



# SILVICULTURE SURVEY REFERENCE

## 1. Steps to Completing Silviculture Surveys

1. Office review
  - Stocking standards (e.g. MSS, TSS, MITD, pref. & acc. species, regen delay)
  - Map showing standards unit (SU) boundaries
  - Treatment reports and history (e.g. harvest start date, planting date(s))
2. Walk-through of each stratum
  - Determine strata boundaries within standards units
  - Survey objectives, method, sampling intensity
  - Site descriptive items
  - Site index method and species
  - Inventory leading and secondary species
  - Critical limiting factors and initial treatment recommendation
3. Data gathering for each stratum
  - Sufficient to produce accurate results and inventory and silviculture labels
  - Competing vegetation
  - Forest health factors
4. Summary of each stratum
  - Mathematical analysis
  - Inventory and silviculture labels
  - Treatment recommendations
5. Reporting of each stratum
  - Mapping
  - Data input to RESULTS (directly or via a corporate database)

## 2. Stratification

1. The following changes constitute criteria for stratification:
  - standards units
  - age class (20 years or less\*)
  - stocking status
  - height class (10m or less\*)
  - leading species
  - site index (3 m)
  - inventory species composition >20%
  - treatment recommendations
  - crown closure >20%
  - stand structure (e.g. even to uneven-aged)
2. In 2007, stratum size and distribution became specified in regulation as follows:
  - Reserves and NP areas: ..... 0.25 hectares (mappable\*\*)
  - SUs less than 1 ha: ..... the entire SU

### Milestone Surveys


- Post-harvest / regeneration / free growing 1 hectare
- Mappable\*\* Not free growing (NFG) area of an SU: 1 to 2 ha, maximum 5% of the SU NAR.
- \* These are MoF inventory minimums. Licensees may choose a lower threshold.
- \*\* Mappable is defined (guidance purposes only) as a polygon greater than 20 m throughout its length. Areas that do not meet the stocking obligations less than 20 m from the nearest NSR or NFG area are considered contiguous units.

## 3. Natural Resource Region and District Codes

COAST AREA		NORTH AREA		SOUTH AREA	
South Coast Region	RSC	Northeast Region	RNO	Cariboo Region	RCB
Sunshine Coast District	DSC	Fort Nelson District	DFN	100 Mile House District	DMH
Chilliwack District	DCK	Peace District	DPC	Quesnel District	DQU
Sea to Sky District	DSQ	Omineca Region	ROM	Cariboo-Chilcotin District	DCC
West Coast Region	RWC	Mackenzie District	DMK	Kootenay/Boundary Region	RKB
Haida Gwaii District	DQC	Vanderhoof District	DVA	Rocky Mountain District	DRM
South Island District	DSI	Fort St. James District	DJA	Selkirk District	DSE
Campbell River District	DCR	Prince George District	DPG	Thompson/Okanagan Region	RTO
North Island-Central Coast District	DNI	Skeena Region	RSK	Okanagan/Shuswap District	DOS
		Nadina District	DND	Thompson Rivers District	DKA
		Coast Mountains District	DKM	Cascades District	DCS
		Skeena-Stikine District	DSS		

## 4. History Symbol

Stand Tending		Site Preparation		Disturbance	
F	Fertilization	B	Broadcast burn	B	Wildfire
H	Hack & squirt	C	Chemical	BE	Escaped Burn
J	Juvenile spacing	G	Grass seeded	BG	Ground Burn
M	Mistletoe control	H	Hand preparation	BR	Range Burn
P	Pruning	RB	Range management burn	BW	Wildlife Burn
R	Conifer release	S	Spot burn	D	Disease
S	Sanitation	M	Mechanical	F	Flooding
	spacing	MS	Mechanical and	I	Insect
T	Commercial		spot burn	K	Flume Kill
	thinning	W	Windrow	L	Logging
W	Brushing & weeding			L%	Logging (10% increments)
		<b>Regeneration</b>		R	Site rehabilitation
		P	Planting	S	Slide
		N	Natural	W	Windthrow



Add the last two digits of the year to the right of the history code.  
 For treatments completed in multiple years add a comma between the years.  
 For treatments roughly continuous over multiple years add a dash between the years.

## 5. Stocking and plot factors



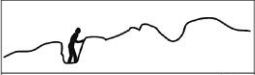





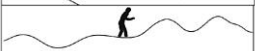
$$^a \text{Inter-tree distance} = \sqrt{\frac{11\,547}{\text{trees/ha}}}$$

Trees/ha	Plot Radius (m)								Triangular spacing inter-tree distance <sup>a</sup> (m)
	1.78	2.52	2.82	3.99	5.64	7.98	11.28		
	Plot Area (m <sup>2</sup> )								
	10	20	25	50	100	200	400		
Plot Multiplier									
Trees Per Plot									
2500	2.5	5	6.25	12.5	25	50	125	2.15	
2400	2.4	4.8	6	12	24	48	120	2.19	
2300	2.3	4.6	5.75	11.5	23	46	115	2.24	
2200	2.2	4.4	5.5	11	22	44	110	2.29	
2100	2.1	4.2	5.25	10.5	21	42	105	2.34	
2000	2	4	5	10	20	40	100	2.40	
1900	1.9	3.8	4.75	9.5	19	38	95	2.47	
1800	1.8	3.6	4.5	9	18	36	90	2.53	
1700	1.7	3.4	4.25	8.5	17	34	85	2.61	
1600	1.6	3.2	4	8	16	32	80	2.69	
1500	1.5	3	3.75	7.5	15	30	75	2.77	
1400	1.4	2.8	3.5	7	14	28	70	2.87	
1300	1.3	2.6	3.25	6.5	13	26	65	2.98	
1200	1.2	2.4	3	6	12	24	60	3.10	
1100	1.1	2.2	2.75	5.5	11	22	55	3.24	
1000	1	2	2.5	5	10	20	50	3.40	
900	0.9	1.8	2.25	4.5	9	18	45	3.58	
800	0.8	1.6	2	4	8	16	40	3.80	
700	0.7	1.4	1.75	3.5	7	14	35	4.06	
600	0.6	1.2	1.5	3	6	12	30	4.39	
500	0.5	1.0	1.25	2.5	5	10	25	4.81	
400	0.4	0.8	1	2	4	8	20	5.37	
300	0.3	0.6	0.75	1.5	3	6	15	6.20	
200	0.2	0.4	0.5	1	2	4	10	7.60	
100	0.1	0.2	0.25	0.5	1	2	5	10.74	

## 6. RESULTS consistent tree species abbreviations

Common name of genus/species	Scientific name of genus/species	Species symbol
Poplar	<i>Populus balsamifera</i>	Ac
Balsam poplar	<i>Populus balsamifera</i> ssp. <i>balsamifera</i>	Acb
Black cottonwood	<i>Populus balsamifera</i> ssp. <i>trichocarpa</i>	Act
Aspen	<i>Populus tremuloides</i>	At
Poplar hybrid	<i>Populus</i> spp.	Ax
Amabilis fir	<i>Abies amabilis</i>	Ba
Balsam fir	<i>Abies balsamea</i>	Bb
Grand fir	<i>Abies grandis</i>	Bg
Subalpine fir	<i>Abies lasiocarpa</i>	Bl
Noble fir	<i>Abies procera</i>	Bn
Western redcedar	<i>Thuja plicata</i>	Cw
Red alder	<i>Alnus rubra</i>	Dr
Alaska paper birch	<i>Betula neolaskana</i>	Ea
Common paper birch	<i>Betula papyrifera</i>	Ep
Douglas-fir (coastal)	<i>Pseudotsuga menziesii</i> var <i>menziesii</i>	Fdc
Douglas-fir (interior)	<i>Pseudotsuga menziesii</i> var <i>glauca</i>	Fdi
Mountain hemlock	<i>Tsuga mertensiana</i>	Hm
Western hemlock	<i>Tsuga heterophylla</i>	Hw
Alpine larch	<i>Larix lyallii</i>	La
Siberian larch	<i>Larix sibirica</i>	Ls
Tamarack	<i>Larix laricina</i>	Lt
Western larch	<i>Larix occidentalis</i>	Lw
Bigleaf maple	<i>Acer macrophyllum</i>	Mb
Whitebark pine	<i>Pinus albicaulis</i>	Pa
Limber pine	<i>Pinus flexilis</i>	Pf
Jack pine	<i>Pinus banksiana</i>	Pj
Lodgepole pine (coastal)	<i>Pinus contorta</i> var <i>contorta</i>	Plc
Lodgepole pine (interior)	<i>Pinus contorta</i> var <i>latifolia</i>	Pli
Red pine	<i>Pinus radiata</i>	Pr
Western white pine	<i>Pinus monticola</i>	Pw
Yellow pine	<i>Pinus ponderosa</i>	Py
Norway spruce	<i>Picea</i> spp.	Sa
Black spruce	<i>Picea mariana</i>	Sb
Engelmann spruce	<i>Picea engelmannii</i>	Se
Sitka spruce	<i>Picea sitchensis</i>	Ss
White spruce	<i>Picea glauca</i>	Sw
Spruce hybrid	<i>Picea</i> spp.	Sx
White x black spruce	<i>Picea</i> spp.	Sxb
Engelmann x sitka	<i>Picea</i> spp.	Sxe
White x sitka spruce	<i>Picea</i> spp.	Sxl
Sitka x unknown spruce	<i>Picea</i> spp.	Sxs
White x englemann spruce	<i>Picea</i> spp.	Sxw
White x englemann x sitka spruce	<i>Picea</i> spp.	Sxx
Bitter cherry	<i>Prunus emarginata</i>	Vb
Yellow cedar	<i>Chamaecyparis nootkatensis</i>	Yc

## 7. Surface expression

		SLOPE
Plain (P)		< 5%
Undulating (U)		5-25% Non-linear
Ridge(s) (R)		26-70%
Terraces (T)		Step-like
Cone (C)		> 26%
Depression (D)		> 2 m
Fan (F)		0-25%
Hummock (H)		26-70%
Rolling (M)		5-25% Linear

## 8. Vegetation Resource Inventory Consistent vegetation abbreviation system (*optional*)

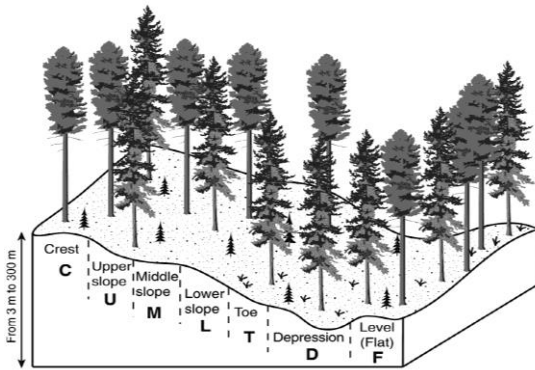
First 4 letters of the genus plus first 3 letters of the species plus a number for variant (if applicable)

aaaa bbb 1

If genus is known, but not species, all characters (up to 7) in the genus are used.

