Protocol for

Stand-level Retention Monitoring

Steps for field data collection and administration

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VERSION 6.0

BRITISH COLUMBIA

FREP Forest & Range Evaluation Program

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Cover photo credit: Doug Lewis

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FREP BACKGROUND

The Forest and Range Evaluation Program (FREP) was established in 2003 as a foundational element of the *Forests and Range Practices Act (FRPA).*

FREP Vision: To collect and communicate trusted and scientifically robust natural resource monitoring information to inform decision making and improve resource management outcomes.

FREP Mission:

1. To assess the impacts of forest and range activities on the 11 FRPA resource values to determine if on-the-ground results are achieving government's desired outcomes for these values;
2. To monitor and report on the condition of resource values, including trends and causal factors; and
3. To identify opportunities for continued improvement of practices, policies, and legislation, and support their implementation.

The monitoring data collected under FREP will help identify implementation issues regarding forest policies, practices, legislation, and Forest Stewardship Plan results and strategies. As a result, FREP is a fundamental component for implementing continuous improvement of forest management in British Columbia.

In order to accomplish the Mission, FREP:

- Develops specific monitoring and evaluation questions to be addressed;
- Documents the status and/or trends of resource values over time through the use of detailed protocols;
- Identifies causal factors where the status or trend is found to be undesirable;
- Determines whether resource values are being managed in a manner that meets the government's intended objectives or outcomes for that value;
- Communicates the results of evaluations; and
- Recommends changes to forest and range policies and legislation, where required.

DOCUMENT PURPOSE

The purpose of this document is to introduce the Stand-level Retention (SLR) protocol as an update and replacement to the Stand-level Biodiversity (SLBD) protocol last updated in 2009. The following document provides background information and instructions for data collection for stand-level retention monitoring under FREP.

What Has Changed?

Several changes have been made to evaluate stand-level wildlife tree and downed wood retention practices relative to existing guidance and scientific literature. Primary changes include:

1. Re-naming the protocol to emphasize evaluation of stand-level retention practices, such as wildlife tree retention consistent with the FRPA objective, and recognizing that the protocol measures retained forest structure and does not directly measure wildlife habitat and biodiversity;
2. Adding GIS-based indicators of landscape context for the stand-level retention practices being evaluated within individual cutblocks;
3. Modifying the protocol to include questions that rate retention practices using indicators and targets based on management guidance/ecological benchmarks, consistent with other FREP protocols; and
4. Providing an overall rating for the cutblock as to how likely retention practices will address the FREP question, consistent with other FREP protocols.

What Hasn't Changed?

The field sampling and data collection portion of the protocol hasn't changed from the original protocol. This ensures that any new data collected will be compatible with all data collected to date. The FREP data collected under the previous versions of the protocol from 2005-2019 on cutblocks harvested from 1996-2017 includes over 2800 samples province-wide and provides a rich data set for evaluating practices over time.

Changes to the field portion of the protocol are intended to be minimal, while recognizing that field work can be time-consuming and working to ensure that sampling for most cutblocks can usually be completed in one field day. The only changes involve comparing measured data to benchmarks after field data collection to determine how likely stand-level retention practices are achieving outcomes for biodiversity and wildlife habitat.

GOAL OF STAND-LEVEL RETENTION MONITORING

The goal of stand-level retention monitoring is to determine if the present policy of retaining wildlife tree patches and coarse woody debris (CWD) 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:

- Quantify levels of stand structure attributes by Biogeoclimatic Ecosystem Classification (BEC) unit,
- Compare these data with known historical levels to determine what if any structures are lacking or significantly below expected quantities, and
- Place the information into a landscape-level context to determine the significance of results.

PRINCIPLES OF SITE SELECTION

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

Districts may choose to sample from an alternate population than described here and apply a different site selection criterion. Any alternate sampling schemes should first be discussed with the Resource Value Team Leader. Such alternate cutblocks must be analyzed separately from the standard list and are considered targeted sampling.

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 FREP monitoring will be selected using random sampling.

The number of sites sampled may vary depending on available resources (largely staff time and funding). Very large, steep, diverse, or rough terrain cutblocks will take longer to sample. Problems in accessing sites will likely mean more expensive travel options. For each sample season, districts will set their own goal for sampling. This is expected to be about six stand-level retention cutblocks. Large cutblocks, greater than 100 ha, can count for more than one sample.

Site Selection Criteria for Stand-level Retention

For stand-level retention, 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 housed in the FREP Information Management System (FREP IMS).

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

- A defined timeframe with an earliest and latest harvest completion date (usually 1-3 years post-harvest), and
- Cutblocks greater than 2.0 ha in size.

If a district completes sampling of their sites and wants to sample additional cutblocks, 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 within IMS (see District Random List tab). If a site clearly does not belong to the population, it can be deleted. Do not sample cutblocks that show up on the list but were sampled in previous years. 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 cutblock make it too dangerous to sample.

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

MANAGEMENT CONTEXT

British Columbia's approach to biodiversity and wildlife habitat conservation is rooted within concepts originally outlined in the Biodiversity Guidebook and associated guidebooks (Riparian Management Guidebook and Managing Identified Wildlife Guidebook). These guidebooks outline a coarse/fine filter management approach where coarse-filter strategies are expected to provide for the habitat requirements of most species, while fine-filter strategies are required to manage for species requiring specific habitat attributes. The coarse/fine filter approach includes various strategies to conserve biodiversity ranging from the establishment of spatial reserves, such as parks and protected areas, that protect habitats; seral targets for the amount of young, mature and old forests at the landscape level over time; to site-level targets for wildlife tree and coarse woody debris retention. The coarse/fine filter approach is applied at scales ranging from a sub-region (natural resource district or timber supply area) to the site level.

The underlying premise of the coarse/fine filter approach, as outlined in the Biodiversity Guidebook, is to maintain habitat diversity, and that all native species and ecosystem processes are more likely to be maintained if managed forests resemble the patterns left following natural disturbances. Generally, if the full range of habitats are maintained, the assumption is that native species diversity and genetic diversity will be maintained. Thus, habitat diversity is a surrogate for species and genetic diversity.

These concepts formed the basis for legal requirements for wildlife tree retention in the *Forest Practices Code of BC* Act (FPC) introduced in 1992, and later carried forward under the *Forest and Range Practices Act* (FRPA) that replaced the FPC in 2004. Stand-level retention of wildlife trees, wildlife tree retention areas, riparian reserves, and coarse woody debris (CWD) are considered part of the coarse-filter approach, and legal planning and practice requirements are outlined in the Forest Planning and Practices Regulation (FPPR). Managing biodiversity and wildlife habitat at the stand level is recognized as one of the 11 FRPA values where objectives are specified in the FPPR. Specifically, *FPPR* Section 9.1 states:

> *The objective set by government for wildlife and biodiversity at the stand level is, without unduly reducing the supply of timber from British Columbia's forests, to retain wildlife trees.*

To be consistent with the FRPA objective, forest licensees specify results and strategies for wildlife tree and CWD retention at the cutblock level in Forest Stewardship Plans (FSPs). Minimum default legal requirements are stated under Section 66 (Wildlife Tree Retention) and Section 68 (Coarse Woody Debris) of the FPPR. While these legal targets provide a minimum requirement at the cutblock level, forest professionals have the flexibility to increase stand-level retention depending on both site-specific factors (e.g., riparian areas or specific wildlife habitat features) that may require protection, and landscape-level context (i.e., the extent of both the area of timber harvesting land base and area disturbed). Various guidance is available to support stand-level retention decisions for wildlife tree retention[1] and CWD management practices to help maintain biodiversity and wildlife habitat. Additional guidance also provides direction for stand-level retention in the context of large-scale salvage operations in response to extensive natural disturbance events such as insect outbreaks[2] or wildfire.

[1] https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/conservation-habitat-management/wildlife-conservation/wildlife-tree-committee/wt-guidance-05-2006.pdf

[2] https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/sustainable-forest-management-practices

When considering stand-level retention, it is important to recognize that forest harvesting creates different amounts and patterns of residual forest structure than what remains following a natural disturbance event such as wildfire, windthrow, or insect attack. However, by following existing guidance on wildlife trees and CWD retention at the time of harvest, forest practices can help to emulate the patterns, types, and in some cases the amount of residual forest structure that may remain after natural disturbances. Whether left by natural disturbance or harvesting, post-disturbance residual forest structure provides "ecosystem memory"[3] allowing forest ecosystems to recover and reorganize following disturbance. Residual forest structure also maintains key ecosystem functions into the regenerating post-harvest forest, including (Franklin et al. 1997; Rosenvald and Lohmus 2008):

1. Life-boating of species and processes over the regenerating phase,
2. Enriching re-established forest stands with structural features, and
3. Enhancing landscape connectivity.

By retaining residual forest structure, forest harvesting can be compatible with objectives for maintaining wildlife habitat and biodiversity conservation, so long as other appropriate stand- and landscape-level management practices are also applied.

Stand-level retention alone cannot meet the needs of all species as the habitat needs of wildlife vary considerably. Some wildlife species are "open-habitat" specialists that benefit from conditions created from recently disturbed forests or non-forest conditions; others are "generalist" species that make use of a wide range of habitat conditions. While others are considered "forest specialist" species that primarily rely on forest conditions and that have specific life requisites associated with forested habitats. As a result, there is no one amount of stand-level tree retention that is optimal or best for wildlife habitat or biodiversity, and none that will meet the needs of all species. In general, open-habitat and generalist species will benefit from conditions created by more severe natural disturbances or forest harvesting, while forest species may decline with loss of forest conditions.

Biodiversity and wildlife habitat conservation in managed landscapes where forest harvesting occurs is most concerned with maintaining habitats for forest species since the habitat requirements for open-habitat and generalist species will largely be met by conditions created by harvested openings. Wildlife tree retention can mitigate some of the effects of forest harvesting on forest species and has been shown to increase both the richness and abundance of forest species compared to clearcuts (Figure 1; Fedrowitz et al. 2014). Some forest species taxonomic groups, particularly lichens, bryophytes, and forest birds showed greater abundance in retention cuts compared to clearcuts (Huggard and Kremsater 2007, Fedrowitz et al. 2014). Mammal response to retention cuts measured 15-18 years post-

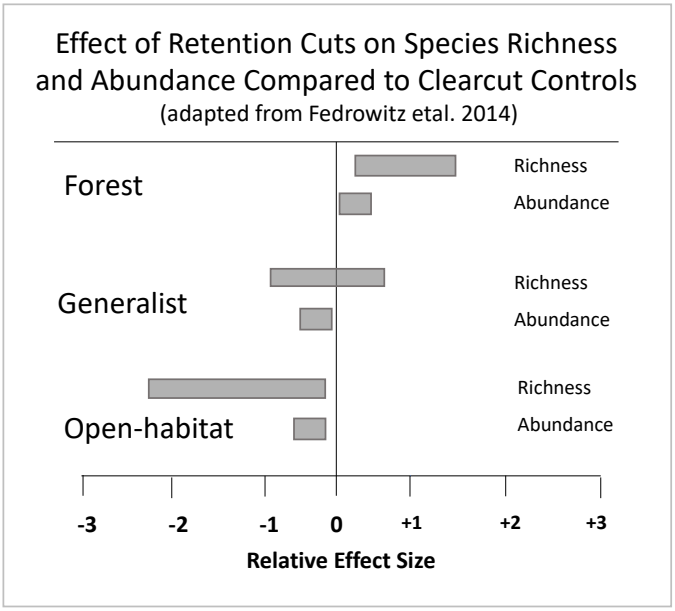


Figure 1. *A comparison of the relative effects on forest specialist, generalist, and open-habitat species richness and abundance in retention cuts compared to clearcuts. A relative effect size = 0 means no difference, whereas positive and negative effect sizes relate to increased or decreased richness or abundance compared to clearcuts. Bars represent the range of effects measured across multiple studies analyzed.*

[3] Ecosystem memory is defined as the adaptations, individuals, and materials that persist after a disturbance and shape responses to future disturbances. (Johnstone et al. 2016. Changing disturbance regimes, ecological memory, and forest resilience. Frontiers in Ecology and Environment 14(7).

harvest can vary where early seral or open-habitat species generally declined or showed no response to retention (Franklin et al. 2019). Some generalist and late-seral forest specialists used forests with increased retention levels, while one forest species of conservation concern (woodland caribou) only used retention cuts at levels greater than 20% retention (Franklin et al. 2019).

This protocol focuses on evaluating tree retention practices (amount, spatial pattern, type) recognized as necessary to maintain key ecosystem functions (habitat refugia, structural enrichment, and landscape connectivity for a limited subset of forest species.[4] Some forest species will require higher levels of retention or retention of specific habitat attributes to support continued use. Stand-level retention alone cannot offset loss of mature and old forest habitats at a landscape scale and managing for most wildlife species and conserving biodiversity requires both stand- and landscape-level habitat management.

[4] Currently, this subset has not been defined.

ECOSYSTEM CONTEXT

British Columbia has a wide range of forested ecosystems that provide diverse habitat conditions for different species. Forest structural conditions including tree species composition, tree size, and the amount of important habitat structures (large live trees, snags, and downed wood) varies considerably between these ecosystems due to factors such as ecosystem productivity and natural disturbance type, extent, and severity. When evaluating against guidance targets using the protocol, benchmark conditions for landscape context indicators consider different ecosystems and natural disturbance types (NDTs) in the province. Benchmarks used in the protocol for stand-level attributes are based on existing plot and transect data summarized for distinct groupings of biogeoclimatic subzone variants (BEC Groups) (Figure 2).[5]

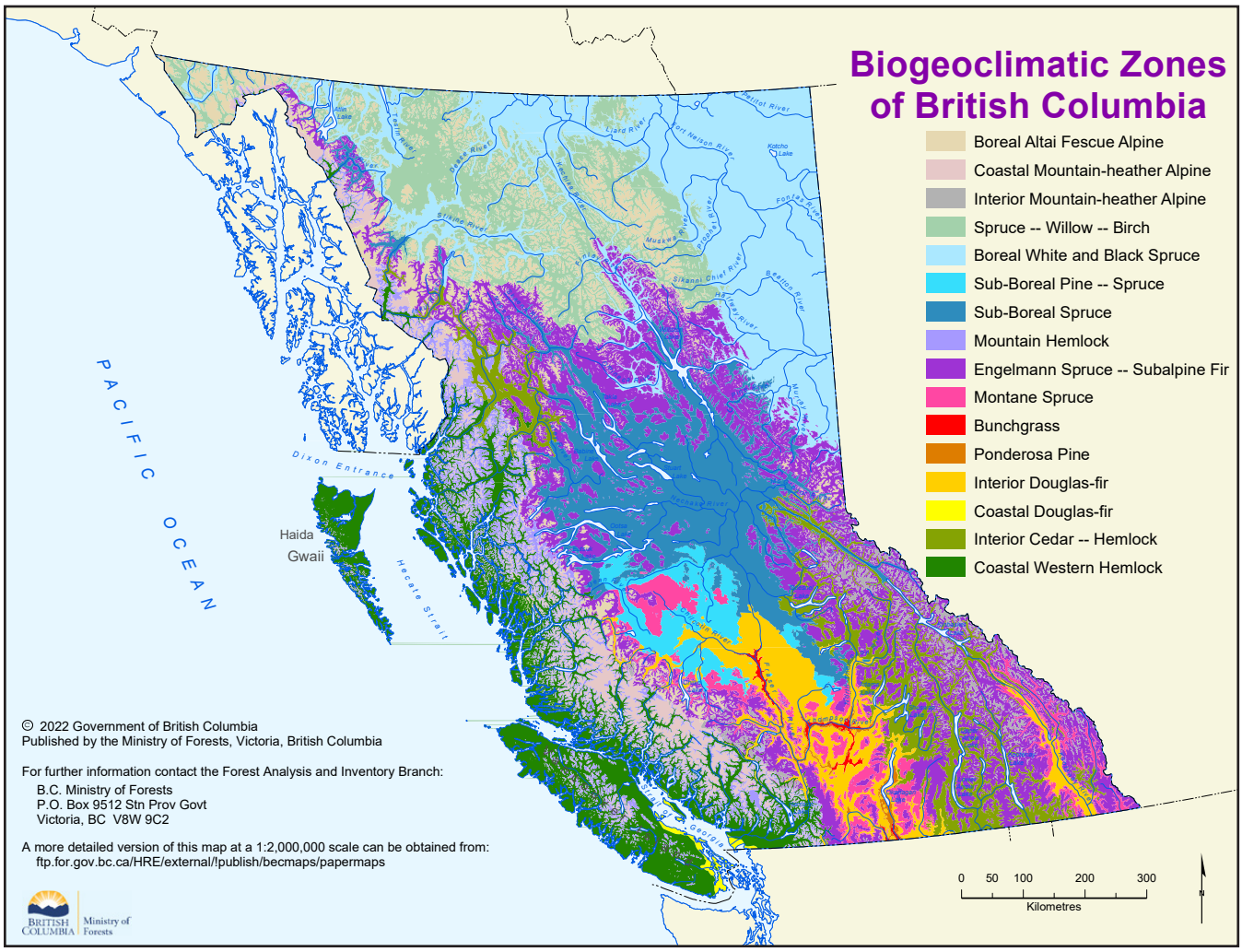


Figure 2. *An illustration of BEC Groups in BC upon which benchmark levels for pre-harvest structural conditions are summarized and used as ecological benchmarks in the protocol.*

[5] Data was summarized using various data sources and relies heavily on cruise plot data to represent likely pre-harvest stand conditions. Data summary by Dave Huggard (2020).

HOW ARE STAND-LEVEL RETENTION PRACTICES EVALUATED?

Stand-level retention practices are evaluated using eight questions, organized into three categories (Table 1). Each question asks evaluators about key characteristics of stand-level retention that are known to be important to maintaining wildlife habitat and conserving biodiversity in managed forests.

Table 1. *Main questions to assess post-harvest stand-level retention*

Category: Landscape Context
Question #1 – Tree Retention Amount – is the amount of stand-level retention adequate considering the landscape context?
Question #2 – Patch Size – Is the amount of stand-level retention in the cutblock adequate considering the size of the associated patch?
Question #3 – Landscape Connectivity – Is the amount and spatial location of stand-level retention adequate to help maintain landscape-level connectivity?
Question #4 – Micro-Environment – Does wildlife tree retention and cutblock shape contribute to a range of microenvironments and structural complexity within the block?
Category: Wildlife Tree Retention Practices
Question #5 –Standing Live and Dead Tree Size and Condition – Will standing live and dead wildlife trees provide habitat refugia and structural complexity in the regenerating stand now and into the future?
Question #6 – Wildlife Tree Retention Practices – Do stand-level retention practices retain wildlife trees and conserve important habitat features by minimizing windthrow?
Category: Coarse Woody Debris Retention Practices
Question #7 – Amount and Spatial Dispersion of Downed Wood – Does the amount and dispersion of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?
Question #8 – Downed Wood Size and Condition – Does the size and condition of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?

