FREP Partial Timber Cutting Protocol

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Ministry of Forests and Range (MFR)
Forest and Range Evaluation Program (FREP)
Resource Stewardship Monitoring (RSM)

Acknowledgements

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FREP Background

The Forest and Range Practices Act (FRPA) introduces the transition to a results-based forest practices framework in British Columbia. Under this new approach to forest management, the forest industry is responsible for developing results and strategies, or using specified defaults, for the sustainable management of the 11 resource values (subject areas) identified under FRPA. The role of government is to ensure compliance with approved results and strategies, and other practice requirements, and evaluate the effectiveness of forest and range practices in achieving government's objectives for FRPA's resource values.

Resource stewardship monitoring (RSM) is a key component of the provincial Forest and Range Evaluation Program (FREP). Resource stewardship monitoring will help identify implementation issues regarding forest policies, practices, legislation, and Forest Stewardship Plan results and strategies. As a result, RSM will be a fundamental component for implementing continuous improvement of forest management in British Columbia.

FREP has been established as a multi-agency program to evaluate whether practices under FRPA are meeting not only the intent of current FRPA objectives, but also to determine whether the practices, policies and the legislation are meeting government's broader intent for the sustainable use of resources. FREP is a long-term commitment designed to:

- assess the effectiveness of FRPA and its regulations in achieving stewardship objectives
- determine if forest and range policies and practices are achieving government's objectives, with a priority on environmental parameters, and consideration for social and economic parameters, where appropriate
- identify issues regarding the implementation of forest policies, practices, and legislation as they affect achieving stewardship objectives
- implement continuous improvement of forest management in British Columbia.

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Introduction

This field protocol is set up to provide guidance on how to collect information and answer each of the questions provided on the field cards found in Appendix IV. Each question has one or several indicator statements that help answer the question. For each indicator statement guidance is provided on how to obtain information to either agree or disagree with the statement. The answer to the main question will depend upon agreement or not with the indicator statements.

Priority FREP Evaluation Questions - relating to partial cutting

In order to determine the impact of FRPA on species and genetic diversity, forest productivity (merchantable timber volume, value, and availability), and forest health, Phase 1 of a two-phase program established benchmarks of current standards and practices established under the *Forest Practices Code of British Columbia Act* (the Code) for comparison. Sufficient data was available on species, species mix, genetic worth, stocking standards, and forest health conditions from October, 1987 to December, 2003 to facilitate the establishment of these key benchmarks. Phase 2 was the successful piloting and implementation of this protocol to be able to answer the following questions.

Are partial cutting forest practices sustainable as measured by maintenance of forest productivity?

Are regeneration opportunities under partial cutting being maintained or diminished?

The priority evaluation questions for the timber resource value are detailed on the FRP web site at:

http://www.for.gov.bc.ca/hfp/frep/values/timber.htm

Intent of the FREP Partial Cutting Timber Assessment

This information will not be published or distributed widely without providing adequate context using information provided by District, Region, and Licensee staff regarding: amount or area impacted; types of areas impacted; and the potential implications for meeting provincial timber objectives on a management unit.

- More direction to follow with consultation with MFR regarding output and analyses.
- An outstanding question, outside the realm of this first approximation, is the context issue, whether other options would better suit the timber value from a watershed or landscape scale. This issue requires further attention once field results are available.

Block Selection Criteria:

The Partial Cutting protocol was designed as a stand-alone tool for field staff to use to assess the health and productivity of partially harvested stands within their districts. As such, candidate stands for sampling will not be part of the Master Random List that is generated each year from FREP IMS. The process for selecting partially cut stands to assess will be left up to district staff. It must be remembered, however, that selection of stands to assess must be conducted on a random basis to ensure the ability to combine assessment information from all partially cut stands to give a clear picture of partial cutting within the district. The recommended approach to generating a list of partially harvested stands to assess would be to create a list of potential blocks using a RESULTS query where strata have layer 1 stems in the inventory label. Alternative criteria for block selection would include use of silvicultural systems other than clearcut and clearcut with reserves. Additionally blocks or strata with multistoried stocking standards or identified as intermediate cuts are eligible as candidate stands. Sample blocks should then be chosen randomly from this generated list. Blocks should be at least five years post-harvest to allow for some ingress to occur. In some cases waiting for the full 7 year regeneration delay may be warranted.

Stratification:

The sampling procedure and assessment will be most effective where stratification is used to target assessment on relatively uniform areas of residual stand structure. Since considerable partial-cutting has been conducted in the last few years focused on the removal of individual species (e.g., Pl in response to Mountain Pine Beetle infestations), residual basal area may be distributed throughout a cutblock in a diverse manner. For that reason, stratification will help reduce the number of plots required, and better characterize the actual situation on a given block.

USE THE FOLLOWING STRATIFICATION CLASSES:

Because the real driver will be the occupation of growing space with the combination of regeneration and overstory trees of species of interest, suggested categories are as follows:

A – Unharvested	• Sample unharvested areas where patches were left and are not mapped, and therefore are part of the NAR, they should be assessed as a separate stratum. Do not sample mapped areas of unharvested timber.

B – High retention of dispersed overstory.	• In most cases there will not be a regeneration objective (these may be categorized in the RESULTS database as an Intermediate Cut, Commercial Thin, or Salvage), **Note:** this may not always be the case – Silvicultural systems can be misclassified and these may be called "Single-tree Selection" ,"Irregular Shelterwood", "Clearcut with reserves" (dispersed) retention system or another type of system. • These stands often will have some clumpiness and variability, even when timber is intended to be relatively uniform in distribution. Layer 1 – has the potential to be 20 m^2/ha or more on average (**Note:** this does not have to be exact – if it is close use this class).
C – Significant overstory, but not high retention.	• A regeneration objective may be relevant (as in a regeneration entry for a partial cut silvicultural system). • Layer 1 overstory appears to be less than 20 m^2/ha, but has the potential to be > 10 m^2/ha on average. Might be relatively uniform or have a high degree of clumpiness and variability (numerous gaps evident).
D – Insignificant overstory	• A regeneration objective is obviously relevant. • Layer 1 overstory is obviously << 10 m^2 on average.

Where discreet manageable strata can easily be defined based on the criteria above, they may be sampled separately. Where a diversity of strata are mixed on a cutblock as smaller units, or less discreet units, in a large mosaic, the stratum that each sample plot falls in will be recorded such that a proportion of the block can then be reported in the various condition categories in the final documentation.

To assist with stratification, consult recent air photos, spot-5 imagery, orthophotos or other images that have a reliable scale to aid in stratification.

Note: This protocol is designed for stratification classes A – C using the Deviation from Potential (DFP) approach for stratification D, simply use the most resent silviculture survey data for stocking. The intent is to summarize results by category. Category delineation will be revisited upon the results of the first year's data collection. Category A is included as patches of unharvested timber and may be found in blocks with patchy distribution and will affect the timber goal.

http://www.for.gov.bc.ca/hfp/silviculture/MPBI/index.htm

Questions, Indicators and Thresholds for Data Collection:

Structure of this Section

The indicators in the Partial Cutting protocol are linked to the Provincial Timber Objectives through the monitoring questions that are of interest for the timber objectives. An overview of the approach for assessment is given as well as thresholds, and notes:

Question	– Each key question is provided
Indicator Statement	– Each indicator statement is listed
Assessment method	– Provides guidance on data collection and ranking.
Threshold	– Explains thresholds.
Note:	– Is used to provide additional background information and
Guidance	– ***Words or phrases in bold italics are done so to draw attention to significant information.***

Major Questions, Associated Indicators and Thresholds

These questions focus on the areas of management performance that are considered to contribute the greatest to the provincial timber objectives, and can reasonably be assessed with representative, reliable, and feasible indicators with thresholds of performance. The presence or potential presence of situations of concern, and excellent performance will be examined over a population of similar cutblocks within a geographic area to explore trends.

The thresholds allow for verification of the indicator statement in the context of the stratum and cutblock being sampled. The indicator makes a positive statement that, if true, would satisfy the criteria to positively address the management question. The threshold values allow the indicator to be verified positively (yes – as expected), negatively (no – a situation of concern), or in some cases questionably (perhaps – possibly a situation of concern). For several indicators performance that goes beyond expectations in a positive manner is indicated as “yes+”.

QUESTION A - Do well spaced, unimpeded ecologically suited crop trees occupy the growing space?

Indicator statement

1. **The growing space is well-occupied by well-spaced, unimpeded, suitable crop trees of ecologically suitably species.**

   Note: A consideration of poor trees, trees at risk (riskers), and impeded trees are all incorporated into this indicator as they assist in answering the general question.

Assessment method:

Using a combination of prism sweep (Layer 1 trees) and a 3.99 m fixed radius plot (Layers 2-4 trees), assess by counting:

Overstory Trees with a Prism Sweep – the number of "IN" Layer 1 (17.5 cm dbh +) trees (while recording the BAF of the prism) for:

- Ecologically suitable species (as per regional guidance documents).
- Trees with suitable crop (C)[1] quality.
- Trees with poor quality characteristics (see definition of poor – P).
- Crop or Poor trees that are also "riskers" in that they will likely die over the short term (20-40 years).

Understory Trees with a Fixed Radius Plot – Using a 1/200th hectare plot (3.99 m radius) – tally well-spaced, unimpeded suitable understory crop trees Layer 1 (12.5 to 17.5 cm dbh) and Layer 2-4 regeneration:

- Well-spaced with a minimum inter-tree spacing of 2.0 m.
- Suitable crop trees – meeting minimum acceptability criteria normally used for silvicultural surveys.
- Unimpeded by vegetation (herbaceous or shrubs) or overstory trees (see explanation of impeded)[1].
- With a minimum Layer 4 height of 15 cm.
- Also – Ingress (trees less than 15 cm tall) of ecological suitable species will be tallied up to a maximum of 10 per plot.