Common name	Latin name	Abbreviation
Palmate coltsfoot	Petasites palmatus	peta pal
White-flowered rhododendron	Rhododendron albiflorum	rhod alb
Scrub birch	Betula glandulosa var. glandulosa	betu gla 1
Willow	Salix	salix

## 9. Guide to slope position



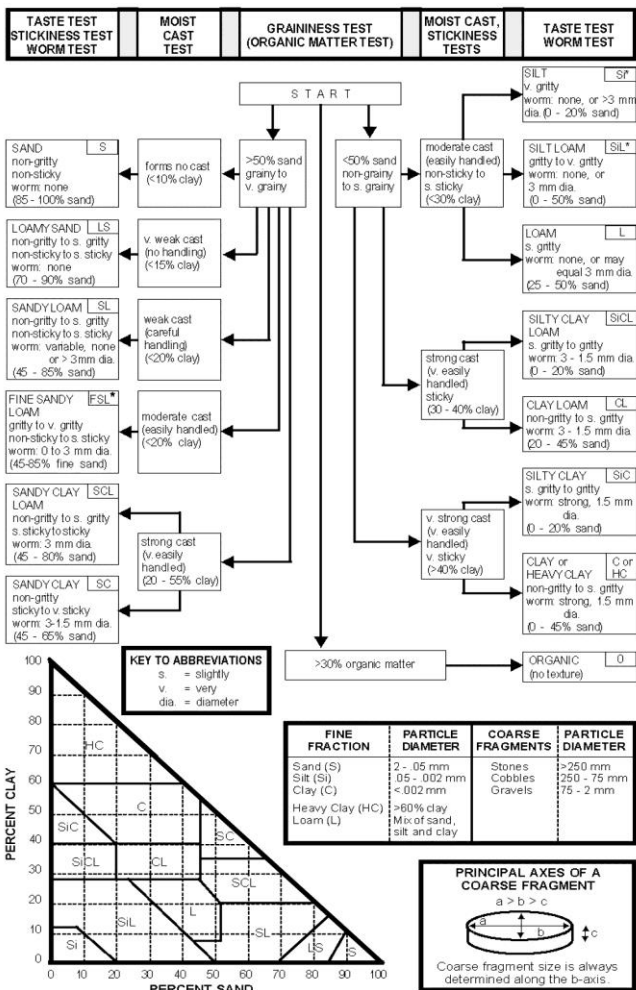
## 10. Plant difficulty rating

Factors	Site characteristics and points rating					
Vegetation	Infrequent grass, herbs and low shrubs	1	Frequent grass patches, herbs, low shrubs, infrequent naturals	3	Continuous grass or other vegetation, naturals, planted trees	6
Thickness of duff or litter	< 5 cm	1	5-20cm	3	>20 cm	6
Fine debris	Scattered branches and tops	1	Grouped branches and tops, < 1 m high, loose arrangement	3	Piled branches and tops >1 high or in a continuous mat	6
Coarse debris	Scattered logs	1	Frequent logs, some grouped and crossed, < 1 m high	3	Frequent logs grouped and crossed >1 m high	6
Stoniness	Infrequent stones or boulders	1	Frequent stone, boulders or coarse gravel	3	Continuous stoney layer and/or frequent boulders, gravel	6
Compaction	Loose	1	Occasional compact areas, e.g. landings	3	Definite hardpan or compact layer throughout	6
Slope	10-30%	1	0-10%, 30-65%	3	Over 65%	6
Unplantable areas	Infrequent patches of surface water, bedrock, etc.	1	Frequent patches <0.2 ha	3	Frequent patches >0.2 ha	6
Circle one point rating in each of the eight factors. Total = _____ = Planting difficulty rating			Planting difficulty class: Less than 10 points = easy 10-20 points = moderate 21-30 points = difficult 31+ points = severe			

## 11. Humus form descriptions

- Mor**
- matted F horizon, abrupt transition from organic to mineral soil layers
  - (slower rate of decomposition)
- Moder**
- loosely structured F horizon, gradual transition from organic to mineral soil layers
  - (medium rate of decomposition)
- Mull**
- F and H horizons thin or absent, upper mineral soil layer rich with organics
  - (faster rate of decomposition)

## 12. Soil hand texturing key



## 13. Soil compaction hazard key

Hazard rating <sup>b</sup> moisture regime		
Soil texture <sup>a</sup> (0–30 cm)	Xeric–subhygric <sup>c</sup> (H horizons <20 cm)	Subhygric <sup>d</sup> –subhydic (H horizons ≥ 20 cm)
Fragmental (coarse fragments >70%)	L	M
Coarse fragments (<70%)		VHe
Sandy (S, LS)	L	
Sandy loam (SL, fSL)	M	
Silty/loamy (SiL, Si, L)	H	
Clayey (SCL, CL, SiCL, SC, SiC,C)	VH	

<sup>a</sup> Use dominant soil texture and coarse fragment content of the upper 30 cm of mineral soil to assess compaction hazard. If a pronounced textural change occurs within the upper 30 cm (e.g., silty over sandy soil), then use the more limiting soil texture, providing it amounts to 5 cm of the top 30 cm.

<sup>b</sup> L = Low; M = Moderate; H = High; VH = Very High.

<sup>c</sup> Use this column for subhygric sites with forest floor H horizons < 20 cm thick.

<sup>d</sup> Use this column for subhygric sites with forest floor H horizons ≥ 20 cm thick.

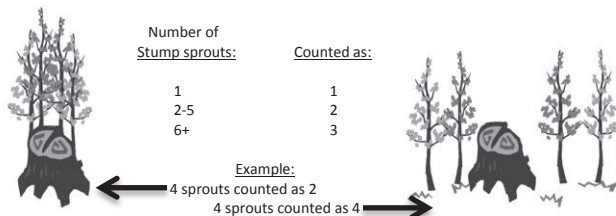
<sup>e</sup> Organic soils composed of more than 40 cm of wet organic material, or forest floors >40 cm (including Folisols <40 cm), are susceptible to rutting because their very low load-bearing strength materials make them easy to displace.

## 14. Number of complete growing seasons suggested as a best management practice following a brushing treatment, prior to a FG survey.

Biogeoclimatic zone	Number of complete growing seasons
ICH, IDF, MS, PP, BG, SBPS, CWH, CDF, MH, and ESSF	2
SBS and BWBS	
• following herbicide treatment	2
• manually or otherwise treated	3

## 15. Post brushing treatment sprout counting - for assessment of competitive broadleaf counts for FG

Following some vegetation management treatments, broadleaf tree species can sprout from the cut stump. Where this occurs, the multiple sprouts present are recorded based on the table below. **This only applies to strata that have had one or more vegetation management treatments. The application of this concept applies to all competitive broadleaf tree species that originate from cut stumps above ground.**



## 16. Two Free Growing Methods

It is the responsibility of the surveyor, during the walk-through, to select and record on the FS 657 card the method used for free growing assessments. The surveyor is directed to select the method that will find the greatest number of free growing stems, the method that is the most beneficial to the licence holder.

There are two approved methods to select from:

### Silviculture Prescription Standards

- complete the survey using the free growing standards as found in the silviculture prescription/site plan/FSP.

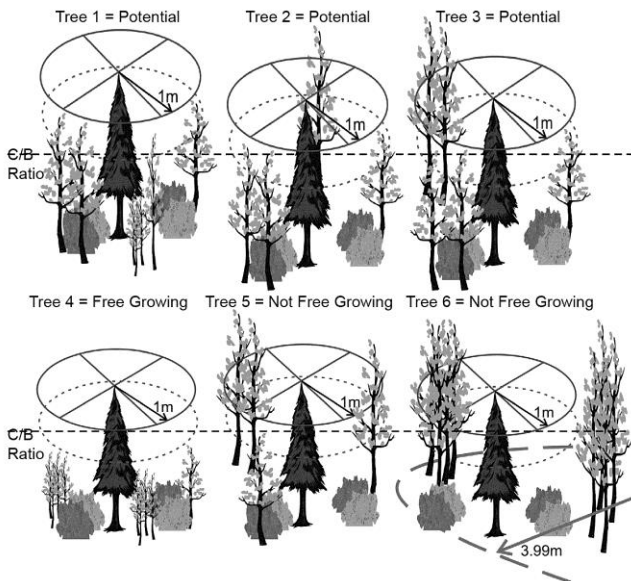
### Free Growing Guideline Method<sup>1 2</sup>

- complete the survey using the free growing standards as found in the silviculture prescription/site plan, except:
  - add minimum free growing heights from an approved source if they are not already specified in the silviculture prescription/site plan,
  - apply the concepts of “3/4 brush free quadrants” and “potential free growing” as described below.

<sup>1</sup> Also known as Appendix 9 of the Establishment to Free Growing Guidelines and the “*Interim Free Growing Guidelines*” and “the quadrant method”.

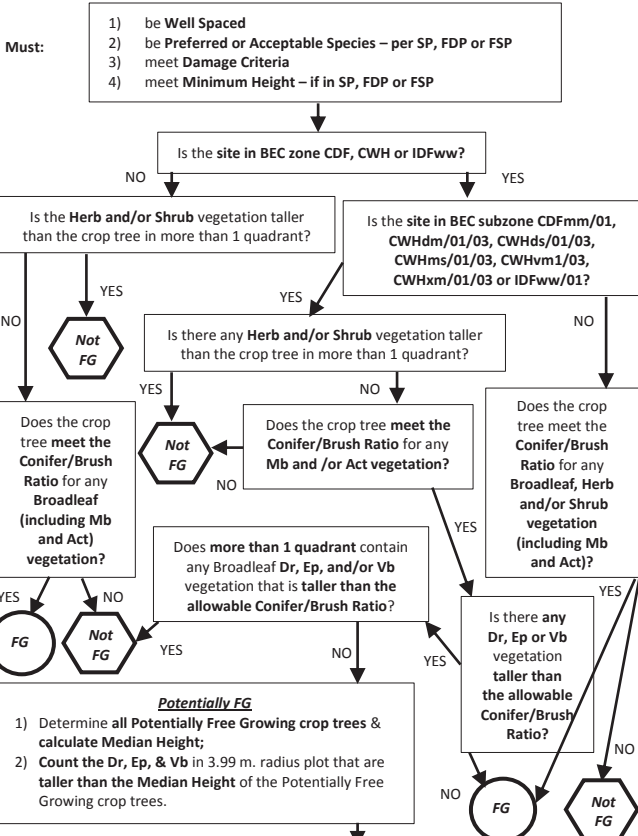
<sup>2</sup> There are variations to the above for some coastal ecological units.

## 17. Potentially free growing trees



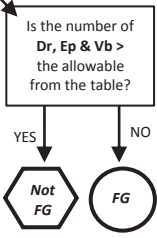


# 18a. COASTAL Vegetation Competition Decision Key for a Free Growing Crop Tree



Crop Tree Species	Biogeoclimatic subzone/variant	Sites Series	Allowable countable broadleaf trees per 50 m <sup>2</sup> plot (3.99 m. radius)
Fdc, Hw, Cw, Ba, Yc, Ss, Pw, Plc	CWH dm,ds,ms, xm	01	1 Dr, Ep, or 2 Vb
	CWH dm,ds,ms, xm	03	2 Dr, Ep, or 4 Vb
	CWH vm1	03	1 Dr, Ep, or 2 Vb
	CDF mm, IDFww	01	2 Dr, Ep, or 4 Vb
	All other		0

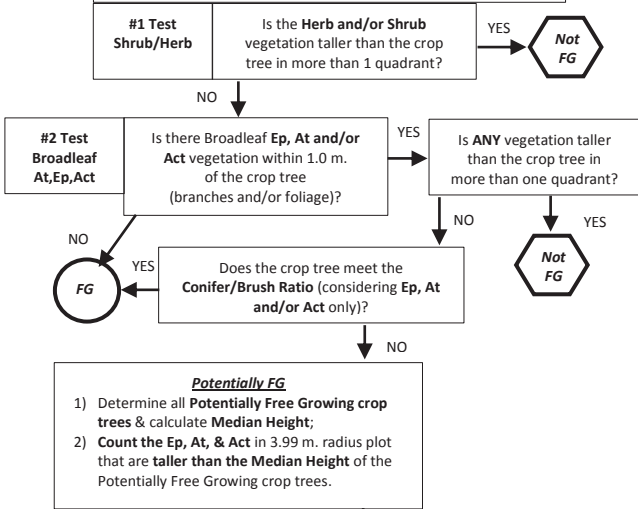
**Note:** When a survey unit contains more than one subzone or site series, use the lower countable broadleaf limit. When a plot contains more than the allowable red alder, birch, and/or bitter cherry trees for a given species and biogeoclimatic subzone/site series, only the potentially free growing trees of that species will become not free growing. A crop tree that meets the required SP crop tree-to-brush ratio (and all other free growing criteria) is free growing regardless of the number of broadleaf trees in the 50 m<sup>2</sup> plot.



