed rust (<i>Pucciniastrum epilobi</i>)
CIS	pine coneworm (<i>Dioryctria rossi</i>)	DFR	Douglas-fir needle cast (<i>Rhabdocline pseudotsugae</i>)
CIV	Py coneworm (<i>Dioryctria auranticella</i>)	DFS	redband needle blight (<i>Mycosphaerella</i> [<i>Schirria</i>] <i>pini</i>)
CIX	coneworms (<i>Dioryctria spp.</i>)	DL	Disease caused dieback of leader
CLO	western conifer seed bug (<i>Leptoglossus occidentalis</i>)	DLD	dermea canker (<i>Dermea pseudotsugae</i>)
CMA	Py seed chalcid (<i>Megastigmus albifrons</i>)	DLF	red flag disease (<i>Potebniamyces basamicola</i>)
CMC	Sx seed chalcid (<i>Megastigmus piceae</i>)	DLP	phomopsis canker (<i>Phomopsis lokoyae</i>)
CML	Bl seed chalcid (<i>Megastigmus lasiocarpae</i>)	DLS	sydowia (<i>Sclerophoma</i>) tip dieback (<i>Sclerophoma pithyophila</i>)
CMP	fir seed chalcid (<i>Megastigmus pinus</i>)	DLV	aspen-poplar twig blight (<i>Venturia spp.</i>)
CMR	(<i>Megastigmus rafni</i>)	DM	Dwarf mistletoe
CMS	Fd seed chalcid (<i>Megastigmus spermotrophus</i>)	DMF	Douglas-fir dwarf mistletoe
CMT	Hw seed chalcid (<i>Megastigmus tsugae</i>)	DMH	hemlock dwarf mistletoe
CMX	seed chalcids (<i>Megastigmus spp.</i>)	DML	larch dwarf mistletoe
CNP	pine cone beetle (<i>Conophthorus ponderosae</i>)	DMP	lodgepole pine dwarf mistletoe
CPS	(<i>Pineus similis</i>)	DR	Root disease
CRX	cone scale midges (<i>Resseliella spp.</i>)	DRA	armillaria root disease
CSN	spiral spruce cone borer (<i>Strobilomyia neanthracina</i>)	DRB	black stain root disease
CTO	Fd cone gall midge (<i>Contarinia oregonensis</i>)	DRC	laminated root rot (cedar strain)
CTW	Fd cone scale midge (<i>Contarinia washintonensis</i>)		
CVP	Pw cone borer (<i>Eucosma ponderosa</i>)		

