

Protocol for Stand-level Biodiversity Monitoring

Steps for field data collection
and administration

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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 FRPA Resource 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 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.

In order to accomplish these objectives, FREP will:

- develop specific monitoring and evaluation questions to be addressed
- document the status and/or trends of resource values over time through the use of detailed protocols
- identify causal factors where the status or trend is found to be undesirable
- determine whether resource values are being managed in a sustainable manner through proven or alternative forest practices
- communicate the results of evaluations
- recommend changes to forest and range policies and legislation, where required.

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Document Purpose

The following protocol was created to provide background information and instructions for data collection for stand-level biodiversity resource stewardship monitoring under FREP.

Goal of Stand-level Biodiversity Monitoring

The goal of stand-level biodiversity monitoring is to determine if the present policy of retaining wildlife tree patches and riparian reserves is achieving the desired levels and types of structures to maintain species diversity. More specifically, this monitoring protocol is designed to answer the following question:

“Is stand-level retention providing the range of habitat with the structural attributes understood as necessary for maintaining the species dependent on wildlife trees and CWD?”

Objectives of the Monitoring Process

The objectives of the monitoring process are to:

- fairly quantify levels of stand structure attributes by BEC unit
- compare these data with known historical levels to determine what if any structures are lacking or significantly below expected quantities
- place the information into a landscape-level context to determine the significance of results.

Principles of Site Selection

A number of statistical design principles were used to develop site selection protocols for RSM. These principles ensure that the data collected and analyzed can be used at multiple scales (district, region, and province) with statistical validity and credibility.

The sampling population is the entire population of potential sites that could be sampled for a given resource value. To ensure the results are objective and defensible, all sites sampled under RSM will be selected using random sampling.

The number of sites sampled may vary depending on available resources (largely staff time and access dollars). Very large, very steep or rough terrain, or very diverse blocks will take longer to sample. Problems in accessing sites will likely mean more expensive travel options. The goal for the number of sites sampled per forest district is 15.

For additional information on the site selection process, refer to *Protocol for 2006 Resource Stewardship Monitoring* at http://www.for.gov.bc.ca/hfp/frep/7_rsm.html.

Site Selection Criteria for Stand-level Biodiversity for 2006

For stand-level biodiversity, each participating district is provided with a random list of 200 sites generated from the population of cutblocks that meet the selection criteria in Forest Tenure Administration (FTA). The list is located on the Forest Practices Branch FTP server at [ftp/hfp/mof_internal/publish/resourcestewardshipmonitoring](ftp://hfp/mof_internal/publish/resourcestewardshipmonitoring).

From the list of 200 sites, each district will begin at the top of the list and select 15 sample sites, working down in sequential order. Site selection criteria include:

- cutblocks harvested under the Forest Practices Code with silviculture prescriptions (SPs) approved after June 15, 1997. This is to ensure that SPs were prepared and forest practices were conducted under full knowledge of Code regulations and the principles and objectives for biodiversity management as described in the *Biodiversity Guidebook* and *Riparian Management Area Guidebook*.
- cutblocks greater than 2.0 ha in size (cutblocks less than 2 ha in size harvested under mountain pine beetle salvage may be monitored separately).

If a district completes sampling the first 15 blocks from the list and wishes to collect additional data, the next sites should continue to be selected sequentially from the random list.

Sites should only be removed from the list for very specific reasons, which must be recorded. If a site clearly does not belong to the population, it can be deleted. Questions regarding whether a site is in or out of the defined population should be referred to the Resource Value Team (RVT). For example, a site may be deleted from the population if active nearby harvesting or other activities in the block make it too dangerous to sample. If there are other reasons for considering deleting a site, these should be discussed with the RVT.

Allocate sufficient time to sample all blocks chosen to do in the year. These blocks may be sampled in any order. However, be careful not to miss blocks. Blocks must be sampled even if there are no wildlife tree patches noted on the site plan. Often, there is retention that is not noted on the SP and, even if that is not the case, zero retention is part of the population. Blocks must be sampled even if there are no streams on the block.

Definition of the Term Stratum/Strata (pl)

Stratum: *One of a number of layers, levels, or divisions in an organized system*
(Source: www.dictionary.com)

In order to facilitate efficient sampling of the cutblock, it will need to be divided into a number of strata. The strata will include each of the reserves and the harvest area. For example, a 32-ha cutblock with two 1-ha wildlife tree (WT) reserves and one riparian management area would have four strata. Each reserve area and the harvest area would be considered individual strata.

A 70-ha cutblock with two 4-ha wildlife tree (WT) reserves, 10 ha of uniform dispersed retention (approximately 10 stems per ha), and another 15 ha of dispersed retention at 75 stems per ha has five sample strata: two strata in the WT reserves, two strata in each of the different dispersed retention areas and one in the clearcut. Why not treat the dispersed retention area as a single stratum? The problem is deciding on a single fixed-area plot radius. If a 50-m plot radius was chosen in the 10 stem per ha area, one would expect to get between seven or eight trees in the plot. That same fixed-area plot in the 75 stem per ha stratum would result in 58 to 59 trees being included in the plot. By defining two separate strata for the dispersed retention, it is possible to use two different fixed-area plots and meet the sampling objective of between 6 to 10 trees per plot. Ideally, these strata would be designed prior to going into the field, which may be possible if good post-harvest aerial photography is available. If this is not possible, the assessors may have to define the area in the field, being careful to clearly mark the stratum on the map (Figure 1) and include the stratum area on the Stratum Summary card (Form B).

Standard Unit Treatment Summary			
	SU1	SU2	Total
Reserve			17.5
NAR*	45	11.2	56.5
Gross			74.0
External reserve			5.0

* Net area to be reforested

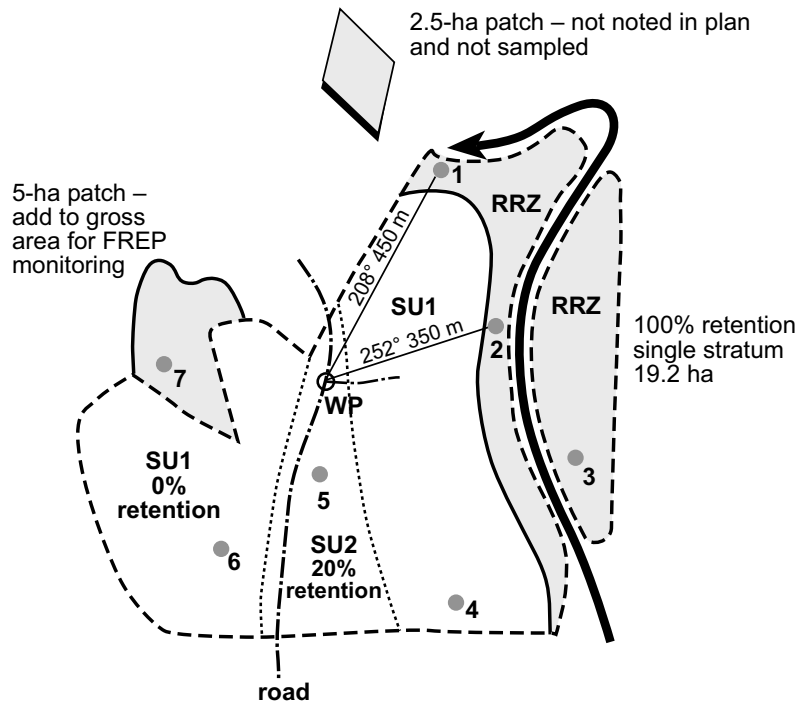


Figure 1. Example map showing strata definition.

Indicators

The indicators used to assess stand-level biodiversity include:

- tree species and size (height and diameter)
- WT classes 1 and 2 (live trees), and 3+ (standing dead trees)
- invasive plants
- amount and type (size, species and decay class) of coarse woody debris (CWD)
- amount of windthrow
- harvesting constraints and ecological attributes used to anchor retention.

Getting Started: Required Equipment and Information

Both office and field procedures are provided in this document. What follows are the required plans, maps, and equipment that will be used to collect the information in an effective and efficient fashion.

For each randomly selected block, you will require:

- a site plan map, silviculture prescription map, or post-harvest map of the site showing retention areas, standard units (SUs), and BEC information. The map should be of suitable quality to be used in the field and preferably waterproof.
- a site plan or silviculture prescription (optional).
- air photos/orthophoto (optional).

For field sampling, you will need:

- prisms appropriate for local conditions – suggested range of prisms 4 BAF to 10 BAF (to bring in about 6 trees in a sweep)

Note: Use only one prism BAF per reserve stratum (e.g., BAF 6).

- compass
- diameter tape
- diameter stick (optional) – with centimetres marked off
- 30-m tape
- clinometer
- calculator
- laser range finder or instrument such as the Vertex (optional – but highly recommended)
- flagging tape and marking pen
- tree marking spray paint for marking trees and CWD
- GPS
- increment borer (optional)

- binoculars (optional)
- camera
- clipboard or field binder to hold field forms
- field forms (FS 1244-A1, A2, B1, B2, C1, C2, D1, D2) and a copy of this protocol.

General Office Procedures

1. Select cutblocks sequentially from the random list provided.
2. For each cutblock, collect the post-harvest map and access information, and if available, the orthophotos, aerial photos, and site plan (or silviculture prescription).
3. Prior to heading into the field, randomly choose plot locations and mark them on the map. The suggested technique is to place an appropriate scale dot grid over the site map.
 - a. *Patch*: Randomly pick one dot per hectare of reserve patch and mark the plot location(s). Record the distance and bearing from an obvious feature (e.g., SW corner of the group, or where a particular creek enters the block) to be used to locate the plots in the field.
 - b. *Harvest area*: Randomly locate three plots in the harvest area (may be dispersed retention or clearcut). Harvest area plots are established to assess any dispersed retention and coarse woody debris. Very large cutblocks (>100 harvest area) will require more harvest area plots (e.g., 5 plots per 100 ha).
4. Fill in the opening identification section of Form C (Section 11) and the header information for the anticipated number of plot cards (Form A) and stratum summary cards (Form B) as necessary for the particular block. Number all plots consecutively, regardless of stratum, starting with 1 for each new block. The important thing is not to duplicate plot numbers in a cutblock.
5. Fill in a Stratum Summary card (Form B – or Section 16 on Form C) for each stratum even if there is no intent of establishing a plot in the field. This will ensure basic information, such as reserve size and type, will be included in the analysis for every reserve and allows for the correct calculation of percent area retention.