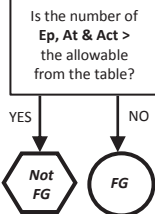
# 18b. INTERIOR (NORTH AREA) Vegetation Competition Decision Key for a Free Growing Crop Tree

Must:

- 1) be **Well Spaced**
- 2) be **Preferred or Acceptable Species** – per SP, FDP or FSP
- 3) meet **Damage Criteria**
- 4) meet **Minimum Height** – if in SP, FDP or FSP



Crop Tree Species	Biogeoclimatic subzone/variant	Sites Series	Allowable countable broadleaf trees per 50 m <sup>2</sup> plot (3.99 m. radius)
Pli, Lw	SBPS dc, mk, xc		5
	SBS dw 1,2	Suberic & drier	5
	All other		2
Fdi, Pa, Pw	All		3
Sw, Se, Sb, Sx	BWBS mw	01,03, 10,11	2 At, Act or 5 Ep
	All other		5
All Other	All		5

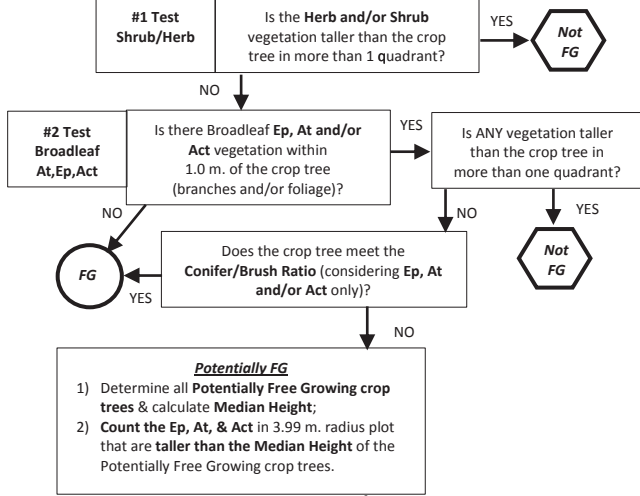


**Note:** When a survey unit contains more than one subzone or site series, use the lower countable broadleaf limit.  
 When a plot contains more than the allowable red alder, birch, and/or bitter cherry trees for a given species and biogeoclimatic subzone/site series, only the potentially free growing trees of that species will become not free growing. A crop tree that meets the required SP crop tree-to-brush ratio (and all other free growing criteria) is free growing regardless of the number of broadleaf trees in the 50 m<sup>2</sup> plot.

# 18c. INTERIOR (SOUTH AREA) Vegetation Competition Decision Key for a Free Growing Crop Tree

Must:

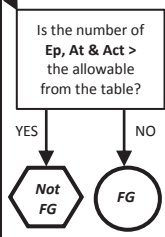
- 1) be **Well Spaced**
- 2) be **Preferred or Acceptable Species** – per SP, FDP or FSP
- 3) meet **Damage Criteria**
- 4) meet **Minimum Height** – if in SP, FDP or FSP



**Potentially FG**

- 1) Determine all **Potentially Free Growing crop trees** & calculate **Median Height**;
- 2) **Count the Ep, At, & Act** in 3.99 m. radius plot that are **taller than the Median Height** of the Potentially Free Growing crop trees.

Crop Tree Species	Biogeoclimatic subzone/variant	Sites Series	Allowable countable broadleaf trees per 50 m <sup>2</sup> plot (3.99 m. radius)
Pli, Py, Lw	IDF dk 1,2,3	Mesic & drier	5
	SBPS dc, mk MSxv	All	5
	SBPS xc, IDF dk 4	All	Non-deleterious (no cap)
	SBS dw 1,2	Suberic & drier	5
	All other	All	2
Fdi, Pa, Pw	All	All	3
All Other	All	All	5

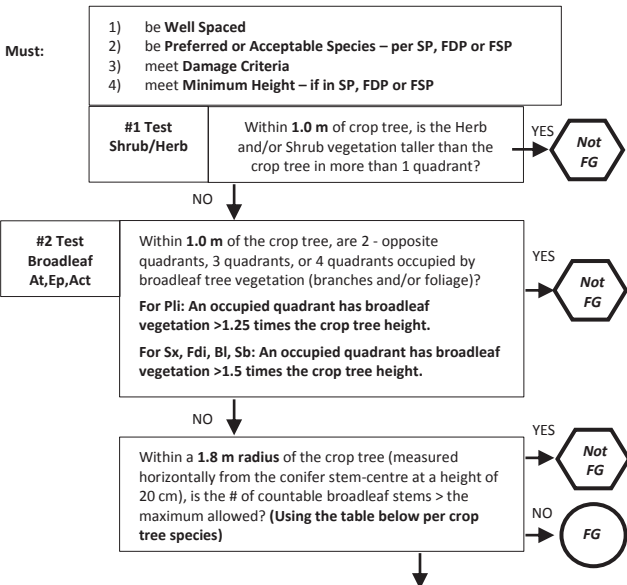


**Note:** When a survey unit contains more than one subzone or site series, use the lower countable broadleaf limit. When a plot contains more than the allowable red alder, birch, and/or bitter cherry trees for a given species and biogeoclimatic subzone/site series, only the potentially free growing trees of that species will become not free growing. A crop tree that meets the required SP crop tree-to-brush ratio (and all other free growing criteria) is free growing regardless of the number of broadleaf trees in the 50 m<sup>2</sup> plot.

# 18d. INTERIOR (SOUTH AREA) \*\*ALTERNATE\*\*

## Vegetation Competition Decision Key for a Free Growing Crop Tree

\*\*only for Williams Lake, Quesnel, and 100 Mile TSAs alternative guidelines for SBPSmk, SBPSdc, SBSdw1, SBSdw2, IDFDk3, and IDFDk1 (only on sites where there has been NO previous brushing or broadleaf tree spacing activity)\*\*



Crop Tree Species	Biogeoclimatic subzone/variant	Sites Series	Allowable countable broadleaf trees per 1.8 m radius around the crop tree <sup>1</sup>
<b>Pli (A countable broadleaf stem is &gt;1.25 times the crop tree height)</b>	IDF dk 3	01, 02, 03, 04, 05, 06	3
		07, 08, 09	1
	IDF dk1	01,02,03,04, 05,06	3
			1
SBPS dc, mk SBS dw 1, 2	All	1	
		1	
<b>All Others (A countable broadleaf stem is &gt;1.5 times the crop tree height)</b>	IDF dk 3	01, 02, 03, 04, 05, 06	3
		07, 08, 09	1
	IDF dk1	01,02,03,04	3
	SBPS dc, mk SBS dw 1,2	05,06	1
		All	1

**Note:** When a survey unit contains more than one subzone or site series, use the lower countable broadleaf limit.

<sup>1</sup> For the countable stem assessment this definition applies to broadleaf stems within 1.8 m (measured horizontally from the crop conifer-stem centre at a height of 20 cm). The 1.8 m radius may extend beyond the perimeter of the 3.99 m radius plot and a single broadleaf tree may be countable within more than one 1.8 m radius.

## 19. Countable conifer principles

The number of countable conifers need only be assessed when the number of total trees per hectare is in excess of the maximum density for the survey standards unit.

- a. All silviculture systems except single tree selection;
  - It is re-assessed at each plot.
  - Determine the median (middle) height of the largest well spaced trees to a maximum of the M value. Where the median height of the well spaced trees is;
    - <2m, the countable height is 30% of the median well spaced height
    - ≥2m, the countable height is 50% of the median well spaced height
- b. Single tree selection silviculture systems;
  - all layer 3 conifers are considered countable.

## 20. Free growing acceptability guidelines for layer 3 and 4 advanced regeneration

Species*	Ba, Bl	Cw** Hm, Yc	Hw		Sx, Se, Sw	Fdi, Lw	Pa, Pli, Py
BEC Zones	All***	CWH, CDF, MH, ICH	CWH, CDF, MH, ICH, (Pr. Rup.)	ICH (Other region s)	All*** (except BWBS)	All** *	All** *
Height at release	No height limit				<0.5m	No height limit	
Scars and damage	All species: No open (unhealed) injuries; no closed (healed) injuries with a horizontal width at the widest point(s), which is greater than 25% of the circumference of the tree at that point; no closed injuries that exceed 10% of the total length of the stem; no stem infection caused by a stem rust or dwarf mistletoe; no other externally visible pathological indicators including broken top, frost crack, conk, extreme basal sweep or unacceptable forks and crooks (see 23b)						
Continuous live crown	All species: An acceptable tree has greater than 30% continuous live crown. Continuous live crown is the length of continuous green foliage on a tree expressed as a percentage of its total height. Continuous live crown refers to foliage on adjacent live green branches that forms the main part of the crown of a tree and extends over at least half of the circumference of the tree.						
Vigour	All species: Evidence of release (i.e., generally good post-harvest height increment) – Increased leader growth is not a requirement for trees in layer three and four in partial cut situations with low basal area removal where the trees remain heavily shaded by layer one and two trees.						

- \* For those species not listed here, the normal free growing acceptability criteria apply. At regeneration delay, consider whether naturals will meet these criteria by free growing. If western white pine (Pw) is to be considered, consult the *Pine Stem Rust Management Guidebook*.
- \*\* Beware of sun scald. If advance regeneration western redcedar is to be used, check for incidence of heart rot.
- \*\*\* "All" refers to zones where these species are acceptable.

# 22a. Damage agent and condition codes (FS 747 Conifer – 2011/10)

## CONIFER DAMAGE AGENT AND CONDITION CODES



FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
<b>A</b>	<b>ANIMAL DAMAGE</b>				
AB	BEAR	AP	PORCUPINE	DFB	Delphinella tip blight <i>Delphinella</i> spp.
AC	CATTLE	AS	SQUIRREL	DFC	Large-spored spruce-labrador tea rust <i>Chrysomyxa ledicola</i>
AD	DEER	AV	VOLE	DFD	Spuce needle cast <i>Lirula macrospora</i>
AE	ELK	AX	BIRDS	DFE	Elytrodema needle and shoot disease <i>Elytrodema deformans</i>
AH	HARE OR RABBIT	AZ	BEAVER	DFH	Larch needle blight <i>Hypodermella laricis</i>
AM	MOOSE			DFJ	Phaeosporia needle cast <i>Phaeosporia contortae</i>
AO	PIKA			DFL	Pine needle cast <i>Lophodermella concolor</i>
<b>N</b>	<b>ABIOTIC INJURIES</b>			DFM	Larch needle cast <i>Mena laricis</i>
NAV	Avalanche or snow slide	NK	FUMEKILL	DFN	Leptomelanconium needle blight <i>Leptomelanconium pinicola</i>
NB	FIRE	NL	LIGHTNING	DFO	Lophodermium needle cast <i>Lophodermium sedticosum</i>
ND	DROUGHT	NN	ROAD SALT	DFP	Fir-fireweed rust <i>Pucciniastrum epiobii</i>
NE	FLOODING	NR	REDBELT	DFS	Douglas-fir needle cast <i>Rhabdocline pseudotsugae</i>
NF	FROST	NS	SLIDE	DFU	Dothistroma (red band) needle blight <i>Mycosphaerella pini</i>
NG	Frost crack	NW	WINDTHROW	DFW	Cedar leaf blight <i>Didymascula thujina</i>
NGC	Frost-heaved	NWS	Windthrow-soil failure	DFX	Swiss needle cast <i>Phaeocryptogaeus gaeumannii</i>
NGH	Shoot / bud frost kill	NWT	Windthrow-treatment	DFY	Brown felt blight <i>Herpotrichia</i> spp.
NGK	Shoot / bud frost kill or harvest related	NX	WIND SCARRING OR RUBBING	DFZ	Hendersonia needle cast <i>Hendersonia pinicola</i>
NH	HAIL	NY	SNOW, ICE, SNOW PRESS		Rhizosphaera needle cast <i>Rhizosphaera kalkhoffii</i>
		NZ	SUNSCALD	DL	LEADER OR BRANCH DIEBACKS
<b>D</b>	<b>DISEASE</b>			DLD	Dermea canker <i>Dermia pseudotsugae</i>
DB	BROOM RUST			DLF	Red flag disease <i>Polebraniomyces balsamicola</i>
DBF	Fir broom rust <i>Melemposorella caryophyllacearum</i>			DLK	Conifer cytospora canker <i>Leucostoma kunzei</i>
DBS	Spruce broom rust <i>Chrysomyxa arctostaphyli</i>			DLP	Diaporthe canker <i>Diaporthe lokojoyae</i>
DD	STEM DECAYS			DLS	Sydowia tip dieback <i>Sclerophoma pithyophila</i>
DDA	White mottled rot <i>Ganoderma applanatum</i>			DLT	Sirococcus tip blight <i>Sirococcus strobilinus</i>
DDD	Sulfur fungus <i>Laetiporus sulphureus</i>			DM	DWARF MISTLETOES
DDE	Rusted stringy rot <i>Echinodontium tinctorium</i>			DMF	Douglas-fir dwarf mistletoe <i>Arceuthobium douglasii</i>
DDF	Brown crumbly rot <i>Fomitopsis pinicola</i>			DMH	Hemlock dwarf mistletoe <i>Arceuthobium tsugense</i>
DDO	Brown cubical butt & pocket rot of cedar <i>Postia sericeomollis</i>			DML	Larch dwarf mistletoe <i>Arceuthobium laricis</i>
DDP	Red ring rot <i>Phellinus pini</i>			DMP	Lodgepole pine dwarf mistletoe <i>Arceuthobium americanum</i>
DDQ	Brown trunk rot (quinine fungus) <i>Fomitopsis officinalis</i>			DR	ROOT DISEASES
DF	FOLIAGE DISEASES			DRA	Armillaria root disease <i>Armillaria ostoyae</i>
DFA	Western pine aster rust <i>Coleosporium asterum</i>			DRB	Blackstain root disease <i>Lepographium wageneri</i>