Tally combinations of understory unimpeded (ecologically suited) well-spaced trees of a minimum size along with a tally of overstory stems within Layer 1 – providing a basal area value for the plot. Refer to "Data Collection" section (that follows) for more details on procedures, information to be recorded, field forms, and data summary.

Stocking is measured using a modification of the DFP approach.

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1 Refer to "Data Collection" section that follows.

Deviation from potential (DFP)

This protocol borrows strongly from the Deviation from Potential (DFP) method of stocking assessment. The approach integrates overstory and understory site occupancy to provide a 'deviation' from the full growth potential if the site were fully stocked (based on TASS[2] model runs). Table 1 indicates the proportion of increase that is available for added stocking, the cell with zero Residual Basal Area (RBA) and no understory is 1 or 100% deviation from full growth potential. For more information on the DFP approach see the following link:

http://www.for.gov.bc.ca/hfp/silviculture/MPBI/documents/SilvNote30-print.pdf

Thresholds For stands < 60 cm average DBH – use table 1

Yes If the average DFP is ***stocked*** – S (DFP ≤ 0.15) AND ≥ 60% of plots are stocked (S) or partially stocked (P).

Yes +[3] where the average DFP ≤ 0.05 AND ≥ 80% of plots are S.

Perhaps (or somewhat) where DFP average is in the ***partially stocked*** class – P (DFP 0.15 – 0.40) AND more than 50% of the plots are in the S or P classes.

No Where none of the above are achieved

Ingress input – Change **No** to **Perhaps** if the average ingress of high value seedlings is ≥ 500 sph.

Poor Overstory Modifier (–)

- **For "Yes" or "Perhaps" scenarios** – Add a minus sign (-) to either condition if the average basal area of poor trees is > 20 m^2/ha and understory stocking is required to achieve the stocking class. A "Yes - " or "Perhaps -" will indicate that growth of understory trees may be significantly impacted by poor trees in the overstory.
- **For "No" scenarios** – Add a minus sign (-) if the average basal area of poor trees is > 20 m^2/ha. This situation indicates that not only is growing space not adequately stocked with suitable trees, but it is dominated by poor trees.

Thresholds for stands ≥ 60 cm average DBH use table 2

Yes If the average DFP is ***stocked*** – S (DFP average is ≥ 2.5) AND ≥ 60% of plots are stocked (S) or ***partially stocked*** (P).

Yes + where the average DFP ≥ 2.8 AND ≥ 80% of plots are S.

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2 TASS – Tree and Stand Simulator, http://www.for.gov.bc.ca/hre/gymodels/TASS/

3 The Yes + category is provided to show active management and is meant to point out successful strategies.

Perhaps (or somewhat) where DFP average is in the ***partially stocked*** class – P (DFP 0.15 – .040) AND more than 50% of the plots are in the S or P classes.

No Where none of the above are achieved.

Ingress input – Change **No** to **Perhaps** if the average ingress of high value seedlings is ≥ 500.

Poor Overstory Modifier (–)

- **For "Yes" or "Perhaps" scenarios** – Add a minus sign (-) to either condition if the average basal area of poor trees is > 20 m^2/ha and understory stocking is required to achieve the stocking class. A "Yes -" or "Perhaps -" will indicate that growth of understory trees may be significantly impacted by poor trees in the overstory.
- **For "No" scenarios** – Add a minus sign (-) if the average basal area of poor trees is > 20 m^2/ha. This situation indicates that not only is growing space not adequately stocked with suitable trees, but it is dominated by poor trees.

Thresholds For stands ≥ 60 cm average DBH use table 2

Yes If the average DFP is ***stocked*** – S (DFP average ≥ 2.5) AND ≥ 60% of plots are stocked (S) or partially stocked (P).

Yes + where the average DFP ≥ 2.8 AND ≥ 80% of plots are S.

Perhaps (or somewhat) where DFP average is in the ***partially stocked*** class – P (DFP 1.5 – 2.5) AND more than 50% of the plots are in the S or P classes.

No Where none of the above are achieved.

Ingress input – Change **No** to **Perhaps** if the average ingress of high value seedlings is ≥ 500.

Poor Overstory Modifier (-)

- **For "Yes" or "Perhaps" scenarios** – Add a minus sign (-) to either condition if the average basal area of poor trees is > 20 m^2/ha and understory stocking is required to achieve the stocking class. A "Yes -" or "Perhaps -" will indicate that growth of understory trees may be significantly impacted by poor trees in the overstory.
- **For "No" scenarios** – Add a minus sign (-) if the average basal area of poor trees is > 20 m^2/ha. This situation indicates that not only is growing space not adequately stocked with suitable trees, but it is dominated by poor trees.

Table 1 Use this table to determine stocking classes in plots with an average diameter under 60 cm[4].

Overstory basal area of good and fair vigour trees: ≥ 17.5 cm dbh (12.5 for Pl)	Understory density – well spaced sph					
	0	200	400	600	800	1000
0	1.00	0.76	0.52	0.34	0.22	0.13
5	0.86	0.65	0.45	0.30	0.19	0.11
10	0.62	0.47	0.32	0.21	0.14	0.08
15	0.38	0.28	0.20	0.13	0.08	0.05
20	0.19	0.14	0.10	0.07	0.04	0.02
25	0.07	0.05	0.04	0.02	0.02	0.01
30	0.00	0.00	0.00	0.00	0.00	0.00
35	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.00	0.00	0.00	0.00	0.00
45	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00	0.00	0.00
65	0.00	0.00	0.00	0.00	0.00	0.00
65+	0.00	0.00	0.00	0.00	0.00	0.00

Red = "Open" stocking class: DFP > 0.40 (40%)

Yellow = "Partially Stocked" class: DFP > 0.15 (15%) and < 0.40 (40%)

Green = "Stocked" stocking class: DFP < 0.15 (15%)

4 Based on Second Approximation Interior DFP numbers (http://www.for.gov.bc.ca/hfp/silviculture/MPBI/documents/MPBI_Report_Mar_16_05.pdf) – best suited to stands with average diameter of ≤ 40 cm. Note only healthy (C) trees are tallied for the overstory component.

Table 2 Use this table to determine stocking classes in plots with an average diameter OVER 60 cm[5].

Overstory basal area of good and fair vigour trees: > 17.5 cm dbh	Understory density – well spaced sph								
	0	100	200	300	400	500	600	700	800+
0	1	1	1	1	2	3	3	3	3
5	1	1	1	1	2	3	3	3	3
10	1	1	1	1	3	3	3	3	3
15	1	1	1	2	3	3	3	3	3
20	1	1	1	2	3	3	3	3	3
25	1	1	1	2	3	3	3	3	3
30	1	1	2	3	3	3	3	3	3
35	1	2	2	3	3	3	3	3	3
40	2	2	3	3	3	3	3	3	3
45	2	3	3	3	3	3	3	3	3
60	3	3	3	3	3	3	3	3	3
65	3	3	3	3	3	3	3	3	3
65+	3	3	3	3	3	3	3	3	3

Red = "Open" stocking class: DFP to be calculated – use 1 for interim DFP number

Yellow = "Partially Stocked" class: DFP to be calculated – use 2 for interim DFP number

Green = "Stocked" stocking class: DFP to be calculated – use 3 for interim DFP number

5 Conceptual ratings based on Coastal observations.

QUESTION B - Is the stand maintaining or increasing in value due to the species composition?

Indicator statement

2. **In stands with a significant amount of basal area in crop[6] trees with suitable vigor and quality – the OVERSTORY is well occupied by suitable crop trees of high value species[7].**

   Note: This indicator is intended to be directed at stands with most of the stocking in overstory Layer 1 trees. For all intents and purposes, the "value" of the stand for timber is related to the potential for another harvesting entry from the overstory timber at some point within the next 5 to 40 years.

Assessment method:

Overstory Trees with a Prism Sweep – while recording the number of "IN" Layer 1 (17.5 cm dbh +) trees for indicator 1, also distinguish the:

- The proportion of crop and poor trees that are of a high value species.
- Stumps (estimated to represent preharvest "IN" trees). The proportion of stumps of high value species will be determined as much as practicable. **Note:** all stumps are assumed to be crop trees if they were living at the time of harvest.

The proportion of high values stems left during harvesting will be determined as follows
(W, X, Y, Z – below):

W. Post-harvest High Value Crop – Average BA for **high value** C (crop) and CR (crop-risker).

X. Post-harvest Total Basal Area – Sum of **all** C, CR, Poor (P), Poor Risker (PR).

Y. Preharvest High Value Crop Basal Area – Sum of Average BA for high value C, CR, and Sts (stumps)[8].

Z. Preharvest Total Basal area – Sum of Average BA for **all** C, CR, P, PR and Sts.

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6 These are trees of satisfactory or suitable crop tree vigor and health.

7 **Trees of high value:** Western Redcedar, Douglas-fir, Western Larch, Spruce, All Pine (Interior), White Pine only (Coast) AND additional species listed as "preferred" only where preferred species are differentiated from acceptable species in an approved stocking standard.

8 **Note:** for preharvest crop basal area the stumps are assumed to meet the criteria as suitable crop trees.