Suggested Number of Plots in Post-harvest Cutblock

The number of plots to establish is based on the retention strategy and the cutblock size. You should establish 1 plot per ha of patch retention, up to a maximum of 5 plots per patch and at least 3 plots within the harvest area.

One of the objectives is to accurately assess the retained stand structure (tree species, size, wildlife tree class, and CWD). Analysis of the 2005 stand-level biodiversity data indicates that to obtain a reasonably accurate estimate of tree structure, we should collect data on between 40 to 60 trees per cutblock (average 6 trees per plot thus 6 to 10 plots). Similarly for downed structure (CWD) approximately 90 m of transect per 20 ha of gross cutblock area (inclusive of plots established both in harvest and retention areas). Time

and stand structure variability also need to be considered. If the retention is homogeneous, it may be acceptable to reduce the number of plots where time is limited.

If there are multiple strata in the harvest area, it may not be necessary to establish three plots in each harvest area strata. Consider the suggestion of trying for an average of 90 m of CWD transect/20 m of gross cutblock area, factoring in the metres of CWD transect that will be established in the patch retention areas.

The following table outlines the intensity of sampling for six different scenarios that will ensure we meeting the objectives of the stand-level biodiversity.

Description of retention	# of plots in cutblock	Discussion
60-ha homogenous cutblock. No trees >12.5 cm DBH retained.	<ul style="list-style-type: none"> 3 randomly located plots in the harvest area. 	In this cutblock, you will not achieve the ideal 40 to 60 sample trees. To achieve the ideal CWD sampling you would need 9 harvest area plots, but because the harvest area is homogenous, 3 plots should be sufficient. How do you tell if it's homogeneous? A visual overview and knowledge of harvest methods.
40-ha cutblock with evenly distributed dispersed retention (approximately 6 trees per ha), no patch retention	<ul style="list-style-type: none"> 3 randomly located fixed-area plots in the dispersed area. 	Full count would take too much time for limited benefit. Three fixed-area plots should adequately characterize relatively uniform retention.
60-ha mixed wood cutblock with variable density dispersed retention and no patch retention. No easily defined strata.	<ul style="list-style-type: none"> 3 randomly located CWD transects. Establish a full count area that is easily defined (so area can be estimated). 	Conducting a full count for the entire harvest area would not be practical. Fixed-area plots would be too large to be practical. Establishing one smaller full count area with an easily defined area will allow extrapolation to the entire harvest area.
25-ha cutblock with a 1.3-ha WTP	<ul style="list-style-type: none"> 1 randomly located plot in patch retention. 3 randomly located plots in harvest area. 	This conforms with the one plot per ha in patch and 90 m of CWD retention.
158-ha Mountain Pine Beetle cutblock with 35 ha of retention. Two 14-ha patches and 12 smaller patches.	<ul style="list-style-type: none"> 8 randomly located plots in the harvest area. 9 randomly located plots in the patch retention. 	Relatively uniform pine stand allows for a reduced number of plots. You have determined it is uniform from the aerial photos and on block overview. Establish 3 plots in each of the 14-ha WTPs. Randomly select 3 of the smaller patches to sample. Ensure reserve summaries are done for all of the patches. In the harvest area, establish 6 plots randomly in the 123 ha of harvest area.
36-ha cutblock with one 2.6-ha WTP and 7 ha of RRZ. Plus evenly distributed (50 stems per ha) dispersed retention in the harvest area.	<ul style="list-style-type: none"> 3 randomly located plots in WTP and 5 randomly located plots in RRZ. 3 randomly located plots in dispersed retention. 	Conforms to the strategy. Dispersed retention plots will likely be fixed area (possible prism plot depending on tree size).

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 guide plot establishment.

- Safety is paramount; if your plot(s) cannot be safely accessed (e.g., steep 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.

Using the GPS Unit

The GPS hand-held unit is a great tool when there is adequate satellite reception. When you have open canopies, open ground, and good satellite reception, the following process works for field-locating your plots.

Find a central access point in the cutblock that has a mapped control (e.g., a road junction). Confirm that this location is positionally true by taking 2 or 3 range finder shots to identifiable reference points (e.g., another road junction, creek crossing, visible F/C, corners of WTR, etc.) and confirm that the junction is relatively correct. If it is not, find an alternate access point.

Using the GPS, establish the access point to be a “WAY POINT” (WP). Locating plots using a GPS hand-held can be accomplished using steps 1–7.

For those using the Garmin GPS 60 hand-held unit, the following steps are used.

- STEP 1:** Turn on the unit. Hold the GPS unit upright (the antenna will get better reception). Let the unit acquire satellites and wait until the location coordinates are $<\pm 10$ m (top of screen).
- STEP 2a:** Press “mark,” then toggle left to select “Avg;” press “enter” and wait until the “estimated accuracy” is below 10 m or there are 100 measurement counts.
- STEP 2b:** Press “enter” to save this location as a WP location. Record this WP number (seen at the top of the screen) on your map access point location.
- STEP 3a:** Using a scale, draw radial transects for the WP to each of the mapped plots. Measure the distance from the WP to the plot and record this distance for each transect. Be sure to verify the map scale.
- STEP 3b:** Using a protractor or your compass, determine the compass bearing from the plot to the WP, and record this for each transect (see Figure 1). Now you are ready to go to the plots. You can “project WPs” for each of your plots, or work “backwards” from your initial WP as described below.

- STEP 4:** Orient yourself towards the plot you seek and begin your hike to the plot. Press “find,” select “waypoint” with toggle, press “enter,” and now select the applicable WP using the toggle; press “enter.” Select “go to,” press “enter.” The GPS unit will now guide your position relative to the WP.
- STEP 5:** Head towards a plot and track your progress on the GPS screen – the bearing and distance readings should equal the mapped transect information for the plot. Hold the GPS unit upright in order to get better reception. You have arrived at the plot the moment the bearing and distance equal the plot’s position from the WP.
- CAUTION:** Be sure to watch your footing and be aware of your surroundings as you walk and monitor the GPS screen.
- STEP 6:** At the plot, tie flagging tape to a stick to mark the plot centre. Tie a length of flagging tape to a secure branch above 1.3 m (this helps in relocating the plot). Remember to record RSM plot details on the flagging tape.
- STEP 7:** Determine the UTM co-ordinates for this plot:
- Select “mark.”
 - Select “Avg,” then press “enter.”
 - Wait until “estimated accuracy” is below 10 m or 100 measurement counts.
 - Record the UTM co-ordinates displayed.
 - You can select “quit” to avoid creating a WP for this plot; or select “enter” to create a WP for this plot (in case you need/want to find this plot again).

Once you have finished the plot work, use your GPS to find the next plot by repeating steps 4–7.

At the end of the day, return to your access point (where you parked your vehicle) by using step 4 to return to the WP. The Garmin GPS 60 has a compass that will guide your return route to the WP.

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 RSM plot on flagging tape.
- Measure at least one height and diameter per plot to calibrate; likewise measure one length and diameter per 30-m CWD line transect. Record measured trees and CWD to one decimal place. Estimates should be recorded without a decimal.
- Use only one measurement type and plot size (i.e., prism, fixed area, or full count) per stratum (see section on stratification).

Prism Plots

- Prism sweeps should be done in patch areas or areas of dense dispersed retention.
- Target is 6–10 trees per plot. Use this target number of trees to select your BAF.
- Standardize the way in which prism sweeps are done. Paint or mark the first tree measured and sweep your prism clockwise.
- For prism plots, use the same BAF within a stratum (reserve).

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 (see Table 1). For example:

- prism BAF = 4 (has a plot radius factor of 0.25)
- DBH of largest tree = 45 cm
- $LD = PRF \times DBH = 0.25 \times 45 = 11.25 \text{ m}$.

Shift the plot perpendicular from the edge so that the plot centre is now 11.25 m from the stratum edge.

Table 1. Table showing plot radius factors $PRF = \frac{1}{2\sqrt{BAF}}$

BAF	PRF	BAF	PRF
1	.500	11	.151
2	.354	12	.144
3	.289	13	.139
4	.250	14	.134
5	.224	15	.129
6	.204	16	.125
7	.189		
8	.177	18	.118
9	.167		
10	.158	20	.112

Full prism plot cannot fit in narrow stratum

A very narrow stratum, such as a riparian reserve zone, may not be wide enough to allow for a complete prism plot, even if it is moved to the centre of the stratum. In that case, follow the MoFR *Cruise Manual* procedure for establishing a border plot (<http://www.for.gov.bc.ca/hva/manuals/cruising/pdf/CH3.pdf>).

Plots which are located on or adjacent to timber type lines or harvesting boundaries inside the sample area, are split through the plot centre parallel to the type line. The trees inside the sample area are recorded and the plot recorded as a B for border or half plot.

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: $LD = PRF \cdot DBH$.

For example, when using a prism with a BAF of 4, the PRF is 0.25. If you have measured a 30-cm tree, it must be within 7.5 m from the plot centre to be in ($0.25 \cdot 30 = 7.5$). If the distance to the pith of the tree is >7.5 m (at 1.3 m DBH), it is out.

Fixed-area Plots

- For strata with very low retention levels, conduct a fixed-area plot (e.g., 15 trees per strata).
- For fixed-area plots, a 30-m radius is recommended. When adjusting this radius to try to achieve the target number of trees, go up or down in 5-m increments to a maximum of 50 m and a minimum of 15 m.

- Use the same plot radius for all plots within a given stratum (reserve).
- Paint or mark the first tree measured and sweep your fixed-area plot in a clockwise fashion.
- If a plot lands on the border of the stratum, move the plot so that it is fully within the stratum. Moving a fixed-area plot is done by relocating the plot centre in a perpendicular direction from the stratum edge so that the plot centre is now 1 plot radius distance from the edge.

Full Count Area

Entire area of stratum

- This method is suitable in a stratum with a very low density of trees.
- The stratum area will typically be the full area of NAR, or the full area of one or more SUs which make up the stratum. If more than 20 or 30 trees are likely to be counted, consider another method to get a smaller tree count.

Subset of stratum area

You may do a full count of a representative subset of the total stratum area. Choose an easily recognizable area in which you can obtain a full count of all trees and an area estimate. Only one full count area is allowed per stratum. If possible, put all the tree data on the stand table of the first plot (Form A) in that stratum. Whenever the full count area is smaller than the total stratum area, the data will be extrapolated to the full stratum.