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## 22b. Damage agent and condition codes

(FS 747 Conifer – 2011/10)

FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
D6S	Schweinitzi butt rot <i>Phaeolus schweinitzi</i>	IDP	Larch sawfly <i>Pristiphora erichsonii</i>
DRT	Tomentosus root rot <i>Tronolus tomentosus</i>	IDS	Conifer sawflies <i>Herodias</i> spp.
DS	STEM DISEASE (CANKER OR RUST)	IDT	Douglas-fir tussock moth <i>Ogryza pseudotsugata</i>
DSA	Atropellis canker <i>Atropellis piniphila</i>	IDV	Variagated cutworm <i>Pendroma saucia</i>
DSB	White pine blister rust <i>Cronartium ribicola</i>	IDW	Western spruce budworm <i>Choristoneura occidentalis</i>
DSC	Commanda blister rust <i>Cronartium comandrae</i>	IDZ	Western false hemlock looper <i>Nepytia freemani</i>
DSE	Elytrodema needle and shoot disease <i>Elytrodema deformans</i>	IS	SHOOT AND STEM INSECTS
DSG	Western gall rust <i>Endoconartium harknessii</i>	ISB	Western cedar borer <i>Trachylela bondeli</i>
DSS	Stelactiform blister rust <i>Cronartium coloposporoides</i>	ISE	European pine shoot moth <i>Rhyacionia buoliana</i>
I	INSECTS	ISG	Gouty pitch midge <i>Cecidomyia pinitropis</i>
IA	APHIDS OR ADELGIDS	ISP	Pitch nodule moth <i>Petrova</i> spp.
IAB	Balsam woolly adelgid <i>Adelges piceae</i>	ISS	Western pine shoot borer <i>Eucosma sonomensis</i>
IAC	Giant conifer aphid <i>Cinara</i> spp.	ISQ	Sequoia pitch moth <i>Syrnathedon sequoiae</i>
IAG	Cootley spruce gall adelgid <i>Adelges cooleyi</i>	IWC	WEEVILS
IAL	Larch cone woolly aphid <i>Adelges lariciatus</i>	IWI	Conifer seedling weevil <i>Stenomimus carinatus</i>
IAS	Spruce aphid <i>Elatobium abietinum</i>	IWP	Megadalis sp.
IB	BARK BEETLES	IWS	Lodgepole pine terminal weevil <i>Pissodes terminalis</i>
IBB	Western balsam bark beetle <i>Dryocoetes confusus</i>	IWW	White pine weevil (on spruce) <i>Pissodes strobi</i>
IBD	Douglas-fir beetle <i>Dendroctonus pseudotsugae</i>	IWX	Warren's root collar weevil <i>Hylobius warreni</i>
IBE	Silver fir beetle <i>Pseudohylesinus saxeus</i>	IWY	Cylindrocarptus weevil <i>Cylindrocarptus</i> spp.
IBF	Fir engraver beetle <i>Scolytus ventralis</i>	IWZ	Yosemite bark weevil <i>Pissodes schwartzii</i>
IBH	Hyurgops beetle <i>Hyurgops rugipennis</i>	M	MITE DAMAGE (TRISETACUS SPECIES)
IBI	Engraver beetles <i>Ips</i>	T	TREATMENT INJURIES
IBL	Lodgepole pine beetle <i>Dendroctonus murryanae</i>	TC	CHEMICAL
IBM	Mountain pine beetle <i>Dendroctonus ponderosae</i>	TH	HARVESTED
IBP	Twig beetles <i>Pityogenes</i> , <i>Pityophthorus</i> spp.	TL	LOGGING
IBS	Spruce beetle <i>Dendroctonus rufipennis</i>	TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
IBT	Red turpentine beetle <i>Dendroctonus valens</i>	TP	PLANTING
IBW	Western pine beetle <i>Dendroctonus brevicornis</i>	TR	Planting — poor microsite
ID	DEFOLIATING INSECTS	TT	PRUNING
IDA	Black army cutworm <i>Actebia fennica</i>	V	THINNING OR SPACING
IDB	Two-year budworm <i>Choristoneura biennis</i>	VH	VEGETATION PROBLEMS
IDC	Larch casebearer <i>Colophostora lanceola</i>	VS	HERBACEOUS COMPETITION
IDD	Spruce budworm <i>Choristoneura fumiferana</i>	VP	VEGETATION PRESS
IDG	Green-striped forest looper <i>Melanoplphia imatula</i>	VV	SHRUB COMPETITION
IDH	Western blackheaded budworm <i>Acleris glomerata</i>	VT	TREE COMPETITION
IDI	Pine needle sheath miner <i>Zelleria hainbachi</i>		
IDL	Western hemlock looper <i>Lambdina fuscicollis lugubrosa</i>		

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# 22c. Damage agent and condition codes (FS 747 Deciduous – 2011/10)



## DECIDUOUS DAMAGE AGENT AND CONDITION CODES

FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION	FIELD CODES	DESCRIPTION
<b>A</b>	<b>ANIMAL DAMAGE</b>				
AB	BEAR	AP	PORCUPINE	DFG	Cottonwood leaf rust <i>Melampsora occidentalis</i>
AC	CATTLE	AS	SQUIRREL	DFK	Linospora leaf blight <i>Linospora tetraspora</i>
AD	DEER	AV	VOLE	DFQ	Septoria leaf spot <i>Septoria populicola</i>
AE	ELK	AX	BIRDS	DFV	Ink spot of aspen <i>Clorinaria whietzelli</i>
AH	HARE OR RABBIT	AZ	BEAVER		Leaf rust <i>Melampsora spp.</i>
AM	MOOSE			DL	LEADER OR BRANCH DIEBACKS
AO	PIKA			DLP	Diaporthe canker <i>Diaporthe lokoyae</i>
				DLV	Aspen & poplar leaf and shoot blights <i>Venturia spp.</i>
<b>N</b>	<b>ABIOTIC INJURIES</b>			DR	ROOT DISEASES
NAV	Avalanche or snow slide	NH	HAIL	DRA	Amillaria root disease <i>Armillaria ostoyae</i>
NB	FIRE	NK	FLAMEKILL	DS	STEM DISEASE (CANKER OR RUST)
NC		NL	LIGHTNING	DSE	Sooty bark canker <i>Ercocella pruinosa</i>
NCA	Aspen decline	NN	ROAD SALT	DSH	Hypoxylon canker <i>Eriobotrya mammatum</i>
NCB	Birch decline	NR	REDBELT	DSP	Cytophthora canker <i>Cytophthora populifera</i>
ND	DROUGHT	NS	SLIDE	DSR	Ceratocystis canker <i>Ceratocystis fimbriata</i>
NF	FLOODING	NW	WINDTHROW	DST	Target canker <i>Nectria galligena</i>
NG	FROST	NWS	Windthrow-soil failure	DSY	Cytospora canker <i>Valsa scordida</i>
	Frost crack	NWT	Windthrow-treatment		
NGC	Frost-heaved	NX	WINDSCARRING OR RUBBING		
NGH	Shoot / bud frost kill	NY	SNOW, ICE, SNOW PRESS		
NGK	Shoot / bud frost kill or harvest related	NZ	SUNSCALD		
<b>D</b>	<b>DISEASE</b>			I	<b>INSECTS</b>
DD	STEM DECAYS			ID	DEFOLIATING INSECTS
DDA	White mottled rot <i>Ganoderma applanatum</i>			IDA	Black army cutworm <i>Actebia fennica</i>
DDB	White spongy trunk rot <i>Formes fomentarius</i>			IDD	Western winter moth <i>Erannis vancouverensis</i>
DDC	Brown cubical rot of birch <i>Piptoporus betulinus</i>			IDF	Forest tent caterpillar <i>Malacosoma disstria</i>
DDD	Sulfur fungus <i>Laetiporus sulphureus</i>			IDJ	Grey forest looper <i>Caripeta divisa</i>
DDF	Brown crumbly rot <i>Fomitopsis pinicola</i>			IDK	Northern tent caterpillar <i>Malacosoma californicum</i>
DDG	Sterile conk trunk rot of birch <i>Inonotus obliquus</i>			IDM	Gypsy moth <i>Lymantria dispar</i>
DDH	Hardwood trunk rot <i>Phellinus ignarius</i>			IDN	Birch leaf miners <i>Fenusa pusilla</i> and <i>Prolenusa thomsoni</i>
DDI	Aspen trunk rot <i>Phellinus tremulae</i>			IDP	Filament beaver <i>Nematocampa filamentaria</i>
DDT	FOLIAGE DISEASES			IDR	Alder sawfly <i>Eriocampa ovata</i>
DDF	Marssonina leaf spots and blights <i>Marssonina spp</i>			IDU	Satin moth <i>Leucoma salicis</i>
				IDV	Vanegated cutworm <i>Peridroma saucia</i>
				IDX	Large aspen tortrix <i>Choristoneura cornificana</i>
				IDY	Birch-aspen leafroller <i>Epinotia solarioriana</i>
				ID1	Leaf beetles <i>Chrysomela spp.</i>
				ID2	Bruce spanworm <i>Operophtera bruceata</i>

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## 22d. Damage agent and condition codes (FS 747 Deciduous – 2011/10)

FIELD CODES	DESCRIPTION
ID3	Winter moth <i>Operophtera brumata</i>
ID4	Cottonwood sawfly, <i>Nematus curranti</i>
ID5	Fall webworm <i>Hyphantria cunea</i>
ID6	Aspen leaf miner, <i>Phyllocnistis populiella</i>
ID7	Woolly alder sawfly, <i>Eriocampa ovata</i>
ID8	Aspen leaf roller <i>Pseudexentera oregonana</i>
ID9	Birch leaf skeletonizer <i>Bucculatrix</i> spp.
IEA	Unidentified aspen defoliation
IEF	Cottonwood leaf skeletonizer, <i>Phylkonocytes apparella</i>
IEJ	Willow leafminer, <i>Microtraptus salicifoliella</i>
IS	SHOOT INSECTS
ISA	Bronze birch borer <i>Agrius anxius</i>
ISC	Poplar borer <i>Saperda calcarata</i>
ISW	Poplar and willow borer <i>Cryphothynchus lapathi</i>
T	TREATMENT INJURIES
TC	CHEMICAL
TH	HARVESTED
TL	LOGGING
TM	OTHER MECHANICAL DAMAGE (NON-LOGGING)
TP	PLANTING
TR	Planting — poor microsite
TT	PRUNING THINNING OR SPACING
V	VEGETATION PROBLEMS
VH	HERBACEOUS COMPETITION
VP	VEGETATION PRESS
VS	SHRUB COMPETITION
VT	TREE COMPETITION

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## 23a. Free growing damage criteria for even-aged (age class 1) coniferous trees (pg. 1)

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Stem	Wound (including sunscald and girdling)	<ul style="list-style-type: none"> <li>the tree has any wound which is greater than 33% of the stem circumference, or</li> <li>the tree has a wound which is greater than 20% of the total length of the stem, or</li> <li>the tree has a wound centered on an infection caused by a stem rust, canker, or dwarf mistletoe (See Note under Stem: Infection).</li> <li>the tree is enclosed within a seedling protector.</li> <li>any amount of girdling or damage to the stem caused by seedling protectors.</li> </ul>	All	cattle AC, squirrel AS, beaver AZ, vole AV, porcupine AP, hare AH, Warrens root collar weevil IWW, sequoia pitch moth ISO, fire NB, wind-throw NW, sunscald NZ, logging TL, mechanical TM	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when the tree is damaged by sunscald). Healed over wounds (=scars) are acceptable. See "Damage types." Girdling can be caused by seedling protectors.
Stem	Insect mining at root collar	<ul style="list-style-type: none"> <li>the tree is currently attacked by a bark-mining insect such as a weevil or a beetle and exhibits symptoms such as foliage discoloration, thinning, and/or reduced height growth increments</li> </ul>	Pl, Sx	root collar weevil IWW	Only trees that are symptomatic should be checked for insect infestation or mining damage. Non-symptomatic trees are presumed to be unaffected by insect mining
Stem	Deformation (including crook, sweep, fork, browse,	<ul style="list-style-type: none"> <li>the pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.</li> <li>the tree leader has been killed three or more times in the last five years (weevil only).</li> <li>the tree has two or more leaders with no dominance expressed after five years growth and the fork originates above 30 cm from the point of germination</li> <li>the tree has a dead or broken top at a point that is &gt;2 cm (&gt;3 cm for the coast) in diameter</li> </ul>	For sweep, all except Cw and Hw	Defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, northern pitch twig moth ISP, sequoia pitch moth ISO, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TM	For horizontal displacement see "Damage types." This criterion applies only for terminal weevil damage. Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See "Damage types."