Each main question contains one or more indicator sub-questions that are used to provide additional information related to answering the main question. Indicator sub-questions require evaluators to compare data collected using the protocol to measurable targets based in existing management guidance or ecological benchmarks to answer the question. The collected data is summarized either to the strata or block level and is compared to the target specified in the protocol. Guidance targets vary based on landscape context, natural disturbance type (NDT), or BEC Group. Depending on how closely the measured data aligns to the specified target, the outcome is assigned to one of four categories:

- Exceeding – retention levels exceed minimum guidance targets,
- Meeting – retention levels meet minimum guidance targets,
- Below – retention levels are below minimum guidance targets, or
- Well Below – retention levels are well below minimum guidance targets.

Retention levels that meet or exceed guidance targets are generally considered to be beneficial to biodiversity and wildlife habitat conservation, while retention levels below or well below targets are less so. However, we recognize there is uncertainty and challenges in applying generalized guidance targets to answering these types of questions. Guidance targets are estimates based on the best available information and are applied across simplified categories of landscape context, ecosystems, and natural disturbance types. In real-world situations, these targets may not always account for all the possible stand and landscape conditions that may be encountered and that may influence stand-level retention practices. For example,

- The type and amount of structural attributes available within the stand considering stand history can be affected by factors such as:
  - Previous harvest entries (harvesting in second-growth stands or harvest re-entries into partially harvested stands), and
  - Natural disturbances such as insects, wildfire or windthrow.
- The type and amount of, or lack of, harvest constraints (riparian, wildlife habitat) and "ecological anchors" (important wildlife trees, nesting, or denning trees) available within the stand that provide opportunities to locate retention within or adjacent to the stand; and
- Legal objectives or management goals expressed in site plans may alter retention levels compared to benchmarks levels.

To account for these types of situations, the protocol includes some built-in flexibility in two ways:

1. The breakpoints between the categories Exceeding, Meeting, Below, and Well Below purposefully span a range to acknowledge the potential for measurement error or circumstances where retention levels are close to guidance targets – thereby achieving the intent.
2. Evaluators can override some analysis results to modify the outcomes to best suit on-the-ground conditions and provide a rationale that explains why they chose to do so.

The Two Main Components Used in the Evaluation

Evaluating stand-level retention practices using this protocol is broken down into two key parts:

1. Evaluating landscape context – This is an office-based exercise where evaluators review a set of GIS-based indicators provided for each random cutblock sample. This portion of the evaluation is used to answer Questions #1-4 of the protocol. The landscape context information can be accessed at any time, but preferably the information should be compiled and verified prior to going in the field as part of the office-review of the cutblock site plan and development of the field sampling plan. This ensures evaluators have a good understanding of the cutblock and can verify any information when in the field. Landscape context indicators can also be verified after field sampling.
2. Field sampling – The field portion of the evaluation is where evaluators establish plots and transects on the ground to record wildlife trees and CWD in randomly sampled cutblocks. Ground plots and transects are stratified to sample in both the wildlife tree retention areas (WTRAs) and in the harvested, or net area to be reforested (NAR), portion of the cutblock. This part of the evaluation is used to answer Questions #5-8 of the protocol.

Once the field data is submitted to FREP IMS, the collected information is compiled and compared to pre-defined benchmarks for stand-level attributes summarized by different forest ecosystems in the province. The landscape context information will be combined with the results of the field sampling to answer all 8 questions in the protocol and assign the overall cutblock rating as described in the next section.

CONCLUDING ON STAND-LEVEL RETENTION PRACTICES

As noted earlier, the response of elements of biodiversity and wildlife to stand-level retention is not directly measured by the protocol, so the effectiveness of retention practices at conserving biodiversity and wildlife habitat can only be inferred from existing management guidance and research information. In the protocol, we use the term "likely" as a qualitative estimate about how probable stand-level retention practices will help conserve biodiversity and wildlife habitat over the rotation period of the stand given how well retention practices follow existing guidance (Table 2). Likelihood is a qualitative approach of estimating probability and incorporates uncertainty in our understanding. These statements refer directly back to the FREP question.

Table 2. *Ratings used to describe how likely stand-level retention practices relate to the FREP question*

Likelihood rating	Estimated probability of occurrence	Description
Very Likely	>90%	Very Likely that stand-level retention provides the range of habitats with the structural attributes understood as necessary for maintaining the species dependent on wildlife trees and CWD.
Likely	>66%	Likely that stand-level retention provides the range of habitats...
Somewhat Likely	33-66%	Somewhat Likely that stand-level retention provides the range of habitats...
Unlikely	<33%	Unlikely that stand-level retention provides the range of habitats...
Very Unlikely	<10%	Very Unlikely that stand-level retention provides the range of habitats ...

Using these ratings, the outcome of the protocol is an estimate of how likely stand-level retention practices maintain biodiversity and wildlife habitat based on the outcomes of the eight questions. Based on how close the evaluated cutblock is to guidance targets, each question is scored from 1 to 4, where: Exceeding = 4, Meeting = 3, Below = 2, and Well Below = 1. The cumulative score of the 8 questions determines the rating for the cutblock (Table 3). To be rated as Likely or Very Likely that the evaluated cutblock provides the range of habitats with the structural attributes understood as necessary for maintaining the species dependent on wildlife trees and CWD, the cutblock must be Meeting or Exceeding targets in at least half of the questions, achieving a minimum combined score of >20. Cutblocks that are Below or Well Below guidance targets of most of the questions will score lower and are considered Unlikely or Very Unlikely to maintain the range of habitat attributes.

Note: Not all sampled cutblocks will have wildlife trees directly associated with the cutblock. Legal wildlife tree retention targets can be achieved at the cutting permit scale. As a result, not all sampled cutblocks will include wildlife tree patch strata or dispersed wildlife tree strata.

In circumstances where no wildlife tree retention exists, the cutblock will not be evaluated based on questions that are specific to wildlife tree retention amount (Questions 1 and 2) or the question that evaluate wildlife tree retention quality (Question 5) or windthrow (Question 6). In that case, scoring for Questions 3, 4, 7 and 8 are averaged and used to calculate a final likelihood rating where <1.625 = Very Unlikely, <2.25 = Unlikely, <2.75 = Somewhat Likely, <3.375 = Likely, and >3.375 = Very Likely.

Table 3. *Rating and scores for determining the likelihood that stand-level retention practices successfully address the FREP question*

Rating	Score (Out of 32)	Relationship to Evaluation Questions
Very Likely	>26	Meeting or exceeding retention guidance benchmarks for most or all questions
Likely	22-26	Meeting or exceeding retention guidance benchmarks for most questions
Somewhat Likely	18-21	Meeting or exceeding retention guidance on about half of the questions
Unlikely	13-17	Below or well below retention guidance benchmarks for most questions
Very Unlikely	<13	Below or well below retention guidance on most to all questions.

LANDSCAPE CONTEXT

Landscape context refers to the condition of the forested land base surrounding a cutblock being evaluated. The landscape unit (LU) and biogeoclimatic subzone (BEC unit) combination in which the cutblock falls is used to define the landscape. Landscape context is important and determines what is necessary and appropriate for stand-level retention (Beese et al. 2019). When considering landscape context in the evaluation of stand-level retention practices, three main factors are important:

1. The area of the operable land base or timber harvesting land base (THLB) – A land base that has more area available for harvesting (that has either been or can be harvested) is more sensitive to loss of important habitat attributes due to harvest practices. Landscapes with high levels of reserves or non-operable forest will generally have more habitat attributes available, so within-stand retention is less critical.
2. The amount of area disturbed through forest harvesting, wildfire, and insect attack – Landscapes with low levels of disturbance will generally have available wildlife habitats associated with older forests. Highly disturbed landscapes, particularly where extensive and severe natural disturbances and forest harvesting have occurred in quick succession, will require more stand-level retention to ensure sufficient habitat is available.
3. Natural disturbance type (NDT), a characterization of the frequency and severity of natural disturbances in a forested ecosystem – Biogeoclimatic subzones in BC are classified into one of five NDTs. Forest ecosystems with fewer stand-initiating disturbance events and more frequent, smaller, and less severe disturbances (e.g., gap phase dynamics) will require more stand-level retention to resemble natural disturbance patterns.

Landscape context affects the potential for forest harvesting to negatively impact wildlife habitat and biodiversity, and the Landscape Context Rating reflects the level of concern of those impacts (Table 4). In general, the level of concern increases as both the amount of operable timber harvesting land base and the level of forest disturbance converting forests to early seral habitats (<40 years old) also increase.

Table 4. *The Landscape Context Rating describes the level of concern for maintaining wildlife habitat and biodiversity*

		% Forest disturbance (<40 years old)				
		<20	20-40	40-60	60-80	>80
% THLB in LU/ BGC subzone	<20	Very Low	Very Low	Very Low	Low	Low
	20-40	Very Low	Very Low	Low	Low	Moderate
	40-60	Low	Low	Moderate	Moderate	High
	60-80	Low	Moderate	Moderate	High	Very High
	>80	Moderate	Moderate	High	Very High	Very High

In landscapes with higher levels of concern, existing management guidance recommends modifying forest harvesting practices to minimize impacts,[6] such as modifying cutblock shape and the amount and location of stand-level wildlife tree retention within the cutblock. Questions #1-4 of the protocol evaluate how well stand-level retention practices (the amount and configuration of retention within the cutblock as well as block shape) consider the landscape context.

[6] Note: some landscapes may have objectives that prioritize timber harvesting over wildlife habitat and biodiversity considerations, so the generalized matrix of management concern shown here may not always reflect management direction.

Question #1 – Retention Amount – evaluates the total amount of retention in the cutblock relative to the amount of timber harvesting land base (THLB) and existing disturbance.

Question #2 – Patch Size – evaluates the total amount of retention within the cutblock relative to the size of the "patch" or "functional opening" created by the cutblock and adjacent cutblocks harvested within a 30-year period.

Question #3 – Landscape Connectivity – evaluates the maximum distance across the cutblock between forest cover within and adjacent to the block.

Question #4 – Microenvironment – evaluates the percent gross cutblock area that is covered by forest or within 1 tree length of forest.

For cutblocks harvested between 2015-2020 evaluated under this protocol, landscape context up to 2015 is used as an estimate of the adjacent forest and landscape condition that planning foresters would have needed to consider prior to harvesting. As of 2023, the landscape context up to 2020 will be used, as cutblocks harvested in 2020-2021 will be considered for sampling.

Landscape context summary information is analyzed and provided annually for each random cutblock on the District Random List in the Resource District Landscape Context Summary Table. This is done to ensure consistency in analysis methodology across the province and provides efficiencies for district staff or others completing stand-level retention evaluations.

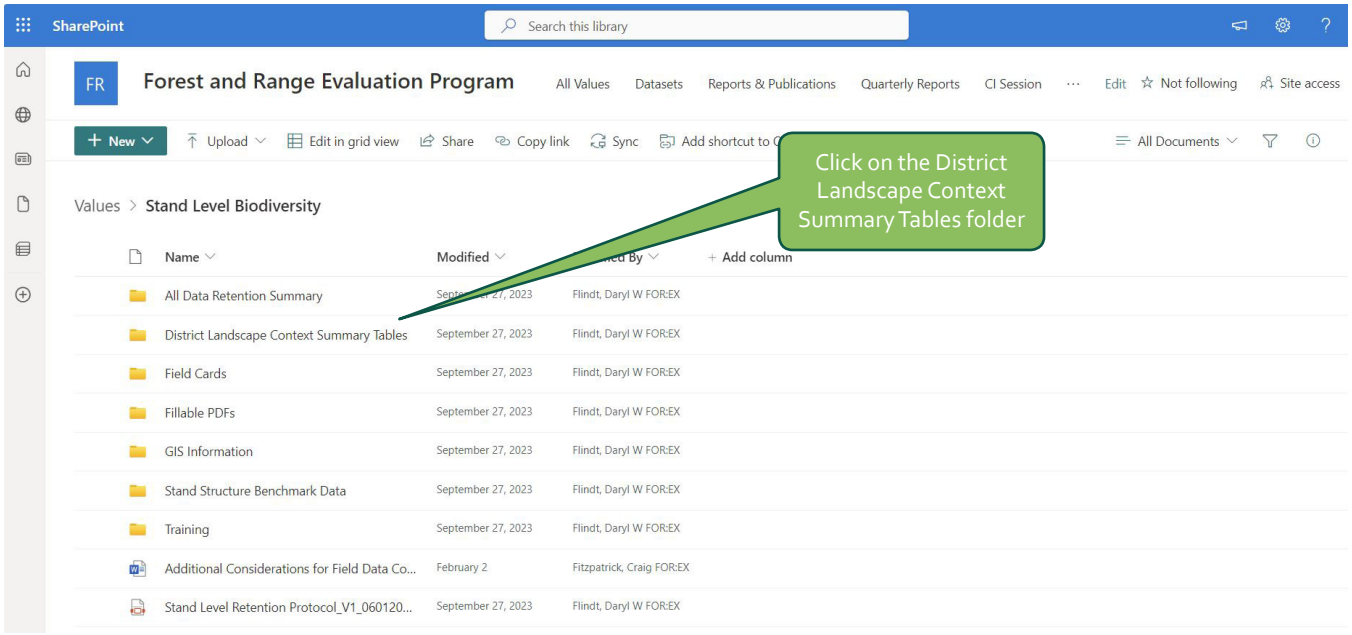
Indicators

The following are a subset of outputs of the key indicators used to evaluate landscape context. All information is summarized to the landscape unit and biogeoclimatic subzone variant (LU/BEC) combination that the cutblock falls within. The indicators include:

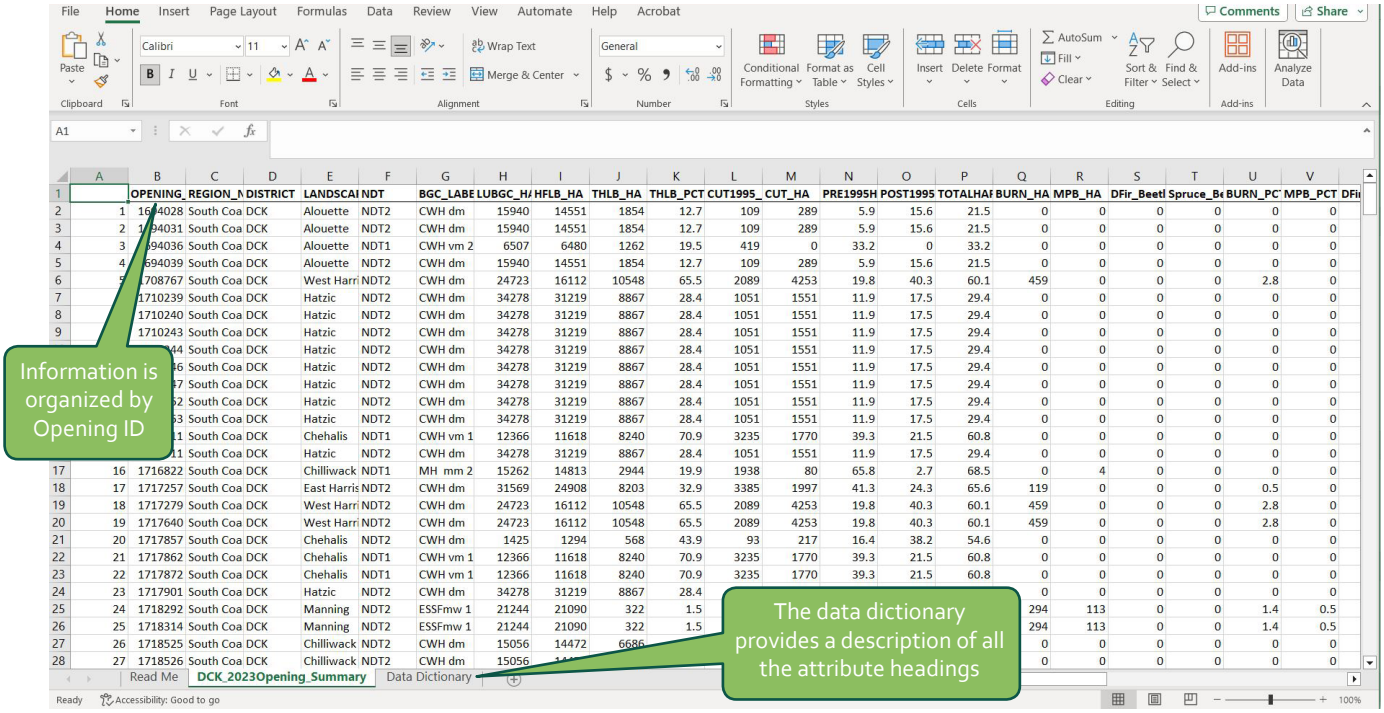
- BEC Group – groupings of biogeoclimatic subzone variants that represent similar climatic and natural disturbance conditions;
- Natural disturbance type (NDT);
- % timber harvesting land base (% of total forest area);
- % area harvest (% of forest area<40 years old that has been harvested);
- % burn (% of forest area in Moderate-High burn severity class due to wildfires) – areas harvested pre or post wildfire are counted as harvested;
- % insects (% of forest area cumulatively affected by insects to 2015) – includes Medium to High Severity insect attack for mountain pine beetle (IBM) and spruce beetle (IBS);
- % total disturbance (% of forest area cumulatively affected by forest harvest, wildfire, and insect attack) – areas affected by more than one disturbance are counted once;
- % forest influence – % of the gross area of the cutblock that is covered by a wildlife tree retention area (WTRA) and/or within 25 m of within stand retention or adjacent forest (>40 years old);
- Maximum distance across the cutblock (metres);
- Patch size in hectares; and
- Patch size class in hectares (<50, 50-250, 250-1000, 1000+) where the opening occurs.

Getting Started: Accessing Landscape Context Information

Resource District Landscape Context Data Summary Tables are generated for all random cutblocks in each district. The results are provided in an Excel spreadsheet available on the FREP SharePoint site. To access the tables, navigate to the "Stand-Level Biodiversity folder" on the site, then open the District Landscape Context Summary Table folder.