Appendix 3. Damage Agent and Condition Codes

Code	Definition	Code	Definition
DRL	laminated root rot	IS	Shoot insects
DRN	annosus root disease	ISB	western cedar borer (<i>Trachykele blondeli</i>)
DRR	rhizina root disease	ISE	European pine shoot moth
DRT	tomentosus root rot	ISP	pitch nodule moths (<i>Petrova</i> species)
DS	Stem disease (canker or rust)	ISQ	sequoia pitch moth (<i>Vesparmima sequoiae</i>)
DSA	atropellis canker (lodgepole pine)	ISS	western pine shoot borer (<i>Eucosma sonomana</i>)
DSB	white pine blister rust	IW	Weevils
DSC	comandra blister rust	IWC	conifer seedling weevil
DSE	sooty bark canker (<i>Encoelia pruinosa</i>)	IWM	<i>Magdalis</i> spp.
DSG	western gall rust	IWP	lodgepole terminal weevil
DSH	hypoxylon canker (<i>Hypoxylon mammatum</i>)	IWS	white pine weevil (on spruce)
DSP	cryptosphaeria canker (<i>Cryptosphaeria populina</i>)	IWW	Warren's root collar weevil
DSR	ceratocystis canker (<i>Ceratocystis fimbriata</i>)	IWY	cyliandrocopturus weevil (<i>Cylindrocopturus</i> spp.)
DSS	stalactiform blister rust	IWZ	Yosemite bark weevil (<i>Pissodes schwartzii</i>)
DST	target canker (<i>Nectria galligena</i>)	M	Mite damage
DSY	cytospora canker (<i>Cytospora chrysosperma</i>)	N	Non-biological (abiotic) injuries
I	Insects	NB	Fire
IA	Aphids or adelgids	ND	Drought
IAB	balsam woolly adelgid	NF	Flooding
IAC	giant conifer aphid (<i>Cinara</i> species)	NG	Frost
IAG	cooley spruce gall adelgid	NGC	frost crack
IAL	cone woolly aphid (<i>Adelges lariciatus</i>)	NGH	frost heaved
IAS	spruce aphid (<i>Elatobium abietinum</i>)	NGK	shoot/bud frost kill
IB	Bark beetles	NH	Hail
IBB	western balsam bark beetle	NK	Fumekill
IBD	Douglas-fir beetle	NL	Lightning
IBI	engraver beetles (<i>Ips</i> species)	NN	Road salt
IBM	mountain pine beetle	NR	Redbelt
IBP	twig beetles (<i>Pityogenes</i> , <i>Pityophthorus</i> spp.)	NS	Slide
IBS	spruce beetle	NW	Windthrow
IBT	red turpentine beetle (<i>Dendroctonus valens</i>)	NWS	windthrow - soil failure
IBW	western pine beetle (<i>Dendroctonus brevicomis</i>)	NWT	windthrow - treatment or harvest related
ID	Defoliating insects	NY	Snow or ice (includes snow press)
IDA	black army cutworm	NZ	Sunscauld
IDB	2-year budworm (<i>Choristoneura biennis</i>)	P	Cone and seedling fungal pathogens
IDC	larch casebearer	PAX	(<i>Alternaria</i> spp.)
IDD	western winter moth (<i>Erranis tiliaria vancouverensis</i>)	PBC	gray mould (<i>Botrytris cinerea</i>)
IDE	spruce budworm (<i>C. fumiferana</i>)	PCD	(<i>Cylindrocarpon destructans</i>)
IDF	forest tent caterpillar	PCF	seed or cold fungus (<i>Caloscypha fulgens</i>)
IDG	greenstriped forest looper	PCP	inland spruce cone rust (<i>Chrysomyxa pirolata</i>)
IDH	western blackheaded budworm	PDT	cedar leaf blight (<i>Didymascella thujina</i>)
IDI	pine needle sheath miner (<i>Zellaria haimbachi</i>)	PFX	(<i>Fusarium</i> spp.)
IDL	western hemlock looper	PPG	damping-off disease (<i>Phoma glomerata</i>)
IDM	gypsy moth	PPX	(<i>Penicillium</i> spp.)
IDN	birch leaf miner (<i>Fenusa pusilla</i>)	PSS	sirococcus blight (<i>Sirococcus strobilinus</i>)
IDP	larch sawfly (<i>Pristophora erichsoni</i>)	PTX	(<i>Trichothecium</i> spp.)
IDR	alder sawfly (<i>Eriocampa ovata</i>)		
IDS	conifer sawflies		
IDT	Douglas-fir tussock moth		
IDU	satin moth (<i>Leucoma salicis</i>)		
IDV	variegated cutworm		
IDW	western spruce budworm (<i>occidentalis</i>)		
IDX	large aspen tortrix (<i>Choristoneura conflictana</i>)		
IDZ	western false hemlock looper		

Appendix 3. Damage Agent and Condition Codes

Code	Definition	Code	Definition
T	Treatment injuries	TR	Pruning
TC	Chemical	TT	Thinning or spacing
TH	Harvested	V	Problem vegetation
TL	Logging	VH	Herbaceous competition
TM	Other mechanical damage (non-logging)	VP	Vegetation press
TP	Planting	VS	Shrub competition
TPM	poor planting microsite	VT	Tree competition

BC Ministry of Forests, Forest Practices Branch, January 1999.

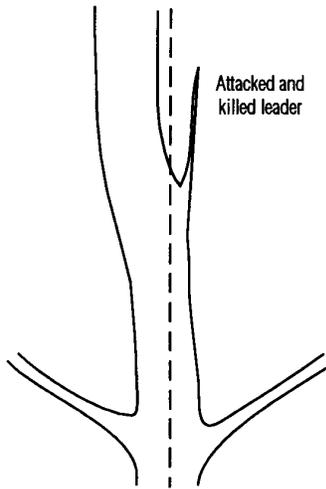
Appendix 4. Damage Severity and Mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples

Damage Code	Damage/condition or agent	Field code	Code description and classification
	Mortality conditions for all damage agents	SR SO WR WS WA BD BS	Standing - Recent dead Standing - Old dead Windthrow - Root and butt rot Windthrow - Soil failure Windthrow - Management/soil related Breakage - Stem decay (stubs and snags) Breakage - Stem shear
A's	Mammals, birds and root collar weevils (girdlers)	Enter % girdled 1 2 3 4 5 6 7 8 9 10	10% of circumference girdled 20% of circumference girdled 30% of circumference girdled 40% of circumference girdled 50% of circumference girdled 60% of circumference girdled 70% of circumference girdled 80% of circumference girdled 90% of circumference girdled 100% of circumference girdled
C, DD, DL, IA, N, P, T, and V	Cone/seed insects and fungal pathogens, abiotic, injuries and problem vegetation	Subjective rating L M S	Low Moderate Severe
DB, DM	Broom rust and Dwarf mistletoe	Enter one of 1, 2, 3, 4, 5, 6 and N M	See Fig. A4.2 for Hawksworth's 6-class rating system for all species and for coast western hemlock: Minor stem swelling Major stem swelling
DR	Root rots	W5 LC SC RL RS BR CS	Within 5 m of <i>A. ostoyae</i> infection source Light crown symptoms Severe crown symptoms Basal resinosis (light) \leq 50% circumference Basal resinosis (severe) $>$ 50% circumference Butt rot Confirmatory symptoms: stain, decay, mycelia, rhizomorphs or sporophores
DS	Stem rusts	BC SC TK	Branch canker(s) Stem canker(s) Top-kill
IB	Bark beetles	FA GR RA GY	Failed attack Current (green) attack Red attack Grey attack
ID, DF, M	Defoliators, mites, needle rusts and blights	Enter % defoliated, discoloured or infected 1=10%, 10=100%	Record percent defoliated, discoloured, or infected (past and present attacks).

Appendix 4. Damage Severity and Mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples

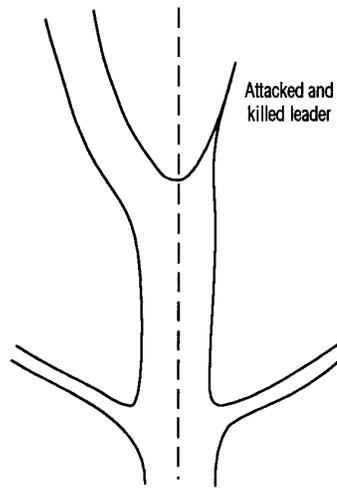
Damage Code	Damage/condition or agent	Field code	Code description and classification
IDW	Defoliators (for special use only) (Fettes' scale; current year foliage only)	Enter percent defoliated 1=10%, 10=100%	Record percent defoliated, current year only (see Fig. A4.3)
IS, IW	Terminal weevils	Enter # of current attacks (1-9); and type of defect (least to worst) N M F S	Record number years of attacks (1 to 9); and Minor crook (see Fig. A4.1) Major crook Forking Staghead

Appendix 4. Damage Severity and Mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples



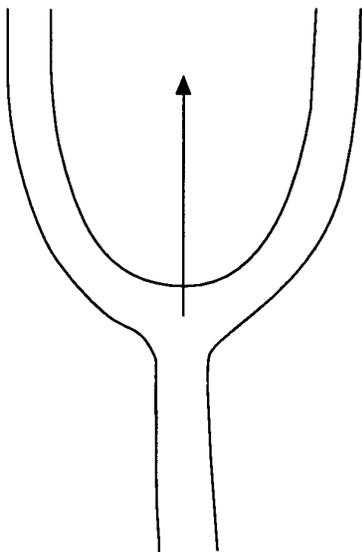
Minor crook (crease)

A defect made up of a linear indentation, but little or no stem curvature at point of attack



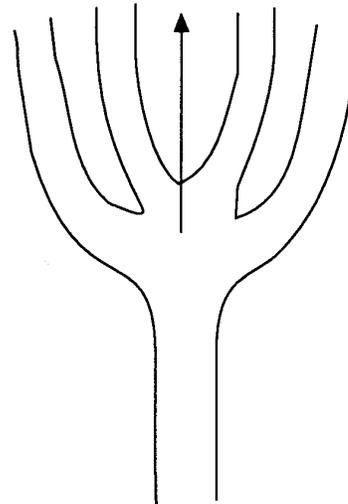
Major crook

A defect defined when a lateral assuming dominance is offset from the main stem by at least 1/2 the stem diameter