Stumps and Stubs

Stems are generally to be tallied in a plot if they are taller than 1.3 m (breast height) and with a DBH of 12.5 cm or greater. Stubs and high stumps could fall into that size category. High stumps from first pass logging or winter logging may add some biodiversity value to a block. However, this value is usually minimal compared to full size trees. Stubs are purposefully made at time of harvest to enhance biodiversity. Stubs may have marginal value as habitat if they already have heartrot established. If stubs occur in regular prism or fixed-area plots, tally them with a comment noting they are a stub. However, don't bother doing a full count of stubs – that time would be better spent doing another retention plot, or getting home earlier. In summary:

- Do not tally high stumps.
- Tally stubs found in prism or fixed-area plots – do not do a full count of stubs.

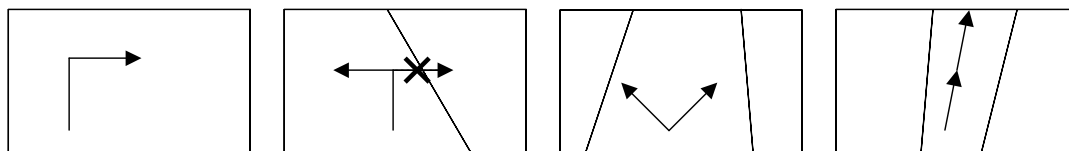
CWD Transects

Data collected for CWD include species, diameter, length, and decay class. Only diameter is used in the line transect equation to calculate volume. Length is collected as a qualitative indicator for CWD – long pieces are generally better for habitat and decay slower. Knowing the species and decay class of the wood helps in an assessment of diversity of CWD, and overall decay rates.

- A CWD line transect is established from each plot centre.
- Establish the first 15-m leg and record the bearing.

General rule for direction (to avoid bias):

- First choice is to continue the bearing from last plot, point of commencement, or WP.
- If the transect extends out of the stratum, add 90°. If that still takes you outside the stratum, go to options 3 or 4 shown in the Figure 2.
- The second leg is at a 90° angle additive from the first bearing, as long as that keeps you within the same stratum. If not subtract 90°. The purpose of the 90° angle is to avoid bias in sampling. For example, CWD resulting from yarding or from windthrow can be oriented predominantly in one direction. A transect along that orientation may pick up very little CWD, but by having half of the transect at a right angle, the probability of this type of error is reduced.
- Paint the CWD pieces at the point where they are crossed by your transect, or flag the end of each of the two 15-m transects.
- If the transect extends outside of a stratum, this leg of the transect must be repositioned so that it is fully within the stratum. If both of the perpendicular directions extend outside the stratum, try establishing both transects perpendicular from the plot centre. And if this does not work, make a single 30-m transect. Record your results on the field card including how you established the anomalies.



1. Normal CWD line transect – continue direction from previous plot or initial WP then turn 90°.
2. Turn transect opposite direction to remain in stratum.
3. Establish both legs from plot centre if necessary to fit in stratum.
4. In a very narrow stratum, establish both legs in line.

Figure 2. Locate CWD transect within the stratum.

CWD and piles

If your random location ends up on a pile, it should be tallied unless it will be removed or burned. Safety is paramount so do not climb over piles with any risk of shifting. Estimate the data for all logs falling under your line transect. In the case of large piles, make a trade-off against time on the block and data collected. For large, fairly uniform piles (where time is limited), it is acceptable to measure a portion (e.g., 50%) of the line transect that is on the pile, and pro-rate the data (i.e., double the data if only 50% of the line was measured).

For large piles where it isn't possible to safely and accurately determine sizes, it may be quickest to keep a running tally of logs in various species groups/diameter classes and length classes. Often wood in such piles is consistently decay class 1. This can then be summarized onto Form A Side 2. The following is an example:

Pile summary	<2 m			2–6 m			7–11 m		
	Cw	Fd	Dr	Cw	Fd	Dr	Cw	Fd	Dr
12–20 cm						///			///
20–30 cm				////			//	###	
30–40 cm		### /							

Log #	Spp.	Decay Class	Dia. (cm)	Length (m)	Comments
1–6	Fd	1	35	1	Start of pile
7–10	Cw	1	25	4	
11–13	Dr	1	16	4	
14–15	Cw	1	25	9	
16–20	Fd	1	25	9	
21–23	Dr	1	16	9	End of pile
24	Fd	2	22.5	4.3	
25	Dr	2	17	3	

Block Stratification

Plots are located randomly within each stratum and only a single sampling technique (i.e., prism, fixed-area plot size, full count area entire stratum, full count area subset of stratum) can be used within a single stratum. Therefore, it is important to first understand what constitutes a stratum. Here are a few points to keep in mind when considering the patch retention mapped for a cutblock:

- All patch retention internal to the harvest boundary is considered part of the cutblock.
- Patch retention external but contiguous, or external and non-contiguous, with the harvest boundary is considered part of the cutblock *if* it is acknowledged as such on the SP or post-harvest map. If it is not acknowledged as associated with the cutblock, do not sample it, as it may be retention related to adjacent or future cutblocks.

- Patch retention may be considered part of the cutblock, but the patch area is not included in the gross area indicated on the SP map. If this is the case, the patch area needs to be added into the gross area noted on Form C, Section 11. Therefore, gross area noted on Form C will be larger than the gross area noted on the SP.
- Even if a road splits up an area of retention, it is considered one retention patch (one stratum ID and one summary). Sample it as such.
- If the SP map shows two patches which are contiguous (e.g., a WTP immediately alongside a RRZ), consider these as one stratum (a single patch). This ensures that the correct patch size (i.e., sum of area for contiguous patches) is recorded on the stratum summary. If the two areas within the single patch are very distinct timber types, and this is not reflected in the plot data, please comment on this in the stratum summary (Form B).

The variability in dispersed retention can cause problems when choosing the type of plot to establish for the tree count. For example, a 30-m fixed-radius plot in one area of the dispersed retention may pull in a reasonable tree count (6–20) while the same 30-m plot elsewhere may end up with a very high tree count. If possible, pre-stratify the dispersed retention area using aerial photos to identify significant variation in tree density. If that isn't possible, stratify areas of dispersed retention in the field (do not do this for patch retention) in order to utilize an appropriate (efficient) tree count methodology. However, each time you switch plot types you must designate the dispersed *stratum area* it applies to by filling out a Form B. In this way, the appropriate weighting can be applied during data analysis.

Note: This stratification of dispersed retention areas is intended to encourage efficient tree count methodology. It is not intended to force 3 plots within each dispersed stratum. The same “rule of thumb” for plot numbers in the harvest area applies regardless of the number of stratum in harvest/dispersed areas (i.e., 3 plots in the harvest area, increasing to 5 plots per 100 ha for larger cutblocks).

Logic for Use of Section 16: When is it acceptable to not sample a patch?

There are cases – one of them being a multitude of very small variable retention patches made up of essentially the same timber type – where it is not likely worth the time to plot each one of a number of similar patches. However, it is always necessary to confirm the existence and approximate size of each patch. Hence Section 16, which is essentially an abbreviated form of the stratum summary (Form B). The purpose of Section 16 is to save on using multitudes of stratum summary pages. The ecological anchors listed in Section 16 are limited to those that you might see when observing the patch from a distance (i.e., those that could stand out from the canopy). It is your choice whether to use Form B (and note “zero” plots in stratum) or Section 16 of Form C.

It is acceptable to not sample a patch when your other observations tell you it is homogeneous with what you've already seen, and time is a critical factor. Where access is an issue (e.g., long or difficult access), a level of professional judgement needs to be made regarding the number and choice of strata sampled versus the time and cost

of returning for a second field day. A stratum summary must be done for each stratum regardless of whether they are sampled.

Stratum ID: Why we need to standardize

The format for stratum ID has been standardized at a maximum of five characters – zero to three alphabetical characters followed by zero to two numeric characters with no spaces between (e.g., WTP1, RMZ2, VR, VR1, NAR, SU1). Since it is essential to have identical identification linking all plots in a stratum, this standardized approach will help to stifle creativity and improve the odds of the same identification being moved forward on all plot cards and onto the stratum summary. Each stratum in a cutblock must have a unique identifier using this standardized approach.

Stratum Type: What is it anyway?

The allowable coding ID for stratum type is shown on Form B, Section 8. It is a two-letter code.

- **CC** stratum type = clearcut – a stratum with no trees greater than 12.5 cm DBH.

Retention Areas

First letter

First letter designations for retention areas are:

- **P** = patch reserves – no harvesting in the stratum (other than removal of trees from patch likely done for safety reasons).
- **D** = dispersed retention reserves – harvest occurred in the stratum and there are trees larger than 12.5 cm dbh.

Second letter

Second letter designations are:

- **T** = temporary, if there is a plan to harvest the retention prior to rotation end. Retained dispersed trees in a commercial thinning operation are considered temporary.
- **R** = riparian, a rotational reserve if there are any riparian (either RRZ or RMA) in the stratum.
- **W** = wildlife tree, a rotational reserve if the SP or SP map note a wildlife or biodiversity purpose for the retained trees.

Required Accuracy

Field assessors should measure one (or more if you are not comfortable estimating) tree diameter and height per plot. These measured trees should be recorded to one decimal place of accuracy. The remainder of the trees in a plot can be estimated. Estimated trees should be recorded with no decimal place. The amount of measurement that is required

can be monitored by occasionally checking your own estimates. Estimates should be within 10% of actual size.

Acceptance of estimated data is appropriate for RSM monitoring as the data will be lumped into diameter and height classes. During the pilot testing of this procedure, an attempt was made to have tree data collected categorically. We found that, in order to place trees in the appropriate categories, field assessors needed to estimate height and diameter. It was felt that since that work was being done anyway, the complete data should be collected. If different category limits are required, the data can be re-analyzed.

Innovative Practices

Innovative – ahead of the times... something new or unusual.
(Source: www.dictionary.com)

This section of the field forms is intended to record new or unusual practices that, in the opinion of the evaluator, would be beneficial to biodiversity. As a result of the evaluators collecting this information, it will be possible to identify new or unusual practices that are being implemented in various areas of the province. This may lead to more specific evaluations of a particular practice to determine effectiveness and ultimately to extend this information to practitioners.

