

# Free-Growing Damage Criteria for Even-Aged (Age Class 1) Coniferous Trees (rev. 6, July 2014)

\*\*Additions to this version identified in red in the text\*\*

## INTRODUCTION

Before a stand can be declared free growing it must have an adequate stocking of healthy, well-spaced trees of a preferred or acceptable species. These free-growing damage criteria can help users employ their professional judgement in identifying 'healthy' trees. The criteria are based on professional opinion, and on the most current knowledge of forest-damaging agents. The criteria are designed to determine the acceptability of **individual trees** (conifers only) across the province. Acceptability of a stand depends on thresholds of damage

(<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/guidetoc.htm#ForestHealth>) and on stocking standards agreed to in the applicable Forest Stewardship Plans.

The criteria list various types of damage, causal agents and species of trees. Damage and casual agents are referred to by their codes

(<http://www.for.gov.bc.ca/hfp/health/fhdata/FS747%20conifer%2020111003.pdf> - on the *Conifer Damage Agent and Condition Codes* [FS 747 Conifer] field form). Tree species abbreviations are found here

(<http://www.for.gov.bc.ca/hfp/silviculture/Surveys/FS660final2011.pdf>)

There are several points to keep in mind when using these criteria:

1. They apply **only** at the time the free-growing survey is conducted and are specific to even-aged, age class 1 stands that are being regenerated primarily to coniferous species for the production of timber. The assumptions made on the impact of pest damage to potential crop trees are founded on these factors.
2. Broadleaf species are noted in these criteria (usually as non-susceptible host species) but damage criteria are not listed since the characteristics of most broadleaf species (e.g., pests, growth habits, etc.) are sufficiently different from those of conifers. (Damage criteria for broadleaf species can be found here <http://www.for.gov.bc.ca/hfp/silviculture/Broadleaf%20damage%20criteria%20Dec%2009.pdf>).
3. A Delegated Decision Maker (DDM) may allow or require deviations from these criteria, as long as the legal requirement <http://www.for.gov.bc.ca/hfp/health/FHintro/fppr.htm#sec26> to produce a healthy tree is met. These free growing damage criteria are not legislated regulations.

The free-growing damage criteria are expected to be revised in the future as knowledge and information becomes available.