Overstory Threshold

Yes if the proportion of Post Harvest High Value Crop RBA is ≥ the proportion of Preharvest High Value Crop Basal Area.

$$W/X \geq Y/Z$$

Yes + if the proportion of Post Harvest High Value Crop RBA is ≥ 120% of the proportion of Preharvest High Value Crop Basal Area.

$$W/X \geq 1.2(Y/Z)$$

Perhaps if the proportion of Post Harvest High Value Crop RBA is < 100% but ≥ 50% of the proportion of Preharvest High Value Crop Basal Area.

$$W/X<1.0 \text{ but } \geq 0.5(Y/Z)$$

No If none of the above are achieved

NA where RBA is < 15 m^2/ha

Indicator statement

3. **The UNDERSTORY is well occupied by a minimum level of well-spaced, unimpeded, suitable crop trees of high value species[9].**

   Note: This indicator is directed at stands that rely on the understory for a significant portion of their stocking. Overstory stocking may be too low for another harvesting entry prior to the end of the next rotation. As well, overstory trees carried over until the end of the next rotation may not be sufficiently reliable as economic crop trees due to the uncertainty associated with old trees. Therefore, the "value" of the stand for timber depends on the understory contribution to stocking.

Assessment method:

Understory Trees with a Fixed Radius Plot – Using a 1/200th hectare plot (3.99 m radius) – tally well-spaced, unimpeded suitable understory crop trees Layer 1 (12.5 to 17.5 cm dbh), and Layer 2-4 regeneration as per indicator 1, including:

- The proportion of well-spaced unimpeded suitable crop trees of high value species.
- The number of high value ingress trees (less than the minimum height of 15 cm) up to a total of 10 per plot.

9 **Trees of high value:** Western Redcedar, Douglas-fir, Western Larch, Spruce, All Pine (Interior), White Pine only (Coast) AND additional species listed as "preferred" only where preferred species are differentiated from acceptable species in an approved stocking standard.

Understory Threshold

Yes if the SPH of High Value UWS ≥ the understory SPH required to be in the "stocked" class from DFP table, considering the overstory RBA stocking of suitable crop trees OR 500 SPH – whichever is less.

> **Yes +** if the average stems per ha of UWS High Value species ≥ of the 80% of the TSS (even aged).

Perhaps – Change **No** to **Perhaps** if ingress of high value seedlings is ≥ 500

No if the SPH of High Value UWS ≤ of the understory SPH required to be in the "stocked" class from DFP table, considering the "overstory stocking".

NA where the Average total SPH in the understory = 0

QUESTION C - In cutblocks where harvesting is directed at a particular species, is the proportion of non directed species below the minimum target?

Indicator statement

4. **Basal area of non-directed harvested trees does not exceed a minimum proportion of the preharvest stand.**

Assessment method:

> **First** – An indication is provided of whether there was harvesting "directed" at a particular species.
>
> **Overstory Trees with a Prism Sweep** – while recording the number of "IN" trees Layer 1 (17.5 cm dbh +) for indicator 1, also distinguish the:
>
> The proportion of crop and poor trees (and stumps) that are of a directed species. Refer to the OVERSTORY TALLY of LAYER 1 stems by species in the assessment tally forms.

Thresholds	
a. YES (no concerns)	E.g., if 20% of harvested basal area (based on the total tally including stumps) is in non-directed species;
b. NO (situation of concern)	E.g., > 20% of harvested basal area (based on the total tally including stumps) is in non-directed species;
Modifier	
• **Modify "YES" to "YES+"**	E.g., if < 5% of average basal area is non directed species.

Other Questions — with no thresholds of performance.

Questions A – C covered above and the associated indicators focus in on the key concerns for provincial timber objectives, which can be assessed at a stand or cutblock level. There are other questions that, while they are important to the provincial timber objectives, they are either of less importance to the provincial timber objectives or, representative, reliable or feasible indicators (and thresholds) are not possible at this time. For many of these questions it is felt that it is inappropriate to assess the impact at the stand level as it can only be considered at a coarser scale, or there is too much uncertainty associated with the impacts that potential indicators may have on provincial timber objectives at the stand level.

For these questions, general questions were designed that should be considered at each sample point and throughout the cutblock as it is being sampled. While this information will be gathered at the block level for these questions, indicators with clear thresholds have not been designed. The resulting information for each cutblock may at some point be considered at a coarse scale (TSA level, TFL level, Landscape Unit level or Watershed level) where impacts and trends may be more appropriately assessed.

List of Other Questions

1. **Was a significant dispersed salvage opportunity potentially missed?**

   Assessment method – Sum of the Crop Riskers and WINDTHROW basal area (average m^2/ha) of LAYER 1 stems of high value species from the assessment tally forms.

   Note: This is a complex indicator and may or may not be a major driver for meeting the provincial timber objectives. Where forest health concerns for bark beetles are associated with blowdown, this may be a major concern.

   With no forest health concerns, the amount of blowdown, and the species, size and quality of dead and down of the timber will all impact contributions to provincial timber objectives. Since a threshold could be complex, and it is not felt that this situation occurs often, the question is deemed to be minor with no thresholds provided.

2. **Was a significant concentrated salvage opportunity potentially missed?**

   Assessment method – Based on observations of the block as a whole, estimate the area equivalent of concentrated blowdown in the block. Estimate the area in which the concentrated blowdown is found, and then estimating the proportion of the basal area in the blowdown. The area is then reduced by the proportion of the basal area. See: Data Collection section for more details.

   Notes: See notes for #2.

3. **What is the general perceived risk of further losses throughout the rotation from forest health concerns?**

   Assessment method – Answer this question for the block as: low, moderate or high while recording the associated forest health risk.

Note: Stands may look healthy and vigorous now, and yet have a high risk of potential losses from forest health factors further along in the rotation. In some cases these losses might constitute a minor growth loss, and in other cases the impact may be large. Yet, at this time, predictive abilities of FREP assessors can be highly variable, based on local knowledge of forest health factors and their perceptions of future risks under various conditions. For this reason, consistency of assessment cannot be assured and a reliable indicator is not available. However, rough trends in the observations recorded may be useful for those considering risks, or perceptions of risk at a coarser scale. Forest health staff may wish to use this category to help identify training needs or to confirm issues.

4. **Is general species diversity in the stand changing due to management and potentially altering ecological resilience?**

   Assessment method – Answer this question for the block with an estimate of: increased diversity, no change, minor decrease, or major decrease.

   Note: The concept of maintaining a diverse mix of species in ecosystems is widely accepted as a way to manage both potential economic and ecological risks over time by promoting resilience. While a notable goal, it is not easily integrated with the other indicators of performance toward the provincial timber goals at the stand level, because performance (good, bad or neutral) depends on many other considerations. For example, where a mixed-species stand is in imminent danger of significant losses due to mountain pine beetle, removing the lodgepole pine and reducing species diversity may be the desired management option. For this reason, these data may be helpful when viewed at a coarser scale with numerous cutblocks (while considering other ecological and species information), but should not be considered as a performance indicator at the stand level.

Cutblock Sampling:

Overview of the Approach:

First read and familiarize yourself with all questions and indicator statements. Begin with a blank field card to take notes.

I) Office preparation

Before the survey, complete the following steps:

1. Selection of partially harvested stands for assessment -- the purpose of the Partial Cutting protocol is to be used by field staff to assess whether stands, recently partially cut are healthy and productive, and will be capable of supporting an additionalcommercial harvest at some point in the future. Not all districts have partial cutting and will not need to utilize this tool. Certain questions have been raised:
    - **Question:** do we want to collect this data on an annual basis or is it district specific; wanting to know how the partial cutting is doing in their district? ***Answer:*** the Partial Cutting Protocol was designed to be used by field staff as a tool to assess partial cutting in their district. Not all districts carry out partial cutting and an assessment of partially harvested stands is not mandatory in those districts that carry out partial cutting. Partial cutting assessments will, however, be counted towards the annual FREP performance measures for the district.
    - **Question:** Is there a need to compare between districts or role up to a regional and provincial basis (e.g., generate a Master Random List)? ***Answer:*** it is always a meaningful endeavour to aggregate data up to a district, region or provincial level to demonstrate trends.
    - **Question:** Should these stands be selected randomly or targeted? ***Answer:*** as with all monitoring done in FREP it is critical to ensure bias is not introduced into the sampling methodology. To ensure this random sampling of cut blocks is imperative.
2. Randomly select assessment areas in the field where plots will be established (e.g., an SU, a TU, the entire cutblock, etc.) Refer to the stratification classes as sometimes the data will be obtained from previous silvicultural surveys.
3. Obtain the site plan and a map (and preferably air photos) of the target area and stratify as recommended previously in this document.
4. Obtain other relevant information (file information, RESULTS reports, discussions with prescribing and implementing foresters, observations of adjacent stands, etc.) that will help identify preferred and acceptable species, tree acceptability criteria, ecology and eco-stratum boundaries, management objectives, site limiting factors, forest health risks, forest practices undertaken, and pre-harvest condition.

5. Record preferred tree species if the applicable standards differentiate between preferred and acceptable.

II) Field observation

1. During the field observation phase, complete the following steps:
2. Establish sample points randomly over the target area, as described in the plot layout section that follows.
3. At each observation location, collect relevant information on the data collection form.
4. Over the entire stratum observe general forest health and look for concentrations of windthrow. Concentrations of windthrow may also be initially detected with orthophotos or satellite imagery.
5. Complete data summary and overview of performance.

III) Drawing conclusions

After collecting the field data, complete the following steps:

1. Use the data collected against the thresholds identified for Indicators A through C and provide the answers on the front of the form.
2. Make comments as per directed on the forms.
3. Assess the contributing factors and note opportunities for improvement.

Sampling Design on a Cutblock

Suggested Number of Plots in Post-harvest Cutblock

The number of plots to establish is based on the retention strategy and the cutblock size. FREP sampling will only be done on strata classes A to C (unharvested patches or partial cuts where residual basal area in the Net Area to be reforested (NAR)[10] IS NOT obviously less than 10 m^2/ha). For stratum D (blocks where residual basal area in NAR is obviously less than 10 m^2/ha) recent silvicultural survey data will be used to complete the evaluation.