Evaluator Opinion

This section is meant to provide a check against the data collected. It is not the conclusion for the cutblock. During the design of this routine assessment, it was recognized that assessors' opinions of how well they feel the cutblock did at retaining stand structures and representing stand conditions could provide valuable feedback to the assessment model. If, for example, the assessment model consistently places cutblocks in the high risk category when the assessors feel they are well done, the assessors' rationale may provide insight into data that should have been collected or a way in which the data might be interpreted differently.

Assessors should ask the questions:

- How well did this cutblock do at retaining the types of stand structural attributes that existed prior to harvest?
- How well does the retention represent the stand conditions present in the area?
- Is the retention distributed in a way that will be beneficial to biodiversity?

Filling in the Field Forms

This section will lead you through the process of filling out stand-level biodiversity RSM forms (FS 1244 A, B, and C).

Section

Instructions/Descriptions

Plot Information

Form A Side 1

[illegible]

1 Plot Identification

Page ____ of ____ – fill in if multiple pages are used for a single stand or CWD table (e.g., page 1 of 3).

Date – date of assessment (year/month/day).

Opening ID – numeric identification from the RESULTS database.

Assessed by – names or initials of assessors.

Plot # – unique plot identification number (start at 1 for each new cutblock).

Stratum ID – unique ID code (maximum of 5 digits – zero to three letters followed by zero to two numbers, with no spaces).

Stratum Type – reserve code from Form B Side 2.

UTM – for plot centre.

2 Plot Information (trees)

If *No Trees* in plot area – tick “No Trees” box.

Fill in **one** of:

BAF – record basal area factor.

Fixed area radius – record radius in metres (15–50 m, recommended 30 m).

Full count – record area (ha) to which full count applies (note if the full count area is smaller than stratum area, the data will be extrapolated to the entire stratum area). Only one full count area allowed per stratum.

3 Stand Table

Tree # – number each tree in plot.

Spp. – record tree species using codes on Reference Form – Side 2 (FS 1244-D2). Record to species if accurately known (e.g., Py), otherwise to genus (e.g., P).

WT Class – record wildlife tree class using codes on Reference Form – Side 1 (FS 1244-D1).

DBH (cm) – diameter in cm; include a decimal place if measured.

HT (m) – height in metres; include a decimal place if measured.

Comments – record comments on individual trees. Any general comments on plot should be included on the strata summary (Form B Side 1).

Section

Instructions/Descriptions

Plot Information Form A Side 2



FRPA Resource
Evaluation Program

Stand-level Biodiversity
Resource Stewardship Monitoring
Plot Information – Form A Side 2

4 Plot Information (CWD)					Stratum ID _____	Plot # _____
Course Woody Debris (30 m transect)					No CWD in transect ☐	
					1st Leg _____° 2nd Leg _____°	
Log #	Spp.	Decay Class	Dia.* (cm)	Length* (m)	Comments	

FS 1244-A2 HFP 2006/03 * Decimal place means measured

4 Plot Information (CWD)

Transfer *Stratum ID* and *Plot #* from front of card, in case cards are photocopied and dropped.

No CWD in transect – tick box if no CWD found on transect; if CWD found, record in table provided.

1st Leg and *2nd Leg* (a transect “leg” is 15 m) – record compass bearing of the transect. This is to help relocate transect for mentoring or auditing.

Log # – number each piece of CWD on transect that is ≥7.5 cm diameter and CWD classes 1–4; see Reference Form – Side 2 (FS 1244-D2)

Spp. – record CWD species using codes on Reference Form – Side 2 (FS 1244-D2). Record to species if known, if not to genus or unknown (e.g., in order of preference Hw, H, Xc or Xd, X).

Decay Class – record CWD decay class using codes on Reference Form – Side 1 (FS 1244-D1) for CWD classes 1–4.

Dia. (cm) – diameter in cm; record decimal place if measured.

Length (m) – length in metres; record decimal place if measured.

Comments – record any comments on individual piece of CWD. General comments on plot should be recorded on the stratum summary Form B Side 1.

Section

Instructions/Descriptions

Stratum Summary Form B Side 1

 **BRITISH COLUMBIA** FRPA Resource Evaluation Program Stand-level Biodiversity Resource Stewardship Monitoring Stratum Summary – Form B Side 1

5 Stratum Summary (one card per Stratum)

Date _____ Opening ID _____
 Assessed by _____
 Stratum ID _____ Stratum type _____
 # of plots in stratum _____ Mapped Stratum size (ha) _____
 BEC subzone variant and site series _____

Stratum location and size consistent with map? Yes ☐ No ☐ Not mapped ☐
 If 'no' or 'not mapped', estimated size (ha) _____

Tick one of: Harvest area with no retention ☐ Harvest area with dispersed retention ☐
 Patch Reserve ☐

6 Patch/Dispersed Summary

Estimated age of oldest trees in reserve (other than Vets) _____

Patch location: Internal to block ☐ Edge of block ☐
 External/not touching block ☐ N/A ☐

% of total trees in reserve windthrown: < 5 ☐ 5–15 ☐ 16–30 ☐ >30 ☐
Distribution of windthrow: Edge ☐ Internal ☐ N/A ☐
Windthrow treatment: Feathering ☐ Topping ☐ None ☐ Other _____

7 Reserve Constraints	% of reserve	Ecological Anchors	stratum estimate
Wetland		Bear Den	stratum count
RMZ		Hibernaculum	stratum count
RRZ		Vet tree/ha	0, 1-10, 10-20, etc.
Rock outcrop		Mineral lick	stratum count
Non-commercial brush		Large stick nest	stratum count
Non (or low) merch timber		Cavity nest	stratum count
Sensitive terrain or soil		Large hollow tree	stratum count
UWR		Large witches broom	stratum count
WHA		Karst feature	Y N
OGMA		Largest tree for site (not Vets)	Y N
Recreation feature		CWD heavy natural concentration	Y N
Other: _____		Active wildlife trails	Y N
		Active WLT/CWD feeding	Y N
Total constrained		Uncommon tree species	Y N
		Other: _____	
None	☐	None	☐

Comments: _____

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5 Stratum Summary

Date – date of assessment (year/month/day).

Opening ID – numeric identification from the RESULTS database.

Assessed by – names or initials of assessors.

Stratum ID – unique plot ID number; must be **identical** to stratum ID used for plots within the strata (maximum 3 letters plus 2 numbers).

Stratum Type – as recorded on Form A Side 1.

of plots in reserve – record the number of plots established in the stratum.

Mapped stratum size – record stratum size from RESULTS or harvest map; note that all non-contiguous patch retention is a separate stratum.

BEC subzone variant and site series – record as per site map; please change if reserve is obviously a different variant or site series from the harvest area.

Stratum location and size consistent with map? – tick either yes, no, or not mapped. If not consistent, or not mapped, record the estimated size in hectares.

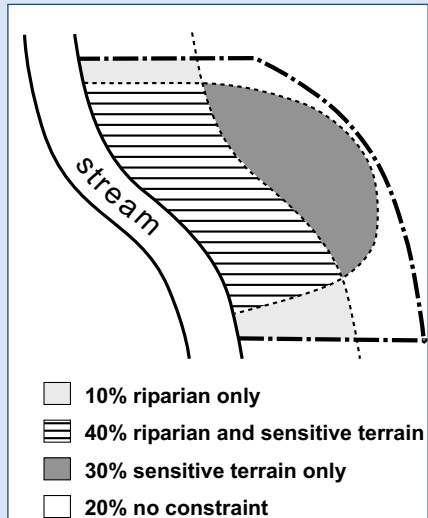
Tick one of:

Harvest area with no retention – tick this box if harvested area contains no trees >12.5 cm dbh.

Harvest area with dispersed retention – tick this box if harvested area contains dispersed retention >12.5 cm dbh.

Patch reserve – tick this box if the area is a designated patch reserve.

Only Section 5 is filled out for a clearcut (CC) stratum.

Section	Instructions/Descriptions
<p>Stratum Summary Form B Side 1 (cont.)</p>	<p>6 Patch/Dispersed Summary</p> <p><i>Estimated age of oldest trees in reserve (other than Vets)</i> – use pre-harvest inventory label, local knowledge, or bore the tree. Confirm approximate age through field verification – occasional coring of trees, or counting the rings on stumps.</p> <p><i>Patch location</i> – tick the appropriate box identifying the location of the reserve or dispersed area. If any part of the patch touches the external harvest boundary, it should be considered on the edge of block.</p> <p><i>% of total trees in reserve windthrown</i> – tick the box closest to the estimated windthrow level. Tick one or two boxes indicating the distribution pattern of windthrow. Identify any observed or known windthrow management treatments. Collect this data for both patch and dispersed retention.</p> <p>Estimate the windthrow impacts based on the number of stems affected (dominant and codominant). Basically, we want to know if windthrow is impacting the features retained for biodiversity: whether lots of blocks are affected; whether the windthrow impacts are edge, or internal, or throughout. Overall, what % of retained trees was affected by wind.</p>
 <p>10% riparian only</p> <p>40% riparian and sensitive terrain</p> <p>30% sensitive terrain only</p> <p>20% no constraint</p>	<p>7 Reserve Constraints and Ecological Anchors</p> <p><i>Reserve constraints</i> – consider if the area would be part of the productive land base if it was not a reserve. Record the % of the reserve that is affected by the identified constraint. This may add up to >100% (e.g., 50% riparian + 70% sensitive terrain), as constraints can overlap. In this example, if 80% of the riparian is also sensitive terrain (4/5 overlap so 10% of the area is constrained by riparian alone, 40% by riparian and sensitive terrain, and 30% sensitive terrain alone), there is a total constraint of 80%. The total recorded needs to be the total proportion of the stratum that is constrained (e.g., 80%) NOT the sum of all constraints.</p> <p><i>Ecological anchors</i> – for a “stratum count” – record the number of times you observed the indicator in the stratum. For vet trees, give an estimate of category for stems per ha of the stratum. Several indicators are just presence or absence (i.e., circle Y [Yes] if at least one instance of the indicator or N [No] if you do not see any incidences). An example of “other” ecological anchors would be a culturally modified tree. Check the “none” box if there are no anchors.</p>

Section

Instructions/Descriptions

Reserve Codes/Plot Guidance Form B Side 2



FRPA Resource
Evaluation Program

Stand-level Biodiversity
Resource Stewardship Monitoring
Reserve Codes/Plot Guidance – Form B Side 2

8 Stratum Type Codes	
PR	Patch riparian Treed patch left within a riparian management area. Use riparian designation regardless of patch being classified as a WTP on site map.
PW	Patch wildlife Treed patch left outside of RMA and designated as a wildlife tree patch.
PO	Patch other Tree patch left outside of RMA for purpose other than PR, PW, and anticipated to remain for the full rotation.
PT	Patch temporary Treed patch that will likely be harvested before rotation end (e.g., indication on map that this is a temporary deferred area).
PU	Patch unidentified A patch found in the field but not mapped. No indication on map regarding patch purpose and patch not in a RMA.
DR	Dispersed riparian Dispersed trees left within a RMA. Use riparian designation regardless of other coding from map.
DW	Dispersed wildlife Dispersed trees left outside of RMA and designated as wildlife trees.
DO	Dispersed other Dispersed trees left outside of RMA for purpose other than DR, DW, and anticipated to remain for the full rotation.
DT	Dispersed temporary Dispersed trees that will likely be harvested before rotation end (e.g., indication on map that trees are left as part of a commercial thin or shelterwood).
CC	Clearcut Zero retention in stratum.