## 23b. Free growing damage criteria for even-aged (age class 1) coniferous trees (pg. 2)

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Stem	Stem Infection (Including cankers and galls)	<ul style="list-style-type: none"> <li>any infection occurs on stem</li> </ul>	All	broom rust DBS, comandra blister rust DSC, stalactiform (IB), Pityogenes, blister rust DSS, white pine blister rust DSB, western gall rust DSG	Note: Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent.
Stem	Bark mining	<ul style="list-style-type: none"> <li>any amount of boring dust, pitch tubes, or bark sloughing is visible</li> </ul>	Pl, Sx, Fd	Bark beetles (IB), mountain pine beetle (IBM), Ips pini (IB), Pityogenes, Pityophthorus (IPB)	The mountain pine beetle outbreak has caused unexpected mortality in young pine. Stressed trees are susceptible to secondary bark and twig beetles.
Branch	Infection (cankers)	<ul style="list-style-type: none"> <li>an infection occurs on a live branch less than 20 cm from the stem.</li> </ul>	Pl, Py	comandra blister rust DSC	See "Damage Types."
Branch	Galls	<ul style="list-style-type: none"> <li>a gall rust infection occurs on a live branch less than 5 cm from the stem</li> <li>any adelgid gouting occurs on a branch</li> </ul>	Pw, Pl, Py	white pine blister rust DSB, stalactiform blister rust DSS	See "Damage Types."
Branch	Gouting	<ul style="list-style-type: none"> <li>a gall rust infection occurs on a live branch less than 5 cm from the stem</li> <li>any adelgid gouting occurs on a branch</li> </ul>	Pl, Py	western gall rust DSG	See "Damage Types."
Branch	Gouting	<ul style="list-style-type: none"> <li>any adelgid gouting occurs on a branch</li> </ul>	Ba, Bg, Bl	balsam woolly adelgid IAB	Gouting is defined as excessive swelling of a branch or shoot caused by balsam woolly adelgid, and is often accompanied by mishapen needles and buds. It is most common on branch tips and at nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Foliage	Defoliation	<ul style="list-style-type: none"> <li>&gt;50% of tree foliage has been removed by Dothi stroma in ICH, CWH and SBS biogeoclimtic zones. (see 23d.)</li> <li>&gt;80% of tree foliage has been removed due to defoliating insects or foliage disease.</li> </ul>	Pl	Dothiostroma needle blight only, DIFS	See "Defoliation for Determinate Growth Species."
Stem or Branch	Dwarf mistletoe infection	<ul style="list-style-type: none"> <li>any infection occurs on the stem or a live branch, or</li> <li>a susceptible tree is located within 10 m of an overtopping tree, which is infected with dwarf mistletoe</li> </ul>	All others Hw, Pl, Lw, Fd	defoliators ID, foliage diseases DF, hemlock dwarf mistletoe DMH, lodgepole pine dwarf mistletoe DMP, larch dwarf mistletoe DML, Douglas-fir dwarf mistletoe DMF	To confirm infection, the surveyor must observe mistletoe aerial shoots or basal cups on regen or live or dead fallen brooms. Overtopping tree is a tree that is three or more times taller than the height of the tree being assessed.

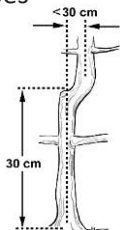
## 23c. Free growing damage criteria for even-aged (age class 1) coniferous trees (pg. 3)

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Roots	Root disease	<ul style="list-style-type: none"> <li>sign(s) or a definitive combination of symptoms of root disease are observed.</li> </ul>	All	amillaria root disease DRA, laminated root rot DRL, tomentosus root rot DRT, amnosus root disease DRN, blackstain root disease DRB	Signs are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. Symptoms include foliar chlorosis or thinning, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. An individual symptom is not sufficient to identify a root disease.
Roots	Root disease (continued)	<ul style="list-style-type: none"> <li>infected tree found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRA is two, except in BEC zones PPDh1 and 2, IDF-R1, IDF-dm1 and 2, MSdk1, and MSdm1 where the multiplier is one.</li> <li>except for Cw (in all BEC zones) the multiplier is one.</li> </ul>	All	amillaria root disease DRA	Note: All conifer species are considered susceptible. Broadleaf species are considered not susceptible for survey purposes only. Example: How to apply net down for root disease. If root disease-infected trees are found in the plot: 1. In the first sweep, determine the total number of susceptible healthy, well-spaced/free growing trees using the prescribed minimum inter-tree distance (MITD) (e.g., 12 trees) ignoring the M-value; 2. In a second independent sweep, determine the number of infected trees (including dead infected trees and for DRT only, infected stumps) that are the MITD from each other (e.g. 4 infected trees or stumps); 3. Multiply the number from step 2 by the multiplier for the specific root disease and subtract this number from the number of susceptible healthy well-spaced trees found in step 1 (e.g., for DRA: $12 \cdot (4) = 4$ ). The result is the maximum number of free growing trees tallied for the plot.
		<ul style="list-style-type: none"> <li>infected conifer found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRL is four.</li> <li>infected conifer or stump found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRT is two.</li> <li>infected conifer found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRN is two.</li> </ul>	Fd, Sx, Se, Lw, Ba, Bg Se, Sx	laminated root rot DRL  tomentosus root rot DRT	Note: Bl, Cw, Pl, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.  Note: Ba, Bl, Cw, Fd, Pl, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.
		<ul style="list-style-type: none"> <li>infected conifer found in plot. See comments for well-spaced tree net down calculation. The multiplier for DRN is two.</li> </ul>	Ba, Hw, Ss	amosus root rot DRN	Note: Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, Py, Sx and broadleaf species are considered not susceptible for survey purposes only.

## 23d. Damage types

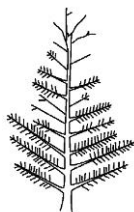
### Crooks (old stems)

A crook is unacceptable if it is displaced more than 30 cm and originates above 30 cm.



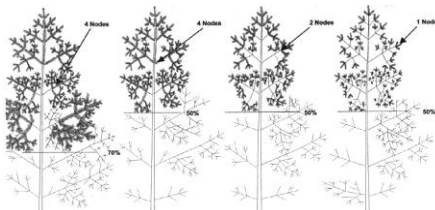
### Defoliation, general

Defoliation is unacceptable if more than 80% of the needles are removed due to insects or disease.



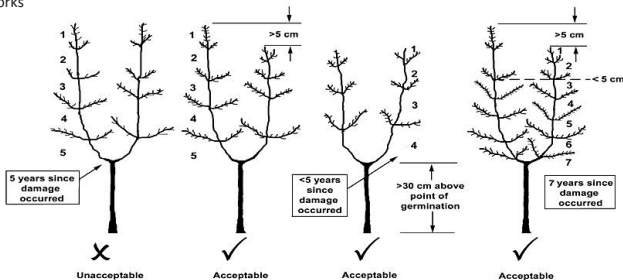
Defoliation, for determinate growth species, (e.g. true firs, Douglas-fir, spruces, pines)

- Determine the % live crown.
- Determine how many of the most recent 4 nodes have >50% of their foliage, express it as a %.
- Step 1% x Step 2%:
  - for Dothistroma, in ICH, CWH and SBS >50% = acceptable
  - all other causes and biogeoclimatic zones >20% = acceptable



a)	b)	c)	d)
70% Live Crown	50% Live Crown	50% Live Crown	50% Live Crown
4/4 Healthy Nodes	4/4 Healthy Nodes	2/4 Healthy Nodes	1/4 Healthy Nodes
70% X 100%	50% X 100%	50% X 50%	50% X 25%
= 70%	= 50%	= 25%	= 12.5%

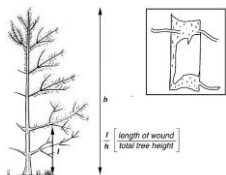
### Forks



### Wounds

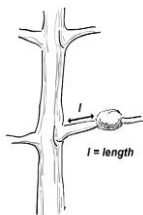
Damage to the cambium or deeper is infection unacceptable where it is:

- more than one-third the circumference, or
- more than 20% of the height of tree.



### Gall and Canker

Distance measurement from point of by canker or gall to main stem (measured along the branch).



## 24. Broadleaf Forest Health Free Growing

### Damage Criteria

Unless otherwise stated in regulation or an approved FDP or FSP stocking standard, an acceptable hardwood crop tree must:

- not have a tree pith that is laterally displaced more than 30 cm from the location of the root-crown pith<sup>1</sup>.
- not originate from a cut stump<sup>2</sup>.
- have at least one dominant live leader<sup>3</sup>.
- not have a wound that is greater than 10% of the stem circumference nor is greater than 10% of the total length of the stem<sup>4</sup>.
- not have any fungal infections or insect infestations affecting tissues below the bark surface, visible without destructive sampling<sup>5</sup>.
- not be browsed so as to limit its ability to become a crop tree.

<sup>1</sup> A requirement of the Establishment to Free Growing Guidebook, Prince George Forest Region, May 2000, Appendix 6, Boreal Broadleaf Stocking Guidelines, BWBS.

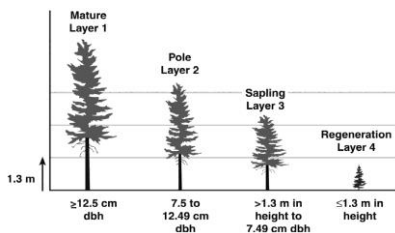
<sup>2</sup> Stems originating from the sides or cut surface of stumps are very susceptible to breakage at the coppice point

<sup>3</sup> The objective is that the tree has a single stem that will develop into a healthy crop tree. Accordingly, a healthy, free growing broadleaf tree must have an identifiable live leader. It is not important if a portion, but not all, of the leader is browsed or killed for example by venturia blight.

<sup>4</sup> This criterion is modified from the conifer criterion, and threshold percent values are chosen subjectively. Research is needed to determine more exactly the size of an open wound at free growing assessment that is likely to limit the development of a healthy crop tree. A wound is defined as an injury in which the cambium is dead or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood. Healed-over wounds (= scars) are acceptable. Fire or sunscald damage can also cause wounds. Injury of broadleaf stems is considered an important entry court for decay organisms.

<sup>5</sup> Visible stem infections include cytospora canker or sooty-bark canker, and visible insect infestations, such as poplar borer. The significance of some diseases, such as armillaria root disease, to aspen is unknown or uncertain, and several cannot be feasibly identified by visual features during free growing surveys.

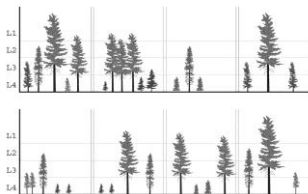
## 25a. Multi-storey layer descriptions



## 25b. Stand structures suitable for multi-storey surveys

\* A stand is considered multi-storied (i.e. suitable for using the multi-storey survey methodology) if:

- the crown closure of the trees in layers 1 and 2 is equal to or greater than 6%,
- layers 3 and/or 4 are also present and
- the stand is being managed for single tree selection.