For Strata A-C:

- Establish a minimum of 5 plots per stratum up to 5 hectares.
- For strata >5 hectares, establish an additional plot for every two hectares over 5 hectares, up to a maximum of 25 plots.
- Time and stand structure variability need to be considered. If the retention is homogeneous, it may be acceptable to reduce the number of plots where time is limited.
- Conversely, where variability is high, and the assessor is not comfortable that the

10

plots established are representative, an additional 5 plots is recommended. **Note:** Assessors will need to be prepared to randomly choose additional plot locations in the field.

Plot layout

Prior to heading into the field, randomly choose plot locations and mark them on the map. A suggested technique is to place an appropriate scale dot grid over the site map. Randomly pick the total number of plots based on the criteria above and mark the plot location(s). Avoid plots that are on roads, landings, burrow pits or other permanent access structures. Record the distance and bearing from an obvious feature (e.g., SW corner of the block, road junction, or where a particular creek enters the block) to be used to locate the plots in the field. Alternatively use GPS coordinates to locate plots.

Navigating to Plots

Once the required plots have been located on the field map, navigating to the plots requires planning for efficiency and safety. The following guiding principles should influence plot establishment.

- Safety is paramount; if your plot(s) cannot be safely accessed (e.g., cliffs, deep-water barriers, extensive windthrow), randomly select an alternative plot from the office exercise.
- Plot locations are horizontal distances, so try to correct for slope distances when working on steep terrain (i.e., slopes >40%).
- Traversing to plots can be done using GPS hand-helds (e.g., Garmin GPS 60), compass and hip-chain, compass and rangefinder, or compass and pacing.

General Procedures for Establishing Plots

In general, to establish plots:

- Use flagging tape to establish plot centres.
- Record plot #, date of assessment, and identify as PCTA (partial cutting timber assessment) plot on flagging tape.
- Use only one prism type and plot size (see section below).

Prism Plots

- Prism sweeps should be done in patch areas or areas of dense dispersed retention.
- Use either a 5 BAF (Basal Area Factor) prism for stands with an average diameter of less than 45 cm and a larger BAF prism for stands with an average of 45 cm DBH or greater (e.g., BAF 8 – 10).
- Standardize the way in which prism sweeps are done. Paint or mark the first tree measured and sweep your prism clockwise. Ensure the position of the prism is maintained over the plot center.
- For prism plots, use the same BAF within a stratum.

Borderline trees for prism plots

Use the following procedure for determining if borderline BAF trees are in/out of plot:

- For prism plots, measure borderline trees to determine if they are indeed IN or OUT. The formula is: LD = PRF*DBH.

  For example, when using a prism with a BAF of 5, the PRF (Plot Radius Factor) is 0.2236. If you have measured a 30-cm tree, it must be within 6.7 m from the plot centre to the center of the tree to be IN (0.2236*30 = 6.7). If the distance to the pith of the tree is >6.7 m (at 1.3 m DBH), it is OUT.

Prism plots on the stratum edge

Where a plot is situated within the fringe areas of a stratum, move the plot centre into the stratum. The fringe width of a stratum depends on the selected prism BAF and the largest diameter tree in the plot. The following procedure can be used.

Determine whether the plot is an edge plot by calculating the plot's limiting distance (LD) based on the largest tree in your prism sweep and the plot radius factor.

For example:

- prism BAF = 5 (0.5/sq rt of BAF = Plot radius factor of 0.2236)
- DBH of largest tree = 45 cm × LD = PRF × DBH = 0.2236 × 45 = 10.06 m.
- Shift the plot perpendicular from the edge so that the plot centre is now 10.06 m from the stratum edge.

Table 3: Basal Area Factor Chart

Basal Area Factor Chart

Basal Area Factor	Plot Radius Factor	Basal Area Factor	Plot Radius Factor
1	0.5000	12.25	0.1429
2	0.3536	13	0.1387
3	0.2887	14	0.1336
4	0.2500	15	0.1291
5	0.2236	16	0.1250
6	0.2041	18	0.1179
6.25	0.2000	20	0.1118
7	0.1890	20.25	0.1111
8	0.1768	24	0.1021
9	0.1667	25	0.1000
10	0.1581	30.25	0.909
11	0.1508	32	0.0884
12	0.1443	64	0.0625

Fixed Radius Plots

- The 3.99 m radius (1/200 ha) plots will be used to capture understory data (Layer 2-4) as in a silvicultural survey.
- Data on total trees, and unimpeded well-spaced acceptable (UWS) stems will be collected (see next section), as well as observations for germinants and seedlings too small to include as a UWS stem.

Data Collection: Filling out the Forms

DATA COLLECTION FORM - Classifying Overstory Trees:

When prism plots are established, overstory trees (Layer 1 trees, 17.5 cm or larger in dbh) will be tallied by species class (High Value, Directed, or Other Ecologically Suitable) as:

Overstory Tree → **CROP (C)** – All trees NOT classed as "Poor"

↓

POOR (P) – These are poor quality trees that have low value or no value based on the presence of a significant defect that is interpreted as the presence of internal decay (may or may not be worthless). They have the following characteristic(s):

1. **Heart rot indicated by conks.** Consider guidance in Appendix I.
2. **Old wounds and scars with obvious decay or associated deformity such that value is low or nil.**

Note: Either Crop or Poor Trees can receive the modifier, "RISKER" –
This modifier is for trees that have a **high likelihood** of mortality over the rotation (most likely in the next zero to 40 years). As indicated there can be CR (crop riskers) or PR (poor riskers). The risker term is added to recognize a less significant impediment on developing understory trees due to limited longevity. If you are not sure if a tree will die over next 40 years, do not add the risker modifier. The following conditions can be used to help determine if a tree is a risker.

Risker trees have the following characteristics:

- *Windthrow/snap prone*[11] – Conifers only – less than 20% live crown and/or more than 100 as a height/diameter ratio.

  Also – Conifers or broadleaf species with a crook or fork, or mistletoe stem infections, that provide a high likelihood of failure (breakage) over the rotation, killing the tree or providing for a major value loss.

11 Based on Windthrow Management Workshop (2006) by Mitchell and Zielke.

- *Dead trees* – If the tree is dead – circle on your form – all dead trees are riskers, and can be either a crop risker or poor risker depending upon the integrity at the time of sampling.
- Crown condition The tree may appear to be dying due to top damage or other impacts, live crown is obviously sparse and/or chlorotic.
- Severe Recent Wound [12] Wounding as described in the Wounding and Decay Guidebook (BC MoF 1997) identifies different damage types that may lead to decay and possibly death. The guidebook breaks out damage criteria by management regime and by species groups.

  Species susceptibility to decay, ranked from greatest to least

  Broadleaf

  B, H, Lw, Ss and Cw under 60 years

  Yc, Sx and Cw over 60 years

  Fd Pw

  Pl, Py

Based on the species group use the following to help identify trees susceptible to mortality:

Fd, Pl, Py and Pw:
- A wound that girdles more than half the stem circumference.

ALL OTHER CONIFERS:
- A wound girdles more than a third of stem circumference.
- A wound on a supporting root within 1 m of the stem.
- A gouge (splintered wood) any size.

All Broadleaf species:
- A wound girdles more than a third of stem circumference.
- A wound exceeding 400 cm^2 on the stem.
- A wound on a supporting root within 1 m of the stem.
- One gouge (splintered wood) any size.

12 Based on the 1997 BC Tree Wounding and Decay Guidebook recommendations for short term retention (20 years). The assumption is that these trees are at significant risk of mortality over the rotation.

- *Old wounds and scars* — Not significant enough to classify the tree as "poor", but it is possible that the tree could die over the rotation.
- *Recently Leaning* — Tilted over their entire length > 15% or may have less than 15% but have other trees leaning against them such that they are at a high risk of falling over (not trees with old "sweep" – i.e., old tilted trees that have re-established a vertical top).

Stumps – **Note:** It is trees that were "harvested" in the last entry that are of interest. Old stumps from historic logging, or non-economic snags that were harvested should, as much as practical, be avoided. Overstory trees that are "IN" with the prism sweep will be used as a reference to conduct an ocular estimate of stumps of a diameter and distance that would obviously be "IN" if they were not cut. Assessors must use their knowledge of the bark and wood characteristics of local species to identify the species of the stump. A Species Identification Field Guide has been produced and can be found at the link below to assist is species stump identification.

file://webprod1.for.gov.bc.ca/public.web/HFP/frep/site_files/indicators/Stump-Identification-Protocol-2008.pdf

As well, they must use their knowledge of the taper of those species to estimate approximate diameter at breast height (dbh – 1.3 m from point of germination). Where the stump is close to being "IN" a dbh will be estimated and a distance measured from the plot center and compared to the horizontal limiting distance to determine whether to count it or not (see borderline trees – previous).

Windthrow – trees windthrown will be indicated on the tally form with a "w". The intent is to capture trees that have blown over since the block was logged, not relic windthrow prior to harvesting. Windthrow will be denoted by circling the tally dot.

Dead trees – will be denoted by circling the tally dot as previously indicated.

DATA COLLECTION FORM - Classifying Understory Trees:

Total Understory Trees

The total understory trees of each species (all living) can be determined by adding the well-spaced unimpeded suitable crop trees with "other" living understory trees.

Unimpeded Well-spaced Understory Trees (UWS)

When fixed radius plots are established, understory trees (Layer 1 trees 12.5 cm – 17.5 cm dbh, and Layer 2, 3, and 4 trees > than a minimum of 15 cm in height) will be tallied by species as:

Well-spaced:
- A minimum of 2 m apart.

Crop:
- To be assessed as crop, trees must be an ecologically suitable species, a minimum of 15 cm tall, free from damage or infection from insects, disease, mammals,

or abiotic agents as outlined in the free growing damage criteria for British Columbia (Appendix II).