9 Guidance for plot establishment (trees)	
	<ul style="list-style-type: none"> For stratum with very low retention levels, do a full count (e.g., < 15 trees/stratum). Target tree/plot is 6–10 trees. For fixed area plots, 30 m radius is standard. When 30 m radius fixed plot needs to be adjusted, go up or down in 5 m increments to maximum 50 m, minimum 15 m. For Basal Area plots or fixed area plots, use same BA or plot radius for all plots in stratum.

10 Guidance for CWD transect establishment	
	<ul style="list-style-type: none"> For every plot in a patch, establish a 30 m transect. For every plot in a dispersed area, establish a 30 m transect. For every harvest area with no retention, establish 3–30 m transects. To establish a 30 m transect, choose a compass bearing for first 15 m of transect, then add 90° to bearing and establish final 15 m (‘L’ shaped) transect. When a piece of CWD is crossed more than once on a transect, count and record each time as a separate piece. Minimum CWD diameter is 7.5 cm.

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Reserve Codes and Plot Guidance

This form provides reference material for:

- reserve codes
- plot establishment
- CWD transects.

Section	Instructions/Descriptions
Block Information Form C Side 1	
 <div style="display: flex; justify-content: space-between; font-size: small;"> <div>FRPA Resource Evaluation Program</div> <div>Stand-level Biodiversity Resource Stewardship Monitoring Block Information – Form C Side 1</div> </div>	
11 Opening Identification Opening # _____ Opening ID _____ Licence # _____ CP# _____ Block _____ Licensee: _____ District _____ Location Description: _____ Year of Harvest: _____ Net Area to be Reforested (ha): _____ Gross area (ha) _____ # of patch reserves in block _____ # of patch reserves sampled _____	11 Opening Identification This section header contains complete identification for the block. Information can be filled in at the office with data from the post-harvest map, SP, or RESULTS. <i>Opening #</i> – from RESULTS. <i>Opening ID</i> – from RESULTS. <i>Licence #</i> – from RESULTS or post-harvest map. <i>CP #</i> – from RESULTS or post-harvest map. <i>Block #</i> – from RESULTS or post-harvest map. <i>Licensee</i> – from RESULTS or post-harvest map. <i>District</i> – enter name or 3-letter code. <i>Location Descriptor</i> – general description of location (e.g., Fury Creek). <i>Year of Harvest</i> – enter year of harvest completion from RESULTS (if doing a pre-harvest block, note that here). <i>Net Area to be Reforested (ha)</i> – enter the total net area to be reforested (the total hectares actually receiving reforestation treatment). <i>Gross area</i> – equivalent to “total area under prescription” (i.e., inclusive of all reserves associated with the cutblock – if reserves associated with cutblock but not included in gross area from SP, add to gross). <i># of patch reserves in block</i> – record the number of patch reserves (multiple patch areas that are contiguous [i.e., touching] are counted as a single patch) identified on site map or in RESULTS. <i># of patch reserves sampled</i> – record the number of reserves that were sampled.
12 Innovative Practices Were any innovative and/or unique forest practices used on this block? Please describe:	12 Innovative Practices <i>Were any innovative and/or unique forest practices used on this block?</i> Please note and describe any practices other than variations in levels of retention that can impact stand-level biodiversity. Innovative may include treatments not commonly used in the district but that have been implemented with the intent of managing for biodiversity.
13 Invasive Plants Were invasive plant species present on this block? Yes ☐ No ☐ Don't know ☐ Species Code / Distribution Code _____ Comments:	13 Invasive Plants Tick one of the boxes to indicate the presence or absence of invasive plants. If you do not know, tick “don’t know.” Record species and distribution code (e.g., CT/10) from Reference Form, Sides 1 and 2. Invasive plants are not plot-based information; simply look for invasive plants during and between plots, while driving the road system, etc. Record any comments you may have concerning invasive plants.
14 Evaluator Opinion/Comments To what extent did the practices on this cutblock maintain stand-level biodiversity, given the opportunities that were likely available? Poorly ☐ Moderately ☐ Well ☐ Excellent ☐ Don't know ☐ Rationale:	

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Section

Instructions/Descriptions

Block Information Form C Side 1 (cont.)

	BRITISH COLUMBIA <small>FRPA Resource Evaluation Program</small>	Stand-level Biodiversity Resource Stewardship Monitoring <small>Block Information – Form C Side 1</small>
11 Opening Identification		
Opening # _____ Opening ID _____ Licence # _____ CP# _____ Block _____ Licensee: _____ District _____ Location Description: _____ Year of Harvest: _____ Net Area to be Reforested (ha): _____ Gross area (ha) _____ # of patch reserves in block _____ # of patch reserves sampled _____		
12 Innovative Practices		
Were any innovative and/or unique forest practices used on this block? Please describe: <div style="border: 1px solid black; height: 40px; margin-top: 5px;"></div>		
13 Invasive Plants		
Were invasive plant species present on this block? Yes ☐ No ☐ Don't know ☐ Species Code / Distribution Code _____ Comments: <div style="border: 1px solid black; height: 40px; margin-top: 5px;"></div>		
14 Evaluator Opinion/Comments		
To what extent did the practices on this cutblock maintain stand-level biodiversity, given the opportunities that were likely available? Poorly ☐ Moderately ☐ Well ☐ Excellent ☐ Don't know ☐ Rationale: <div style="border: 1px solid black; height: 100px; margin-top: 5px;"></div>		

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14 Evaluator Opinion/Comments

To what extent did the practices on this block maintain stand-level biodiversity, given the opportunities that were likely available – tick one of poorly, moderately, well, excellent or don't know.

This is a subjective ranking of the cutblock, which will be used as a check against the objective data collected. A question you should ask yourself is "did they do as well as they could have considering the forest they began with?" Note general comments as well as anything unusual about the cutblock in the comments section. Please provide a rationale for your professional opinion. Some points to consider:

Species mix is different from pre-harvest (e.g., Pw left in Fd-dominated stand):

- often considered good as it provides greater species diversity and a possible seed source of a rust-resistant tree
- mistletoe-laden hemlock left in a stand dominated by Fd with planned natural regeneration may be seen as a negative, as Hw would impact negatively on the next crop and does not provide the same long-term standing potential as the Fdc
- mistletoe in mature trees can provide excellent nesting habitat.

Height is different from pre-harvest:

- shorter than pre-harvest trees may be better if taller trees are susceptible to blow down.
- if trying for longer term inputs of CWD, a few younger patches may be considered good.
- short, stunted, unhealthy trees may be considered bad, as they will not age well and will not create desired characteristics.

Amount of standing retention:

- high levels of retention with good ecological anchors is good.
- high levels of retention with no ecological anchors is not necessarily good.

Amount of CWD:

- long (>12 m) logs in decay classes 1, 2, and 3 in the harvested area is good.

Section	Instructions/Descriptions																																																																																																																		
Block Information Form C Side 2	15 Access, Time and People on Block Tick one or more boxes to indicate type of access used to get to block. Fill in blanks in equation to calculate total hours of time to access block and complete the field assessment.																																																																																																																		
<div> <div>  <p>FRPA Resource Evaluation Program</p> </div> <div> <p>Stand-level Biodiversity Resource Stewardship Monitoring Block Summary – Form C Side 2</p> </div> </div> <div> <p>15 Access, Time and People on Block</p> <p>Access type: ☐ truck ☐ ATV ☐ boat ☐ heli ☐ walk ☐ other _____</p> <p>(_____ hrs. access time + _____ hrs. on block) x _____ people on block = _____ total hours</p> <p>% _____ stand level biodiversity, % _____ riparian, % _____ other</p> </div> <div> <p>16 Stratum Summary When No Plots Established</p> <table border="1"> <thead> <tr> <th rowspan="2">Stratum ID</th> <th rowspan="2">Stratum type</th> <th rowspan="2">Size (ha)</th> <th rowspan="2">BEC</th> <th colspan="3">Patch Location</th> <th rowspan="2">Total Constrained %</th> <th colspan="7">Ecological Anchor (count by stratum unless otherwise noted)</th> <th rowspan="2">Windthrow %</th> </tr> <tr> <th>Internal</th> <th>Edge</th> <th>External</th> <th>Large Broom</th> <th>Lgtst Tr Y/N</th> <th>Uncom Tree Y/N</th> <th>Other</th> <th>None</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> </div> <div> <p>17 Photo Section</p> <table border="1"> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> <tr><td> </td></tr> </table> </div> <div> <p>18 Quality Check: Sum of patch area + Sum of dispersed + CC + NP + Other = Cutblock gross area</p> </div>	Stratum ID	Stratum type	Size (ha)	BEC	Patch Location			Total Constrained %	Ecological Anchor (count by stratum unless otherwise noted)							Windthrow %	Internal	Edge	External	Large Broom	Lgtst Tr Y/N	Uncom Tree Y/N	Other	None																																																																																											<p>FS 1244-C2 HFP 2006/03</p>
Stratum ID					Stratum type	Size (ha)	BEC		Patch Location			Total Constrained %	Ecological Anchor (count by stratum unless otherwise noted)							Windthrow %																																																																																															
	Internal	Edge	External	Large Broom				Lgtst Tr Y/N	Uncom Tree Y/N	Other	None																																																																																																								

Figure 3 shows field cards required to fully sample a 30-ha cutblock with two wildlife tree patches (WTPs) and dispersed retention.