Major forks

A defect resulting when two laterals assume dominance



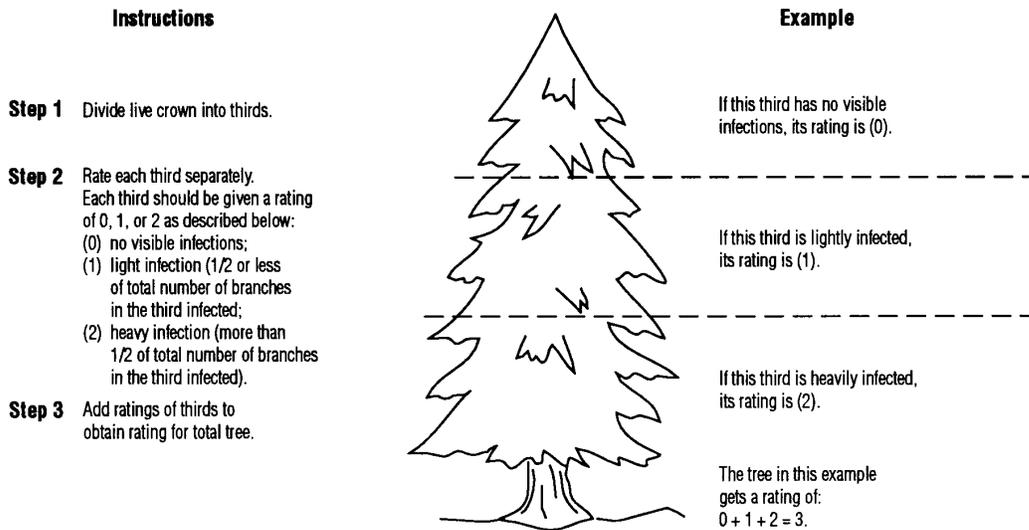
Staghead

A defect resulting from three or more laterals assuming dominance

FIGURE A4.1. Terminal weevil defect rating scale.

Appendix 4. Damage Severity and Mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples

The 6-class Dwarf Mistletoe rating system



Coastal Western Hemlock Dwarf Mistletoe rating system

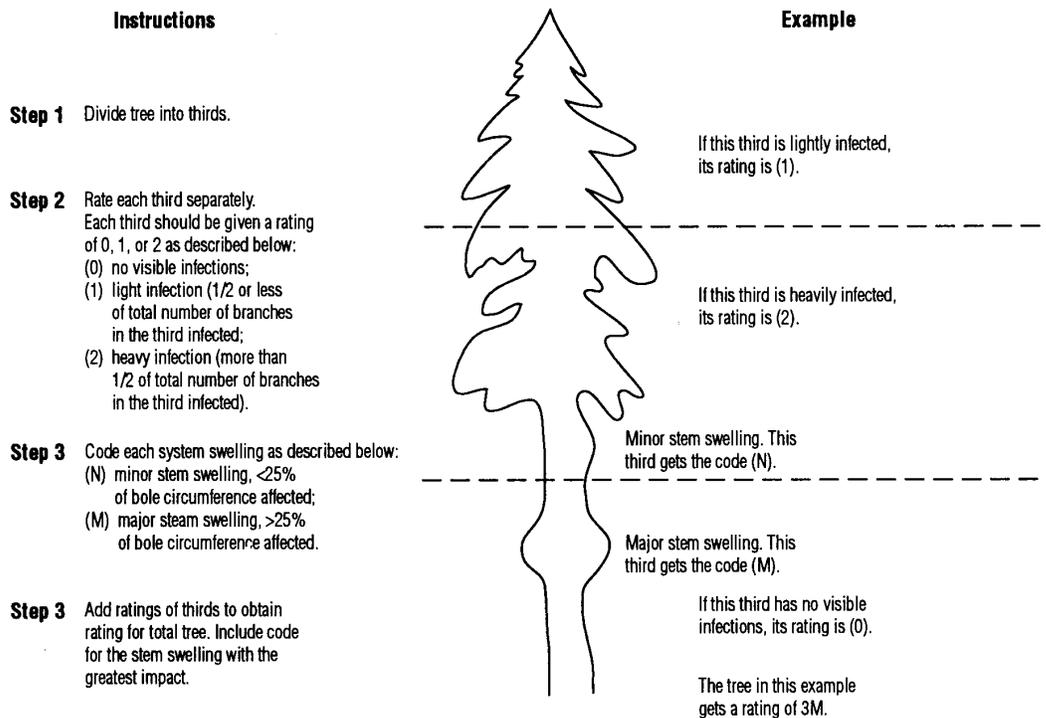


FIGURE A4.2 Dwarf mistletoe rating systems.