- Advance regeneration must meet the provincial requirements listed in Appendix III, or region-specific requirements where they exist.

Unimpeded: Two situations impede understory tree growth:

1. **Mortality due to Heavy Brush (shrubs or herbs)** – To be unimpeded, understory trees must not be in imminent danger of mortality from understory vegetation competition or mechanical damage (e.g. snow press). Understory vegetation may include herbaceous plants, shrubs or Layer 2 and 3 understory trees (not UWS) that sufficiently compete with the overtopped tree being considered to limit its ability to achieve crop tree status.

   The interest is in brush competition so severe that mortality is likely. Trying to assess growth reductions due to brush impacts is difficult as they will be highly variable, and in the end may be relatively short lived. Mortality will have a much greater impact on the provincial timber objectives. Potential mortality will be a judgment call, based on the silvics of the tree species, the amount and type of overtopping brush, the morphology, health and vigor of the crop trees. Where imminent mortality is not clear but quite possible, the tree should be considered "impeded".

2. **Long Term Growth Suppression from a Specific Overstory Tree** – To be unimpeded, understory trees must not be directly under the dripline of a larger **'non-risker'** coniferous tree. Larger Overstory Trees include Layer 1 trees with a diameter of 17.5 cm dbh or greater OR Layer 2 trees (12. 5 – 17.5 cm dbh) with a pointed crown indicating epinastic growth.

   To assess, the leader (or crown center) of the understory tree must be directly within the crown spread of the overstory tree when viewed straight overhead (90 degrees from the ground).

Note – RE: Suitable Crop Trees – (adapted from the Stocking and Free Growing Survey Procedures Manual – May 2002) – The provincial free growing damage criteria do not directly apply to well-spaced trees at the regeneration stage (i.e., before free growing declaration). It may not be realistic to apply all of the free growing damage criteria to well-spaced trees. Damage agents affecting well-spaced trees at the regeneration stage could still be affecting the same trees at the free growing stage.

For example, if mistletoe is found on the stem of a young tree, it will likely persist to the free growing age and beyond. This tree should not be accepted as well spaced. Unless a district, region, or licensee provides its own criteria for well-spaced trees, the final decision may be left to the surveyor's common sense. In this case the surveyor should document the rationale for the decision.

Once the field forms are completed an appendix with a filled in example will be provided here.

DATA SUMMARY FORM:

Stratification – indicate an estimate of the proportion of the cutblock in the four stratification categories.

Overall Ratings / Comments – Complete after completing the rest of the form. Transfer information forward for these key indicators. Complete the comments / question sections.

Description of timber trajectory – This exercise is optional. The intent is to use the graph to help assessors describe the understory and overstory development over time. Assessors need only use this section if they feel it is useful.

Performance Summary – **MAJOR INDICATORS** – In the data summary sections, key data from the field data forms are summarized, and then used to describe performance using the indicator thresholds indicated on the form.

Other Questions – Here values are provided for indicators that have no established thresholds of performance.

Optional Additional Information – This is an optional section that should only be completed if assessors feel they have knowledge and/or expertise to complete it. When this type of information and expertise is available, it can provide valuable context, if at some point trends among a number of blocks are investigated.

Appendix I: Detailed description of poor and risker quality defect indicators for overstory sample trees.

POOR TIMBER QUALITY - BASED ON SUSPECT INDICATORS (PROVINCIAL CRUISING MANUAL - JUNE 2007)

CONKS – Heartrot conks on roots, live branches or trunks, as considered below:

Conks are the fruiting bodies (sporophores) of decay fungi and are definite and reliable indicators of decay. Conks occur anywhere on the main stem, branches and exposed roots of the tree but appear most frequently around knots and on the underside of both dead branch stubs and live branches. Only specific root, butt and heart rot conks are suspect indicators. Slash conks are not suspect indicators.

It is necessary to be able to recognize the conks of the major heart rotting fungi found on living conifers and hardwoods. On conifers, the main conks to recognize are, Echinodontium tinctorium, Phellinus (Fomes) pini, Phaeolus (Polyporous) schweinitzii and Fomitopsis (Fomes) pinicolii. On hardwoods, the main conks are Phellinus igniarius and Phellinus tremulae. See the following host list for major and some minor heartwood decay species.

Conks vary in size and shape and therefore are hard to spot, particularly when they are just developing or occur on the upper trunk. Conks of E. tinctorium and Phellinus pini, frequently appear as a small hoof-like or shelf-like structure on the underside of dead branch stubs on the middle and/or lower trunk of an infected tree. Moss-covered branch stubs and burls often resemble conks, particularly when viewed from directly below; it is important therefore to view the tree from the side before making a decision.

P. schweinitzii

P. schweinitzii is the cause of brown cubical root and butt rot of most conifers but Douglas-fir and spruce are the most susceptible. The fruiting bodies may occur:

- *on the base of a tree,*
- *on the ground up to 2 m from the tree where no exposed roots are evident, or*
- *on the exposed roots.*

If a P. schweinitzii conk is mid-way between:

- *Two living susceptible trees only one tree is considered to be infected.*
- *A highly susceptible species (e.g., Douglas-fir) and a less susceptible species (e.g., red cedar), the most susceptible species is considered to be infected.*
- *A living tree and a stump showing brown cubical rot, and it is not on a root of the live tree, it is assumed to be associated with the stump.*

BLIND CONKS

Blind conks are pronounced swellings or depressions around knots caused mainly by P. pini on conifers and P. tremulae on aspen and if identified correctly, are definite indicators of decay (see Figure A.4). The swelling or depression results from the tree attempting to heal over an abortive conk; a newly developing conk; or a point from which an old conk has dropped. Non-typical forms may appear as small branch holes or branch stubs at the base of trees. This form is often found in over-mature Douglas-fir and balsam species in the coast-interior transition zone (e.g., Boston Bar). Therefore over-mature trees with basal branch stubs should be examined for blind conk.

Poor trees should have only those indicators which have a high chance of being blind conk such as large swollen knots and large caved-in knots. Do not call small knots and knot indicators on any species.

WOUNDS / SCARS

A tree will be considered poor with a wound or scar on the main stem (or secondary leader) that is not recent in origin. This is interpreted as the injury having not occurred within approximately the past five years. These may be open or closed wounds and generally have the following characteristics:

- **Aging** – the scar or catface should show greyed or weathered wood and enough decay, when combined with other factors, indicates little or no value.

RISKER TREES - SOME CHARACTERISTICS BASED ON SUSPECT INDICATORS (PROVINCIAL CRUISING MANUAL - JUNE 2007)

FORK OR PRONOUNCED CROOK

Any tree with a fork or pronounced crook as described below:

A fork or crook is the result of damage to the main leader of the tree where one or more lateral limbs take over as the main stem. A Fork or a crook is called if severe enough to indicate that the original injury exposed the wood and provided an entrance point for decay fungi. A Fork or a crook is to be called between the root collar and the minimum top diameter specified in the cutting authority document.

Forks are used to indicate a poor tree for any of the following conditions:

- *The main stem is markedly forked to indicate that 2 or more leaders have resulted from serious damage to the original leader.*
- *The diameter of the main stem changes excessively from its normal taper to indicate that a serious injury has occurred. For cruising purposes, the diameter change must be at least 10 percent.*
- *Where there is not evidence of a broken top in the stem at the fork/crook position and neither of the leaders are merchantable, record fork/crook.*

Crooks are used to indicate a poor tree if:

- *There is at least a 10 percent diameter change in the bole above and below the crook.*
- *The offset is severe enough to indicate that damage occurred to the main stem. For cruising purposes, the offset must be at least 50 percent of the diameter of the tree at the crook.*
- *There is a high likelihood that the stem could be snapped or broken by winds or snow-loading during the rotation.*

Some forks and crooks are not used as "RISKER" indicators. Forks and crooks may be a growth characteristic of the tree species (for example deciduous species) or may have developed from malformation of the terminal leader due to insect or mistletoe attack. In addition, a fork may be confused with a branch. Forks or crooks which are not used as indicators of poor trees are as follows:

- *Crooks with a minor offset (for cruising purposes, an offset less than 50 percent of the diameter of the tree at the crook).*
- *Small sharply angled branches or spikes (for cruising purposes, less than a 10 percent change in the diameter of the main stem).*
- *Natural forking in deciduous tree species.*
- *If the damage is less than 5 years old and/or occurs above the minimum timber merchantability specifications specified in the Timber Utilization Policy (Coast or Interior).*
- *Flattening of the top of the tree caused by wind or natural outgrowth.*
- *Candelabra branches in coniferous species.*

MISTLETOE TRUNK INFECTIONS

Characteristics and impacts are described below:

Trunk infections of mistletoe are indicated either by abnormal swelling or malformations of the trunk at the point of infection, or by clusters of dead and broken branches on the trunk or on hypertrophied branches immediately adjacent to the trunk.

Wood-rotting fungi gain entrance to the trunk through the dead hypertrophied branches or branch stubs where the swelling is on, or adjacent to the trunk. This can often put the tree at a high risk of breakage from wind or snow.

Do not include mistletoe on living limbs or limbs that are swollen only at some distance from the trunk. Include only those branch infections in which the swelling has clearly extended to trunk.

Appendix II: Provincial Free Growing Damage Criteria (Appendix 5 of the Establishment to Free Growing Guidebooks).

Introduction

Before a stand can be declared free growing, it must have adequate stocking of healthy, well-spaced trees of a preferred or acceptable species. The free growing damage criteria identified in the attached guidelines are not legislated regulations. The guidelines are based on the most current knowledge of forest-damaging agents, and are provided to help users exercise their professional judgment in identifying "healthy" trees. The district manager may allow or require deviations from these guidelines, as long as the legal requirement to produce a healthy tree is met.