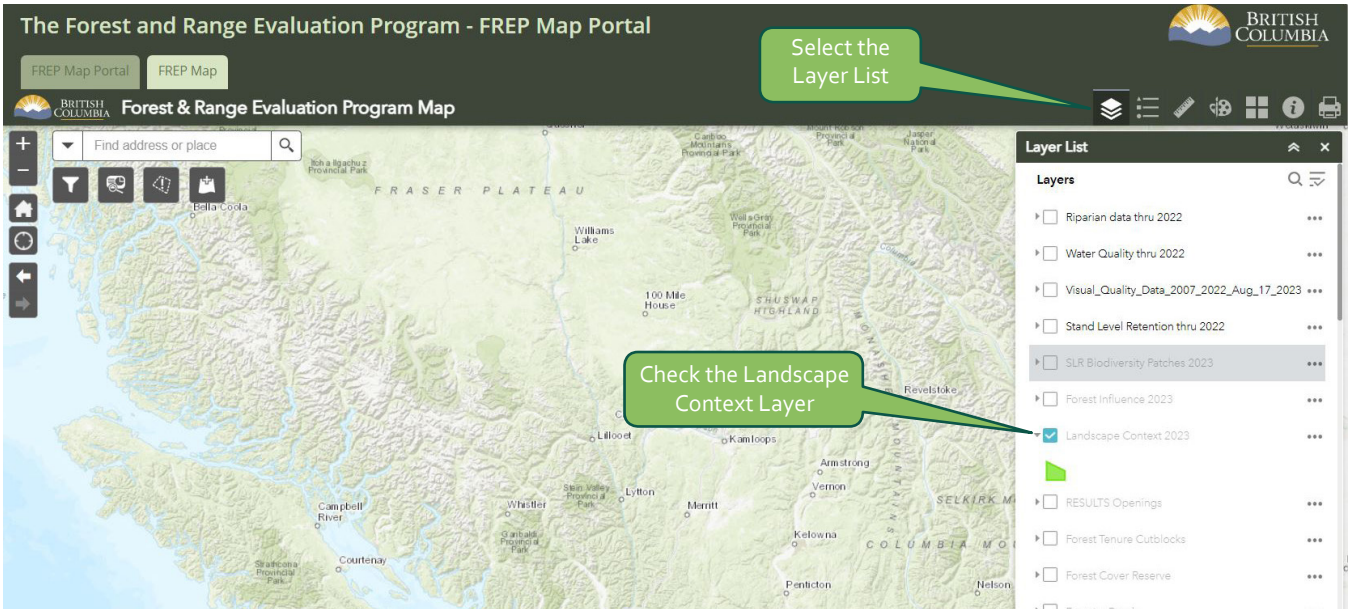


Inside the folder, the tables are organized by resource district. Locate the district of interest and open the file. Landscape context information is provided by the cutblock "Opening_ID". A data dictionary is included as a separate worksheet to provide more detailed descriptions of each of the associated columns.

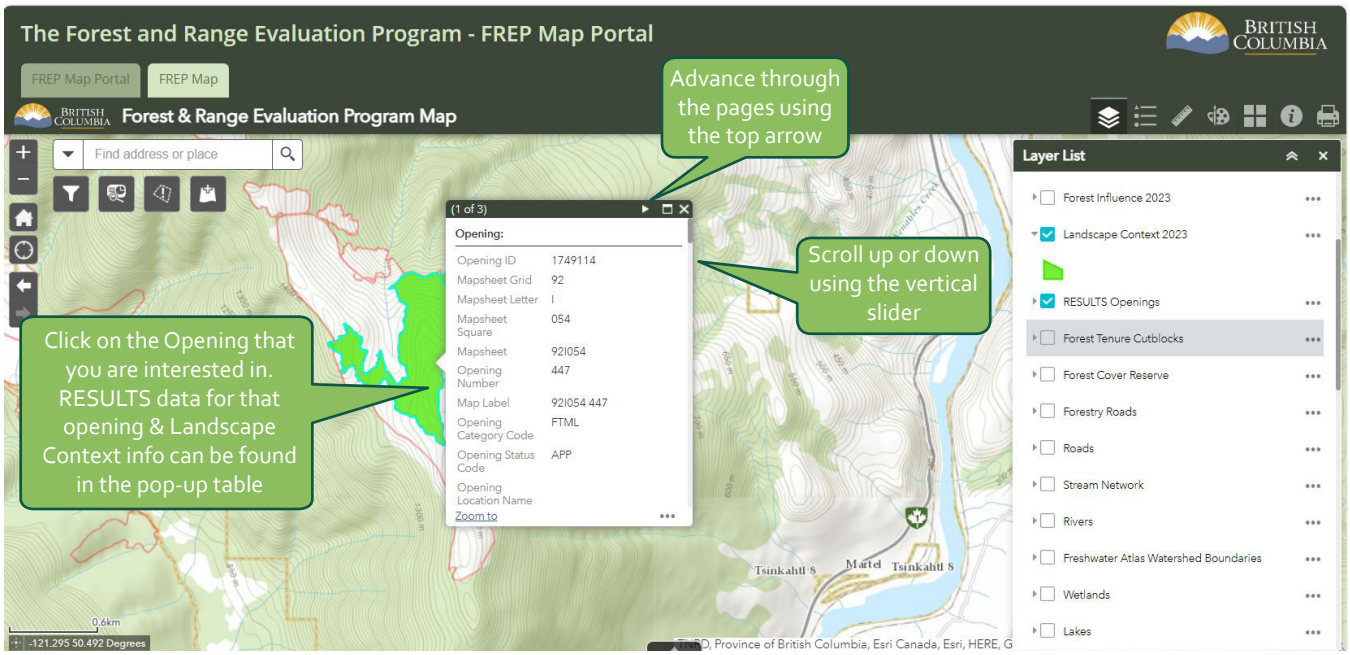


In addition, the landscape context information can be viewed spatially on FREP Map. To access this information, follow these steps:

1. Open FREP Map, select the layer list and check the Landscape Context layer to ensure you can access the stand-level retention information for the desired cutblock.



2. On the map, zoom into the cutblock of interest. Click on the cutblock and RESULTS data and Landscape Context will show up on the pop-up table. Scroll down through the pop-up table to find the landscape context indicator data toward the bottom of the table.



Verifying Landscape Context Information

The landscape context information in the District Landscape Context Summary Tables is derived by completing a province-wide analysis using available provincial datasets. The analysis is generally accurate, but data inaccuracies or analysis issues can sometimes cause incorrect results.

The accuracy of the GIS analysis should be verified prior to use to ensure it accurately reflects the broader landscape condition and forest condition immediately adjacent to the cutblock, which affects patch size, forest influence, and maximum distance.

The section titled "Answering the Routine Evaluation Questions" of this protocol provides further information on the indicators used to evaluate stand-level practices relative to landscape context. That section also provides detailed steps and considerations to verify and, if necessary, override the landscape context results.

Overriding GIS-based Landscape Context Results

Evaluators can override the GIS indicators if the results of the GIS analysis don't accurately reflect conditions on the ground around the time the cutblock was planned and harvested. To do this, the evaluator should identify specific indicators associated with each question that are inaccurate. Where the indicator is inaccurate, evaluators can use other sources of information to estimate conditions that better reflect the actual conditions.

The District Landscape Context Summary Tables provide additional columns at the end of each table to incorporate evaluator overrides. These columns are labelled "Q1_Override", "Q2_Override", "Q3_Override", "Q4_Override" and "Comments". When verifying the landscape context indicators and ratings, if an evaluator has evidence that a different rating is appropriate for that question, the evaluator can override the rating and assign an appropriate rating in the column associated with that question. If an override is used, that rating will replace the rating in the associated column. Evaluators also need to provide a rationale in the "Comments" column describing why the change was made.

Recording the Landscape Context Information

The landscape context information is compiled separately from the field sampling data that is recorded in FREP IMS. Once the field sampling data has been recorded in FREP IMS, the Stand-level Retention Value Lead will summarize the field sampling data with the landscape context data and assign ratings based on the benchmarks described for all questions in the protocol. District staff involved in the sampling will have an opportunity to review the outcomes of the combined GIS landscape context and field sampling ratings, as well as any documented overrides to adjust the final ratings.

To record the landscape context data for the cutblocks sampled from the random list, follow these steps:

1. Create a new Excel spreadsheet – a blank template with the field headings can be found on the FREP SharePoint site labelled "landscape context template.xlsx".
2. Save the Excel file to the same folder in the SharePoint site but save the file under a new name that shows it contains sample data and the district name. For example, landscape context information for sampled cutblocks in the Okanagan Shuswap Resource District can be named "DOS_Landscape_Context_Samples.xlsx".
3. For each random cutblock that has been sampled, copy the landscape context information from the original District Landscape Context Summary Table into the new Excel spreadsheet. Copy over information for those cutblocks that have or will be sampled. This will result in a spreadsheet that is similar to the original District Landscape Context Summary Table but only includes the random cutblocks that were sampled for that year.

FIELD SAMPLING

Indicators

The indicators used to assess stand-level retention 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; and
- 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 cutblock, you will require:

- A site plan 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);
- A site plan (optional); and
- Air photos/orthophotos (optional).

For field sampling, you will need:

- Prisms appropriate for local conditions – suggested range of prisms 4 BAF to 10 BAF (Interior) or 20 BAF (Coast) (to bring in, on average for a stratum, 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
- 30-m tape
- Clinometer
- Calculator
- Laser range finder (optional – but highly recommended) or instrument such as the Vertex
- Flagging tape and marking pen
- Tree marking spray paint for marking trees and CWD
- GPS
- Increment borer (optional)

- Binoculars (optional but highly recommended)
- 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.
3. Identify the patch retention strata and determine if the harvest area requires stratification. Remember that each retention area is a separate stratum.
4. Prior to heading into the field, randomly choose plot locations and mark them on the map. A suggested low-tech technique is to place an appropriate scale dot grid over the site map.
    a. Patch: Randomly pick one plot 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 (can be dispersed retention or clearcut). Harvest area plots are established to assess dispersed retention and coarse woody debris. If the harvest area has clearcuts and areas having different levels of dispersed retention, try to randomly divide these three harvest area plots amongst the treatments. Very large cutblocks (>100 ha harvest area) will require more harvest area plots (e.g., 5 plots per 100 ha), as described in Appendix 1. If possible, increase the number of plots in harvest areas with high levels of dispersed retention to allow for better estimates of the tree indicators.
5. 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 cutblock. 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.
6. 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.

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).

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. Example 1 shows that a 32-ha cutblock with two 1-ha wildlife tree retention areas (WTRAs) and one riparian reserve area would have four strata. Each reserve area and the harvest area (no retention) would be considered individual strata.

Example 1. *Potential stratum ID and type – 32-hectare cutblock*

Description	Stratum ID	Stratum type	Plot type
Edge patch	WTR1	PW	BAF 6
Internal patch	WTR2	PW	BAF 6
20-m reserve along S3 stream	WTR3	PR	15-m radius
Negligible retention	NAR	CC	30-m radius

Example 2 shows that a 70-ha cutblock with two 4-ha wildlife tree retention areas (WTRAs), 10 ha of uniform dispersed retention (approximately 10 stems per ha), and another 15 ha of dispersed retention at 75 stems per ha can be stratified into five sample strata: two strata in the WTRAs, two strata in each of the different dispersed retention areas, and one in the clearcut. Stratification of the net area to be reforested (NAR) (i.e., the harvest area) allows for a different plot type (e.g., BAF, fixed-area radius or fixed area) to be used between the strata to get a "reasonable" number of sample trees. Plot type (e.g., same BAF or fixed-area radius) *must* be consistent within a single stratum. 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 evaluators may have to define the area in the field, being careful to clearly mark the stratum on the map (Figure 3 and include the stratum area on the Stratum Summary card (Form B).

Example 2. *Potential stratum ID and type – 70-hectare cutblock*

Description	Stratum ID	Stratum type	Plot type
Edge patch – rocky outcrop, few trees	WTR1	PW	BAF 4
Internal patch	WTR2	PW	BAF 8
Heavy retention	NAR1	DW	BAF 4
Sparse seed tree	NAR2	DW	Full count
Clearcut	NAR3	CC	30-m radius

Standard Unit Treatment Summary			
	SU1	SU2	Total
Reserve			19.2
NAR*	45	11.2	56.2
Gross			75.4
External reserve			5.0
Override (adjusted gross)			80.4

*NAR refers to net area to be reforested.

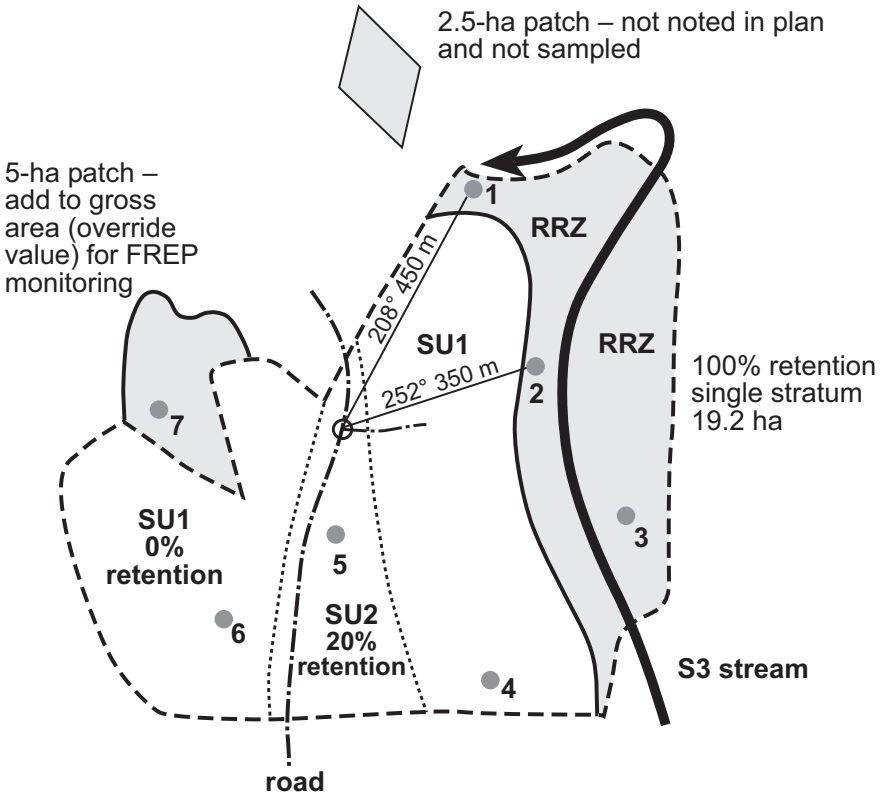


Figure 3. *Map of Example #2, showing strata definition.*

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.

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.

If multiple strata are designated in the harvest area to allow for different plot types, it is not necessary to establish three plots in each harvest area strata. However, areas of high-density dispersed retention will benefit from additional harvest area plots to better estimate the tree indicators.

Table 5 outlines the intensity of sampling for six different scenarios that will ensure the objectives of stand-level retention monitoring are met.

Table 5. *Examples of intensity of sampling for six different scenarios*

Description of retention	# of plots in cutblock	Discussion
60-ha homogenous cutblock. No trees >12.5 cm DBH retained.	• 3 randomly located plots in the harvest area.	Since 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.	• 3 randomly located fixed-area plots in the dispersed area.	A 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.	• 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 WTRA.	• 1 randomly located plot in patch retention. • 3 randomly located plots in harvest area.	This conforms with the one plot per ha in patch.
158-ha mountain pine beetle cutblock with 35 ha of retention. Two 14-ha WTRA patches with riparian influence and 12 smaller internal patches.	• 6 randomly located plots in the harvest area. • 8 randomly located plots in the riparian influence retention. • 6 randomly located plots in the smaller patches.	Relatively uniform pine stand allows for a reduced number of plots, according to the "Big Block" sampling procedure (Appendix 1). Establish 8 plots total in the two 14-ha WTRAs. Randomly select 6 of the smaller patches to sample. Ensure reserve summaries are done for all patches. In the harvest area, establish 6 plots randomly in the 123 ha of harvest area.
3 6-ha cutblock with one 2.6-ha WTRA and 7 ha of RRZ. Harvest area has evenly distributed (50 stems per ha) dispersed retention.	• 3 randomly located plots in the WTRA and 5 randomly located plots in the 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 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-held devices, 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 centers and the CWD transect segments.
- Record plot #, date of assessment, and identify as a FREP monitoring 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.
- The target is an average of 6-10 trees per plot. In a stratum with variable stocking, some plots will have few (or no) trees, others will have many trees. Try for a BAF that averages about 6-10 trees per plot.
- 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 6).

For example:

- Prism BAF = 4 (has a plot radius factor of 0.25)
- DBH of largest tree = 45 cm
- LD = PRF × DBH = 0.25 × 45 = 11.25 m.

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

Table 6. *Table showing plot radius factors where* $PRF = \frac{1}{2\sqrt{BAF}}$

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.

Plots which are located on or adjacent to timber type lines or harvesting boundaries inside the sample area, can be split through the plot centre parallel to the type line. The trees inside the sample area are recorded and note on the plot card that it is a border or half plot. Each tree captured by the prism sweep will be tallied twice. When entering this data into the Information Management System, ensure each tree is entered twice.

Borderline trees for prism plots

Use the following procedure for determining if borderline BAF trees are in/out of the 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 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*30 = 7.5). If the distance to the center 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 (e.g., 15 trees/ha), conduct a fixed-area plot.
- For fixed-area plots, a 30-m radius is recommended. When adjusting this radius to try to achieve about 6-10 trees per plot, 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 one plot radius distance from the edge.

Full Count Area

Entire area of stratum

This method is suitable in a stratum with an extremely low density of trees (e.g., less than 30 sample trees total).

The stratum area will typically be the full area of NAR, or the full area of one or more treatment units which make up the stratum. If more than 20 or 30 trees are likely to be counted, use 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 and the tree tally is recorded as if it is one plot. If possible, put all the tree data onto the stand table of the first plot card (Form A) in that stratum. You will still require plots to tally CWD. Whenever the full count area is smaller than the total stratum area, the data will be extrapolated to the full stratum. Be sure to show this subset area on the field map.

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 greater than 12.5 cm. 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 cutblock. However, this value is usually minimal compared to full size trees, and thus are NOT tallied. Stubs are purposefully made at the time of harvest to enhance biodiversity. Stubs may have marginal value as habitat if they already have heart rot 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.