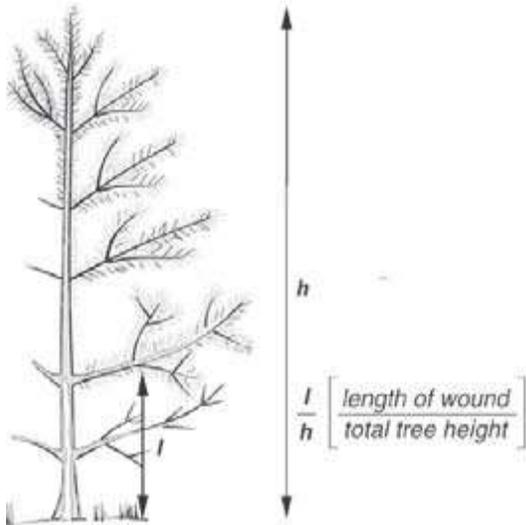
Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host Species	Damage agent codes & damage agents	Comments
Stem	Wound (including sunscald and girdling)	<ul style="list-style-type: none"> <li>The tree has any wound which is greater than 1/3 of the stem circumference, or</li> <li>The tree has a wound which is greater than 20% of the total length of the stem, or</li> <li>The tree has a wound centred on an infection caused by a stem rust, canker, or dwarf mistletoe (See Note under Stem: Infection and Stem or Branch: Dwarf mistletoe infection).</li> <li><b>The tree is enclosed within a seedling protector.</b></li> <li><b>Any amount of girdling or damage to the stem caused by seedling protectors.</b></li> </ul>	All	AC, cattle; AH, hare; AP, porcupine; AS, squirrel; AV, vole; AZ, beaver; ISQ, sequoia pitch moth; IWW, Warren's root collar weevil; NB, fire; NW, wind-throw; NZ, sunscald; TL, logging; TM, mechanical.	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 Figure 1  <b>Girdling can be caused by seedling protectors.</b>
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	IWW, Warren's root collar weevil.	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	Bark mining	<ul style="list-style-type: none"> <li>Boring dust, pitch tubes, or bark sloughing is visible</li> </ul>	Fd, Pl, Sx	IB, bark beetles; IBM, mountain pine beetle; IBI, <i>Ips pini</i> ; IBP, <i>Pityogenes</i> and <i>Pityophthorus</i> spp.	The mountain pine beetle outbreak has caused unexpected mortality in young pine. Stressed trees are also susceptible secondary bark and twig beetles.
Stem	Deformation (including crook, sweep, fork, browse, 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> </ul>	For sweep, All except Cw and Hw	ID, defoliators; ISP, northern pitch twig moth; IWP, lodgepole pine terminal weevil; IWS, white pine (spruce) weevil; AC, cattle; AD, deer; AE, elk; AM, moose; ND, drought; NG, frost; NH, hail; NY, snow; TL, logging; TM, mechanical.	For horizontal displacement. See Figure 2.
		<ul style="list-style-type: none"> <li>The tree leader has been killed three or more times in the last five years (weevil only).</li> </ul>	Pl, Ss, Sx	IWP, lodgepole pine terminal weevil; IWS, white pine (spruce) weevil.	This criterion applies only for terminal weevil damage.
		<ul style="list-style-type: none"> <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> </ul>	All	A, animal damage; IWP, lodgepole pine terminal weevil; IWS, white pine (spruce) weevil; NG, frost.	Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Figure 3
		<ul style="list-style-type: none"> <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>	All	A, animal damage; UBT, unknown broken top	
Stem	Infection (including cankers and galls)	<ul style="list-style-type: none"> <li>Any infection occurs on the stem.</li> </ul>	Pl, Pw, Py	DSB, white pine blister rust; DSC, comandra blister rust; DSG, western gall rust; DSS, stalactiform blister rust.	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><b>An infection occurs on a live branch less than 20 cm from the stem.</b></li> </ul>	Pl, Py	DSC, comandra blister rust;	See Figure 4.
		<ul style="list-style-type: none"> <li>An infection occurs on a live branch less than 60 cm from the stem.</li> </ul>	Pl, Pw, Py	DSB, white pine blister rust. DSS, stalactiform blister rust.	See Figure 4.
