

## **Suggested Survey Methodology for Measuring the Stocking of Secondary Structure**

The intention of the Forest Planning and Practices Regulation amendments to protect secondary structure is that forest professionals would walk potential cutblocks in lodgepole pine leading stands prior to cutblock layout and cruising to determine if an “adequate stocking density” of “suitable secondary structure” is either present or absent. Areas  $\geq 5$  hectares in size where there is “adequate stocking density” of “suitable secondary structure” would need to be excluded from proposed cutblocks or harvested in a manner that protects an adequate stocking density of suitable secondary structure, unless the regulation, a result or strategy in an FSP or the district manager provides an exemption from doing so.

The term “suitable secondary structure” has been defined to describe saplings, poles, sub-canopy and canopy trees that are likely to survive a MPB infestation and are of a species that has been approved for use in establishing a free growing stand on the particular site. If the applicable forest stewardship plan (FSP) identifies a tree species as being preferred, acceptable or otherwise suitable for use in the establishment of a free growing stand, on a site, then the species qualifies as a suitable secondary structure species for that site. For situations where there is no FSP (e.g. a Small Scale Salvage forestry licence to cut), tree species listed as preferred or acceptable for a site in the Ministry of Forests’ publication “Reference Guide to FDP Stocking Standards” will qualify as a suitable secondary structure species for that site. The definition also requires “suitable secondary structure” trees to have sufficiently good form, health and vigor to provide merchantable trees for future harvesting.

### **Determining if Secondary Structure Trees are Healthy**

A slightly modified version of the current Free Growing Damage Criteria for Even-Aged Coniferous Trees is included in Appendix I to help forest professionals exercise their judgment in identifying if secondary structure trees are healthy and of reasonably good form. This version of the free growing damage criteria anticipates that most secondary structure trees will be saplings which will require 40 to 50 years to reach a merchantable size and includes some comments on how to assess damage on mature secondary structure trees.

Secondary structure trees should be assessed as having acceptable vigor if they appear to be growing well enough to release and develop into merchantable timber. Forest professionals should be guided by the following considerations when determining if secondary structure trees have acceptable vigor:

- trees should have at least 30% continuous live crown with healthy foliage
- trees with both spindly stem form and sparse foliage may not be acceptable
- if the pine overstorey has been dead for several years, it is desirable, but not essential, for secondary structure trees to exhibit recent improvements in foliage color, needle length and growth,
- smaller trees should be securely rooted so that they can’t be easily pushed over

### **Understory lodgepole pine**

When assessing the stocking of suitable secondary structure, understory lodgepole pine trees need to have been recently established in stand openings and showing signs of vigorous growth (i.e. comparable to plantations). Badly suppressed lodgepole pine understory trees with the following characteristics should not be counted as suitable secondary structure:

- trees with less than 15 cm of leader growth,
- trees with a height: diameter ratio of  $\geq 80$  (height in cm / dbh in cm), [an 4 m tall tree would require a dbh of  $\geq 5$  cm to be acceptable],
- trees with less than 30% continuous live healthy crowns, or
- trees growing under a pine stand that has significant levels of dwarf mistletoe.

To satisfy the regulation definition of “**adequate stocking density**” there must be at least the following minimum numbers of healthy, suitable secondary structure trees per hectare that achieve the specified minimum heights. The regulation also requires the trees to be a minimum of 1.6 meters apart from each other.

Minimum # of Trees/Ha	Minimum Height
700	6 meters
900	4 meters

The intent is to rely on forest professionals to make a reasonable determination of whether there are any lodgepole pine leading stands  $\geq 5$  hectares in size within a proposed cutblock where there is an adequate stocking density of suitable secondary structure. For many lodgepole pine leading stands it will be apparently obvious that an adequate stocking density of suitable secondary structure simply doesn’t exist. In such situations there is no expectation that a systematic survey would be undertaken to determine the stocking of suitable secondary structure.

To avoid non-compliance with the FPPR section 43.1 requirement to not harvest in a “targeted pine leading stand”, licensees and BCTS may need to complete a survey in pine leading stands where the stocking of suitable secondary structure appears to be close to the minimum threshold for what is defined as “adequate stocking density”. The following guidelines are suggested as a survey method for determining if an “adequate stocking density” of “suitable secondary structure” exists in these borderline areas.

### **Plot Size and Well Spaced Criteria**

The suggested procedure is to use silviculture survey methodology to estimate the average number of well spaced suitable secondary structure trees per hectare using 3.99 meter radius plots with a maximum of 8 well spaced trees allowed per plot. The regulation establishes the minimum distance between well spaced secondary structure trees of 1.6 meters.

### **Plot Layout**

Plots should be established on a systematic grid (e.g. 100 X 100 meter grid) with a random starting location, to provide systematic coverage over the area. A minimum of one plot per hectare should be established to determine the average number of well spaced, suitable secondary structure trees per hectare that are equal to or exceed the specified heights of 4 or 6 meters.