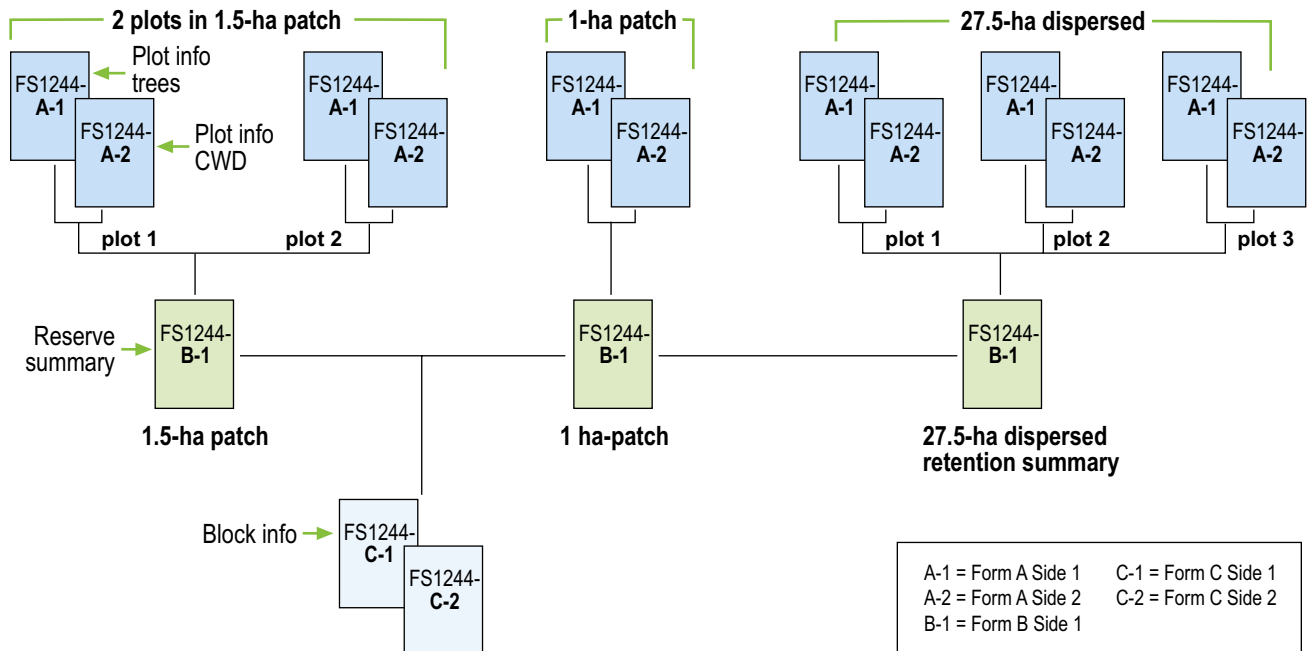


Figure 3. Field cards used to complete sampling of 30-ha cutblock. This cutblock contains two WTPs and dispersed retention.

Wildlife Tree Classes

Wildlife tree classes are shown in Figure 4. Species codes are found in Appendix 2.

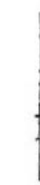
Wildlife Tree Class								
Live		Dead						Dead Fallen
		Hard			Spongy	Soft		
1	2	3	4	5	6 ≈ 2/3 original height	7 ≈ 1/2 original height	8 ≈ 1/3 original height	9
								
Live			Dead				Dead Fallen	
1	2	3	4	5	6			
								

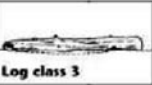
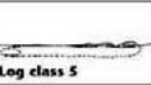
Figure 4. Wildlife tree classes for conifers and hardwoods.

Use standard species coding – tree species list provided on summary field card. For invasive plants, use the species codes identified on reference card (Form D Side 2).

CWD Decay Classes

For a more detailed description of CWD line transect methodology, visit the following web site: <http://ilmbwww.gov.bc.ca/risc/pubs/teecolo/fmdte/cwd.htm#sampling%20Methods>.

The following are CWD decay classes (Figure 5). Decay class 5 is not tallied since it is subsurface and therefore too difficult to accurately identify for the purposes of this assessment.

CWD Decay class					
	I	II	III	IV	V
Characteristics of fallen Douglas-fir*	 Log class 1	 Log class 2	 Log class 3	 Log class 4	 Log class 5
Bark	intact	intact	trace	absent	absent
Twigs	present	absent	absent	absent	absent
Texture	intact	intact to partly soft	hard, large pieces	small, soft block pieces	soft and powdery
Shape	round	round	round	round to oval	oval
Colour of wood	original colour	original colour	original colour to faded	light brown to reddish brown	red brown to dark brown
Portion of tree on ground	tree elevated on support points	tree elevated on support points but sagging slightly	tree sagging near ground	all of tree on ground	all of tree on ground
Invading roots	none	none	in sapwood	in heartwood	in heartwood

* Characteristics of other tree species may differ. Five other species use texture, shape, and invading roots to determine decay class.

Figure 5. CWD decay classes.

Completed Plot Cards and Field Map

Keep a copy of all plot cards and maps. *Please* ensure location of completed plots are marked and labeled on the map.

Mail original plot cards with the associated site map and site plan, if available, to:

Forest Practices Branch
Attn: Nancy Densmore
PO Box 9513 Stn Prov Gov't
8th Floor, 727 Fisgard Street
Victoria, BC V8W 9C2

Help

If you require assistance on the use of the stand-level biodiversity RSM forms and/or protocol, please contact one of the following:

Nancy Densmore (250) 356-5890 or Nancy.Densmore@gov.bc.ca
Richard Thompson (250) 356-5467 or Richard.Thompson@gov.bc.ca
Dean McGeough (250) 642-2666 or DeanMcG@shaw.ca
Peter Bradford (250) 365-2134 or Peter.Bradford@gov.bc.ca

Plot Information - Form A Side 1



Stand-level Biodiversity
Resource Stewardship Monitoring
Plot Information – Form A Side 1

* Decimal place means measured

BRITISH COLUMBIA

Stand-level Biodiversity
Resource Stewardship Monitoring
Plot Information – Form A Side 2

4 Plot Information (CWD) Stratum ID WTP2 Plot # 1

Course Woody Debris (30 m transect)

No CWD in transect ☐
1st Leg 300° 2nd Leg 30°

[illegible]

Stratum Summary - Form B Side 1



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Resource Stewardship Monitoring
Stratum Summary – Form B Side 1

5 Stratum Summary (one card per Stratum)			
Date <u>2005/10/12</u> Opening ID <u>103807</u> Assessed by <u>IB/WB</u> Stratum ID <u>WTP2</u> Stratum type <u>PR</u> # of plots in stratum <u>3</u> Mapped Stratum size (ha) <u>3.1</u> BEC subzone variant and site series <u>SBS mc2 01</u>			
Stratum location and size consistent with map? Yes ☒ No ☐ Not mapped ☐ If 'no' or 'not mapped', estimated size (ha) _____			
Tick one of: Harvest area with no retention ☐ Harvest area with dispersed retention ☐ Patch Reserve ☒			
6 Patch/Dispersed Summary			
Estimated age of oldest trees in reserve (other than Vets) <u>120</u>			
Patch location: Internal to block ☐ Edge of block ☒ External/not touching block ☐ N/A ☐			
% of total trees in reserve windthrown: < 5 ☐ 5–15 ☒ 16–30 ☐ >30 ☐ Distribution of windthrow: Edge ☒ Internal ☒ N/A ☐ Windthrow treatment: Feathering ☐ Topping ☐ None ☒ Other _____			
7 Reserve Constraints		Ecological Anchors	
	% of reserve		stratum estimate
Wetland		Bear Den	stratum count
RMZ	10	Hibernaculum	stratum count
RRZ		Vet tree/ha	0, 1-10, 10-20, etc.
Rock outcrop		Mineral lick	stratum count
Non-commercial brush	15	Large stick nest	stratum count
Non (or low) merch timber		Cavity nest	stratum count
Sensitive terrain or soil		Large hollow tree	stratum count
UWR		Large witches broom	stratum count
WHA		Karst feature	Y N
OGMA		Largest tree for site (not Vets)	Y N
Recreation feature		CWD heavy natural concentration	Y N
Other: _____		Active wildlife trails	Y N
		Active WLT/CWD feeding	(Y) N
Total constrained	15	Uncommon tree species	Y N
		Other: _____	
None	☐	None	☐
Comments:			

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Block Information - Form C Side 1



**BRITISH
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FRPA Resource
Evaluation Program

Stand-level Biodiversity
Resource Stewardship Monitoring
Block Information – Form C Side 1

11 Opening Identification
<p>Opening # <u>93 L 018 112</u> Opening ID <u>103807</u></p> <p>Licence # <u>A16828</u> CP# <u>473</u> Block <u>PARRSX10</u></p> <p>Licensee: <u>Canfor</u> District <u>DND</u></p> <p>Location Description: <u>24 Km Parrott West</u> Year of Harvest: <u>2001</u></p> <p>Net Area to be Reforested (ha): <u>47.7</u> Gross area (ha) <u>67.6</u></p> <p># of patch reserves in block <u>6</u> # of patch reserves sampled <u>4</u></p>
12 Innovative Practices
<p>Were any innovative and/or unique forest practices used on this block? Please describe:</p> <p style="margin-top: 20px;">No</p>
13 Invasive Plants
<p>Were invasive plant species present on this block? Yes ☐ No ☒ Don't know ☐</p> <p>Species Code / Distribution Code</p> <p><u>CT10</u></p> <p>Comments:</p> <p><i>Concentrated at landings & pulled culverts</i></p>
14 Evaluator Opinion/Comments
<p>To what extent did the practices on this cutblock maintain stand-level biodiversity, given the opportunities that were likely available?</p> <p>Poorly ☐ Moderately ☒ Well ☐ Excellent ☐ Don't know ☐</p> <p>Rationale:</p> <p><i>Good amount, plus number of patches – primarily the wet areas. S3 reserve mostly dead or windthrown.</i></p>

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Block Information - Form C Side 2

Stand-level Biodiversity
Resource Stewardship Monitoring
Block Summary – Form C Side 2