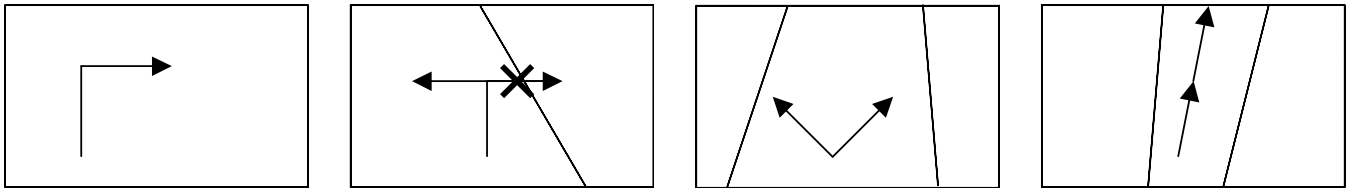
In summary:

- 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 includes 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):
  - The first choice is to use a cardinal bearing that you've pre-determined prior to the start of sampling, for the whole block.
  - If the transect extends out of the stratum, add 90º. If that still takes you outside the stratum, go to options 3 or 4 shown in Figure 4.
- The second leg is at a 90º angle additive from the first bearing, as long as that keeps you within the same stratum. If not, subtract 90º. The purpose of the 90º 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.
- Flag the end of each of the two 15-m transects. Consider painting the CWD pieces at the point where they are crossed by the transect, especially when there are a lot of pieces (it helps to ensure you have tallied all pieces).
- 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 perpendicular directions extend outside the stratum, try establishing both transects perpendicular from the plot centre. If this doesn't work, make a single 30-m transect. Record your results on the field card including how you modified the transect.



1. Normal CWD line transect – travel 15m from plot centre, turn 90º, then go another 15 m.
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 4. *How to locate CWD transects within a stratum.*

CWD and piles

If your random transect 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 that are at 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, 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 determine sizes safely and accurately, 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.

Example 1. *The following is an example of a pile summary*

Diameter classes	<2 m length			2–6 m length			7–11 m length		
	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	Start of Leg #2
25	Dr	2	17	3	

Cutblock 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, or 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 site plan (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 and this total is recorded as the "override" area (the adjusted gross area).
- 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 that are contiguous (e.g., a WTRA immediately alongside an 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).
- Non-productive areas (e.g., swamp) that are netted out of NAR should not be sampled.

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) to utilize an appropriate (efficient) tree count methodology. Remember, each time you switch plot types you must stratify the dispersed area and attribute a size for the stratum, as well as complete 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., minimum of 3 plots in the harvest area (this may be increased if there is a high density of dispersed retention), 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 version 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 retention 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. However, if there are patches in existence on a cutblock, always establish *at least* one patch plot. A cutblock containing retention patches may be rejected for data analysis if there are no patch plots established (no information for development of tree indicators). 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 patch stratum regardless of whether they are sampled. *Do not* use Section 16 for a dispersed stratum.

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., WTR1, 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 curb deviation 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 Side 2. It is a two-letter code.

- CC stratum type = clearcut – a stratum with no trees >12.5 cm DBH in any of the plots (regardless of tree species or merchantability) and, in the evaluator's opinion, the total of the dispersed trees in the stratum equate to a patch smaller than 0.1 ha (see Appendix 2).

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 – if there are any riparian areas (either RRZ or RMA) in the stratum and the reserve is expected to be maintained for the full rotation.
- W = wildlife tree – if the SP or SP map notes a wildlife or biodiversity purpose for the retained trees and the reserve is expected to be maintained for the full rotation.
- O = other.
- U = unidentified.

Required Accuracy

Evaluators should measure one (or more if you are not comfortable estimating) tree diameter and height per plot to calibrate your eye. 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 FREP monitoring as the data will be combined into diameter and height classes. During the pilot testing of this procedure, an attempt was made to have tree data collected in pre-defined categories. We found that to place trees in the appropriate categories, evaluators needed to first estimate height and diameter. It was felt that since that work was being done anyway, the complete data should be collected. Furthermore, if different diameter or length or height limits are required, the data can be re-analyzed.

Innovative Practices

Innovative –something new or different. (Source: www.dictionary.com)

This section of the field form 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.

Reserve Constraints

A constraint percentage is determined for every stratum other than the CC (clearcut) stratum type. This information is used in the provincial analysis to assess the component of retention that is either:

- Being maintained to fulfill an additional purpose other than wildlife tree retention (e.g., RRZ, RMZ, visuals, recreation feature), or
- Had a very low likelihood of providing an economic harvest opportunity (e.g., rock, non-commercial, sensitive terrain).

In essence, what percentage of the area would have been retained regardless of wildlife tree retention? An ungulate winter range (UWR) or wildlife habitat area (WHA) should only be noted as a constraint if the block overlaps the designated UWR or WHA, harvesting is permitted, and retention requirements are specified in the SP or UWR/WHA order. A spatially designated old growth management area is not likely going to be a component of a cutblock. However, if this does occur, the percent constraint is likely 100 (assuming no harvesting is allowed in the OGMA).

Windthrow

Windthrow is tallied as the percentage of windthrown trees by stratum. In previous years, this was collected within categories (<5%, 5-15%, 15-30% and >30%). Starting in 2009, the categories were eliminated to reflect the level of windthrow more accurately, particularly for strata with a very high percentage of windthrow.

It is recommended that you sketch out areas of very high windthrow on your field map. When all sampling is completed in a stratum, assign a total windthrow percentage by weighting areas of higher and lower windthrow amounts. Windthrow is often highly variable and dependent on prevailing winds and stand structure, therefore, it is best to sketch and make notes on windthrow amounts as you travel through a stratum.

An example for a 5-hectare retention patch:

1 ha - 70% windthrow (equivalent to 0.7 ha windthrown)
4 ha - 4% windthrow (equivalent to 0.16 ha windthrown)

$\frac{(.7 + .16)}{5 \text{ ha}}$ = 0.172 or 17% windthrow average for the stratum

Example using tree count estimates: 2 plots in the WTRA with a total of 17 trees standing and 8 trees windthrown. The total windthrow estimate is 8/(17+8) or 8/25 = 32%. This example is simply a ratio and does not require a particular fixed area plot size – just keep the size consistent at each plot and large enough to capture a good tally.

Ecological Anchors

The provincial guidance provided for the selection of wildlife tree retention is to first look for important features to protect such as high value wildlife trees (e.g., veteran trees or trees containing cavity nests, hollow stems, stick nests, large witch's brooms, bear dens, active feeding on the tree), or features such as a mineral lick or hibernaculum. A hibernaculum would be an important feature – this is primarily a den (e.g., hollow tree or cave) where bats may overwinter. The presence of bat guano and the smell should be clues to such a hibernaculum. Other hibernacula are possible for ground dwelling creatures (e.g., snakes), but since these are much harder to identify –unless they are a component of a WHA and noted as such in a silviculture prescription – it is not expected that evaluators will find and note them. The presence of these types of ecological anchors on a site may indicate a choice on the part of the licensee to protect such high value attributes.

The provincial guidance goes on to say that if no important features require protection through wildlife tree retention, then look to retain an area with trees that will likely attain high value wildlife tree status. If you determine that there are trees being retained equivalent in size to the dominant trees pre-harvest, then we might assume that this guidance is being considered (i.e., largest trees for the site).

It is understood that you will not be walking through 100% of every stratum. However, take some time to visually assess each stratum as you walk by or through it. An unsampled stratum should also be scanned with binoculars to detect the presence of ecological anchors.

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 the evaluator's opinions of how well they feel the cutblock retained stand structures and representative 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 evaluators feel they are well done, the evaluator's rationale may provide insight into data that should have been collected or a way in which the data might be interpreted differently.

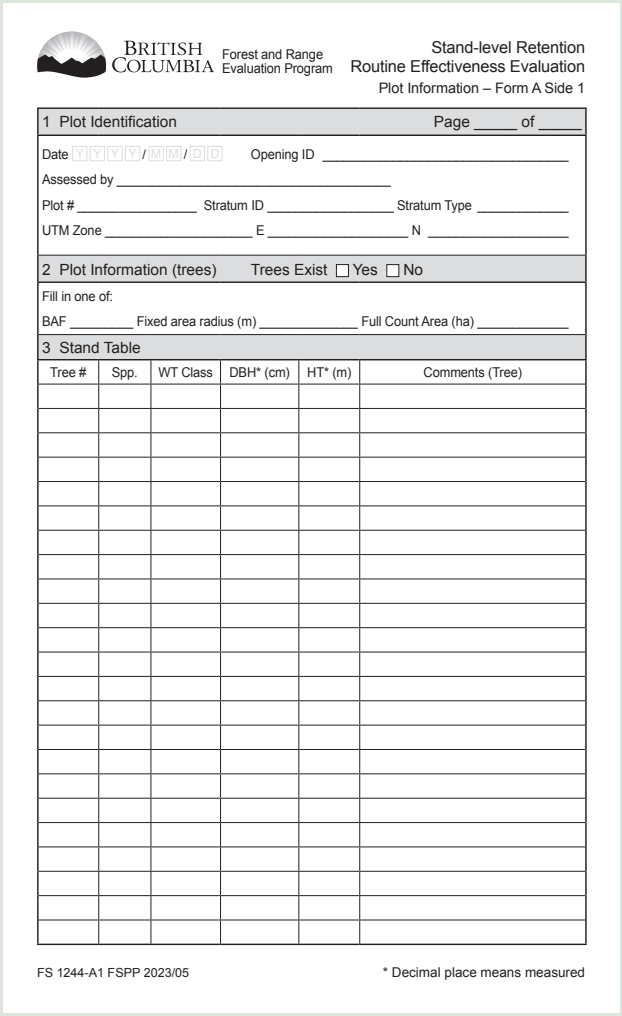
Evaluators should ask the following questions:

- 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 retention Resource Stewardship Monitoring forms (FS 1244 A, B, and C). Examples of completed forms are provided in Appendix 3.

Section	Instructions/Descriptions
Plot Information **Form A Side 1**	**1. Plot Identification** *Page ___ of ___* – fill in if multiple pages are used for a single plot (e.g., page 1 of 3). *Date* – date of assessment (month/day/year). *Opening ID* – numeric identification from the RESULTS database. *Assessed by* – names or initials of evaluators. *Plot #* – unique plot identification number (start at 1 for each new cutblock; no letters and no repeat numbers). *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. (If no signal, note that fact, but make sure the plot is accurately mapped and labelled, in case of future site visits.) **2. Plot Information (trees)** *BAF* – record basal area factor of prism. *Fixed area radius* – record radius in metres (15–50 m, recommended 30 m). *Full Count* – record area (ha) to which full count applies (if the full count area is smaller than the 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 (with diameter >12.5 cm and height >1.3 m). *Spp.* – record tree species using codes on Reference Form – Side 2 (FS 1244-D2). Record to species (e.g., Py). *WT Class* – record wildlife tree class using codes on Reference Form – Side 1 (FS 1244-D1). *DBH (cm)* – diameter at breast height 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 the plot can be included in the strata summary (Form B Side 1).



BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Plot Information – Form A Side 1

1 Plot Identification Page _____ of _____

Date Y Y Y Y / M M / D D Opening ID _____

Assessed by _____

Plot # _____ Stratum ID _____ Stratum Type _____

UTM Zone _____ E _____ N _____

2 Plot Information (trees) Trees Exist ☐ Yes ☐ No

Fill in one of:

BAF _____ Fixed area radius (m) _____ Full Count Area (ha) _____

3 Stand Table

Tree #	Spp.	WT Class	DBH* (cm)	HT* (m)	Comments (Tree)

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* Decimal place means measured

Section	Instructions/Descriptions
Plot Information **Form A Side 2**	**4. Plot Information (CWD)** Transfer *Stratum ID* and *Plot #* from front of card, in case cards are photocopied or lost. *CWD in transect* – tick "Yes" or "No". *1st Leg* and *2nd Leg* (a transect "leg" is 15 m) – record compass bearing of the transect. This is to help relocate the 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 where transect intersects log; record decimal place if measured. *Length (m)* – length in metres; record decimal place if measured. *Comments* – record any comments on individual pieces of CWD. General comments on the plot should be recorded on the stratum summary Form B Side 1. For guidance on measuring CWD, refer to Appendix 4.

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Plot Information – Form A Side 2

4 Plot Information (CWD) Stratum ID _____ Plot # _____

Coarse Woody Debris (30 m transect) CWD in transect ☐ Yes ☐ No

1st Leg _____° 2nd Leg _____°

Log #	Spp.	Decay Class	Dia.* (cm)	Length* (m)	Comments

FS 1244-A1 FSPP 2023/05 * Decimal place means measured

Section	Instructions/Descriptions

Stratum Summary

Form B Side 1

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Stratum Summary – Form B Side 1

5 Stratum Summary (one card per Stratum)

Date Y Y Y Y / M M / D D 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 ☐ NA

% of total trees in reserve windthrown: _____ %

Distribution of windthrow: ☐ Edge ☐ Internal ☐ NA

Windthrow treatment: ☐ Feathering ☐ Topping ☐ Both ☐ None ☐ Other _____

7 Reserve Constraints	% of reserve	Ecological Anchors		stratum estimate
None	☐	None		☐
Wetsite		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 / WHA		Large witches broom	stratum count	
OGMA		Karst feature		Y N
Visuals		Largest tree for site (not Vets)		Y N
Cultural heritage feature		CWD heavy natural concentration		Y N
Recreation feature		Active wildlife trails		Y N
Other:		Active WLT/CWD feeding		Y N
		Uncommon tree species		Y N
Total constrained		Other:		

Comments:

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5. Stratum Summary

Date – date of assessment.

Opening ID – numeric identification from the RESULTS database.

Assessed by – names or initials of evaluators.

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 stratum – 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. Harvest areas are considered as mapped by SU designation.

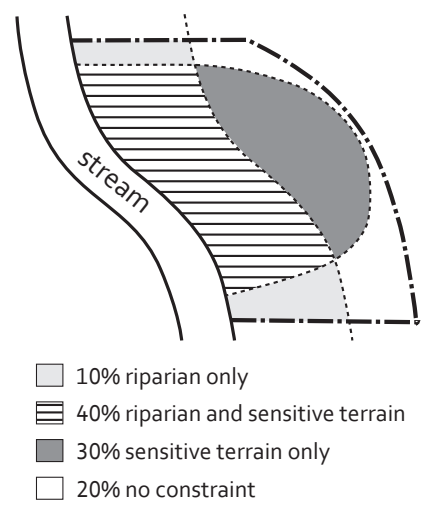
Tick one of:

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

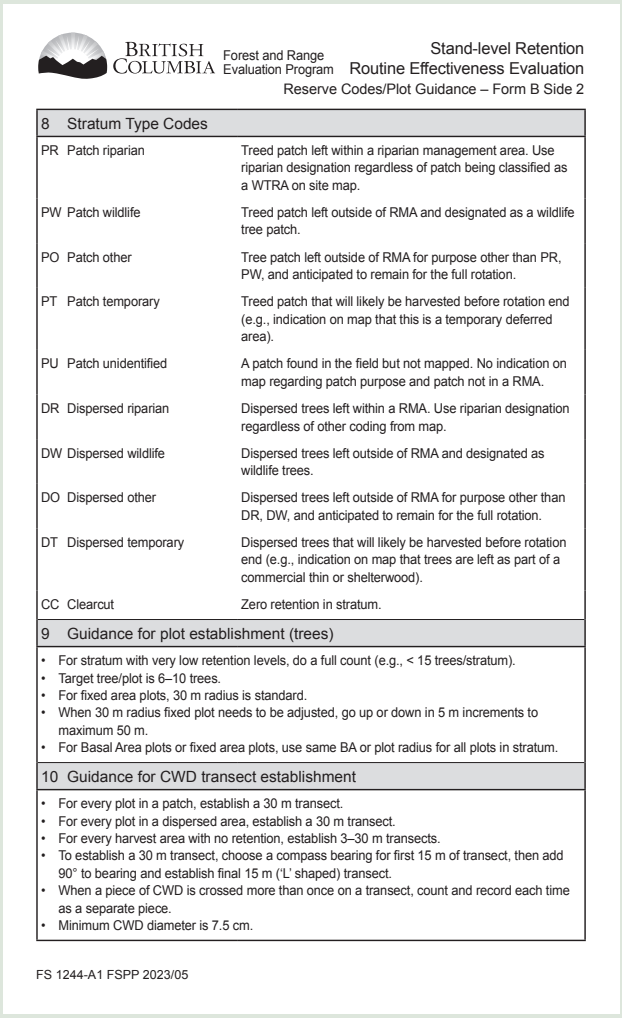
Harvest area with dispersed retention – tick this box if harvested area contains dispersed retention >12.5 cm DBH.

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
	6. Patch/Dispersed Summary *Estimated age of oldest trees in reserve (other than vets)* – 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. *Patch location* – 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. *% of total trees in reserve windthrown* – estimate the % of trees windthrown in the stratum. 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. 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, and whether the windthrow impacts are edge, or internal, or throughout. Overall, what % of retained trees was affected by wind.
Stratum Summary **Form B Side 1 (cont.)**  	**7. Reserve Constraints and Ecological Anchors** *Reserve constraints* – the amount of area contributing to an alternate requirement or if the area is inoperable. 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" must be the total proportion of the stratum that is constrained (e.g., 80%) NOT the sum of all constraints. *Ecological anchors* – 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 could be an artificially modified tree (e.g., nest platform, nest box). Check the "none" box if there are no anchors.