Appendix 4. Damage Severity and Mortality Condition Standards for Individual Trees in Growth and Yield PSPs and Forest Inventory Samples

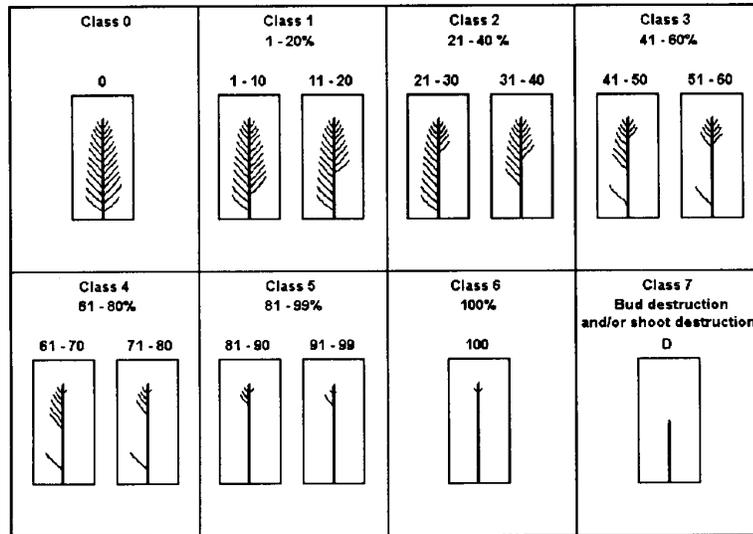


FIGURE A4.3. Insect defoliation scale.

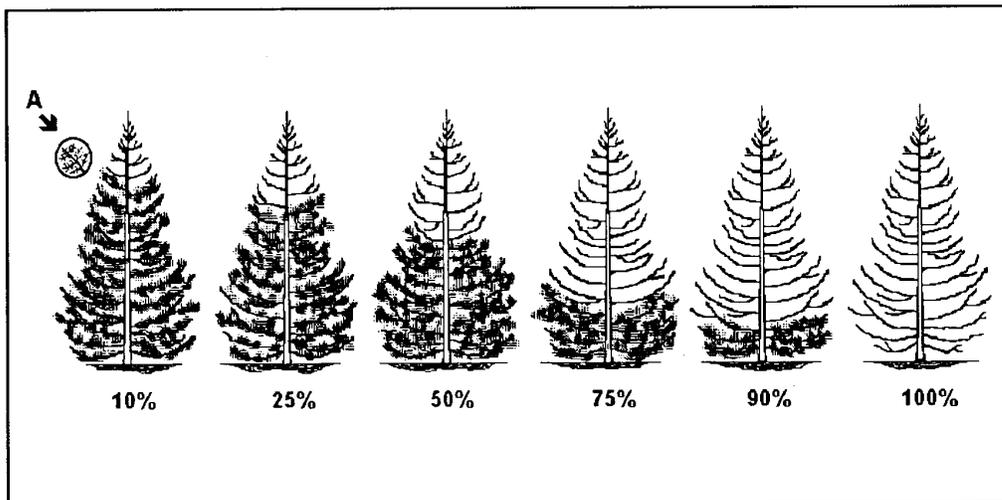


FIGURE A4.4. Douglas-fir tussock moth defoliation scales.

Appendix 5. Minimum Data Collection Requirements for Ecological Field Forms (FS882)

Site Form

- | | |
|---|---|
| 1. Date (Y/D/M) | 13. Moisture regime |
| 2. Plot number | 14. Nutrient regime |
| 3. Surveyor(s) | 15. Successional status |
| 4. General location | 16. Structural stage |
| 5. Forest region | 17. Site disturbance |
| 6. Mapsheet | 18. Elevation |
| 7. UTM (zone, easting and northing) or latitude and longitude | 19. Slope |
| 8. Site diagram | 20. Aspect |
| 9. Plot representing | 21. Meso slope position |
| 10. Biogeoclimatic unit | 22. Surface topography |
| 11. Site series | 23. Exposure type (if applicable) |
| 12. Transition/Distribution | 24. Surface substrates (organic matter, decaying wood, bedrock, rocks, mineral soil, water) |