## 26a. Free growing damage criteria for multi-storey conifer stands (pg. 1)

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Stem	Wound (including sunscald and girdling)	<ul style="list-style-type: none"> <li>Refer to table X for layers 1-4.</li> </ul>	All	squirrel AS, beaver AZ, vole AV, porcupine AP, hare AH, Warrens root collar weevil IWW, fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TT	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when the tree is damaged by sunscald). Healed over wounds (=scars) are acceptable
Stem	DECAY	<ul style="list-style-type: none"> <li>Any pathological indicator(s) are present. This may include conk, blind conk, frost crack, or rotten branches.</li> </ul>	All	various decay fungi DD	
Stem	Deformation (including crook, fork, and dead or broken top)	<ul style="list-style-type: none"> <li>These criteria apply to layer 1 &amp; 2 trees only. For layers 3 &amp; 4 use the even-aged damage criteria.</li> <li>A crook displaces the portion of the stem above the defect by &gt;50% from the line of growth formed by the stem below the point of defect in the bottom 2/3rds of the stem only.</li> <li>A fork occurs above stump height in the bottom 2/3rds of the stem only.</li> <li>A dead or broken top extends more than 20% of the stem length or the live crown is removed.</li> </ul>	All	defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TT, Dwarf mistletoes (see below).	
Stem	INFECTION (including cankers, and galls)	<ul style="list-style-type: none"> <li>any infection occurs on the stem.</li> </ul>	All	comandra blister rust DSC, stalactiform blister rust DSS, white pine blister rust DSB, western gall rust DSG, atropellis canker DSA, exploding canker DTNT, Dwarf mistletoes (see below).	Note: Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent
Branch	INFECTION (cankers)	<ul style="list-style-type: none"> <li>These criteria apply to layer 2, 3 &amp; 4 trees only. An infection occurs on a live branch less than 60 cm from the stem.</li> </ul>	Pw,Pl,Py	white pine blister rust DSB, comandra blister rust DSC, stalactiform blister rust DSS.	Branch infections on layer 1 trees can be ignored.
Branch	GALLS	<ul style="list-style-type: none"> <li>These criteria apply to layer 2, 3 &amp; 4 trees only. A gall rust infection occurs on a live branch less than 5 cm from the stem</li> </ul>	Pl, Py	western gall rust DSG	Branch infections on layer 1 trees can be ignored.

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Foliage	DEFOLIATION	For defoliating insects: <ul style="list-style-type: none"> <li>&gt; 80% of foliage has been removed, lost or damaged due to foliage disease.</li> </ul> For foliar diseases: <ul style="list-style-type: none"> <li>&gt; 50% of foliage has been removed, lost or damaged</li> </ul>	All	defoliators ID, foliage diseases DF.	
Stem or Branch	ADELGID GOUTING	<ul style="list-style-type: none"> <li>Any adelgid gouting occurs on a stem or branch.</li> </ul>	Ba, Bg, BI	balsam woolly adelgid IAB.	Gouting is defined as excessive swelling on a branch or shoot caused by balsam woolly adelgid and is often accompanied by misshapen needles and buds. It is most common on branch tips and at nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Stem or Branch	DWARF MISTLETOE INFECTION	These criteria apply to layer 2, 3 & 4 trees: <ul style="list-style-type: none"> <li>Any infection occurs on the stem or a live branch, or</li> <li>A susceptible tree is located within 10 m from the bole of a higher layer tree that is infected with dwarf mistletoe.</li> </ul> These criteria apply to layer 1 trees: <ul style="list-style-type: none"> <li>Hawksworth rating &gt;3, or severe stem infections (major swelling or deformity) present..</li> </ul>	All	hemlock dwarf mistletoe DMH, lodgepole pine dwarf mistletoe DMP, larch dwarf mistletoe DML, Douglas-fir dwarf mistletoe DMF.	Note: To confirm infection, the surveyor must observe mistletoe aerial shoots or basal cups on regeneration or on live or dead fallen brooms. The Hawksworth rating system is described in the FPC Dwarf Mistletoe Management Guidebook.

**TABLE X. Tree wounding criteria for layers 1-4. Trees are unacceptable if any ONE criterion is met**  
**STAND MANAGEMENT OBJECTIVE<sup>1</sup>**

TREE SPECIES	SHORT TERM RETENTION <sup>2</sup> (layers 1 & 2)	LONG TERM RETENTION <sup>3</sup> (layers 1 & 2)	UNEVEN AGED <sup>4</sup> (layers 1 & 2)	LAYERS 3 & 4	
B, H, Lw, Ss and Cw <60 years	W.>33%C., or MRW 1m, or G.	W.>33%C., or MRW 1m, or G.1 W.>400cm <sup>2</sup>	W.>33%C., or MRW 1m, or G.1 W.>400cm <sup>2</sup>	See Table 21	
Cy, Sx and Cw >60 years	W.>33%C., or MRW 1m, or G.	W.>33%C., or MRW 1m, or G.1 W.>400cm <sup>2</sup>	W.>33%C., or MRW 1m, or G.1 W.>400cm <sup>2</sup>		
Fd, Pw	W.>50% C.	W.>33%C., or MRW 1m, or G	W.>33%C., or MRW 1m, or G.1 W.>400cm <sup>2</sup>		
Pl, Py	W.>50% C.	W.>50% C.	W.>33%C., or MRW 1m, or G		W. = Wound C. = Circumference G. = Gouge <sup>5</sup> MRW = Major Root Wound within 1 m of the stem.

<sup>1</sup> The stand management objective should be specified in the site plan. Where it is not, the criteria for uneven-aged management should be applied.

<sup>2</sup> Where tree will be removed within 20 years.

<sup>3</sup> Where tree will be removed in more than 20 years.

<sup>4</sup> Where stand is managed in a true uneven state.

<sup>5</sup> A gouge involves a wound where penetration is into the sapwood or deeper.



## 26c. Free growing damage criteria for multi-storey conifer stands (pg. 3)

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents & damage agent codes	Comments
Roots	ROOT DISEASE	<ul style="list-style-type: none"> <li>Sign(s) or definitive combinations of symptoms of root disease are observed</li> </ul>	All	armillaria root disease DRA, laminated root rot DRL, tomentosus root rot DRT, annosus root disease DRN, blackstain root disease DRB	Signs are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. Symptoms include foliar thinning or chlorosis, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. Symptoms alone are not usually sufficient to identify root disease. Both signs and symptoms may be detected from old stumps, root balls, or other post-harvest remains.
		<ul style="list-style-type: none"> <li>Infected conifer found in plot. See Table Y for well-spaced tree net down calculation by layer.</li> </ul>	All	armillaria root disease DRA	<p>Note: All conifer species are considered susceptible. Broadleaf species are considered not susceptible for survey purposes only. Example: How to apply net down for root disease. If root disease-infected trees are found in the plot:</p> <ol style="list-style-type: none"> <li>Determine number of susceptible healthy, well-spaced/free growing trees using the prescribed minimum inter-tree distance (MITD) (e. g. 3 layer 1, 3 layer 3 and 4 layer 4 = 10 trees) ignoring M-value;</li> <li>Count the number of infected trees (e. g., 1 layer 1 tree and 1 layer 3 tree);</li> <li>Working from the uppermost layer down, apply the multiplier in Table Y to each lower layer. Subtract the resultant from each layer in turn, for susceptible species only (e. g., if all trees are susceptible, 1 infected layer 1 tree removes 1 healthy, well-spaced layer 1 tree plus 3 layer 3 trees plus 4 layer 4 trees). Note the effects are cumulative, not exclusive and lower layers do not effect higher layers;</li> <li>Calculate the remaining healthy, well-spaced trees once all removals due to infected trees are completed (e. g. 10 – 8 = 2). The result is the maximum number of free growing trees tallied for the plot.</li> </ol>
		<ul style="list-style-type: none"> <li>Infected conifer found in plot. See Table Y for well-spaced tree net down calculation.</li> </ul>	Fd, Sx, Se, Lw, Ba, Bg	laminated root rot DRL	Note: Bl, Cw, Pl, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.
		<ul style="list-style-type: none"> <li>Infected conifer or stump found in plot. See Table Y for well-spaced tree net down calculation.</li> </ul>	Se, Sx, PI	tomentosus root rot DRT	Note: Ba, Bl, Cw, Fd, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.
		<ul style="list-style-type: none"> <li>Infected conifer found in plot. See Table Y for well-spaced tree net down calculation.</li> </ul>	Ba, Hw, Ss	annosus root rot DRN	Note: Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, Py, Sx and broadleaf species are considered not susceptible for survey purposes only.

Table Y Deductions from number of acceptable well spaced uninfected stems for trees infected by root disease in uneven aged stand layers.					
Infected trees or stumps	Multiplier to determine number of trees to be deducted from:	Layer 1	Layer 2	Layer 3	Layer 4
Layer 1	1	1	2	3	4
Layer 2	-	2	2	2	3
Layer 3	-	-	-	2	2
Layer 4	-	-	-	-	2

# 27a. Free Growing Damage Criteria for Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 1)

TABLE A-Layer 1

**TABLE A - Layer 1 -  $\geq 12.5$  cm DBH. SEDRSS damage criteria**

**Note: Table A overrides all other damage criteria for SEDRSS managed stands**

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:		Possible damage agents & codes	Comments
		Hw, Ba, Bg, Bl, Cy, Fd, Ss, Pw, Pl, Lw, Sx, Py or	Cw		
Stem	Wound	<ul style="list-style-type: none"> <li>Wound girdles <math>&gt; 33\%</math> stem circumference,</li> <li>One wound <math>&gt; 400</math> cm<sup>2</sup> on stem, or</li> <li>Wound on major root within 1 m of stem, or</li> <li>Tree has gouge in stem.</li> </ul>	<ul style="list-style-type: none"> <li>No criteria.</li> </ul>	fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TT.	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood for dead cambium when the tree is damaged by sunscald. Healed over wounds (=scars) are acceptable.
Stem	Decay	<ul style="list-style-type: none"> <li>Any pathological indicator(s) are present. This may include conk, blind conk, frost crack, or rotten branches.</li> </ul>		various decay fungi DD.	
Stem	Bark Mining	<ul style="list-style-type: none"> <li>Any of the following signs are visible: pitch tubes, boring dust, exit holes on bark surface, galleries under the bark.</li> </ul>	<ul style="list-style-type: none"> <li>No criteria.</li> </ul>	Douglas-fir beetle IBD, Ips pini IBI, Pityogenes & Pityophthorus IBP	Note: pitch tubes can be associated with trees that have successfully repelled bark beetles, bark must be removed above pitch tube to confirm successful attack (successful galleries will be filled with frass and not pitch, contain adult beetles and/or larval galleries). Stressed trees are susceptible to secondary bark and twig beetles.
Stem	Deformation (including crook, fork and dead or broken top)	<ul style="list-style-type: none"> <li>A crook displaces the portion of the stem above the defect by <math>&gt;50\%</math> from the line of growth formed by the stem below the point of defect in the bottom 2/3 of the stem only.</li> <li>A fork occurs above stump height in the bottom 2/3 of the stem only.</li> <li>A dead or broken top extends more than 20% of the stem length or the live crown is removed.</li> </ul>	<ul style="list-style-type: none"> <li>No criteria.</li> <li>A dead tree with no live foliage the stem is unable to produce <math>&gt; 50\%</math> merchantable volume.</li> </ul>	frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TT, dwarf mistletoes (see below).	Note: Unacceptable as a contributing Crop Tree if assessed as unable to produce $> 50\%$ Merchantable Volume in the first 10 m. log length – defined as either: 1.Utility Grade – At least a solid 8 inch shell – Shake and Shingle and /or 2.Higher Grade – Complete solid wood – Saw Logs  Note: Field guidance procedures and photo examples for the estimation of merchantable Cw volume are identified in Appendix BB in the Surveys Procedures Manual.
Stem	Dwarf Mistletoe Infection	<ul style="list-style-type: none"> <li>Hawksworth rating <math>&gt; 3</math>, or severe stem infections (major swelling or deformity) present.</li> </ul>	<ul style="list-style-type: none"> <li>No criteria.</li> </ul>	hemlock dwarf mistletoe DMH.	The Hawksworth rating system is described in the FPC Dwarf Mistletoe Management Guidebook (or refer to Appendix AA in the Surveys Procedures Manual). For SEDRSS, this rating system will only apply to the tree/plot assessment level, and not at the stand level.