Section	Instructions/Descriptions
Reserve Codes/Plot Guidance **Form B Side 2**	**Reserve Codes and Plot Guidance** This form provides reference material for: • Reserve codes • Plot establishment • CWD transects



BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
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 WTRA 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)
• 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. • 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
• 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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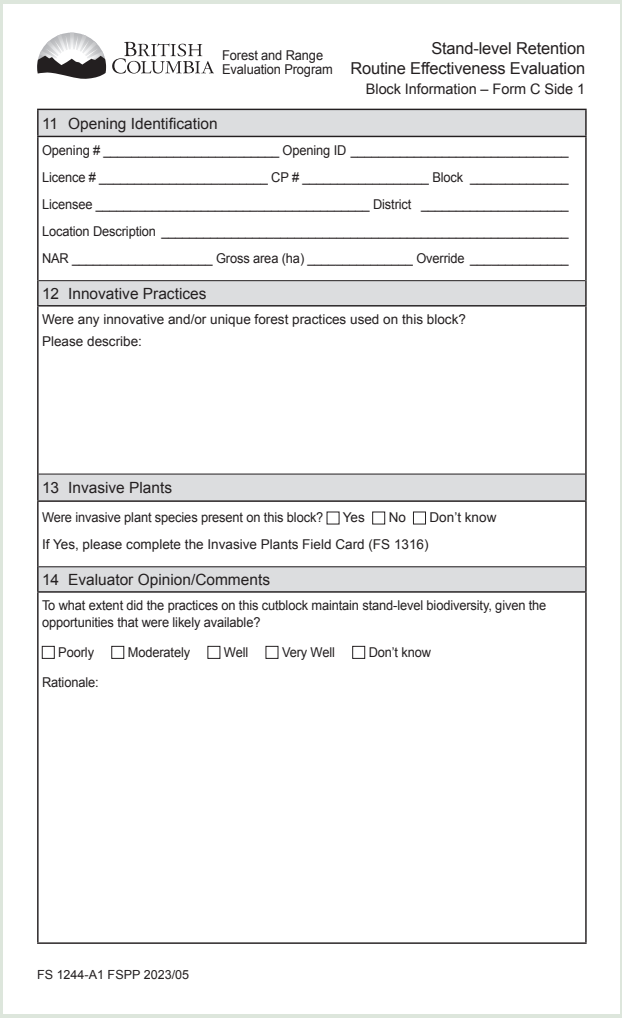
Section	Instructions/Descriptions
Block Information **Form C Side 1**	**11. Opening Identification** This section header contains complete identification for the block. Information can be filled in at the office with data from the post-harvest map, SP, or RESULTS *Opening #* – from RESULTS. *Opening ID* – from RESULTS. *Licence #* – from RESULTS or post-harvest map. *CP #* – from RESULTS or post-harvest map. Block # – from RESULTS or post-harvest map. Licensee – from RESULTS or post-harvest map. District – enter name or 3-letter code. *Location descriptor* – general description of location (e.g., Fury Creek). *NAR* – enter the total net area to be reforested (the total hectares actually receiving reforestation treatment) from RESULTS. *Gross area (ha)* – equivalent to "total area under prescription" (i.e., inclusive of harvest area and all reserves associated with the cutblock) from RESULTS. *Override* – to attribute reserves associated with the cutblock but not included in gross area. Sum gross plus reserves as the "override" area (the corrected gross area). Note: Whether or not a patch reserve has been sampled, please fill out either Form B Side 1, Section A or use Form C Side 2, section 16, but NOT both. **12. Innovative Practices** *Were any innovative and/or unique forest practices used on this block?* 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 biodiversity.



BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Block Information – Form C Side 1

11 Opening Identification

Opening # _____ Opening ID _____

Licence # _____ CP # _____ Block _____

Licensee _____ District _____

Location Description _____

NAR _____ Gross area (ha) _____ Override _____

12 Innovative Practices

Were any innovative and/or unique forest practices used on this block?

Please describe:

13 Invasive Plants

Were invasive plant species present on this block? ☐ Yes ☐ No ☐ Don't know

If Yes, please complete the Invasive Plants Field Card (FS 1316)

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 ☐ Very Well ☐ Don't know

Rationale:

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Section	Instructions/Descriptions
Block Information **Form C Side 1 (cont.)**	**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, very well, 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; and • 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 windthrow. – If trying for longer term inputs of CWD, a few younger patches may be considered good. – Short, stunted, unhealthy trees may be considered poor, as they will not age well and may not create desired WT characteristics. • Amount of standing retention: – High levels of retention with good ecological anchors are good. – High levels of retention with no ecological anchors are not necessarily good. • Amount of CWD: – Long (>10 m) logs in decay classes 1, 2, and 3 in the harvested area is good.

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Block Information – Form C Side 1

11 Opening Identification

Opening # _____ Opening ID _____

Licence # _____ CP # _____ Block _____

Licensee _____ District _____

Location Description _____

NAR _____ Gross area (ha) _____ Override _____

12 Innovative Practices

Were any innovative and/or unique forest practices used on this block?

Please describe:

13 Invasive Plants

Were invasive plant species present on this block? ☐ Yes ☐ No ☐ Don't know

If Yes, please complete the Invasive Plants Field Card (FS 1316)

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 ☐ Very Well ☐ Don't know

Rationale:

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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 distribution code (e.g., CT/5) from Reference Form, Sides 1 and 2. Species codes will be provided separately.

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.

Section	Instructions/Descriptions
Block Information **Form C Side 2**	**15. Photo Notes** Record photo numbers and other information that will help identify where the photos were taken **16. Stratum Summary When No Plots Established** This section provides minimum information for patch retention strata that are not sampled. It is your choice to use this section or Form B Side 1. Do NOT use this section for tallying strata already summarized on Form B. **17. Quality Check** Please take the time to work through this calculation. There should be Stratum Summaries (either Form B Side 1, or Section 16 of Form C) that add up to entire patch, dispersed and CC areas. Gross area (or "override" area) is therefore that sum plus NP area plus other areas (e.g., NC Br or Imm). If it doesn't add up, check whether the SP may not have added some reserves associated with the cutblock into the gross area.

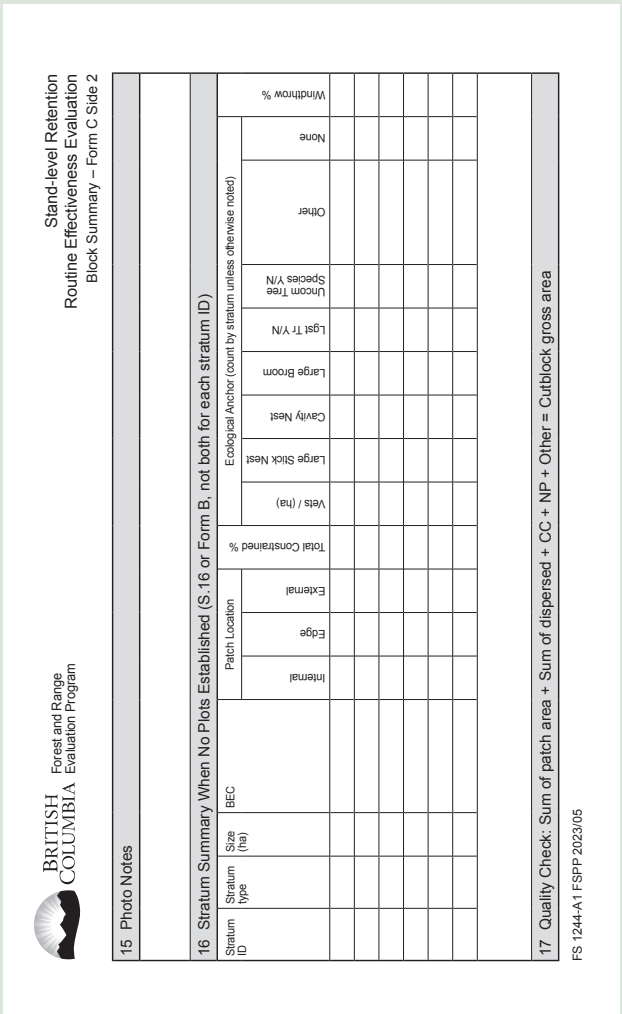


Figure 5 shows field cards required to fully sample a 30-ha cutblock with two wildlife tree retention areas (WTRAs) and dispersed retention.

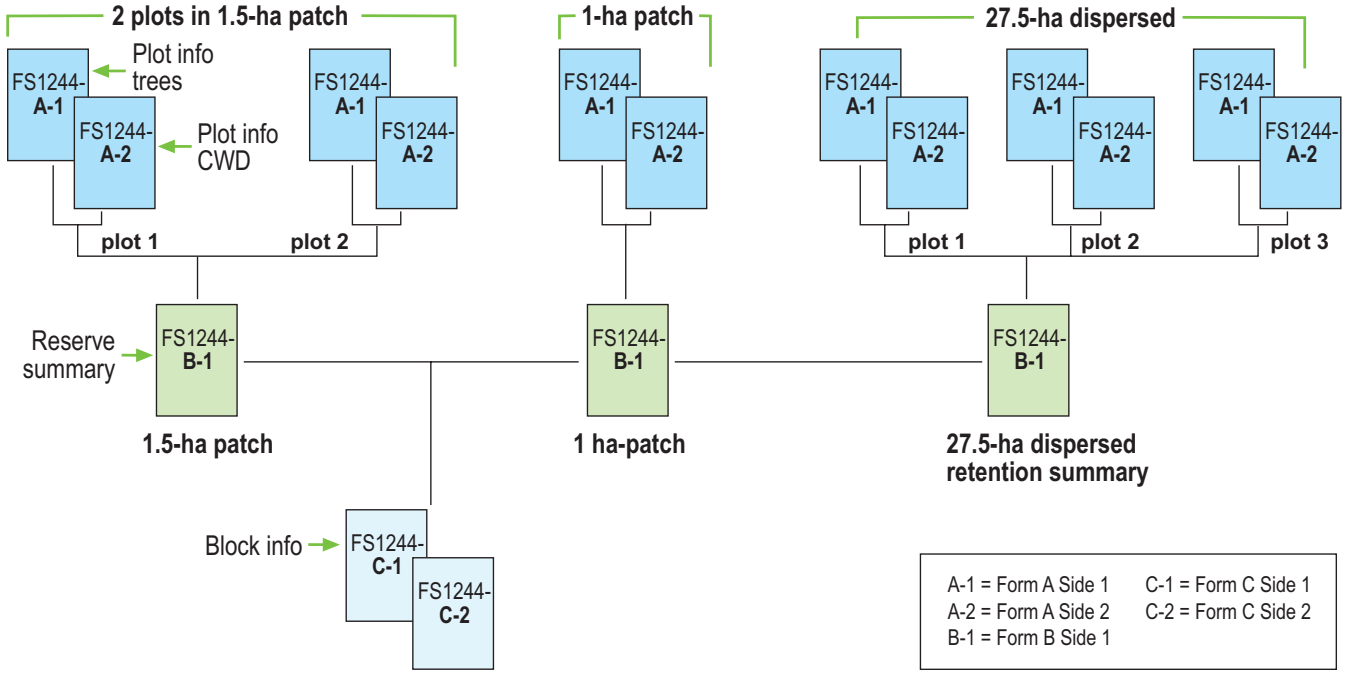


Figure 5. *Field cards used to complete sampling of 30-ha cutblock. This cutblock contains two WTRAs and dispersed retention.*

Wildlife Tree Classes

Wildlife tree classes are shown in Figure 6 and Appendix 5.

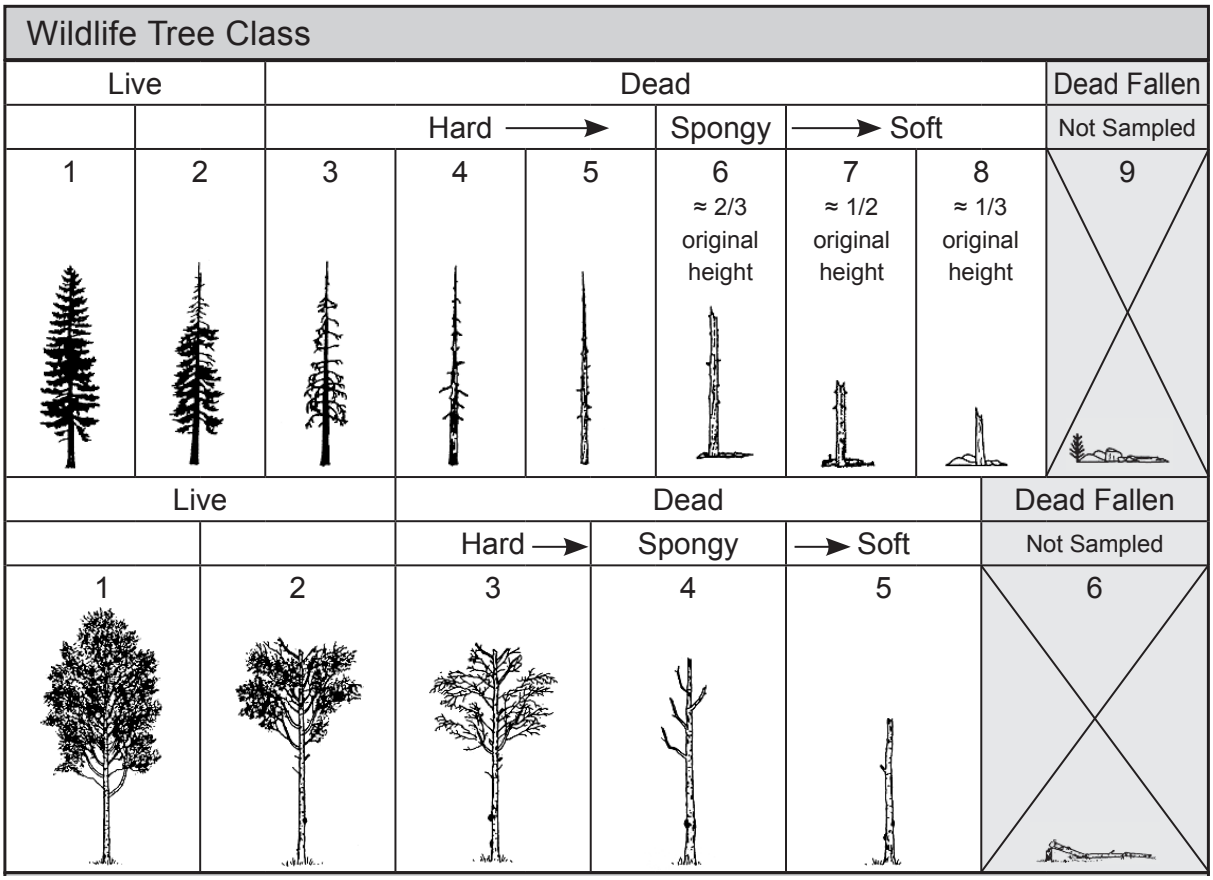


Figure 6. *Wildlife tree classes for conifers and hardwoods.*

Species codes are found in Appendix 6. Use standard species coding – a tree species list is provided on the summary field card. For invasive plants, use the species codes identified on the reference card (Form D Side 2).

CWD Decay Classes

For a more detailed description of CWD line transect methodology, see Appendix 6 and consult the RISC Vegetation Resources Inventory – British Columbia, Ground Sampling Procedures (2018).

The following are CWD decay classes (Figure 7 and Appendix 5). Decay class 5 is not tallied since it is subsurface and therefore too difficult to accurately identify for the purposes of this assessment.

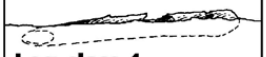
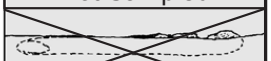
CWD Decay Class				
 **Log class 1**	 **Log class 2**	 **Log class 3**	 **Log class 4**	Not Sampled  **Log class 5**
Hard	Sap rot (but still hard)	Advanced decay (spongy)	Extensive decay (crumbles/mushy)	Many small pieces, soft
Bark firm	Loose bark	Bark trace/absent	Bark absent	Bark absent
Elevated	Sagging	Sagging to settled on ground	Fully settled on ground	Partly sunken in ground
Hard branches with twigs	Soft branches	Branches stubs/ absent	No branches	No branches
Supports person	May not support person	Breaks easy	Shape collapses when stepped on	Collapsed oval
No invading roots	No invading roots	Roots in sapwood	Roots in heartwood	Roots in heartwood

Figure 7. *CWD decay classes.*

Data Submission

Your evaluation data is to be entered into the FREP Information Management System (IMS). However, before you do so, it is recommended that you perform a quality assurance check on the cards by following the "data cleaning" methodology in Appendix 7. After your data has been submitted to FREP IMS, the Branch value lead will summarize the data into a single Retention Summary spreadsheet where districts can filter out data as needed.

ANSWERING THE ROUTINE RETENTION EVALUATION QUESTIONS

This section provides a description of the different indicators used to answer the 8 questions pertaining to stand-level retention, as well as providing details for how to measure those indicators in the field.

Category: Landscape Context

Question #1: Is the amount of stand-level retention adequate considering the landscape context?

Early guidance on stand-level retention amounts in the Biodiversity Guidebook recognized the need to increase stand-level retention in landscapes with more operable THLB, and/or where more of the landscape is affected by previous harvesting with no wildlife tree retention (pre-1995). The Biodiversity Guidebook provided initial estimates for wildlife tree retention at the individual cutblock level, suggesting ranges from 0-15% and 3-18% as appropriate considering the area of the operable land base, existing area harvested or disturbed, and depending on whether landscape units and biodiversity objectives had been established.[7] These targets assumed that landscape-level biodiversity tools, such as seral stage distribution targets, old growth management areas (OGMAs), forest ecosystem networks (FENs), and riparian reserves, would be established to help maintain habitat attributes for wildlife outside of harvested areas. However, it is important to note that not all landscape-level tools outlined in the Biodiversity Guidebook were implemented.

As a result, in some situations, such as large-scale natural disturbances and salvage harvesting, additional guidance recommends increased wildlife tree retention compared to the original Biodiversity Guidebook estimates. Most salvage harvest guidance is derived from NDT3 forest ecosystems where large-scale severe natural disturbances are more frequent (See Eng 2004, Snetsinger 2005, Klenner 2006, Province of British Columbia 2017). For other forest ecosystems that experience less frequent severe disturbances (NDT1,2,4), the minimum retention targets provided here are based on guidance from the Coast Forest Conservation Initiative (CFCI 2007) and (Zielke et al. 2008) or are scaled according to landscape condition as for NDT3 ecosystems (Table 7). Both natural disturbance regime and landscape context play a significant role in guidance targets for wildlife tree retention at the cutblock level (Table 7).