These free growing damage criteria are intended to help users uniformly define "healthy" as part of "healthy, well-spaced trees" used in the *Forest Practices Code of British Columbia Act* and regulations. These damage criteria are designed for use at the free growing assessment to determine the damage to, and acceptability of, individual trees (conifers only) across the province. Acceptability of a stand will depend on several factors including thresholds of damage and stocking standards agreed to in the prescription.

The table lists various types of damage, causal agents, and species of trees. Agents and damage are often referred to by their codes listed on the Ministry of Forests Integrated Data Dictionary Pest_Species_Code list (partly listed on the *Silviculture Damage Agent and Condition Codes* (FS 747) field form). Tree species abbreviations are listed in the Forest Productivity Council publication *Minimum Standards for the Establishment and Remeasurement of Permanent Sample Plots in British Columbia* (1999).

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

1. These criteria 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 there are no damage criteria listed for these species. This is because the characteristics of most broadleaf species (e.g., pests and growth habits) are sufficiently different from those of conifers that creating a single table would be difficult and confusing. It is envisioned that broadleaf species, and partial-cut stands (age class 2 and older), will be covered by separate tables in the future.

These criteria are based on best available data and professional opinion, and are expected to be revised in future with newly available knowledge or information.

Table A5-1. Free growing damage criteria for even-aged (age class 1) coniferous trees

PLEASE READ the preceding introduction before using the following table and figures.

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	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 length of the stem, or • the tree has a wound centred on an infection caused by a stem rust, canker, or dwarf mistletoe (See Note under Stem: Infection).	All	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. See Figure A5-1.
Stem	**Insect mining at root collar**	• 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	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, 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.	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 ISQ, cattle AC, deer AD, elk AE, moose AM, frost NG, hail NH, snow NY, drought ND, logging TL, mechanical TM.	For **horizontal displacement** see Figure A5-2.
		• the tree leader has been killed three or more times in the last five years (weevil only).	Sx, Ss, Pl	White pine (spruce) weevil IWS, lodgepole pine terminal weevil IWP.	This criterion applies only for terminal weevil damage.
		• 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.	All	terminal weevils (IWS, IWP), frost NG, animal damage A.	**Leader dominance** occurs when the tallest leader is at least 5 cm taller than the second tallest leader. See Figure A5-3.
		• the tree has a dead or broken top at a point that is >2 cm (>3 cm for the coast) in diameter.	All		
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.	**Note**: Wounds caused by rodent feeding around rust cankers should have stem rust recorded as the causal agent.
Branch	**Infection** (cankers)	• an infection occurs on a live branch less than 60 cm from the stem.	Pw, Pl, Py	white pine blister rust DSB, comandra blister rust DSC, stalactiform blister rust DSS.	See Figure A5-4.
Branch	**Galls**	• a gall rust infection occurs on a live branch less than 5 cm from the stem.	Pl, Py	western gall rust DSG.	See Figure A5-4.

Table A5-1. Continued

Location of damage	Type of damage	Tree being assessed is UNACCEPTABLE if:	Host species	Likely damage agents & damage agent codes	Comments
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 nodes near the ends of branches. Consult a recent distribution map to identify the geographic extent of this pest.
Foliage	Defoliation	• >80% of tree foliage has been removed due to defoliating insects or foliage disease.	All	defoliators ID, foliage diseases DF.	
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.	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, 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 median height of the trees being assessed.
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.	**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. See comments for well-spaced tree net down calculation. The multiplier for DRA is **two**, except in BEC zones PPdh1 and 2, IDFxh1, IDFdm1 and 2, MSdk1, and MSdm1 where the multiplier is **one**.	All	armillaria 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 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 free growing trees tallied for the plot.
		• infected conifer 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.	**Note:** 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.	**Note:** Ba, 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.	**Note:** Bg, Bl, Cw, Cy, Fd, Hm, Pl, Pw, Py, Sx and broadleaf species are considered **not susceptible** for survey purposes only.

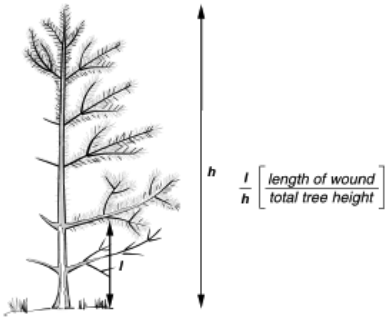

Figure A5-1. Calculation of wound along stem length.

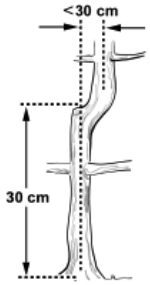

Figure A5-2. Determining horizontal displacement and height above point of germination when assessing stem deformation.

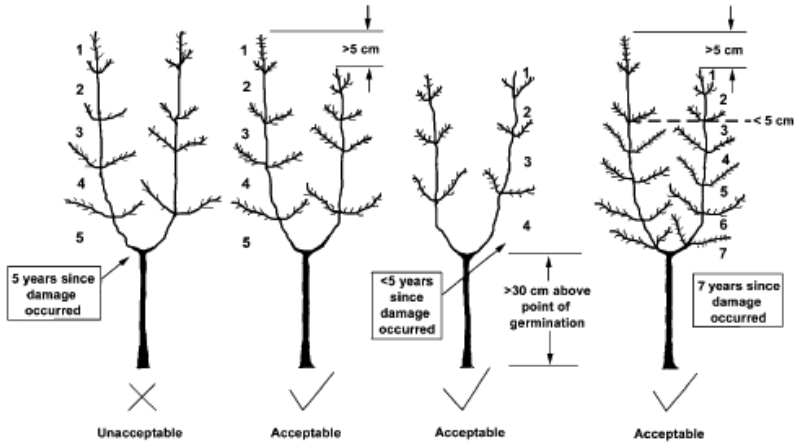

Figure A5-3. Acceptable and unacceptable forks.

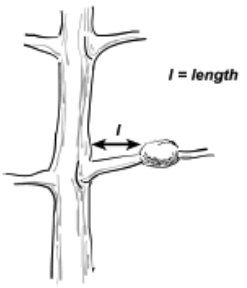

Figure A5-4. Distance measurement from point of infection by canker or gall to main stem.

Appendix III: Detailed description of suitable crop tree characteristics for advanced understory regeneration (based on provincial Establishment to free growing Guide Books)

Table A10-1. Free growing acceptability guidelines for layer three and four advance 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 regions)	All*** (except BWBS)	All***	All***
Height at time of 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 free growing damage criteria in Appendix 5 for description of unacceptable forks and crooks)						
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.

For additional information regarding decay fungi and advance regeneration refer to the *Tree Wounding and Decay Guidebook*.

Appendix IV Field Form

FREP Partial Cut Timber Protocol (PCTP) (August, 2009 v2.4) p.1

BAF _____ Block =_____ Stratum =_____

BEC Variant/ site series= _____

High Value Spp. (Preferred) =_____Additional Ecol Suitable Spp =_____

Overstory Tally[1] (**C**= crop, **CR**=Crop-risker **P**= poor, **PR**= poor risker, **St**- stump)

Directed Spp. _____ or NA

Plot #	Species and condition class																		
	High Value Spp.					Add Ecol Suit Spp.					Directed Spp.					Summary			
	C	CR	P	PR	St	C	CR	P	PR	St	C	CR	P	PR	St	RBA C	RBA C+CR (W)	Tot C,CR,P,Pr (X)	Stumps Hv/Tot for (Y & Z)
Avg BA																			

Understory Tally and DFP Compilation:

	Overstory ≥17.5 DBH	Understory: > 15 cm tall and < 17.5 cm DBH- by species														
Plot	BA of C trees	Total / Ingress HVS[2]	Species (list HVS first then Additional Ecol Suitable)										DFP		SPH UWS HVS	SPH UWS not HVS
													No.	Class		
			UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS				
Avg																

BA of Crop trees:
Transfer the total basal area of C trees from overstory table. This is used for the determination of DFP.

Regeneration classes:
UWS = unimpeded well spaced ecologically suitable trees.
INGRESS = high value trees < 15 cm tall including germinants.

DFP Classes:
O = open
P = partially stocked
S = stocked

[1] Use a dot to tally, use "w" if windthrow and circle the dot if dead.
[2] Ingress is < 15 cm, count up to a maximum of 10 per plot.

Date_____ Assessed by:_____ District :_____ v 2.4

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FREP Partial Cut Timber Protocol (PCTP) (August, 2009 v2.4) p.2

BAF_____ Block =_____ Stratum =_____
BEC Variant/ site series= _____
High Value Spp. (Preferred) =_____Additional Ecol Suitable Spp =_____

Plot #	Species and condition class																		
	High Value Spp.					Add Ecol Suit Spp.					Directed Spp.					Summary			
	C	CR	P	PR	St	C	CR	P	PR	St	C	CR	P	PR	St	RBA C	RBA C+CR (W)	Tot C,CR,P,Pr (X)	Stumps Hv/Tot for (Y & Z)
Avg BA																			

Understory Tally and DFP Compilation:

	Overstory ≥17.5 DBH	Understory: > 15 cm tall and < 17.5 cm DBH- by species															
Plot	BA of C trees	Total / Ingress HVS[3]	Species (list HVS first then Additional Ecol Suitable)										DFP		SPH UWS HVS	SPH UWS not HVS
													No.	Class		
			UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS	UWS				
Avg																

Notes

[3] Ingress is < 15 cm, count up to a maximum of 10 per plot.