**Plot Information to be Recorded**

The following is suggested information that should be recorded at each plot:

Plot #

# of WS<sup>1</sup> suitable secondary structure trees, by species, that are  $\geq 4.0$  m tall &  $< 6.0$  m tall

# of WS suitable secondary structure trees, by species, that are  $\geq 6.0$  m tall &  $< 17.5$  cm dbh

# of WS suitable secondary structure trees, by species, that are  $\geq 6.0$  m tall &  $\geq 17.5$  cm dbh

It is suggested that the  $\geq 6.0$  height class could be divided into two subclasses to identify the stocking of merchantable and un-merchantable secondary structure trees. This information can be useful for determining if the secondary structure is largely composed of merchantable trees or smaller trees. Optional comments can be recorded on significant forest health factors, blowdown potential or other circumstances to justify an exemption from not harvesting the area or support a decision to avoid harvesting the area. Directly below is a possible plot card layout for recording the number of well spaced suitable secondary structure trees by tree species into height classes.

Plot #	# of WS Trees $\geq 4 < 6$ m				# of WS Trees $\geq 6$ m $< 17.5$ cm dbh				# of WS Trees $> 6$ m $\geq 17.5$ cm dbh				Comments	
	Bl	Sx	Fd	Pl	Bl	Sx	Fd	Pl	Bl	Sx	Fd	Pl		

When selecting well spaced trees in each plot, preference should be given to trees in the  $\geq 6$  m height class as fewer of these taller trees are required per hectare for the area to have an adequate stocking density of suitable secondary structure. Once a sufficient number of plots have been established on the area, the average number of well spaced suitable secondary structure trees of all species should be calculated for the two height classes. If there is an average of more than 700 well spaced secondary structure trees/ha  $\geq 6.0$  m tall, the area is considered to have an adequate stocking density of suitable secondary structure.

If the surveyed area has an average of less than 700 well spaced suitable secondary structure trees/ha  $\geq 6.0$  m. tall, the average number of well spaced suitable secondary structure trees/ha  $\geq 6.0$  m tall should be added to the average number of well spaced suitable secondary structure trees/ha  $\geq 4.0$  m. tall to determine if there are more than 900 well spaced suitable secondary structure trees/ha  $\geq 4.0$  m. tall. If there is an average of more than 900 well spaced suitable secondary structure trees/ha  $\geq 4.0$ m tall, the area is considered to have an adequate stocking density of suitable secondary structure.

If the surveyed area has an average of less than 700 well spaced suitable secondary structure trees/ha  $\geq 6.0$  m. tall and less than 900 well spaced suitable secondary structure trees/ha  $\geq 4.0$  m. tall, there would be no legal requirement to protect the secondary structure on the area unless  $\geq 5$  ha areas containing an adequate stocking density of suitable secondary structure can be stratified out of the larger area.

<sup>1</sup> WS = Well Spaced trees greater than 1.6 meters apart

If you require additional information please contact Alan Waters at 250 658-3419, Allan Powelson at 250 356-6932 or Dave Weaver at 250 387-4768.

## Appendix I: Unacceptable Damage Criteria for Coniferous Secondary Structure Trees

Location of Damage	Type of Damage	Tree being assessed in UNACCEPTABLE if:	Host Species	Likely Damaging Agent and Damage Agent Code	Comments
Stem	Wound (including sunscald, and girdling)	- the tree has any wound which is greater than 33% of the stem circumference, or - the tree has a wound which is greater than 20% of the total height of the tree -the tree has a wound centered on an infection caused by a stem rust, canker, or dwarf mistletoe	All	cattle AC, squirrel AS, beaver AZ, vole AV, porcupine AP, hare AH, Warrens root collar weevil IWW, sequoia pitch moth ISQ, fire NB, windthrow 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.
Stem	Insect mining under bark	Signs of pitch tubes, boring dust, exit holes on bark surface, galleries under bark	PL, Sx, Fd	Bark beetles IB, mountain pine beetle IBM, Ips beetles IBI, Pityogenes, Pityophthorous IBP	The mountain pine beetle is causing mortality in young pine and older trees of other species may be susceptible to bark beetles. Stressed trees are susceptible to secondary bark and twig beetles.
Stem	Insect mining at the root collar	- the tree is currently attacked by a bark mining insect such as a weevil or beetle and exhibits symptoms such as foliage discoloration, thinning and/or reduced height growth increments	PI, 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, and dead or broken top)	- the pith is horizontally displaced more than 30 cm from the point of defect and originates above 30 cm from the point of germination.  - the tree leader has been killed three or more times in the last five years (weevil only).  - the tree has two or more leaders with no dominance expressed after five years of growth and the fork originates above 30 cm from the point of germination.  -the tree has a dead or broken top at a point that is > 2 cm in diameter in the Interior or 3 cm in diameter on the Coast.	For sweep all except Cw and Hw  Sx, Ss, PI  All  All	defoliators ID, white pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP, northern pitch twig moth ISP, sequoia pitch moth ISQ, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TM.  White pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP.  terminal weevils (IWS, IWP), frost NG, animal damage A.	This criterion applies only to terminal weevil damage.  Leader dominance occurs when the tallest leader is at least 5 cm taller than the second tallest leader.
Stem	Infection (including cankers and galls)	- any infection occurs on the stem	All	Comandra blister rust DSC, stalactiform blister rust DSS, white pine blister rust DSB, western gall rust DSG, atropellis canker DSA	<b>Note:</b> Wounds caused by rodents feeding around rust cankers should have stem rust identified as the causal agent.