7 See Tables 20(a) and 20(b), page 65, Biodiversity Guidebook.

Table 7. *Minimum recommended stand-level wildlife tree retention based on natural disturbance type (NDT) and landscape context (adapted from the Biodiversity Guidebook 1995 and Klenner 2006)*

		NDT3[b]					NDT 1/2/4[c]				
		Percent (%) forest disturbance Percent of LU/BEC subzone that is early seral forest (<40 years) based on harvested openings, and forests >40 years affected by Very Severe insect-induced mortality or Medium-High severity wildfires									
		<20	20-40	40-60	60-80	>80	<20	20-40	40-60	60-80	>80
Percent of THLB in LU/BEC subzone	<20	>3.5[a]	>3.5[a]	3.5	7	10	3.5	3.5	3.5	10	15
	20-40	3.5	3.5	7	10	15	3.5	3.5	10	15	20
	40-60	7	7	10	15	20	10	10	15	20	25
	60-80	10	10	15	20	25	15	15	20	25	30
	>80	10	15	20	25	25	15	20	25	30	30

a 3.5% wildlife tree retention is the minimum legal requirement at the cutblock level and is consistent with recommended levels of 0-3 and 3-6% for landscapes where <33% is available for harvest and the percent of area harvested is <50% as per Table 20(a) and 20(b) of the Biodiversity Guidebook.

b The remaining retention targets for NDT3 ecosystems are based on Klenner (2006), reflecting increased retention as the area available for harvest (THLB) and the area disturbed increases. These values are also generally consistent with the Biodiversity Guidebook Table 20(a) and 20(b) which recommends 6-10% retention where a landscape has 30-70% area in either THLB or area disturbed, and 10-16% retention where either percent THLB or area disturbed is >70% . In landscapes where both the THLB and disturbed area exceed 70%, the guidebook recommends between 11-15% and 14-18% retention. The increased stand-level retention at greater disturbance levels considers that other landscape-scale biodiversity elements (e.g., seral stage distribution targets) are not able to be applied.

c NDT1, NDT2 and NDT4 ecosystems experience infrequent stand-initiating disturbance events and longer disturbance return intervals (>200 years) and more frequent intermediate to small gap phase disturbances (Biodiversity Guidebook 1995, Delong 2011). For all landscape combinations where THLB and harvested/disturbed area both exceed Low-Moderate, a level of 15% was used as a starting point based on guidance from the 2007 Coast Forest Conservation Initiative (CFCI), and retention amounts were scaled according to NDT3 estimates and consistent with Zielke (2008).

Indicator Sub-question to Question #1

The indicator sub-question required to answer Question #1 asks: *Is the total amount of retention associated with the cutblock equal to or less than recommended based on the landscape context within the landscape unit and biogeoclimatic subzone (LU/BEC) of the random cutblock?*

To answer the question, the District Landscape Context Summary Tables provide outputs to evaluate whether the total amount of retention in the cutblock is Exceeding, Above, Below, or Well Below the recommended guidance target. The cutblock is automatically assigned to one of the four categories in the district summary spreadsheet based on the retention information provided for the cutblock in RESULTS compared to the recommended targets in Table 7. The categories Exceeding, Meeting, Below, or Well Below are assigned as per Figure 8 below.

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the minimum guidance target. For example, the category Meeting is set slightly below the minimum guidance target. So, if the recommended minimum guidance target is 10%, the Meeting guidance target category is set at 8-15%. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

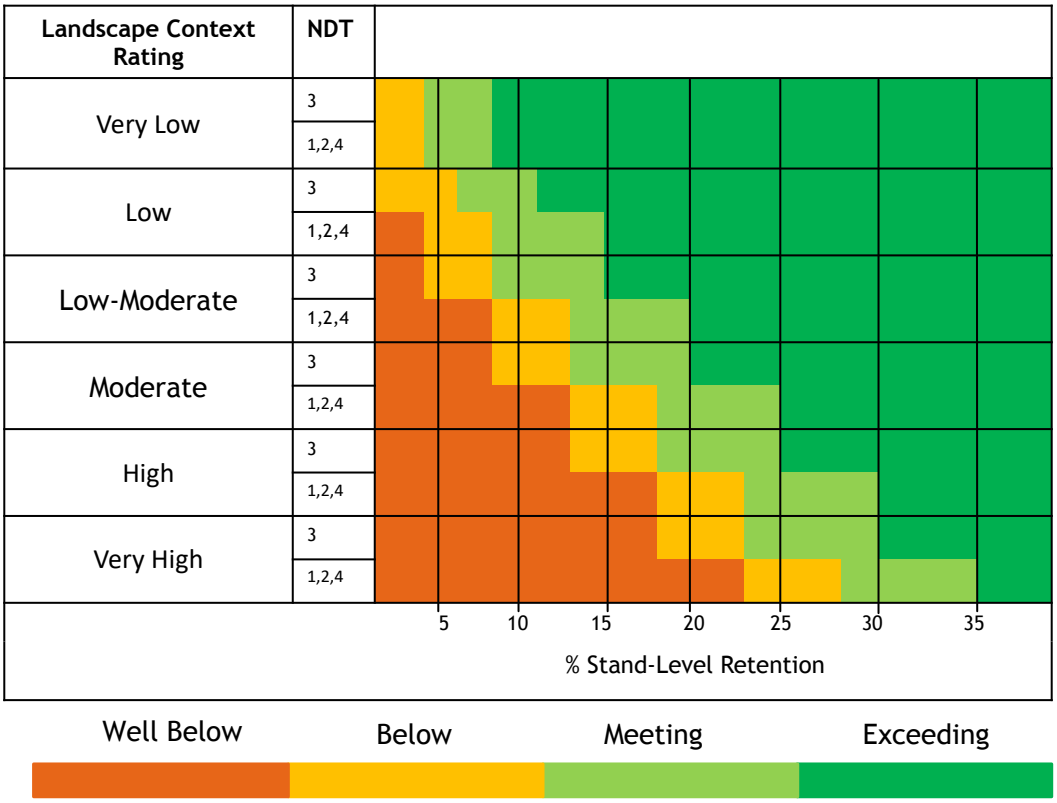


Figure 8. *Categories of Exceeding, Meeting, Below, and Well Below for comparing actual percent stand-level retention to recommended percent (%) stand-level retention considering natural disturbance type (NDT) and landscape context (percent timber harvesting land base and percent disturbance).*

Verifying the Indicator Information

As the answers to the indicator sub-questions are provided based on the GIS analysis, evaluators are asked to verify if the answer to this question is accurate. To verify the provided answer is accurate, complete the following steps:

1. Familiarize yourself with the landscape context for the random cutblock by identifying the categories of % THLB and % forest disturbance. Note if any of the reported amounts are close to the breakpoints between % THLB and % forest disturbance classes (20%, 40%, 60% and 80%).
2. Next, identify the total retention amount (PCT_RET) for the random sample cutblock from the summary table. Compare the block gross area (GROSS_HA), reserve area (RES_HA), dispersed reserve area (DISP_RES_HA), and percent total retention (PCT_RET) provided in the District Landscape Context Summary Table with the site plan provided to ensure the amounts align with the plan. If there are differences, field verification may be required.

   Note: Wildlife trees in areas of dispersed retention are not counted towards the total retention amount in the District Landscape Context Summary Table. If dispersed retention amounts exist, these will need to be quantified and added to the overall retention amount and re-considered in the rating.
3. If the percent retention is consistent with the site plan, compare the reported retention amount with the target amount (Q1_Target) and rating (Q1_Rating). If the total retention for the cutblock appears to be different than the site plan, evaluators have the option to override the outcomes in the steps below if they feel the licensees attempted to follow the guidance and are close, or the landscape context is close, to a breakpoint that will affect the rating for the cutblock.

Tip: Note if the % stand-level retention is close to the breakpoints between categories. If either is close to the lower breakpoint, note the amount. Moving to a landscape context category with higher % THLB or forest disturbance will change the guidance targets, which may mean a cutblock is rated as Below targets using one THLB % category and Meeting guidance targets if it fell in the next category lower. For example, if the percent THLB is 41% for a landscape with 60-80% disturbance, the recommended retention would be 15% based on the 40-60% THLB category, but only 10% recommended retention in the 21-40% THLB category for the same level of disturbance. A cutblock with 12.6% retention would fall Below the guidance target of 15% in the 40-60% THLB category. That same cutblock would easily be Meeting the recommended guidance target set at10% in the 21-40% THLB category.

4. As a final step, if the evaluator has modified the rating, provide the revised rating in the "Q1_Override" column and record any rationale for modifying the block retention amount, targets, or ratings in the "Comments" column.

Question #2: Patch Size – Is the amount of stand-level retention adequate considering the size of the harvested patch?

In managed landscapes, as forest harvesting progresses over time or as severe disturbance occurs, existing harvested or disturbed areas can coalesce to create large "functional openings" or "patches". To help conserve wildlife habitat and biodiversity within these patches, existing guidance recommends increasing the amount of stand-level retention within newly planned cutblocks that form parts of larger patches with adjacent young forest (Table 8). In heavily affected and cutover landscapes where large areas are rapidly converted to young forest, increasing stand-level retention can help offset the reduction in mature forest outside of harvested areas (Eng 2004, Snetsinger 2005, Klenner 2006, Province of British Columbia 2017).

Table 8. *Recommended percent stand-level wildlife tree retention for different patch size classes, relative landscape context ratings, and natural disturbance types. Adapted from (Eng 2004, Snetsinger 2005, Klenner 2006, Province of British Columbia 2018).*

Patch size	Landscape context											
	VL	L	L-M	M	H	VH	VL	L	L-M	M	H	VH
	NDT3						NDT 1/2/4[a]					
	Recommended % retention											
<50 ha[b]	3.5	7	10	15	20	25	3.5	10	15	20	25	30
50-250 ha[c]	7	10	10	15	20	25	10	15	15	20	25	30
250-1000 ha[c]	10	15	15	20	25	25	15	20	20	25	30	30
>1000 ha[c]	15	20	20	25	25	25	20	25	25	30	30	30

[a] Estimates for patch sizes in NDT1/2/4 are scaled according to NDT3 estimates with increased retention levels representing lower severity disturbances.

[b] For cutblocks and patches <50 ha – guidance targets follow Table 7 for Question 1 based on landscape context and NDT.

[c] Patch sizes >50 ha where the landscape context is Low-Moderate (L-M) or greater represent landscape conditions where large-scale salvage situations may occur. In these situations, the minimum recommended retention levels by patch size class in NDT3 ecosystems follow Eng (2004), Snetsinger (2005), and Province of British Columbia (2018). For other NDTs where guidance for these landscape conditions doesn't exist, the recommended retention targets are scaled up to consider less severe disturbance events are more common in these NDTs.

Indicator Sub-question to Question #2

The indicator sub-question required to answer Question #2 asks: *Is the total amount of retention associated with the cutblock equal to or less than recommended based on the patch size and landscape context of the random cutblock?*

Retention amounts in patches <50 ha are, at a minimum, consistent with recommended levels by NDT and landscape context referenced in Question #1, but increase with larger patch sizes.

To answer the sub-question, the District Landscape Context Summary Tables provide outputs to evaluate whether the total amount of retention in the cutblock is Exceeding, Above, Below, or Well Below the recommended guidance target. The cutblock is automatically assigned to one of the four categories in the district summary spreadsheet based on the retention information provided for the cutblock in RESULTS compared to the recommended targets in Table 8. The categories Exceeding, Meeting, Below, or Well Below are assigned as per the example for the 250-1,000-hectare patch size class shown in Figure 9.

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the minimum guidance target. For example, the category Meeting is set slightly below the minimum guidance target. So, if the recommended minimum guidance target is 10%, the Meeting guidance targets category is set at 8-15% (Figure 9). This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

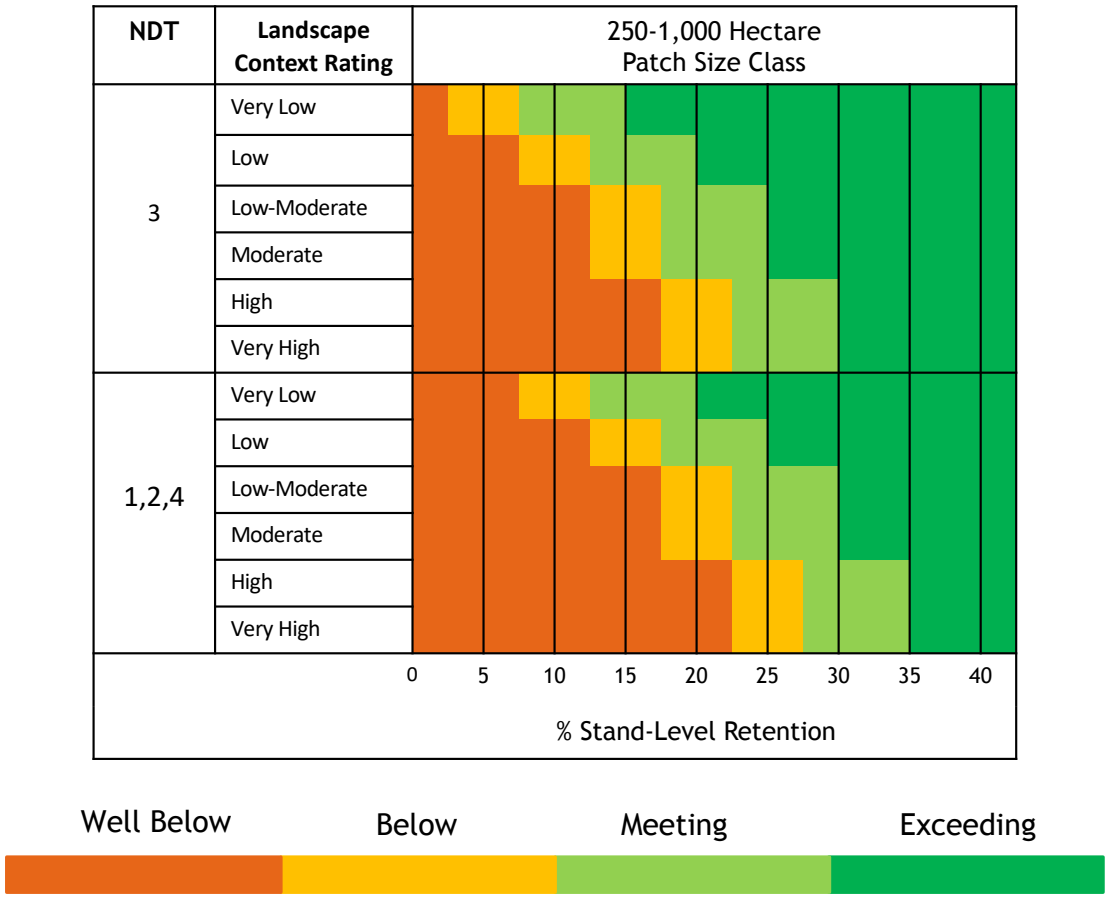


Figure 9. *Categories of Exceeding, Meeting, Below, and Well Below for comparing actual percent stand-level retention to recommended percent (%) stand-level retention considering patch size class, natural disturbance type (NDT), and landscape context.*

To provide information to answer the sub-question, a GIS-based patch size analysis was completed for all random cutblocks on the list. The GIS analysis completes a 3-step buffering exercise for each random cutblock to evaluate the size of patch the cutblock is associated with. The random cutblock is first buffered by 150 metres to identify any adjacent openings harvested within 30 years prior to 2015 (2015 is used as the pre-harvest reference year for cutblocks harvested between 2015-2020). Any adjacent cutblocks are then merged to create a new patch (Figure 10 A and B). This step is then repeated two more times forming a larger patch if adjacent blocks exist or are stabilizing at the same size if no adjacent cutblocks are found (Figure 10 C and D). After the three iterations of the buffering exercise, the area in hectares of the resulting patch is calculated and assigned into one of the five patch size classes (<50, 50-250, 250-1,000, >1,000, and >10,000).

Note: several random cutblocks can be associated with the same patch if they fall nearby in the same landscape and incorporate the same adjacent cutblocks.

The results of the GIS patch size analysis are used to populate the District Landscape Context Summary Tables. The summary tables show the patch size (Patch_Size) and patch size class (Ptch_Class) that each random cutblock on the list is associated with. That information is used to provide the answer to whether the total amount of retention in the cutblock is Exceeding, Above, Below, or Well Below the recommended guidance target for a patch of that size. The recommended targets for each patch size category considering both landscape context and NDT are assigned as per Table 8.

Verifying the Indicator Information

As the answer to the sub-question is provided through a GIS analysis, evaluators are asked to verify if the answer to this question is accurate. To verify the answer, evaluators will take the following steps:

1. Familiarize yourself with the landscape context by identifying which categories of %THLB and % forest disturbance apply to the random cutblock. Note if any of the reported amounts are close to the breakpoints between %THLB or % forest disturbance classes (20%, 40%, 60% and 80%).
2. Next, identify the patch size (Patch_Size), patch size class (Ptch_Class) and retention target for a patch of that size (Q2_target) for the random cutblock from the District Landscape Context Summary Table of FREP Map and ensure it is consistent with Table 8 Note if the patch size (hectares) is close to the breakpoints between patch size classes as this may influence the final rating.
3. As an extra measure, visually review the patch boundary associated with the random cutblock in FREP Map. This will help to validate the results of the GIS analysis. Also, review the results against the site plan map provided for the cutblock to ensure any WTRAs inside the cutblock and adjacent forest are correctly captured. Remember, only cutblocks up to 2015 will be captured in the GIS analysis. Any blocks that occurred adjacent after this date will not be included.
4. Like Question #1, confirm that the reported retention amount for the random cutblock is consistent with the site plan and compare it to the target for the cutblock.
5. As a final step, confirm if the rating assigned for Question #2 (Q2_Rating) is correct. If the evaluator decides to override the results, record the revise rating in the "Q2_Override" and provide rationale in the "Comments" column.