Date_____ Assessed by:_____ District :_____ v 2.4

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Appendix V Field Summary Form

FREP Partial Cutting Timber ProtocolFREP Partical Cutting Timber Protocol Field SUMMARY August 2009 V 2 4.doc

FREP Partial Cut Timber Protocol Summary Form (v 2.4)

District_____Location _____

Block =_____Stratum =_____ BEC Variant / site series= _____

High Value Species =_____

Additional Ecol Suitable Species =_____

Stratification group[1] (underline / %)

A – Unharvested,

B – High retention of dispersed overstory (minimum 20 m^2/ha avg),

C – Significant overstory but not high retention (often clumpy),

D – clearcut (note D is not to be sampled using this form of the protocol)

Overall Ratings (circle – add qualifier if necessary)

Indicator A Site Occupancy Do well-spaced, unimpeded, crop trees of ecologically suitable species occupy the growing space?	**Indicator B Species Composition** Is the stand maintaining or increasing in value due to the species composition?	**Indicator C Non Directed Species** In cublocks where harvesting is directed at a particular species, is the proportion of non-directed species below the minimum target?
Yes	Yes	NA
No	No	Yes
Perhaps	Perhaps	No

If the achieved rating does not reflect your assessment of the degree to which the area is maintaining or enhancing an economically valuable supply of commercial timber, please comment.

Comment

[1] Identify the proportion of the unit in each category – ideally a stratum will be dominated by one of the categories.

Date_____ Assessed by:_____ Block number _____ v 2.4

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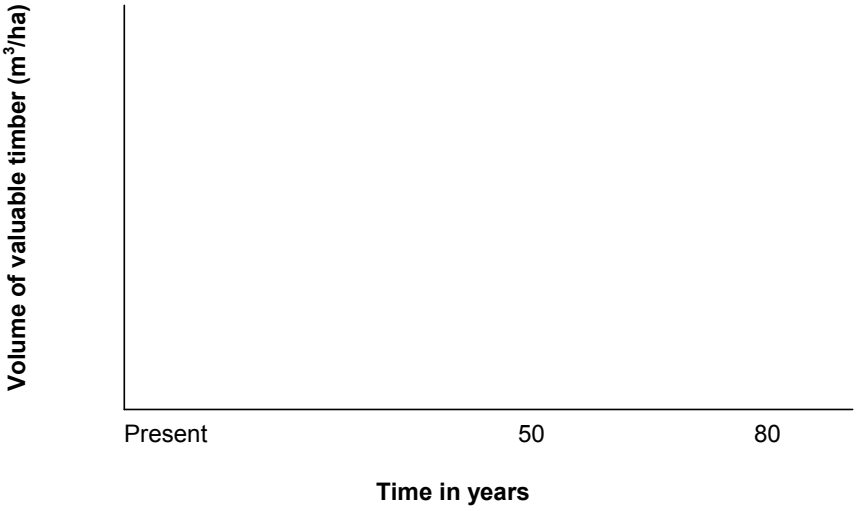
OPTIONAL

Description of timber trajectory – draw a diagram of expected overstory and understory growth over the next 50 (80) years estimating growth of valuable timber. Start with estimate of volume preharvest, show reduction then future trajectory. This is an approximation and is meant to ID basic trajectories, up flat or down.



For Overstory use a solid line, dashed line for understory

Notes

Date_____ Assessed by:_____ Block number _____ v 2.4

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Performance Summary – MAJOR INDICATORS

Indicator A – Do well-spaced, unimpeded, ecologically suited crop trees occupy the growing space?

DATA SUMMARY	**DFP Value[2]**		**DFP Class**
DFP Averages			
SITE OCCUPANCY (using DFP) % plots by class	**O**	**P**	**S**
(e.g., Open (O) 20%, Partial (P) 60%, Stocked (S) 20%) =			

PERFORMANCE SUMMARY	**Reported Performance**
A. SITE OCCUPANCY - Growing space is well-occupied by well-spaced, unimpeded, crop trees of ecologically suitable species. **Thresholds For stands < 60 cm average DBH** **Yes** If the average DFP is ***stocked*** – S (DFP ≤ 0.15) AND ≥ 60% of plots are stocked (S) or partially stocked (P). **Yes +** where the average DFP ≤ 0.05 AND ≥ 80% of plots are S. **Perhaps** (or somewhat) where DFP average is in the ***partially stocked*** class – P (DFP 0.15 – 0.40) AND more than 50% of the plots are in the S or P classes. **No** Where none of the above are achieved **Refinements:** **Ingress input** – Change **No** to **Perhaps** if ingress of high value seedlings is ≥ 500 **Poor Overstory Modifier** • **For "Yes" or "Perhaps" scenarios** - Add a minus (-) to either condition if the average basal area of poor trees is > 20 m^2/ha and understory stocking is required to achieve the stocking class. A "Yes-" or "Perhaps-" will indicate that growth of understory trees may be significantly impacted by poor trees in the overstory. • **For "No" scenarios** - Add a minus (-) if the average basal area of poor trees is > 20 m^2/ha. This situation indicates that not only is growing space not adequately stocked with suitable trees, but it is dominated by poor trees.	Circle the category chosen at left. Add modifier if appropriate. (e.g., Yes -)
Thresholds For stands ≥ 60 cm average DBH **Yes** If the average DFP is ***stocked*** – S (DFP average is ≥ 2.5) AND ≥ 60% of plots are stocked (S) or partially stocked (P). **Yes +** where the average DFP ≥ 2.8 AND ≥ 80% of plots are S. **Perhaps** (or somewhat) where DFP average is in the ***partially stocked*** class – P (DFP 1.5 – 2.5) AND more than 50% of the plots are in the S or P classes. **No** Where none of the above are achieved. **Refinements: See above**	

Yes – no concerns **Yes+** - beyond expectations **Perhaps** – potential situation of concern

No – situation of concern[3]

[2] Note for stands ≥ 60 cm avg DBH use 1,2,3 values for DFP, (e.g., 3 – S)

Date_____ Assessed by:_____ Block number _____ v 2.4

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Indicator B – Is the stand maintaining or increasing in value due to the species composition?

OVERSTORY DATA SUMMARY - *Determine the proportion of high values stems left after harvesting.*	
W. RBA of high value stems post harvest: Average BA for high value C (crop) and CR (crop-riskers)	
X. RBA of Post-harvest Total Basal Area: Average BA for all C, CR, P, PR	
Y. Calculate the preharvest level of high value crop basal area: Add the stump tally average BA of high value crop trees to W.	
Z. Calculate the total BA preharvest – Add the total stump tally average BA to X.	
OVERSTORY PERFORMANCE SUMMARY	**Reported Performance[4]**
Overstory is well occupied by acceptable trees of high value species **NA** where RBA is < 15 m^2/ha – go to Understory Performance Summary below. **Yes** if the proportion of *Post Harvest High Value Crop* RBA is ≥ the proportion of *Preharvest High Value Crop Basal Area.* ***W/X*** **≥ 0.9*Y/Z** **Yes +** if the proportion of *Post Harvest High Value Crop* RBA is ≥ 120% of the proportion of *Preharvest High Value Crop Basal Area.* ***W/X*** **≥ 1.2(Y/Z)** **Perhaps** if the proportion of *Post Harvest High Value Crop* RBA is < 100% but ≥ 50% of the proportion of *Preharvest High Value Crop Basal Area.* ***W/X<0.9 but*** **≥ 0.5(Y/Z)** **No** If none of the above are achieved	**Total RBA =** W/X = Y/Z = **RATIO W/X / Y/Z =**

[3] Note that these categories are meant to focus attention for further analysis where objectives and total area affected are considered.
[4] Circle the indicator used for the determination. Provide value and threshold for verification of result.

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FREP Partial Cutting Timber ProtocolFREP Partical Cutting Timber Protocol Field SUMMARY August 2009 V 2 4.doc 5

UNDERSTORY DATA SUMMARY Average SPH of High Value UWS =	
UNDERSTORY PERFORMANCE SUMMARY	**Reported Performance**
Understory is occupied by a minimum level of well-spaced, unimpeded, well spaced suitable crop trees of high value species. **Yes** if the SPH of High Value UWS ≥ the understory SPH required to be in the "stocked" class from DFP table, considering the overstory RBA stocking of suitable crop trees OR 500 SPH – whichever is less. **Yes +** if the average stems per ha of UWS Valuable species ≥ of the 80% of the TSS (even aged) **Perhaps** – Change **No** to **Perhaps** if ingress of high value seedlings is ≥ 500 **No** if the SPH of High Value UWS ≤ of the understory SPH required to be in the "stocked" class from DFP table, considering the acceptable overstory stocking. **NA** where the Average total SPH in the understory = 0	ID sph to meet fully stocked based on Crop Tree BA from DFP table.

Answer Yes if either are Yes, No if both No or NA if both are NA

Date_____ Assessed by:_____ Block number _____ v 2.4

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Indicator C – In cublocks where harvesting is directed at a particular species, is the proportion of non-directed species below the minimum target?

DATA SUMMARY *(If no directed species = **NA**)*	**Reported Performance**
A. Average BA of stumps of all non directed species =	**A =**
B. Average BA preharvest (C+CR+P+PR+St) (value Z from previous page)	**B =**
Ratio of A/B x 100 = % of harvest in non directed species.	**A/B * 100 =**

PERFORMANCE SUMMARY *(If no directed species = **NA**)*	**Reported Performance**
Directed proportion is _____, Use the average RBA of stumps of all non directed species divided by the Average Preharvest BA for all standing stems and stumps. **Yes** if below the minimum directed proportion. _____, **No** if not	**Compare** A/B * 100 to minimum directed proportion Circle < = or >

Date_____ Assessed by:_____ Block number _____ v 2.4

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Other Questions

POTENTIAL SALVAGE Average DISPERSED basal area of acceptable windthrow plus dead = No threshold, simply a measure of potentially available volume and provide at right	
Estimated area equivalent of CONCENTRATED WINDTHROW =	
FOREST HEALTH Circle category - (Describe agent and issue)	L M H
SPECIES DIVERSITY change relative to prior stand increase (↑), decrease (↓) or none =	

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OPTIONAL ADDITIONAL INFORMATION - This section is provided to allow commentary on the stand conditions as it relates to the prescription. Use only if you have the information and knowledge (and expertise) to comment.