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	DSG, western gall rust.	See Figure 4.

Branch	Gouting	• Any adelgid gouting occurs on a branch.	Ba, Bg, Bl	IAB, balsam woolly adelgid.	Gouting is defined as excessive swelling of 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	• Any infection occurs on the stem or a live branch, or • A susceptible tree is located within 10 m of an overtopping tree, which is infected with dwarf mistletoe.	Fd, Hw, Lw, Pl	DMF, douglas-fir dwarf mistletoe; DMH, hemlock dwarf mistletoe; DML, larch dwarf mistletoe; DMP, lodgepole pine dwarf mistletoe.	Note: To confirm infection, the surveyor must observe mistletoe aerial shoots or basal cups on regeneration or on 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.
Foliage	Defoliation	• >50% of tree foliage has been removed by Dothistroma in ICH, CWH and SBS biogeoclimatic zones.	B, F, P, S	DFS, dothistroma needle blight.	See Figure 5.
		• >80% of tree foliage has been removed due to defoliating insects or foliage disease.	All others	DF, foliage diseases; ID, defoliators.	See Figure 5.
Roots	Root disease	• Sign(s) or a definitive combination of symptoms of root disease is observed.	All	DRA, armillaria root disease; DRB, blackstain root disease; DRL, laminated root rot; DRN, annosus root disease; DRT, tomentosus root rot.	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.
		• Infected tree found in plot. • The multiplier for DRA is two; • except in BEC zones PPdh1 and 2, IDFxh1, IDFdm1 and 2, MSdk1, and MSdm1 - the multiplier is one. • <b>Except for Cw (in all BEC zones) the multiplier is one.</b>  • See comments for well-spaced tree net down (multiplier) calculation.	All	DRA, armillaria root disease.	<b>Note:</b> All conifer species are considered susceptible. Broadleaf species are considered not susceptible for survey purposes only. <b>Example:</b> How to apply net down for root disease. If root disease-infected trees are found in the plot: <ul style="list-style-type: none"> <li>• In the first sweep, determine the total number of healthy, well-spaced /free growing trees using the prescribed minimum inter-tree distance (MITD) (e.g., 12 trees) ignoring the M-value;</li> <li>• 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);</li> <li>• 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 /free growing trees found in step 1 (e.g., for DRA: 12-4(2) = 4). The result is the maximum number of free growing trees tallied for the plot.</li> </ul>
		• Infected conifer found in plot. • The multiplier for DRL is four.	Ba, Bg, Fd, Lw, Se, Sx	DRL, laminated root rot.	<b>Note:</b> Bl, Cw, Pl, Pw, Py and broadleaf species are considered <b>not</b> susceptible for survey purposes only.
		• Infected conifer found in plot. • The multiplier for DRN is two.	Ba, Hw, Ss	DRN, annosus root rot.	<b>Note:</b> Ba, Bl, Cw, Fd, Pl, Pw, Py and broadleaf species are considered <b>not</b> susceptible for survey purposes only.
		• Infected conifer or stump found in plot. • The multiplier for DRT is two.	Se, Sx	DRT, tomentosus root rot.	<b>Note:</b> Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, Py, Sx and broadleaf species are considered <b>not</b> susceptible for survey purposes only.