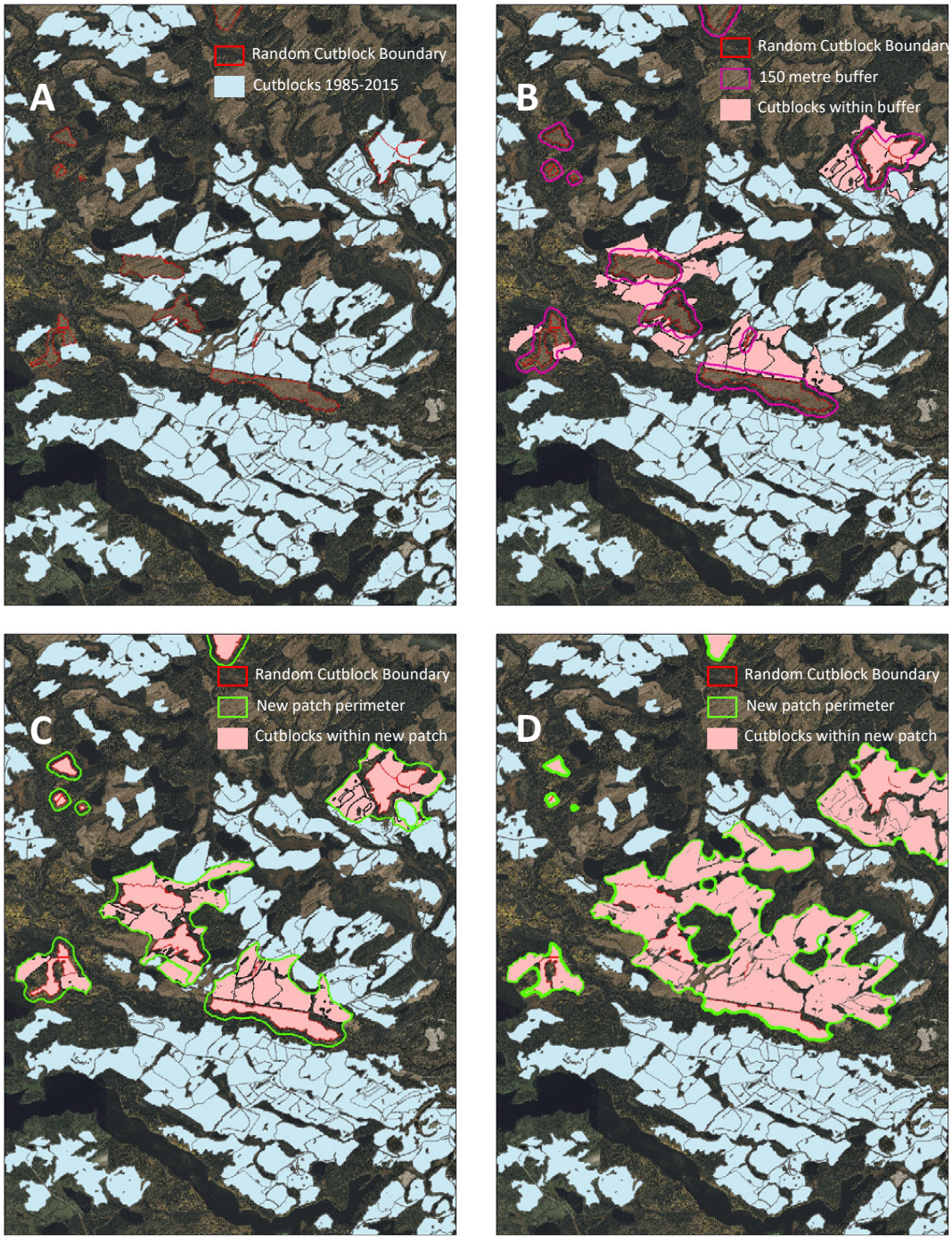


Figure 10. *An illustration of steps in patch formulation for randomly selected cutblocks. A) Random cutblocks from the district random cutblock list (red outline) and adjacent existing cutblocks (light blue) harvested within the last 30 years (1985-2015). B) a 150-metre buffer to the outside of the random cutblocks (dark pink line) and adjacent cutblocks within the 150-metre buffer (pink colored blocks). C) The harvested "patch" (green outline - pink colored blocks) that consists of the random cutblock, and any adjacent blocks harvested within 30 years after one buffering iteration. The new patch boundary will be used for further buffering. D) The final "patch" after three buffering iterations. Note that some patches expanded significantly and could expand further, whereas the patch associated with cutblocks with no surrounding blocks (upper left of inset photos) did not change after three buffering iterations.*

Question #3: Is the amount and spatial location of stand-level retention adequate to help maintain landscape-level connectivity?

Maintaining landscape connectivity[8] during forest harvesting can be improved by providing reasonable distances between wildlife tree retention areas (WTRAs), areas of dispersed tree retention within the cutblock, and forest adjacent to the cutblock. The Biodiversity Guidebook originally recommended a maximum distance of 500 metres between WTRAs and adjacent suitable forest habitat. This recommendation assumed other stand- and landscape-level biodiversity elements (e.g., riparian reserves, OGMAs, seral distribution targets or FENs) would also be established to ensure habitat attributes associated with mature and old forests are generally available and connected in the surrounding landscape. However, in many cases these landscape-level tools were not implemented, and some landscapes have been highly modified through multi-pass harvesting or due to large-scale natural disturbances and salvage. In those situations, existing guidance recommends reducing the maximum distances between WTRAs and adjacent suitable habitat (Klenner 2006, Province of British Columbia), coinciding with increased cutblock-level wildlife tree retention amounts (Table 9).

Table 9. *Recommended distances between retention areas >0.25 ha within harvested openings relative to surrounding landscape conditions. Table adapted from Klenner (2006).*

		Percent (%) forest disturbance Percent of LU/BEC subzone disturbed (<40 years old)				
Percent of THLB in LU/ BEC subzone		<20%	21-40%	41-60%	61-80%	>80%
	<20%	<500ma	<500m	<500m	<400m	<300m
	21-40%	<500m	<500m	<400m	<300m	<300m
	41-60%	<400m	<400m	<300m	<300m	<200m
	61-80%	<300m	<300m	<300m	<200m	<150m
	>80%	<300m	<300m	<200m	<150m	<150m

a 500 m is the maximum recommended distance between wildlife tree retention areas in the Biodiversity Guidebook. The remaining distances are from Klenner (2006). Omenica Region Guidance (Province of British Columbia) also recommends <250 m between retention consistent with ecosystems that experience fewer stand-replacing disturbances and more gap-phase dynamics (Delong 2011) and is consistent with recommended levels in the lower right of this table.

Indicator Sub-question for Question #3

The indicator sub-question required to answer Question #3 asks: *Is the average distance between WTRAs and adjacent forest equal to or less than recommended?*

The District Landscape Context Summary Tables provide outputs to evaluate whether the maximum distance in the cutblock is Exceeding, Above, Below, or Well Below the recommended guidance target. The cutblock is automatically assigned to one of the four categories in the district summary spreadsheet based on the maximum distance information calculated for the cutblock compared to the recommended targets in Table 9 the categories Exceeding, Meeting, Below, or Well Below are assigned as per Figure 11.

[8] The term landscape connectivity is defined as a "human perception of the connectedness of patterns of vegetative cover in a landscape" (Lindenmayer and Fisher 2006). Landscape connectivity measured as the spatial distribution of specific vegetative cover can be directly related to habitat connectivity, but not always. The term habitat is species-specific, referring to the environments necessary to support an individual species. The term habitat connectivity refers to the connectedness of habitat patches for individual species (Lindenmayer and Fisher 2006). How connected habitats are is also species-specific as it relates to the natural distribution of species and the mobility and mode of travel – the ability of different animals to move between habitats.

Note: The categories *of* Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the minimum guidance target. For example, the category Meeting is set slightly below the minimum guidance target. So, if the recommended minimum guidance target is <300 m, the Meeting guidance targets category is set at 350 m. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

Landscape context rating	Target maximum distance
Very Low	<500
Low	<400
Low-Moderate	<300
Moderate	<300
High	<200
Very High	<150

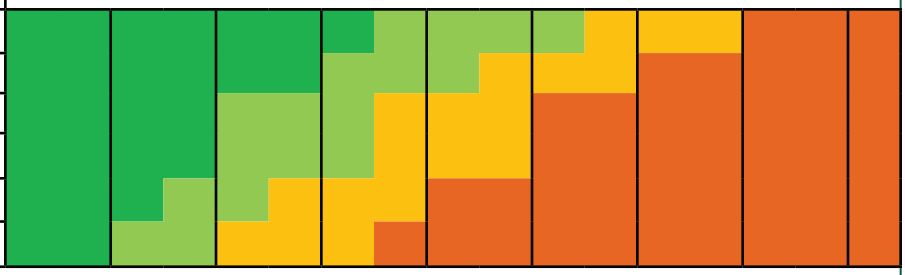


Figure 11. *Rating categories assigned to maximum distance (metres) between wildlife tree retention based on target maximum distance by landscape context rating.*

To provide information to answer the sub-question, a GIS-based buffer analysis was completed for all random cutblocks on the FREP sampling list. First, the GIS analysis identifies any internal forest reserves and adjacent forest >40 years that is within 100 metres of the cutblock boundary (Figure 12A and B).

Next, a series of buffer distances are computed at 25, 50, 100, 150, 200 and 250 metres internal to the cutblock (Figure 12B). The area of the cutblock that is covered by internal forest reserves and each buffer distance is then calculated. The area of forest reserves inside the block and any of the NAR within 25 m (1 tree length) of internal forest or forest adjacent to the cutblock is calculated as the area of "forest influence" (Figure 12C). If a buffer distance covers >90% of the gross area of the cutblock, then that buffer distance is used to calculate the maximum distance across the cutblock. So, maximum distance = 2X the buffer distance covering >90% of the gross cutblock area (reserve areas internal to the cutblock are part of the internal buffer). For example, if 90% of the cutblock is covered by a combination of WTRAs or is within 100 m of an WTRA or adjacent forest, then the maximum distance an organism would need to travel between adjacent forest within or across the cutblock is <200 m (Figure 12D).

Verifying the Indicator Information

As the answer to the sub-question is provided through a GIS analysis, evaluators are asked to verify if the answer to this question is accurate. To verify the accuracy of the answer to this question, complete the following steps:

1. Familiarize yourself with the landscape context by identifying which categories of percent THLB and percent disturbance apply to the random cutblock. Note if any of the reported amounts are close to the breakpoints between % THLB or % forest disturbance classes (20%, 40%, 60% and 80%).
2. Next, identify the calculated maximum distance (Max_Dist) and target maximum distance (Q3_target) for the cutblock from the District Landscape Context Summary Table of FREP Map and ensure it is consistent with Table 9.

3. Visually review the forest influence layer for the cutblock in FREP Map to validate the results of the GIS analysis. Review the results against the site plan map provided for the cutblock to ensure any WTRAs inside the cutblock and adjacent forest are correctly captured. Remember, for cutblocks sampled in 2023, as an example, harvesting typically would have occurred in 2020 or later. So, in this case only cutblocks up to 2020 will be captured in the GIS analysis and any blocks that occurred adjacent to the sampled cutblock after this date will not be considered because they were not present at the time the cutblock was planned and harvested.
4. Identify if any dispersed retention for the cutblock is captured in the District Landscape Context Summary Table and compare with the site plan. Dispersed retention is not accounted for in the GIS analysis but contributes to within-block connectivity and should be considered. As a rule, if at least 25% of the cutblock has dispersed strata, the calculated maximum distance (Max_Dist) for the cutblock can be reduced by 100 metres.
5. If the forest influence layer appears to be incorrect, evaluators can visually estimate the portion of the cutblock that has forest influence and assign the appropriate rating based on Table 8. Likewise, if a cutblock is close to the breakpoint between categories and is close to a breakpoint for %THLB or % forest disturbance, the evaluator can assign a different target value that may better reflect that the intent of the retention is close to the landscape context.
6. As a final step, compare the measured maximum distance to the target maximum distance in the landscape context summary table. Use the difference between the measured and target amount to assign whether the stand-level retention is Exceeding, Above, Below, or Well Below the recommended guidance targets.

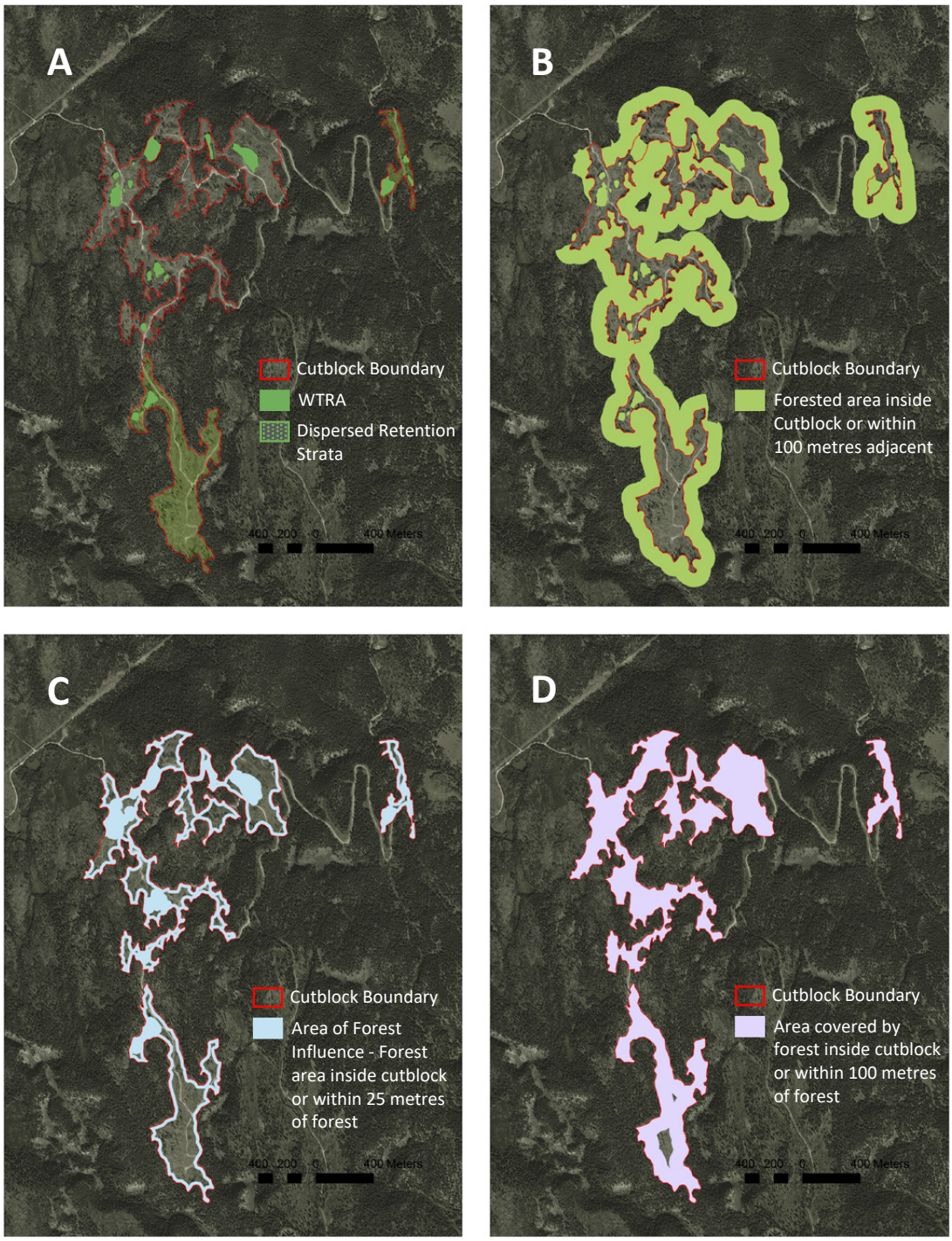


Figure 12. *(A) Cutblock boundary (red), WTRAs within the block (green), and area of dispersed retention (green hatched). (B) The area of forest influence, including WTRAs inside the block and forest within 100 m surrounding the cutblock perimeter. Note: the area of dispersed retention is not included. (C) The percentage of forest influence inside the cutblock includes areas covered by forest or within 1 tree length (25 m) of forest. (D) Area of the cutblock within 100 m of forest influence covers >90% of the cutblock area so the maximum distance for the cutblock is <200 m.*

Question #4: Does wildlife tree retention and block shape contribute to a range of microenvironments and structural complexity within the cutblock?

Wildlife tree retention areas (WTRAs) in harvested openings has long been used as a silvicultural treatment to modify the microenvironment in the harvested stand to promote tree regeneration (e.g., seed-tree, shelterwood and selection silvicultural systems). WTRAs within a harvested opening and forest edge adjacent to an opening also has ecological benefits within the harvested opening because modifying the microenvironment allows some forest species to persist, facilitates dispersal of organisms, and contributes to structural complexity. The term "forest influence" is used to describe the ecological effects of residual trees and forest edge on a harvested opening and is typically measured as the area surrounding a tree or forest edge with a radius equal to the tree height (Beese et al. 2019). The extent of forest influence in a cutblock is affected by cutblock size, shape and the amount, type (patch, dispersed or aggregate) and placement (interior, edge or exterior to the cutblock) of wildlife trees.

Limited guidance exists to define the area of the cutblock that should be within forest influence to achieve biodiversity and wildlife habitat conservation goals. As a preliminary target, a minimum of 40% of the gross block area should be within 1 tree length (approximately 25 m) of adjacent forest or a WTRA >0.1 ha.[9] The area of forest influence is calculated as both the total area of the cutblock as WTRAs, the total NAR that is within 25 m of a WTRA or adjacent forest edge as well, as the retention-weighted area of dispersed tree retention. The 40% target is based on the work of Chan-McLeod and Moy (2007) who modelled different amounts (10, 20, 30 and 40% retention) and sizes of retention areas (0.1, 0.5, 1.0, 1.5 and 2 ha) randomly dispersed in a 40-hectare cutblock. They found that at 10% retention, inter-patch distance ranged from as low as 40 m to 180 m. Assuming 25 m either side of the inter-patch distance is influenced by adjacent forest, then approximately 25% of the harvested area would have forest influence at 10% retention and 2-ha patches. The level of forest influence increases at that level of retention with smaller patches and a lower inter-patch distance. At or above 20% retention – approximately 50% or more of the harvested area will have forest influence. The 40% target is based on a minimum 25% forest influence in the NAR plus 10% associated with WTRAs.

Indicator Sub-question for Question #4

The indicator sub-question required to answer Question #4 asks: *Is 40% or more of the gross area of the cutblock under forest influence?*

The District Landscape Context Summary Tables provide outputs to evaluate whether the level of forest influence in the cutblock is Exceeding, Above, Below, or Well Below the recommended guidance target of 40%. The cutblock is automatically assigned to one of the four categories in the district summary spreadsheet based on the forest influence calculated for the cutblock compared to the recommended target of 40%. The categories Exceeding, Meeting, Below, or Well Below are assigned as per Table 10.

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance target are interpreted around the minimum guidance target. For example, the category Meeting is set slightly below the minimum guidance target. So, if the recommended minimum guidance target is 40%, the Meeting guidance targets category is set at 38-45%. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

[9] For most cutblocks <10 ha in size, the 40% area of forest influence should be achieved even with no internal retention patches.