# 27a. Free Growing Damage Criteria for Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 2)

TABLE A-Layer 1

TABLE A - Layer 1 - ≥ 12.5 cm DBH. SEDRSS damage criteria (cont'd) Note: Table A overrides all other damage criteria for SEDRSS managed stands

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:		Possible damage agents & codes	Comments
		Hw, Ba, Bg, Bl, Cy, Fd, Ss, Pw, Pl, Lw, Sx, Py	Cw		
Foliage	Defoliation	<b>For defoliating insects:</b> <ul style="list-style-type: none"> <li>&gt; 80% of foliage removed, lost or damaged due to insect defoliation.</li> </ul> <b>For foliar diseases:</b> <ul style="list-style-type: none"> <li>&gt; 50% of foliage removed, lost or damaged.</li> <li>Stems &lt; 17.5 cm dbh - &lt; 30% live crown due to poor vigour.</li> <li>Stems &lt; 17.5 cm dbh - &lt; 20% live crown due to poor vigour.</li> </ul>		defoliators ID, foliage diseases DF.	Percent live crown is the length of continuous green foliage on a tree expressed as a percentage of its total height.
Foliage	Live Crown Vigour	<ul style="list-style-type: none"> <li>Sign(s) or definitive combinations of symptoms of root disease are observed.</li> <li>Infected conifer or stump found in plot. See Table Y for well-spaced tree net down calculation by layer.</li> </ul>		armillaria root disease DRA, laminated root rot DRL, annosus root disease DRN.	Signs are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. Symptoms include foliar thinning or chlorosis, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. Symptoms alone are not usually sufficient to identify root disease. Both signs and symptoms may be detected from old stumps, root balls, or other post-harvest remains.
Roots	Root Disease	For Cw, there is no criterion for net down calculation - considered not susceptible or low susceptibility.		armillaria root disease DRA, laminated root rot DRL, annosus root disease DRN.	Signs are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. Symptoms include foliar thinning or chlorosis, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. Symptoms alone are not usually sufficient to identify root disease. Both signs and symptoms may be detected from old stumps, root balls, or other post-harvest remains.
		<b>TABLE Y. Deductions from numbers of acceptable well-spaced uninfected stems for trees infected by root disease in layered stands.</b>			<b>Example:</b> How to apply net down for root disease. If root disease-infected trees are found in the plot: <ol style="list-style-type: none"> <li>Determine the number of healthy, well-spaced trees in each layer using the prescribed minimum inter-tree distance (MITD) (e.g., 3 layer 1, 3 layer 3 and 4 layer 4 = 10 healthy, well-spaced) ignoring M-value;</li> <li>Count infected trees (e.g., 1 layer 1 tree and 1 layer 3 tree);</li> <li>Working from the uppermost layer down, apply the multiplier in Table Y to each lower layer. Subtract the resultant from each layer in turn, for susceptible species only (e.g., if all trees are susceptible, 1 infected layer 1 tree removes 1 healthy, well-spaced layer 1 tree plus 3 layer 3 trees plus 4 layer 4 trees). Note the effects are cumulative, not exclusive and lower layers do not affect higher layers;</li> </ol> Calculate the remaining healthy, well-spaced trees once all removals due to infected trees are completed (e.g. 10 - 8 = 2). The result is the maximum number of free growing trees tallied for the plot.
		<b>Multiplier used to determine number of acceptable trees to be deducted from:</b>			
	Tree layer with infected tree(s) or stumps	Layer 1	Layer 2	Layer 3	Layer 4
	Layer 1	Deduct BA of infected layer 1 from Crop BA	2	3	4
	Layer 2		2	2	3
	Layer 3			2	2
	Layer 4				2

# 27a. Free Growing Damage Criteria for Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 3)

TABLE A-Layer 1

**Note: Table A overrides all other damage criteria for SEDRSS managed stands**

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:		Possible damage agents & codes	Comments
		Hw, Ba, Bg, Bl, Cy, Fd, Ss, Pw, Pl, Lw, Sx, Py	Cw		
Stem	Wound	<ul style="list-style-type: none"> <li>Wound girdles &gt; 25% stem circumference, or</li> <li>One wound &gt; 10% the length of stem.</li> </ul>	All	fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TT.	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when tree is damaged by sunscald). Healed over wounds (scars) are acceptable.
Stem	Decay	<ul style="list-style-type: none"> <li>Any pathological indicator(s) are present. This may include <b>conk</b>, <b>blind conk</b>, <b>frost crack</b>, or <b>rotten branches</b>.</li> </ul>	All	various decay fungi DD.	
Stem	Bark Mining	<ul style="list-style-type: none"> <li>Any of the following signs are visible: pitch tubes, boring dust, exit holes on bark surface, galleries under the bark.</li> </ul>	All	Douglas-fir beetle IBD, Ips pini IBI, Pityogenes & Pityophthorus IBP.	Note: pitch tubes can be associated with trees that have successfully repelled bark beetles; bark must be removed above pitch tube to confirm successful attack (successful galleries will be filled with frass and not pitch, contain adult beetles and/or larval galleries). Stressed trees are susceptible to secondary bark, twig beetles.
Stem	Deformation (including crook, fork and dead or broken top)	<ul style="list-style-type: none"> <li>The pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.</li> <li>The tree leader has been killed three or more times in the last 5 years (weevil only).</li> <li>The tree has two or more leaders with no dominance expressed after five years growth and the fork originates above 30 cm from the point of germination.</li> <li>The tree has a dead or broken top at a point that is &gt; 3 cm in diameter.</li> <li>The tree has a flat top (umbrella like) form and no distinct leader.</li> </ul>	All	defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TT, Dwarf mistletoes (see below).	This criterion applies only for terminal weevil damage. Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Appendix AA in Surveys Procedures Manual on Damage Types.
Stem	Lean and Sweep	<ul style="list-style-type: none"> <li>The tree leans &gt; 30° from the vertical with or without growth correction.</li> </ul>	All	flooding NF, snow NY, slides NS, wind NW, mechanical TM.	

# 27b. Free Growing Damage Criteria for Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 1)

TABLE B-Layers 2, 3, 4

TABLE B - Layers 2, 3 & 4 - < 12.5 cm DBH, SEDRSS damage criteria		Note: Table B overrides all other damage criteria for SEDRSS managed stands			
Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents and codes	Comments
Stem	Wound	<ul style="list-style-type: none"> <li>Wound girdles &gt; 25% stem circumference, or</li> <li>One wound &gt; 10% the length of stem.</li> </ul>	All	fire NB, windthrow NW, sunscald NZ, logging TL, mechanical TT.	A wound is defined as an injury in which the cambium is dead (e.g., sunscald) or completely removed from the tree exposing the sapwood. Measure the wound across the widest point of the exposed sapwood (or dead cambium when tree is damaged by sunscald). Healed over wounds (scars) are acceptable.
Stem	Decay	<ul style="list-style-type: none"> <li>Any pathological indicator(s) are present. This may include <b>conk</b>, <b>blind conk</b>, <b>frost crack</b>, or <b>rotten branches</b>.</li> </ul>	All	various decay fungi DD.	
Stem	Bark Mining	<ul style="list-style-type: none"> <li>Any of the following signs are visible: pitch tubes, boring dust, exit holes on bark surface, galleries under the bark.</li> </ul>	All	Douglas-fir beetle IBD, (ps pini) IBI, Pityogenes and Pityophthorus IBP.	Note: pitch tubes can be associated with trees that have successfully repelled bark beetles, bark must be removed above pitch tube to confirm successful attack (successful galleries will be filled with frass and not pitch, contain adult beetles and/or larval galleries). Stressed trees are susceptible to secondary bark, twig beetles.
Stem	Deformation (including crook, fork and dead or broken top)	<ul style="list-style-type: none"> <li>The pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.</li> <li>The tree leader has been killed three or more times in the last 5 years (weevil only).</li> <li>The tree has two or more leaders with no dominance expressed after five years growth and the fork originates above 30 cm from the point of germination.</li> <li>The tree has a dead or broken top at a point that is &gt; 3cm in diameter.</li> <li>The tree has a flat top (umbrella like) form and no distinct leader.</li> <li>The tree leans &gt; 30° from the vertical with or without growth correction.</li> </ul>	All	defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TT, Dwarf mistletoes (see below).	This criterion applies only for terminal weevil damage. Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Appendix AA in Surveys Procedures Manual on Damage Types.
Stem	Lean and Sweep	<ul style="list-style-type: none"> <li>The tree leans &gt; 30° from the vertical with or without growth correction.</li> </ul>	All	flooding NF, snow NY, slides NS, wind NW, mechanical TM.	

27b. Free Growing Damage Criteria for **Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 2)** **TABLE B-Layers 2, 3, 4**

**TABLE B - Layers 2, 3 & 4 - < 12.5 cm DBH. SEDRSS damage criteria (cont'd)** **Note: Table B overrides all other damage criteria for SEDRSS managed stands**

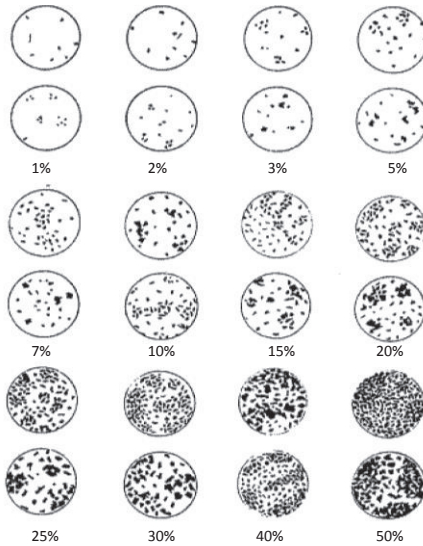
Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents and codes	Comments
Stem	Infection (includes cankers and galls)	<ul style="list-style-type: none"> <li>Any infection occurs on the stem.</li> </ul>	All	white pine blister rust DSB, atropellis canker DSA, dwarf mistletoes (see below).	<b>Note:</b> Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent.
Branch	Infection (cankers)	<ul style="list-style-type: none"> <li>An infection occurs on a live branch less than 60 cm from the stem.</li> </ul>	Pw, Pl, Py	white pine blister rust DSB, comandra blister rust DSC, stalactiform blister rust DSS.	
Branch	Galls	<ul style="list-style-type: none"> <li>A gall rust infection occurs on a live branch less than 5 cm from the stem.</li> </ul>	Pl, Py	western gall rust DSG.	
Foliage	Defoliation	<ul style="list-style-type: none"> <li>&gt; 60% tree foliage has been removed by hemlock looper.</li> <li>&gt; 80% of foliage has been removed, lost or damaged due to insect defoliation.</li> <li>&gt; 50% of foliage has been removed, lost or damaged due to foliar disease.</li> <li>&lt; 30% live crown present due to poor vigour.</li> </ul>	Hw All other	hemlock looper IDL. defoliators ID.	
Foliage	Live Crown Vigour	<ul style="list-style-type: none"> <li>&lt; 30% live crown present due to poor vigour.</li> </ul>	All	foliage diseases DF.	Percent live crown is the length of continuous green foliage on a tree expressed as a percentage of its total height.
Stem or Branch	Adelgid Gouting	<ul style="list-style-type: none"> <li>Any adelgid gouting occurs on a stem or branch.</li> </ul>	Ba, Bg, BI	balsam woolly adelgid IAB.	<b>Gouting</b> is defined as excessive swelling on a branch or shoot caused by balsam woolly adelgid, and is often accompanied by misshapen needles and buds. It is most common on branch tips and at nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Stem or Branch	Dwarf Mistletoe Infection	<ul style="list-style-type: none"> <li>Any infection occurs on the stem or a live branch, or</li> <li>A susceptible tree is located within 10 m of the bole of a higher layer tree that is infected with dwarf mistletoe.</li> </ul>	Hw	hemlock dwarf mistletoe DMH.	<b>Note:</b> To confirm infection, the surveyor must observe mistletoe aerial shoots or basal cups on regeneration or on live or dead fallen brooms.