## WOUND

A tree is **unacceptable** where damage to the cambium is more than 1/3 of the circumference of the stem, or the wound is greater than 20% of the total length of the stem.

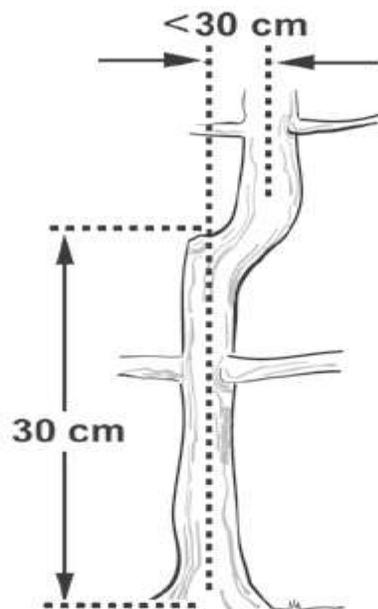
Figure 1



## HORIZONTAL DISPLACEMENT (CROOKS)

A tree is **unacceptable** if a crook displaces the pith more than 30 cm from the point of defect, and it must occur 30 cm above the point of germination.

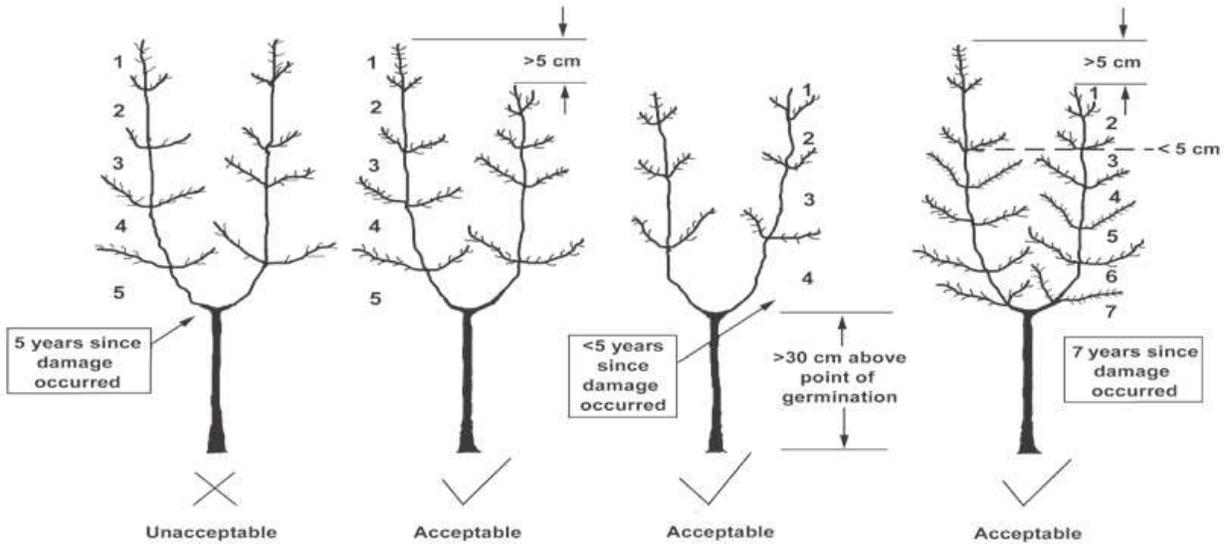
Figure 2



## FORKS

The tree is **unacceptable** if it 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.

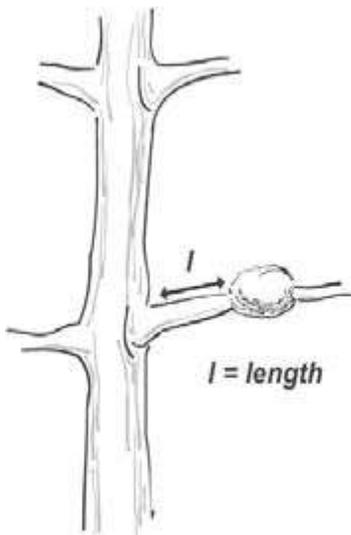
Figure 3



## GALL or CANKER ON A BRANCH

A tree is **unacceptable** if the gall occurs less than 5 cm from the stem for DSG, or if the canker occurs less than 20 cm from the stem for DSC or DSS, or if the canker occurs less than 60 cm on the stem for DSB.

Figure 4

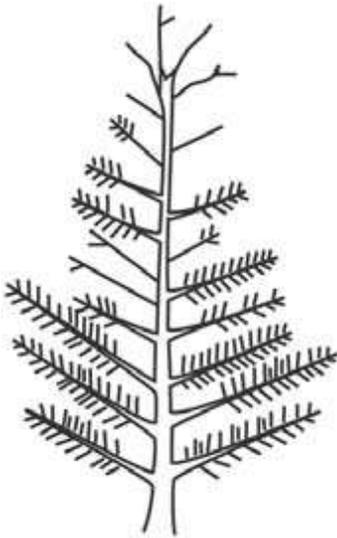


## **DEFOLIATION**

General Defoliation - A tree is **unacceptable** if more than 80% of the leaves or needles are removed because of insects or disease.

If defoliation is wide-spread, it might be a one off insect or disease occurrence; consider a resurvey at a later date.

**Figure 5**



## **Definitions**

**basal resinosis (pitching):** copious exudation of pitch at the base of the stem at or below the root collar. This symptom often is associated with Armillaria root disease or attack by Warren's root collar weevil.

**decay:** the disintegration of plant tissue. The process by which sound wood is decomposed by the action of wood-destroying fungi and other microorganisms.

**fork:** two or more leaders have originated from the loss of a leader or apical shoot. At free-growing age, a fork is considered persistent if it has not differentiated in height between competing leaders by more than 5 cm after five years of growth since the leader damage occurred. Forks may provide entry points for decay fungi, are points of weakness during felling, and may create waste in the highest value first log.

**gall:** nodule or lump of malformed bark or woody material caused by a variety of damaging agents, such as western gall rust and some insects.

**girdling:** A transversal cut across the phloem in a stem so that downward transport of substances is unable to occur within the plant.

**gouting:** excessive swelling of a branch or shoot, often accompanied by misshapen needles and buds. Most common at nodes on branches and frequently caused by balsam woolly adelgid on true firs (*Abies* spp).

**infection:** characterized by a lesion or canker on stem or branches or by swelling around the entrance point of a pathogen.

**injury:** damage to a tree by a biological, physical or chemical agent.

**scar:** a wound completely healed-over by callus tissue

**wound:** an injury where cambium is dead (e.g., sunscald) or completely removed. Wounds often serve as entry points for decay fungi.

(July 2013)