15 Access, Time and People on Block																
Access type: ☒ truck ☐ ATV ☐ boat ☐ heli ☐ walk ☐ other (<u>3</u> hrs. access time + <u>6</u> hrs. on block) x <u>2</u> people on block = <u>18</u> total hours % <u>70</u> stand level biodiversity, % <u>30</u> riparian, % other																
16 Stratum Summary When No Plots Established																
Stratum ID	Stratum type	Size (ha)	BEC	Patch Location			Total Constrained %	Ecological Anchor (count by stratum unless otherwise noted)						Windthrow %		
				Internal	Edge	External		Vets (ha)	Large Stick Nest	Cavity Nest	Large Broom	Lgst Tr Y/N	Uncom Tree Y/N	Other	None	
WTP1	PW	0.6	SBSmc2.06	☒			50								☒	<5
WTP5	PW	0.7	SBSmc2.06	☒			50								☒	5-15
17 Photo Section																
18 Quality Check: Sum of patch area + Sum of dispersed + CC + NP + Other = Cutblock gross area																

FS1244-C2 HFP 2006/03

Appendix 2. Reference - Form D Side 1



**BRITISH
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FRPA Resource
Evaluation Program

**Stand-level Biodiversity
Resource Stewardship Monitoring
Reference – Form D Side 1**

Wildlife Tree Class								
Live		Dead						Dead Fallen
		Hard			Spongy	Soft		
1	2	3	4	5	6 ≈ 2/3 original height	7 ≈ 1/2 original height	8 ≈ 1/3 original height	9
Live		Dead					Dead Fallen	
1	2	3	4	5	6			
CWD Decay class								
	I	II	III	IV	V			
Characteristics of fallen Douglas-fir*								
Bark	intact	intact	trace	absent	absent			
Twigs	present	absent	absent	absent	absent			
Texture	intact	intact to partly soft	hard, large pieces	small, soft block pieces	soft and powdery			
Shape	round	round	round	round to oval	oval			
Colour of wood	original colour	original colour	original colour to faded	light brown to reddish brown	red brown to dark brown			
Portion of tree on ground	tree elevated on support points	tree elevated on support points but sagging slightly	tree sagging near ground	all of tree on ground	all of tree on ground			
Invading roots	none	none	in sapwood	in heartwood	in heartwood			
* Characteristics of other tree species may differ. Five other species use texture, shape, and invading roots to determine decay class.								
Invasive Plants Distribution Code Chart								
0	no occurrence	4	several sporadically spread individuals	8	spread throughout site with some gaps			
1	rare or single occurrence	5	clustered in a few spots	9	spread densely throughout			
2	a few spread sporadically throughout	6	clustered in several spots	10	distributed on roadside only			
3	cluster in a single spot	7	spread uniformly throughout					

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Appendix 3. Reference - Form D Side 2



BRITISH COLUMBIA

FRPA Resource
Evaluation Program

Stand-level Biodiversity
Resource Stewardship Monitoring
Reference – Form D Side 2

Invasive Plants Species Code Chart					
Name	Code	Name	Code	Name	Code
Annual Sowthistle	AS	Hound's Tongue	HT	Spotted Knapweed	SK
Canada Thistle	CT	Jointed Goatgrass	JG	Tansy Ragwort	TR
Crupina	C	Leafy Spurge	LS	Velvetleaf	VL
Dalmation Toadflax	DT	Perennial Sowthistle	PS	Wild Oats	WO
Diffuse Knapweed	DK	Purple Nutsedge	PN	Yellow Nutsedge	YN
Dodder	D	Rush Skeletonweed	RS	Yellow Starthistle	YS
Gorse	G	Scentless Chamomile	SC	Yellow Toadflax	YT

British Columbia Tree Code List					
NATIVE CONIFERS			NATIVE HARDWOODS		
Cedar	Thuja	C	Alder	Alnus	D
western redcedar	<i>T. plicata</i>	Cw	red alder	<i>A. rubra</i>	Dr
Cypress	Chamaecyparis	Y	Apple	Malus	U
yellow-cedar	<i>C. nootkatensis</i>	Yc	Pacific crab apple	<i>M. fusca</i>	Up
Douglas-fir	Pseudotsuga	F	Arbutus	Arbutus	R
Douglas-fir	<i>P. menziesii</i>	Fd	Arbutus	<i>A. menziesii</i>	Ra
coastal Douglas-fir	<i>P. menziesii</i> var. <i>menziesii</i>	Fdc	Aspen, Cottonwood, Populus		A
interior Douglas-fir	<i>P. menziesii</i> var. <i>glauca</i>	Fdi	or Poplar		
Fir (Balsam)	Abies	B	poplar	<i>P. balsamifera</i>	Ac
amabilis fir	<i>A. amabilis</i>	Ba	balsam poplar	<i>P. b. ssp. balsamifera</i>	Acb
grand fir	<i>A. grandis</i>	Bg	black cottonwood	<i>P. b. ssp. trichocarpa</i>	Act
subalpine fir	<i>A. lasiocarpa</i>	Bl	hybrid poplars	<i>P. spp.</i>	Ax
Hemlock	Tsuga	H	trembling aspen	<i>P. tremuloides</i>	At
mountain hemlock	<i>T. mertensiana</i>	Hm	Birch	Betula	E
western hemlock	<i>T. heterophylla</i>	Hw	Alaska paper birch	<i>B. neoalaskana</i>	Ea
mountain x western hemlock hybrid	<i>T. mertensiana</i> x <i>heterophylla</i>	Hxm	Alaska x paper birch hybrid	<i>B. x winteri</i>	Exp
Juniper	Juniperus	J	paper birch	<i>B. papyrifera</i>	Ep
Rocky Mtn. juniper	<i>J. scopulorum</i>	Jr	water birch	<i>B. occidentalis</i>	Ew
Larch	Larix	L	Cascara	Rhamnus	K
alpine larch	<i>L. lyallii</i>	La	cascara	<i>R. purshiana</i>	Kc
tamarack	<i>L. laricina</i>	Lt	Cherry	Prunus	V
western larch	<i>L. occidentalis</i>	Lw	bitter cherry	<i>P. emarginata</i>	Vb
Pine	Pinus	P	choke cherry	<i>P. virginiana</i>	Vv
jack pine	<i>P. banksiana</i>	Pj	pin cherry	<i>P. pensylvanica</i>	Vp
limber pine	<i>P. flexilis</i>	Pf	Dogwood	Cornus	G
lodgepole pine	<i>P. contorta</i>	Pl	Pacific dogwood	<i>C. nuttallii</i>	Gp
lodgepole pine	<i>P. contorta</i> var. <i>latifolia</i>	Pli	Maple	Acer	M
lodgepole x jack pine hybrid	<i>P. x murraybanksiana</i>	Pxj	bigleaf maple	<i>A. macrophyllum</i>	Mb
ponderosa pine	<i>P. ponderosa</i>	Py	vine maple	<i>A. circinatum</i>	Mv
shore pine	<i>P. contorta</i> var. <i>contorta</i>	Plc	Oak	Quercus	Q
western white pine	<i>P. monticola</i>	Pw	Garry oak	<i>Q. garryana</i>	Qg
whitebark pine	<i>P. albicaulis</i>	Pa	Willow	Salix	W
Spruce	Picea	S	Bebb's willow	<i>S. bebbiana</i>	Wb
black spruce	<i>P. mariana</i>	Sb	Pacific willow	<i>S. lucida</i>	Wp
Engelmann spruce	<i>P. engelmannii</i>	Se	peachleaf willow	<i>S. amygdaloides</i>	Wa
Sitka spruce	<i>P. sitchensis</i>	Ss	pussy willow	<i>S. discolor</i>	Wd
white spruce	<i>P. glauca</i>	Sw	Scouler's willow	<i>S. scouleriana</i>	Ws
spruce hybrid	<i>Picea</i> cross	Sx	Sitka willow	<i>S. sitchensis</i>	Wt
Engelmann x white	<i>P. engelmannii</i> x <i>glauca</i>	Sxw	UNKNOWN		X
Sitka x white	<i>P. x lutzii</i>	Sxl	Unknown		Xc
Sitka x unknown hybrid	<i>P. sitchensis</i> x ?	Sxs	Unknown conifer		Xh
Yew	Taxus	T	Unknown hardwood		
western yew	<i>T. brevifolia</i>	Tw	OTHERS		
			Other tree, not on list		Z
			Other conifer		Zc
			Other hardwood		Zh

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Appendix 4. CWD measurements

To assist with the fieldwork for the *Protocol for Stand-level Biodiversity*, the following information is provided following the summer 2005 field training sessions.

Field procedures for measuring CWD were adapted from the CWD field procedures, as found at <http://ilmbwww.gov.bc.ca/risc/pubs/teecolo/fmdte/cwd.htm#coarse>.

Excerpts are included here to clarify and guide protocol fieldwork.

CWD Defined

Coarse woody debris is dead woody material, in various stages of decomposition, located above the soil, larger than 7.5 cm in diameter (or equivalent cross-section) at the crossing point, which is not self-supporting. Trees and stumps (intact in ground) are considered self-supporting, and therefore are NOT considered CWD.

Pieces of CWD may be suspended on nearby live or dead trees, other pieces of CWD, stumps, or other terrain features. There is NO minimum length for CWD.

Coarse woody debris includes:

- downed horizontal or suspended (not self-supporting) dead tree boles with or without roots attached
- fallen trees which still have green foliage if they no longer have roots attached (no living cambium) to the ground to keep them alive
- woody pieces greater than 7.5 cm at the point where the sampling line crosses the piece
- uprooted (not self-supporting) stumps greater than 7.5 cm in diameter at the crossing point and any of their exposed dead roots greater than 7.5 cm in diameter at the crossing point;
- fallen broken tree tops which may be horizontal or leaning, or large fallen branches
- recently cut logs.

Coarse woody debris does not include:

- dead branches still connected to standing trees
- self-supporting (not overturned) stumps
- exposed roots of self-supporting trees or stumps
- material that is buried beneath organic or mineral soil layers, or has decomposed enough to be part of the forest floor
- live or dead trees (still rooted) which are self-supporting.