Soil Form

- | | |
|---|--|
| 1. Plot number | 16. Organic horizons/layers; for each: horizon/layer code depth <ul style="list-style-type: none">• mycelial abundance• fecal abundance• von Post (for organic soils) |
| 2. Surveyor(s) | |
| 3. Bedrock (at least to general level, where significant to site) | 17. Mineral horizons/layers; for each: horizon/layer code <ul style="list-style-type: none">• depth• colour (when required for diagnostic purposes)• colour aspect (when colour entered)• soil texture (< 2 mm fraction)• % coarse fragments (gravel, cobbles, stones, and total)• comments (especially mottles) |
| 4. Coarse fragment lithology (at least to general level) | |
| 5. Terrain texture, surficial material, surface expression | |
| 6. Soil classification (to subgroup) | |
| 7. Humus classification (at least to group) | |
| 8. Hydrogeomorphic unit (at least to system) | |
| 9. Rooting depth | |
| 10. Rooting zone particle size | |
| 11. Root restricting type and depth (if applicable) | |
| 12. Water source (if applicable) | 18. Profile diagram |
| 13. Seepage depth (if applicable) | 19. Notes |
| 14. Soil drainage | |
| 15. Flooding regime (if applicable) | |

Vegetation Form

- | | |
|----------------------------------|--|
| 1. Surveyor(s) | 4. Species by layer |
| 2. Plot Number | 5. Cover for each species by layer and sublayers |
| 3. % cover by layer (A, B, C, D) | 6. Notes |

B.C. Ministry of Forests, Research Branch, 1999.

Appendix 6. Dead Tree Attributes

For each dead tree that is ≥ 10.0 cm in DBH and ≥ 1.3 metres in height, collect the following attributes if, the tree is standing—both at establishment and remeasurement—or down, if it was living at the last measurement:

Number

Number certainty

- positively identified (1)
- likely correct (2)
- uncertain (3)

Species

Species certainty

- positively identified (1)
- likely correct (2)
- uncertain (3)

Diameter at 1.3 metres

Tagging sector

Near tree number

Tree class

Vertical position

- standing (S)
- down (D)
- supported (S)
- on ground (G)

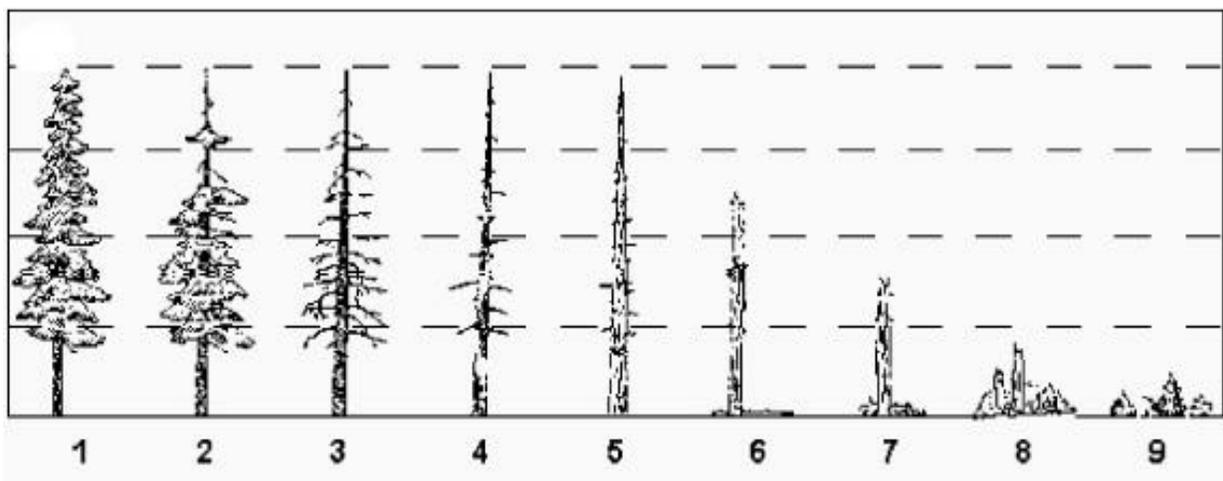
Broken and standing

- yes (Y)
- no (N)

Height to break (ocular estimate to the nearest metre)

Damage agent and severity codes (see Appendices 3 and 4)

Wildlife tree appearance as follows:



BC Ministry of Forests, Resources Inventory Branch, March 1999.