In your opinion, did the approach meet the objectives identified in the prescription?

- ID the prescribed management objectives and indicate if the objectives were valid as a rationale for the resulting stand structure (e.g., VQO, MPB, Cultural heritage – Other).

- Is a second pass planned (yes, no, don't know)

- Is a second pass feasible based on the value remaining and current logging costs? Would it benefit the timber objective?

- Were there any policy directives or site and stand conditions and limitations that promoted the approach taken?

General comments – are there future options available?

Opportunity to improve the results

Identify and comment on alternative approaches that could be undertaken (or could have been undertaken) that would improve the results.

Date_____ Assessed by:_____ Block number _____ v 2.4

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Appendix VI FREP Partial Cutting Timber Protocol Chronosequence up to 2008.

The FREP partial cutting timber protocol is a work in progress. The following provides a sequence of steps and changes that occurred as a result of field testing with input from District Staff. We would like to thank all those who provided input (see table A for a list of those who participated in the field testing). Unfortunately not all input was used in the present design as there were at times different opinions and in some cases we felt the need to keep things relatively simple, as comments often looked at specific examples, that made the procedure more complicated. The intent is to create a tool that gives you insightful answers using the right amount of data in an efficient fashion. These data are to be compatible with the Intensive approach if comparisons are desirable.

Table A Field participants and locations

Williams Lake, Gavin Lake – preliminary session August 9th 2007 – Gavin Lake		
Participant	Affiliation	Email
Pat Martin	Forest Practices Branch	Pat.Martin@gov.bc.ca
Al Powelson	Forest Practices Branch	Allan.Powelson@gov.bc.ca
Ken Day	UBC Research Forest Gavin Lake	Ken.Day@ubc.ca
Arrow Boundary, Kootenay, Columbia Lake September 19th 2007 – Rover Creek		
Kristine Sacenieckss	DKL	Kristine.Sacenieks@gov.bc.ca
Dean Christianson	DAB	Dean.Christianson@gov.bc.ca
Dave Brown	DAB	David.M.Brown@gov.bc.ca
Barb Wadey	DCO	Barb.Wadey@gov.bc.ca
Kevin Levalle	DCO	Kevin.Lavelle@gov.bc.ca
Dianne Miller	DCO	Diane.Miller@gov.bc.ca
Bob Richkum	DCO	Bob.Richkum@gov.bc.ca
Williams Lake, September 27th 2007 Gavin Lake		
Mike Pelchat	Quesnel FD	Michael.Pelchat@gov.bc.ca
Sam Davis	Mackenzie FD	Sam.Davis@gov.bc.ca
Kerri Howse	CCFD	Kerri.Howse@gov.bc.ca
Brad Powell	Quesnel FD	Brad.Powell@gov.bc.ca

Kathy Danchuk	Southern Region	Kathy.Danchuk@gov.bc.ca
Don Coombes	CCFD	Don.Coombes@gov.bc.ca
Coast, October 11th 2007 Tofino Junction,		
Rod Negrave	Vancouver Region	Roderick.Negrave@gov.bc.ca
Scott Dunn	Campbell River District	Scott.Dunn@gov.bc.ca
Pat Martin	Forest Practices Branch	Pat.Martin@gov.bc.ca

Steps in Creating the Prototype

The design of this protocol is a result of modifications based on field review and comments provided by the above participants. The original field form included all the factors used in the FREP Intensive Timber Evaluation. It was used to identify key questions. From the nine main factors from the intensive assessment, three main questions were identified that related best to the Provincial objectives to Timber.

The factors were fit into three main areas of interest:

- Site occupancy
- Change in value
- Harvesting of non directed species

From these main areas of interest, questions, indicator statements, assessment methods and thresholds were created. The questions evolved slightly but remained relatively consistent based on input from the various field sessions. There were minor wording changes; those with earlier versions of the protocol should now refer to the most recent version (V 1.8 October 22nd 2007). It is in the area of assessment methods and thresholds where user input provided useful direction resulting in significant improvements between versions.

Question A

> *Is growing space well-occupied by High Value, unimpeded crop trees of an ecologically suitable species, suitable minimum size, with no obvious risk of loss over the rotation?*

This question incorporated the original indicators (Martin 2007) 1, 2, 3 and 5. To ensure compatibility with the intensive evaluation methodology, a description of how the Routine Evaluation captures the elements of the Intensive Evaluation are provided as follows:

Intensive indicator 1 – Stocking relative to site potential. Captured by the assessment method for Question 1 Routine.

Intensive indicator 2 – Dead or down timber – Captured by trees identified as W – windthrown and those trees that are Crop Risker and circled. These data are used to answer the question on salvage opportunities.

Intensive indicator 3 – Timber at high risk – This is captured using the risker categories, both Crop Risker which has value now but a high likelihood of mortality in the next 20 to 40 years and Poor Risker, that has no value now and will not be standing in 20 to 40 years. These data are collected but not summarized; they are available for comparison with Intensive data if desired. Risker trees are not considered as impeding for understory growth as they are considered to be short lived.

Intensive indicator 5 – Overstory occupancy by poor trees – This is captured by using the Poor category. The poor BA data are tallied and used as a descriptor for site occupancy.

Question B

Is the stand maintaining or increasing in value due to the species composition?

This question addresses the various subsets of indicator 9 (Martin 2007). For this question two indicators were designed, one for the overstory and one for the understory. One of the Intensive Evaluation indicators was addressed as follows:

Intensive indicator 9 – Species composition –High Value species are tallied separately from those species that are considered ecologically suitable, but not high value. The information collected allows for summaries to address questions 9 a through d.

Question C

In cutblocks where harvesting is directed at a particular species, does the proportion of non-directed species exceed a minimum target?

This question addresses the Intensive indicator 4, harvest of non-Pl (Martin 2007). The present form of the question has been clarified from earlier versions as follows:

Intensive indicator 4 – Harvest of non-Pl – This is captured for all targeted species by the creation of the separate Directed Species category. It is used to answer question C.

Other Questions

A list of 'other' questions were added to capture information for the other factors outlined in Martin (2007) but not completely captured by the three main questions. In most cases the questions were challenging to find representative, reliable or feasible indicators (and thresholds). Therefore comments can be made on the question and further follow up could occur.

Data for some of the questions are available as part of the data collection procedure. For example: Was a significant dispersed salvage opportunity potentially missed? Trees that are considered as valuable but at high risk are tallied separately as is windthrow and could be used to quantify this factor. Additional information on concentrated windthrow is captured for the block as a whole allowing an informed comment on whether a potential salvage opportunity has been missed.

The Intensive indicator number six – Understory non-crop competition – is answered using a slightly modified approach using the concept of impeded versus unimpeded.

Intensive indicator 7 – Forest Health – Is captured by other question number 3 – What is the general perceived risk of further losses throughout the rotation from forest health concerns. This question has three categories and space for discussion.

Evolution of the Routine Assessment Method

A preliminary assessment method was presented in the field on August 9th. At each field session, participants had the opportunity to provide feedback and suggestions. After each session a revised version of the assessment methods and protocol were created to reflect their comments. In that way each new group had the most up to date version to work from. The following provides a brief chronology of the changes made to the original version and why.

Question A – site occupancy. The DFP procedure is the basis for the assessment with some modifications. Tree class categories evolved through feedback. The original categories were Good Fair and Poor along with Dead and Dead merchantable to C= **crop**, CR= **Crop-risker** P= **poor**, PR= **poor risker**, St= **stump**. These categories are then used to inform the DFP process (Crop only) and whether a tree is considered as impeding understory growth over the long term (non riskers). If there are enough poor trees above a threshold it is identified as specific category.

The criteria used to separate trees into the various categories borrows from the Cruising manual and Wounding and Decay Guidebook.. Suggestions on use of the Vegetation Inventory categories were suggested and contemplated, yet not used as they were seen as too detailed for the use of the data. If added categories were included in the protocol, to provide more detailed information on pathology and vigour, Vegetation Inventory categories would be useful. Application of specific information for what would become the “poor” and “risker” categories, and how to address “dead” trees evolved from discussions mostly with UBC and MFR staff at the Williams Lake session. These categories evolved even further at the Tofino session, where old growth cedar can have many characteristics that would indicate a “risker” with other species, and yet the cedar may persist for centuries.

Species information was originally collected by species. Input from Kootenay staff, where up to 19 species grow, suggested the simpler, High Value, Ecologically Suited and Directed Species Categories. The species in each category are listed for each site on the top of each form.

Thresholds for site occupancy had two significant additions from feedback. The first was to add in a Yes + category to account for performance that goes beyond expectations in

a positive fashion, a modification that evolved out of discussions with UBC Williams Lake staff. Additionally, a poor overstory modifier (-) was added after the Coastal session to account for the situation where the site is ether stocked in the understory or not but in either case there is a high proportion of poor quality overstory basal area left on site.

Information on relative understory growth was added after the first session to try and capture whether understory trees were growing or simply in a holding pattern.

Layout of the form evolved as well to allow for logical placing of summary data as well as reflecting the new categories. The final summary forms were designed to be sequential and self-guiding (would not have to refer back too often to the protocol).

Changes relating to Question B were made in each session. Each iteration reflected subtleties in choosing thresholds that made sense. The indicator has both an overstory and understory threshold, depending on the retained structure.

The question and indicator statement for Question C were modified from the earlier versions for clarity and simplicity.