# 27b. Free Growing Damage Criteria for Single Entry Dispersed Retention Stocking Standard (SEDRSS) Managed Stands in Coastal B.C. and for Interior DFP and Layered Surveys (pg. 3) TABLE B-Layers 2, 3, 4

**TABLE B - Layers 2, 3 & 4 - < 12.5 cm DBH. SEDRSS damage criteria (cont'd)** **Note: Table B overrides all other damage criteria for SEDRSS managed stands**

Location of Damage	Type of Damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Possible damage agents and codes	Comments
Roots	Root Disease	<ul style="list-style-type: none"> <li>Sign(s) or definitive combinations of symptoms of root disease are observed.</li> </ul>	All	<p>armillaria root disease DRA, laminated root rot DRL, annosus root disease DRN.</p>	<p><b>Signs</b> are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. <b>Symptoms</b> include foliar thinning or chlorosis, pronounced resin flow near the root collar, reduced recent leader growth, a distress cone crop, and wood decay or stain. Symptoms alone are not usually sufficient to identify root disease. Both signs and symptoms may be detected from old stumps, root balls, or other post-harvest remains.</p> <p><b>Example:</b> How to apply net down for root disease.</p> <p>If root disease-infected trees are found in the plot:</p> <ol style="list-style-type: none"> <li>Determine the number of healthy, well-spaced trees in each layer using the prescribed minimum inter-tree distance (MITD) (e.g., 3 layer 1, 3 layer 3 and 4 layer 4 = 10 healthy, well-spaced) ignoring the M-value;</li> <li>Count the number of infected trees (e.g., 1 layer 1 tree and 1 layer 3 tree);</li> <li>Working from the uppermost layer down, apply the multiplier in Table Y to each lower layer. Subtract the resultant from each layer in turn, for susceptible species only (e.g., if all trees are susceptible, 1 infected layer 1 tree removes 1 healthy, well-spaced layer 1 tree plus 3 layer 3 trees plus 4 layer 4 trees). Note the effects are cumulative, not exclusive and lower layers do not affect higher layers;</li> <li>Calculate the remaining healthy, well-spaced trees once all removals due to infected trees are completed (e.g. 10 - 8 = 2). The result is the maximum number of free growing trees tallied for the plot.</li> </ol> <p><b>Note:</b> Bl, Cw, Pl, Pw, and broadleaf species are considered <b>not susceptible</b> for survey purposes only.</p>
		<ul style="list-style-type: none"> <li>Infected conifer or stump found in plot. See <b>Table Y</b> for well-spaced tree net down calculation by layer.</li> </ul>	All	armillaria root disease DRA.	
		<ul style="list-style-type: none"> <li>Infected conifer or stump found in plot. See <b>Table Y</b> for well-spaced tree net down calculation by layer.</li> </ul>	Fd, Ba, Bg	laminated root rot DRL.	
		<ul style="list-style-type: none"> <li>Infected conifer or stump found in plot. See <b>Table Y</b> for well-spaced tree net down calculation by layer.</li> </ul>	Ba, Hw, Ss	annosus root rot DRN.	<p><b>Note:</b> Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, and broadleaf species are considered <b>not susceptible</b> for survey purposes only.</p>

## 28a. Estimating Crown Closure via visual observation



## 28b. Average crown radius, area, and number of trees equivalent to 6% crown closure

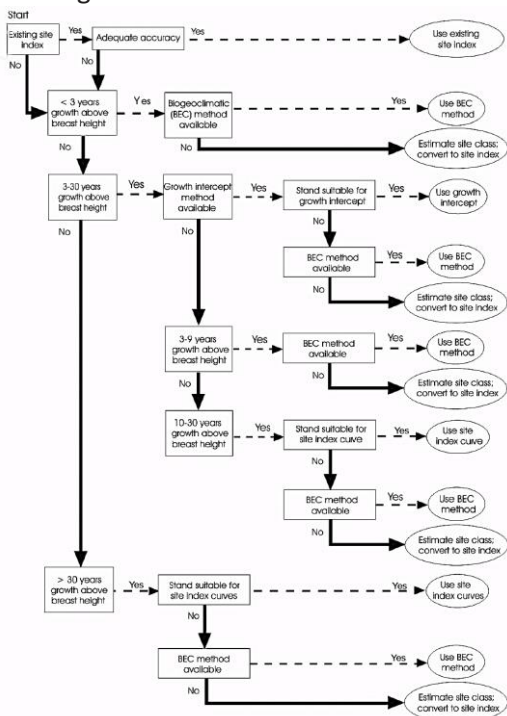
Average crown radius (m)	Area (m <sup>2</sup> )	Number of trees/ha for 6% C/C**	
2.0	12.6	48	
2.5	19.6	31	
3.0	28.3	21	
3.5	38.5	16	
4.0	50.2	12	
4.5	63.6	9	** Caution: Most effective Coastal Sites
5.0	78.5	8	



## 29. Steps to calculate confidence limits for silviculture surveys

df	95% (.05, 1 TAILED)	# of PLOTS	STEPS TO CALCULATE CONFIDENCE LIMITS
	90% (.05, 2 TAILED)		
4	2.132	5	n = # of plots
5	2.015	6	$x_i$ = # of well-spaced trees in plot
6	1.943	7	$\Sigma$ = summation of
7	1.895	8	pm = plot multiplier
8	1.860	9	LCL = lower confidence limit
9	1.833	10	MSS = minimum stocking standard
10	1.812	11	e = desired precision level
11	1.796	12	
12	1.782	13	1. Calculate mean of well-spaced trees ( $\bar{x}$ )
13	1.771	14	
14	1.761	15	2. Calculate standard deviation (s).
15	1.753	16	
16	1.746	17	$s = \sqrt{\frac{\Sigma x_i^2 - (\Sigma x_i)^2/n}{n-1}}$
17	1.740	18	
18	1.734	19	3. Calculate standard error of mean ( $S_{\bar{x}}$ )
19	1.729	20	
20	1.725	21	$S_{\bar{x}} = s/\sqrt{n}$
21	1.721	22	
22	1.717	23	4. Find t value for 90% & n - 1 df.
23	1.714	24	
24	1.711	25	
25	1.708	26	5. Multiply t value by $s_{\bar{x}}$ which equals the Confidence Interval (CI)
26	1.706	27	This can be expressed as average per plot or multiplied by 200 (plot multiplier for 50m <sup>2</sup> plots) to convert to stems/ha.
27	1.703	28	
28	1.701	29	
29	1.699	30	
30	1.697	31	6. Compare $\bar{x}$ and CI to the following decision rules:
40	1.684	40	(a) $\bar{x} - CI \geq MSS$ , then the area is considered SR. No further plots are required.
60	1.671	60	(b) If $\bar{x} < MSS$ , then the area is considered NSR. No further plots are required.
120	1.658	120	(c) If $\bar{x} > MSS$ and $\bar{x} - CI < MSS$ , check e value (as outlined below). If the desired level of precision (e) has been met <u>or</u> maximum plots have already been established then no more plots are required, and if $\bar{x}$ is $\geq MSS$ , the area is considered SR. Otherwise, determine the additional plot requirements as per the Surveys Procedures Manual.
$\infty$	1.645	$\infty$	<u>e Value</u> when $\bar{x} > 1,000$ sph, then $e = \pm 10\% \bar{x}$ when $\bar{x} \leq 1,000$ sph, then $e = \pm 100$ sph

## 30. Selecting a method to estimate site index



## 31. Site Index Source Codes

- A Site index from adjacent stand, (rarely used)
- I Site index growth intercept
- O Site index from the November 1998 SIBEC rollover, (not used by surveyors)
- C Site index from height age reference curves
- H Site index from stand before harvest, (rarely used)
- E Site index from SIBEC, biogeoclimatic classification
- M Site index converted from site class, ('last resort')
- S Site index assigned by District Silviculture. Section

## 32. Site Class to Site Index Conversion for Broadleaf Tree Species

	Good	Medium	Poor	Low
	G	M	P	L
Ac	26	18	9	3
At	27	20	12	4
Dr	33	23	13	6
E, Ea, Ep	27	20	12	4
Mb	33	23	13	6

### 33. Average site index relationship<sup>1</sup>

The species that can be predicted

Average site index (m) relationship											
When you know interior BI site index											
	10	12	14	16	18	29	22	24	26	28	30
Interior PI	10	13	15	17	19	21	23	26	28	30	32
Interior Sw	10	12	14	17	19	21	24	26	28	31	33

<sup>1</sup>Example: If you have data that were gathered on interior BI that indicates a site index of 22, it can be used to predict the site index of interior white spruce as 24.

When you know interior Fd site index											
	10	12	14	16	18	20	22	24	26	28	30
Interior PI	10	12	14	16	19	21	23	25	27	29	31
Interior Sx	7	10	13	15	18	21	23	26	29	32	34
Interior Hw	6	8	11	13	15	17	20	22	24	27	29
Interior LW	11	13	15	17	19	21	23	25	27	29	31

When you know interior Hw site index											
	10	12	14	16	18	20	22	24	26	28	30
Interior Fd	13	15	17	19	21	22	24	26	28	29	31

When you know interior Lw site index											
	10	12	14	16	18	20	22	24	26	28	30
Interior PI	8	10	13	15	17	19	21	23	25	27	29
Interior Fd	9	11	13	15	17	19	21	23	25	27	29

When you know interior Sx site index											
	10	12	14	16	18	20	22	24	26	28	30
Interior BI	10	12	14	15	17	19	21	22	24	26	27
Interior Fd	12	14	15	17	18	19	21	22	24	25	27
Interior PI	11	13	15	17	19	20	22	24	26	28	30

When you know interior PI site index											
	10	12	14	16	18	20	22	24	26	28	30
Interior BI	10	12	13	15	17	19	21	23	24	26	28
Interior Fd	10	12	14	16	18	19	21	23	25	27	29
Interior Lw	12	13	15	17	19	21	23	25	27	29	31
Interior Sx	9	11	13	15	18	20	22	24	26	28	31

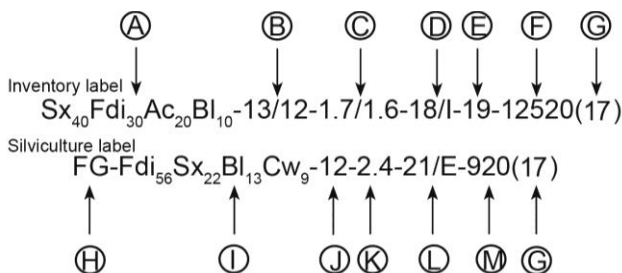
When you know coastal Ba site index										
	15	18	21	24	27	30	33	36	39	42
Coastal Hw	17	20	23	26	29	32	35	39	42	45

When you know coastal Fd site index										
	15	18	21	24	27	30	33	36	39	42
Coastal Hw	13	16	18	21	24	27	29	32	35	37

When you know coastal Hw site index										
	15	18	21	24	27	30	33	36	39	42
Coastal Ba	13	16	19	22	25	28	31	34	36	39
Coastal Fd	17	20	24	27	30	34	37	40	44	47
Coastal Ss	14	18	21	25	29	33	36	40	44	48

When you know coastal Ss site index										
	15	18	21	24	27	30	33	36	39	42
Coastal Hw	16	18	21	23	26	28	30	33	35	38

## 34. Parts of silviculture/inventory labels



*These are mandatory specifications. If you feel it does not adequately describe the stratum, add comments into the notes and treatment recommendations.*

- A Roughly averaged species composition to the nearest 10% based on visual observations recorded on the FS 658. The leading and secondary species are particularly important to be correct.
- B Using the FS 658 data, roughly average the age of the dominant and co-dominant leading (13 years) and then repeat for the second species (12 years).
- C Using the FS 658 data, roughly average the height of the dominant and co-dominant leading species (1.7 m) and then repeat for the second species (1.6 m).
- D Site index of the leading species in the label. The Sx is predicted to be 18 m tall at 50 years after 1.3 m in height is reached. In this example the method used to determine the site index is growth intercept. (see Table 30)
- E Crown closure estimated by visual observation of aerial photograph. Ground observation is possible but commonly less accurate (see Table 27 a, b, c). The trees described in A and F have a crown closure of 19%.
- F The average number of total trees of commercial species per hectare. 12520 total trees per hectare.
- G The last 2 digits of the year the survey was conducted. 2017 = (17).
- H This prefix identifies the stocking status NSR, SR or FG. Subsequently the data that follows NSR and SR represent well spaced trees and following FG represents free growing trees.
- I The calculated species composition of the well-spaced trees present, recorded to the nearest 1%.
- J Using the FS 658 data, average the free growing sample ages. 12 years.
- K Using the FS 658 data, average free growing sample heights. 2.4 m.
- L Site index of the leading species in the label. The Fdi is predicted to be 21 m tall at 50 years after 1.3 m in height is reached. E in this example indicates the method used to determine the site index is SIBEC. (see Table 30)
- M The average number of free growing trees per hectare. 920 well-spaced trees per hectare. When the results of a free growing survey indicate that the stratum is free growing, all of the components of the label should be replaced by values representing the free growing trees.