### Appendix I: Unacceptable Damage Criteria for Coniferous Secondary Structure Trees Continued

Location of Damage	Type of Damage	Tree being assessed in UNACCEPTABLE if:	Host Species	Likely Damaging Agent and Damage Agent Code	Comments
Branch	Infection (cankers)	- an infection occurs on a live branch less than 60 cm from the stem	Pw, Pl, Py	Comandra blister rust DSC, stalactiform blister rust DSS, white pine blister rust DSB.	Branch infections on merchantable layer 1 trees can be ignored.
Branch	Galls	- a gall rust infection occurs on a live branch less than 5 cm from the stem	Pl, Py	Western gall rust DSG.	Branch infections on merchantable layer 1 trees can be ignored.
Branch	Gouting	- any adelgid gouting occurs on a branch	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 misshapen needles and buds. It is most common on branch tips and at the nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Foliage	Defoliation	> 50 % of the tree foliage has been removed by Dothistroma in ICH, CWH and SBS biogeoclimatic zones	P, B, F, S	Dothistroma needle blight only DFS	
		> 80% of the tree foliage has been removed by defoliating insects or foliage disease.	All others	defoliators ID, foliage diseases DF.	
Stem or branch	Dwarf Mistletoe Infection	- any infection occurs on the stem or a live branch  - a susceptible tree is located within 10 meters of an overtopping tree, which is infected with dwarf mistletoe	Hw, Pl, Lw, Fd	Hemlock dwarf mistletoe DMH, lodgepole pine dwarf mistletoe DMP, larch dwarf mistletoe DML, Douglas-fir dwarf mistletoe DMF.	Note: To confirm infection surveyors must observe mistletoe aerial shoots or basal cups on trees or on live or dead fallen brooms. Overtopping tree is a tree that is three or more times taller than the median height of the trees being assessed. Mature layer trees must have a Hawksworth rating >3 or severe stem infection (major swelling or deformity) present. Hawksworth rating described in the FPC Dwarf Mistletoe Guidebook

### Appendix I: Unacceptable Damage Criteria for Coniferous Secondary Structure Trees Continued

Location of Damage	Type of Damage	Tree being assessed in UNACCEPTABLE if:	Host Species	Likely Damaging Agent and Damage Agent Code	Comments
Roots	Root disease	- sign(s) or a definitive combination of symptoms of root disease are observed	All	armillaria root disease DRA, laminated root rot DRL, tomentosus root rot DRT, annosus root disease DRN, blackstain root disease DRB.	<b>Signs</b> are direct evidence of the pathogenic fungus including fruiting bodies, distinctive mycelium or rhizomorphs. <b>Symptoms</b> 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. See comments for well spaced tree net down calculation. The multiplier for DRA is two except in BEC zones PPdh1 and 2, IDFxh1, IDFdh1 and 2, MSDdk1 and MSdm1 where the multiplier is one.	All	armillaria root disease DRA.	<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 the net down factor for root disease. If root disease-infected trees are found in the plot: 1. In the first sweep determine the total number of healthy, well spaced 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 well spaced infected trees (including dead infected trees and for DRT only infected stumps) using MITD (e.g. one infected tree); 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: 12-1(2)=10). The result is the maximum number of healthy well spaced secondary structure trees in the plot.
		- infected tree found in plot. See comments for well spaced tree net down calculation. The multiplier for DRL is four.	Fd, Sx, Se, Lw, Ba, Bg	laminated root rot DRL.	<b>Note:</b> Bl, Cw, Pl, Pw, Py and broadleaf species are Considered not susceptible for survey purposes only.
		- infected conifer or stump found in plot. See comments for well spaced tree net down calculation. The multiplier for DRT is two.	Se, Sx	tomentosus root rot DRT.	<b>Note:</b> Bl, Cw, Fd, Pl, Pw, Py and broadleaf species are considered not susceptible for survey purposes only.
		- infected conifer found in plot. See comments for well spaced tree net down calculation. The multiplier for DRN is two.	Ba, Hw, Ss	annosus root rot DRN	<b>Note:</b> Bg, Bl, Cw, Fd, Pl, Pw, Py, Sx and broadleaf species are considered not susceptible for survey purposes only.