Rules for Sampling Coarse Woody Debris

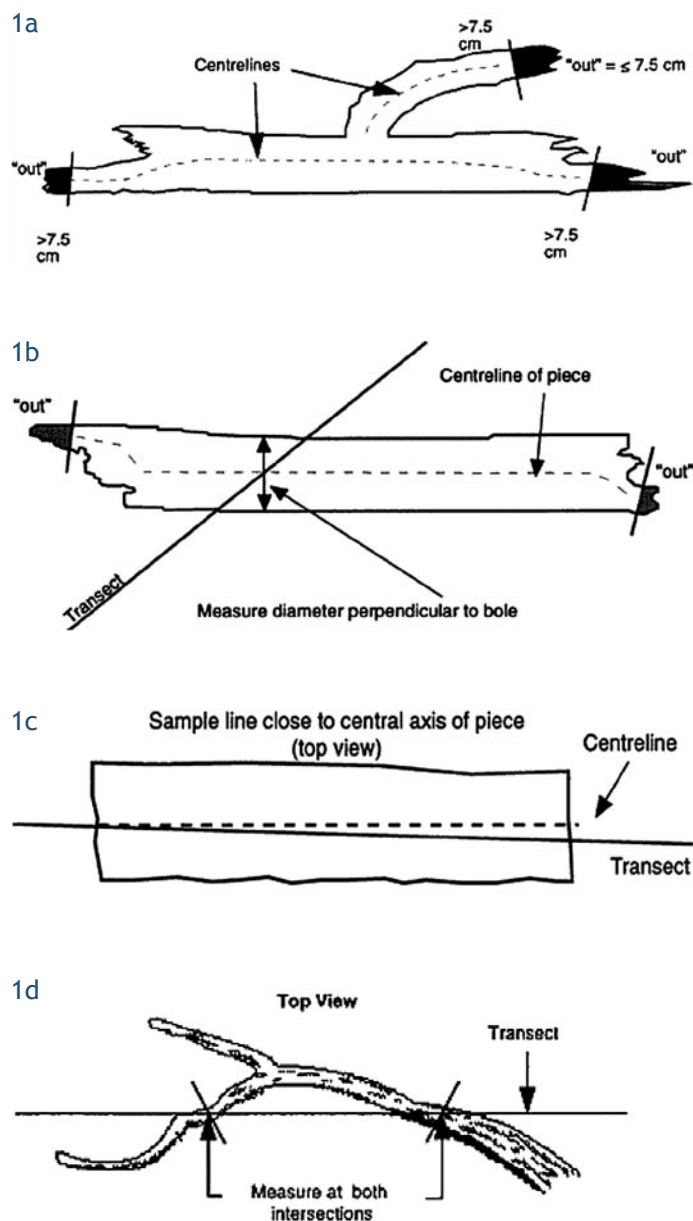


Figure A4-1. Rules for sampling CWD.

- Coarse woody debris must be greater than 7.5 cm in diameter (or equivalent) at the line intersect point (see Figure A4-1a). There is NO minimum length.
- The transect must cross the central axis of the piece (see 1b).
- If the transect coincides closely with the centreline, make the best decision as to whether the line crosses the centreline and where (see 1c).
- If the transect intersects a curved or angular piece more than once, measure each intersection as a separate observation (see 1d).
- If a log has split open, but is still partially held together, record the diameter as if the piece were whole. If a stem has shattered into a number of distinct, unconnected pieces, record each piece that is greater than 7.5 cm in diameter at the point of sampling.
- Do not tally undisturbed stumps. Tally uprooted stumps and their exposed dead roots if they meet the other criteria.

- Tally only the CWD that lies above the soil (see Figure A4-2). A piece is no longer above the soil when it is entirely buried beneath a layer of surface organic matter (forest floor) and/or mineral soil. Estimate an “equivalent” diameter for the remaining portion of logs where part of the wood has decayed and become part of the soil layer.

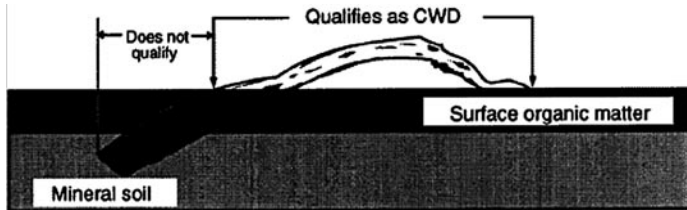


Figure A4-2. Tally only CWD that lies above the soil.

CWD Length

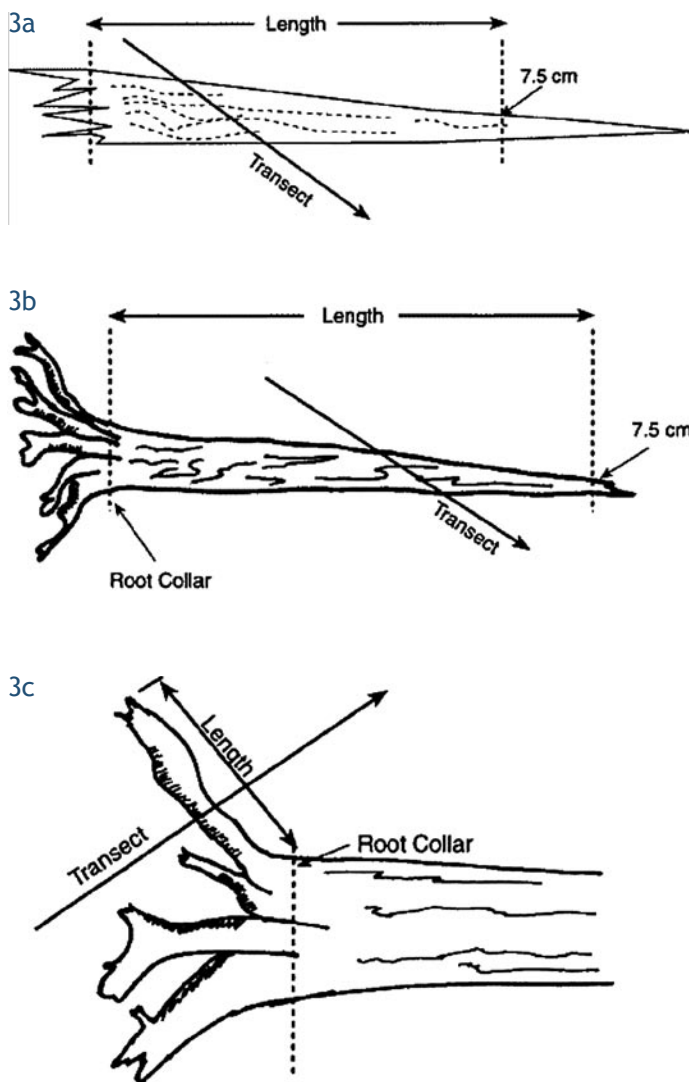


Figure A4-3. Rules for measuring length of CWD.

Record the length of each piece to the nearest 0.1 m (see Figure A4-3a).

- If a log has broken lengthwise but is still partially held together, record the equivalent length as if the piece were whole.
- If the end(s) of the piece are broken, visually fold in the broken sections to compensate for the missing parts.
- Piece length is from the largest end down to the 7.5-cm diameter limit.

Measurement of stems from attached roots:

- For main boles with exposed roots, piece length is measured only down to the root collar (see 3b).
- If a root mass is transected, piece length for individual roots (larger than the minimum diameter) is measured only up to the root collar (see 3c).

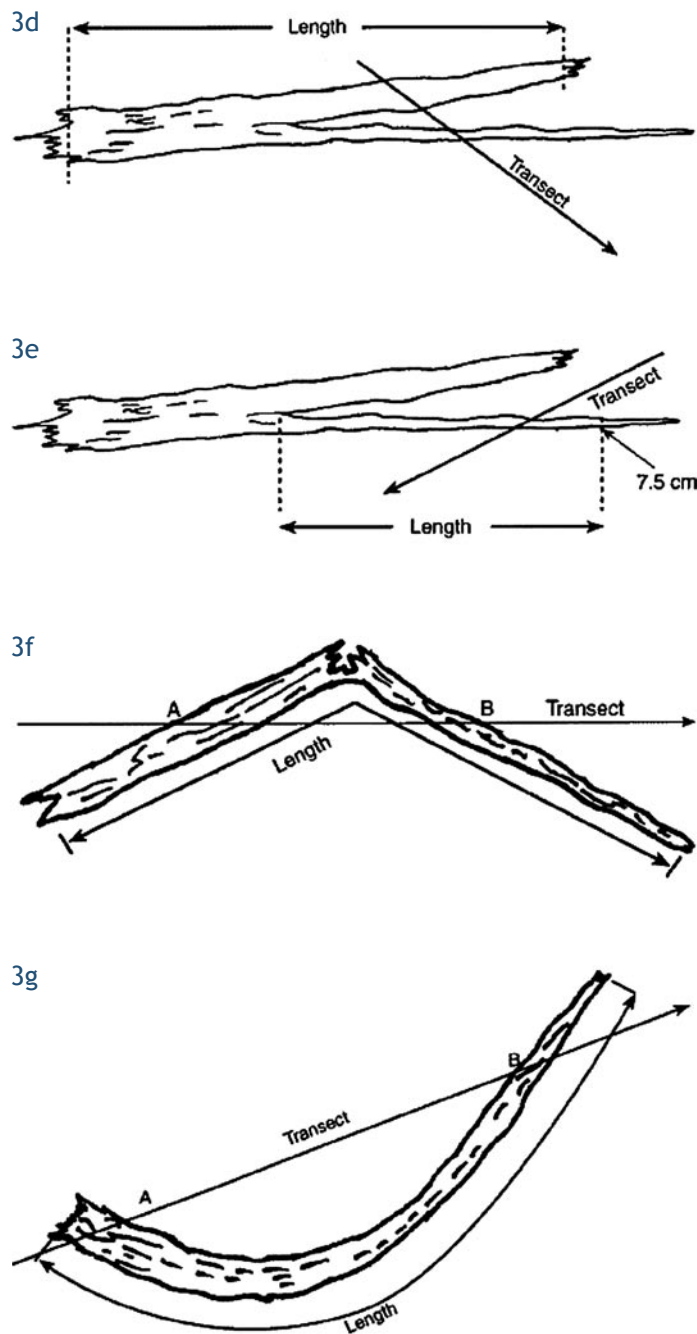


Figure A4-3. Rules for measuring length of CWD (cont.).

Measurement of forked stems

- Where one of the forks transected is determined (by largest diameter) to be a continuation of the main bole then the length will be measured to the ends of the main piece (see 3d).
- The piece length of the smaller stem(s) (smaller diameter) will be measured only to the junction with the main bole (see 3e).
- For forks of near equal stature, make a determination as above and measure accordingly.

Measurement of pieces that are crossed more than once on the transect:

- Pieces broken but still physically attached are measured as one piece at each transect point. The length measurement is taken along the central axis of the piece (see 3f).
- The full piece length of curved/crooked pieces is measured at both crossings (see 3g).
- In the same manner as above, record the full piece length twice where the same piece is crossed by two transects at right angles to each other.