Table 10. *Assigned ratings for Question #4 based on the percent of forest influence in the sampled cutblock*

Percent (%) forest influence	Assigned rating
<30%	Well Below
30-45%	Below
45-60%	Meeting
>60%	Exceeding

To provide an answer for this question, the protocol uses outputs from the same GIS buffer analysis used for Question #3 and as illustrated in Figure 12. However, the final rating uses results of the field sampling for dispersed strata to estimate the contribution of dispersed trees to forest influence in the cutblock. To calculate forest influence, the GIS analysis outputs provide the gross area of the cutblock that is covered by WTRAs plus any part of the NAR that is within the 25-m buffer (approximating 1 tree length) of a WTRA or forest >40 years adjacent to the cutblock. The field sampling data provides information on strata within the NAR that have dispersed wildlife tree retention. Forest influence associated with dispersed wildlife trees is calculated based on the percent of gross cutblock area as dispersed wildlife tree retention. Percent area of dispersed wildlife tree retention is calculated using the basal area equivalent hectares of dispersed retention where the measured basal area (m^2/ha) of dispersed retention from plots is divided by the average basal area (m^2/ha) based on cruise data from the same BEC zone. The result is a number from 0-1.0 that is then multiplied by dispersed stratum size in hectares. As the percentage dispersed wildlife tree retention basal area increases, the contribution to forest influence also increases (Table 11).

Table 11. *Percent of dispersed strata area that contributed to overall cutblock forest influence based on percent of pre-harvest basal area that is retained as wildlife trees (Percent dispersed wildlife tree retention)*

Percent dispersed wildlife tree retention	Percent of dispersed strata area that contributes as forest influence
0%	0%
1-5%	10%
5.1-10%	25%
10.1-15%	40%
>15%	50%

Verifying the Indicator Information

As the answer to the sub-question is provided through a combination of GIS analysis and results from the field sampling, the evaluators are asked to verify if the answer to this question is accurate. To verify the answer, complete the following steps:

1. Familiarize yourself with the landscape context for the random cutblock by identifying which categories of percent THLB and percent disturbance apply. Note if any of the reported amounts are close to the breakpoints between %THLB or % forest disturbance classes (20%, 40%, 60% and 80%).
2. Next, identify the percent forest influence (PCT_Forest_Influence) for the random sample from the District Landscape Context Summary Table or FREP Map.

3. Visually review the forest influence layer for the cutblock in FREP Map to validate the results of the GIS analysis. Review the results against the site plan map provided for the cutblock to ensure any WTRAs inside the cutblock and adjacent forest are correctly captured. Remember, only cutblocks up to 2015 will be captured in the GIS analysis. Any adjacent blocks that occurred after this date will not be captured.
4. Identify if any dispersed retention for the cutblock is captured in the District Landscape Context Summary Table and compare with the site plan. Dispersed retention is considered in the calculation of percent forest influence as contributing 50% of the dispersed retention area.
5. If the forest influence layer appears to be incorrect, evaluators can visually estimate the portion of the cutblock that has forest influence and assign the appropriate rating based on the breakpoint value of 25%. Likewise, if a cutblock is close to the breakpoint between categories and is close to a breakpoint for % THLB or % forest disturbance, the evaluator can assign a different target value that may better reflect that the intent of the retention is close to the landscape context.
6. As a final step, compare the calculated percent forest influence to the target maximum distance in the landscape context summary table. Use the difference between the measured and target amount to assign whether the stand-level retention is Exceeding, Above, Below, or Well Below the recommended guidance targets.

Category: Quality of Standing Live and Dead Tree Retention

Stand-level forest structure plays a key role in providing habitat for many wildlife species that have life history traits (e.g., breeding, nesting, denning) associated with unique tree structural attributes such as large size, large branches, loose bark, or hollows on dead trees. Forest structural conditions that support these attributes may only occur or develop in some seral stages (e.g., post disturbance or late seral conditions) and so the amount and frequency at which these conditions occur varies with natural disturbance regimes. The abundance and distribution of many vertebrate species is often directly related to the range of forest structural conditions that emerge consistent with natural disturbance patterns (Bunnell 1995).

Ensuring a range of habitat structures are available to support wildlife use in managed stands requires careful consideration and planning during forest operations. Maintaining and recruiting large structural attributes (large trees, snags, CWD) into managed forests is challenging as rotation periods for managed stands are often short (60-80 years) relative to disturbance return intervals. Shortened rotation periods do not allow for the decades or even centuries of later seral forest conditions necessary to develop large trees and snags with important habitat attributes. So, retention and recruitment of large trees and snags through wildlife tree retention practices can assist in improving how well managed stands function at maintaining wildlife habitat and biodiversity. Guidance for wildlife tree retention includes:

- Targeting specific tree species, or large, rare, or uncommon larger trees as well as larger hard (class 3-6), or soft` snags (class 7-8);
- Planning WTRAS to incorporate "ecological anchors" such as high densities of large snags or uncommon standing live (large veteran trees) or dead trees (large soft snags);
- Retaining a buffer for windfirmness to allow for safety tree removal on the perimeter of the WTRA without affecting targeted trees; and
- Spatially locating wildlife tree retention to protect unique features within or adjacent to the cutblock, such as wetter sites, riparian features, or dry rocky outcrops, that due to their unique site conditions may host uncommon or rare tree species.

To evaluate the quality of live and dead standing tree retention at the individual cutblock scale, the protocol identifies two questions (Questions 5 and 6) related to the size and condition of standing live and dead trees, and whether the effects of windthrow on residual trees has been minimized:

> **Question #5. Standing live and dead tree size and condition** – Will standing live and dead wildlife trees provide habitat refugia and structural complexity in the regenerating stand now and into the future?
>
> **Question #6. Wildlife tree retention practices** – Do stand-level retention practices retain wildlife trees and conserve important habitat features by minimizing windthrow?

Factors Influencing Standing Dead and Live Tree Retention Attributes

Prior to answering indicator questions, evaluators should review the cutblock site plan to determine factors that may alter standing live or dead wildlife tree density relative to "average" pre-harvest conditions. Several factors can influence the ability to retain large wildlife trees such as when large trees or snags have yet to develop in the stand or have been affected by recent disturbance, including:

- Harvesting of second- or third-growth forests,
- Commercial thinning in young stands (<60 years), or
- Salvage harvesting of forests affected by wildfire, windthrow, or insect-induced tree mortality.

Question #5: Will standing live and dead trees provide habitat refugia and structural complexity in the regenerating stand now and into the future?

Wildlife tree retention guidance recommends maintaining larger trees and snags, and trees in later stages of decay (Wildlife Tree Classes 3-8). In managed stands with a shortened rotation cycle, trees with these attributes are difficult to recruit. By following the guidance, wildlife trees retention should include a greater proportion of large live and dead trees than found in the pre-harvest stand.

Pre-harvest stand structural conditions (tree size, species composition, decay) for each cutblock being evaluated by FREP are not available, and so "average" pre-harvest stand conditions are provided as benchmarks for different forest ecosystems in BC. To characterize wildlife tree characteristics in different ecosystems in the province, a comprehensive data summary was compiled from existing plot information from various sources by Biogeoclimatic (BEC) Groups.[10] Due to similar structural conditions across multiple BEC Groups, the groups were further compiled into broad forest types to simplify the comparison against measured data (Table 12). Benchmark information from various forest types in BC show differences in the expected amount and percent of live trees >30 cm and >50 cm DBH in mature to old forests. Differences are associated with forest productivity and disturbance return intervals. Areas with relatively frequent stand-initiating disturbances (NDT3) consist of shorter-lived tree species, such as lodgepole pine or trembling aspen, that rarely achieve large diameters, while NDT1 and 2 ecosystems, associated with more productive Cool Montane and Cool Wet Montane forests, have longer periods between stand-initiating events and longer-lived tree species (such as redcedar) that grow to larger diameters.

Table 12. *Categorization of Biogeoclimatic (BEC) Groups into six broad forest types used in developing benchmark levels of wildlife trees and snags*

Forest type	Biogeoclimatic (BEC) Group
Dry Forest	IDF Dry, IDF Very Dry
Cool Dry Montane 1	SBS Dry/SBPS, MS Dry (SWB)*
Cool Dry Montane 2	ICH/IDF, ICH Dry
Cool Montane 1	SBS Moist, BWBS Dry, BWBS Moist, ESSF Dry, ESSF Moist
Cool Montane 2	SBS Wet, ESSF Wet, ICH Moist
Cool Wet Montane	ICH Wet, CWH Moist, CWH Wet, MH

* The SWB group is colder and wetter than these other BEC Groups but was included here due to similar structural conditions.

[10] Huggard, D. 2020. Baseline datasets.

Indicator Sub-questions for Question #5

The following three indicator sub-questions are used to answer Question #5:

- **Sub-question 5a – Large Trees** – *Is the total density of large (>30 cm DBH) retained stems (standing live and dead trees) in the cutblock equal to or greater than the average pre-harvest stand condition?*
- **Sub-question 5b – Large Snags** – *Is the total density of all large (>30 cm DBH) snags (WT Classes 3-5) in the cutblock equal to or greater than the average pre-harvest stand condition?*
- **Sub-question 5c – Large Soft Snags** – *Is the total density of large (>30 cm DBH) soft snags (WT Classes 6-8) in the cutblock equal to or greater than the average pre-harvest stand condition?*

Each sub-question is evaluated and categorized as either Exceeding, Meeting, Below, or Well Below pre-defined guidance targets. To answer Question #5, the average score assigned to each category (Exceeding=4, Meeting=3, Below=2, and Well Below=1) across all sub-questions is used. The average score is rounded up or down to the nearest whole number. For example, if two sub-questions are Meeting (score =3), and one sub-question is Below (score =2), the arithmetic average is = (3+3+2=8) ÷ the number of questions (3). The arithmetic average is thus 8 ÷ 3 = 2.67. This value is then rounded up to the nearest whole number, which is 3, and the result is that retention is Meeting recommended guidance targets.

Note: Cutblocks with no wildlife tree retention are not evaluated for sub-questions 5a-5c, are assigned a "NA" value, and Question 5 does not contribute to the overall cutblock rating.

Note: In assigning rating, the recorded density of large live trees and snags is calculated from plots sampled in both WTRAs and dispersed strata in the net area to be reforested (NAR). However, when assigning the rating, any large live trees or snags retained in the NAR are additive to the WTRA densities, and not area weighted. So, if a WTRA has 75 stems/ha >30 cm DBH and an additional 10 stems/ha is retained in the NAR, the cutblock is credited with 85 stems/ha trees >30 cm DBH. This approach inflates the density of large trees in the cutblock when assigning the ratings for questions 5a-5c, giving increased value to practices that retain large wildlife trees in the harvested portion of cutblocks.

Sub-question 5a – Large Trees

Is the total density of large (>30 cm DBH) retained stems (standing live and dead trees) in the cutblock equal to or greater than the average pre-harvest stand condition?

To answer sub-question 5a, field data collected in WTRAs and dispersed tree strata are summarized and compared against benchmark levels depending on the forest type in which the cutblock resides. Benchmark levels for all trees >30 cm DBH are derived based on the reported interquartile range (20-80% of all plots falling in this range) from benchmark data compiled for different biogeoclimatic groups in BC and then grouped by forest type (Table 13).

Table 13. *Representative pre-harvest tree density by forest type. Reported data shows the approximate interquartile range (20-80%) density (stems/hectare) for all trees >30 cm and >50 cm and percent (%) of total stems DBH.*

Forest type	All trees			
	Trees >30 cm DBH		Trees >50 cm DBH	
	% of all trees	stems/ hectare	% of all trees	stems/ hectare
Dry Forest	15-25%	90-125	1-4%	10-20
Cool Dry Montane 1	5-15%	70-85	<1%	2-7
Cool Dry Montane 2	25-30%	175-200	3-6%	25-35
Cool Montane 1	15-20%	125-175	1-3%	5-20
Cool Montane 2	25-35%	175-225	2-6%	20-35
Cool Wet Montane	35-40%	250-350	10-15%	75-125

The reported range of large tree density is interpreted from Table 13 to provide a target large tree density range in Table 14. The target categories of Meeting and Exceeding are set to include the interquartile range. Essentially, if the assessed large tree density retained on the cutblock is greater than the lowest 20% of benchmark conditions, retained large tree density is assessed as Meeting or Exceeding the target. The measured density of large trees is assessed as Well Below, Below, Meeting, or Exceeding the target densities in Table 14.

Table 14. *Target densities (stems/ha) for large trees (>30 cm DBH) by forest type used to evaluate sub-question 5a*

Forest type	Trees >30 cm			
	Well Below	Below	Meeting	Exceeding
Dry Forest	<50	50-70	70-150	>150
Cool Dry Montane 1	<25	25-50	50-110	>110
Cool Dry Montane 2	<75	75-125	125-250	>250
Cool Montane 1	<50	50-75	75-225	>225
Cool Montane 2	<75	75-125	125-275	>275
Cool Wet Montane	<150	150-200	200-400	>400

Sub-question 5b – Large Snags

Is the total density of all large (>30 cm DBH) snags (WT Classes 3-5) in the cutblock equal to or greater than the average pre-harvest stand condition?

To answer sub-question 5b, field data collected in WTRAs and dispersed tree strata are summarized and compared against benchmark levels depending on the forest type in which the cutblock resides. Benchmark levels for all large snags >30 cm DBH are derived based on the reported interquartile range (20-80% of all plots falling in this range) from benchmark data compiled for different biogeoclimatic groups in BC and then grouped by forest type in Table 15.

Table 15. *Representative pre-harvest snag density by forest type. Reported data shows the approximate interquartile range (20-80%) density (stems/hectare) and percent (%) of total stem density for all snags, and snags >30 cm and >50 cm DBH.*

Forest type	Snags					
	All snags		Snags >30 cm DBH		Snags >50 cm DBH	
	% of all trees	stems/ hectare	% of all snags	stems/ hectare	% of all snags	stems/ hectare
Dry Forest	15-35%	90-200	5-15%	5-15	<1%	<1
Cool Dry Montane 1	45-60%*	400-550	5-10%	30-40	<1%	<1
Cool Dry Montane 2	15-20%	150-200	15-20%	15-25	2-3%	2-3
Cool Montane 1	20-50%	150-300	10-20%	25-50	1-2%	1-4
Cool Montane 2	15-35%	125-225	20-35%	30-60	1-5%	3-7
Cool Wet Montane	5-15%**	40-75	20-35%	10-25	5-15%	3-10

* Note: Most BGC groups (MS, SBS, SBPS, ESSF-Dry, some IDF and ICH) with lodgepole pine leading show high snag densities, particularly hard snags – reflecting cruise data of MPB-impacted salvage logged forests.

**Note: Pre-harvest conditions for the Coast-Moist and Coast-Wet BEC Groups show relatively low snag levels – likely reflecting data from cruise plots in second-growth forests.

The reported range of large snag density is interpreted from Table 15 to provide a target large snag density range. The target categories of Meeting and Exceeding are set around the interquartile range. Essentially, if the assessed large snag density retained on the cutblock is greater than the lowest 20% of benchmark conditions, retained large snag density is assessed as Meeting or Exceeding the target. The measured density of large snags is assessed as Well Below, Below, Meeting, or Exceeding the target densities in Table 16.

Table 16. *Target densities (stems/ha) for large snags (>30 cm DBH) by forest type used to evaluate sub-question 5b*

Forest type	Snags (WT Class 3-8) >30 cm			
	Well Below	Below	Meeting	Exceeding
Dry Forest	0	1-2	2-20	>20
Cool Dry Montane 1	<5	5-10	10-50	>50
Cool Dry Montane 2	<5	5-10	10-30	>30
Cool Montane 1	<10	10-20	20-55	>55
Cool Montane 2	<10	10-20	20-70	>70
Cool Wet Montane	0	1-5	5-30	>30

Sub-question 5c – Large Soft Snags

Is the total density of large (>30 cm DBH) soft snags (WT Class 6-8) in the cutblock equal to or greater than the average pre-harvest stand condition?

To answer sub-question 5c, field data collected in WTRAs and dispersed tree strata are summarized and compared against benchmark levels depending on the forest type in which the cutblock resides. Benchmark levels for large soft snags >30 cm DBH are derived based on the reported interquartile range (20-80% of all plots falling in this range) from benchmark data compiled for different biogeoclimatic groups in BC and then grouped by forest type in Table 17.

Table 17. *Representative pre-harvest soft snag density. Reported data shows the approximate interquartile range (20-80%) density (stems/hectare) and percent (%) of total snag stems for all soft snags, and soft snags >30 cm and >50 cm DBH.*

Forest type	Soft snags (WT Class 6-8)					
	All soft snags		>30 cm DBH		>50 cm DBH	
	% of all snags	stems/ hectare	% of all snags	stems/ hectare	% of all snags	stems/ hectare
Dry Forest	2-10%	5-8	<1 -2%	<1	0 to <1%	<1
Cool Dry Montane 1	1-2%	5-8	<1 -2%	<1	0 to <1%	<1
Cool Dry Montane 2	15-20%	15-20	1-3%	1-3	0 to <1%	0
Cool Montane 1	5-10%	10-20	<1 -2%	<1-3	0 to <1%	<1
Cool Montane 2	5-20%	10-25	1-5%	1-5	<1-2%	<1
Cool Wet Montane	10-30%	5-25	2-7%	2-7	1-5%	1-5

The reported range of large soft snag density is interpreted from Table 17 to provide a target large soft snag density range. The target categories of Meeting and Exceeding are set around the interquartile range. Essentially, if the assessed large soft snag density retained on the cutblock is greater than the lowest 20% of benchmark conditions, retained large soft snag density is assessed as Meeting or Exceeding the target. The measured density of large soft snags is assessed as Well Below, Below, Meeting, or Exceeding the target densities in Table 18.

Note: Large soft snags are relatively rare in most ecosystems. Thus, target values are not set for most forest types except the Cool Montane 2 and Cool Wet Montane. Where targets are not applicable (NA) and large soft snags are recorded, the indicator sub-question 5c is automatically assessed as Meeting the target.

Table 18. *Target densities (stems/ha) for large (>30 cm DBH) soft snags (Wildlife Tree Classes 6-8) by forest type used to evaluate sub-question 5c*

Forest type	Soft snags (WT Class 6-8) >30 cm			
	Well Below	Below	Meeting	Exceeding
Dry Forest	NA	NA	NA	NA
Cool Dry Montane 1	NA	NA	NA	NA
Cool Dry Montane 2	NA	NA	NA	NA
Cool Montane 1	NA	NA	NA	NA
Cool Montane 2	NA	NA	1-5	>5
Cool Wet Montane	0	1	1-7	>5

Verifying the Indicator Information and Ratings

The verification step provides an evaluator the opportunity to verify the outputs of field data collection and the ratings assigned to wildlife tree retention practices. This is an important step, and because field data are summarized and indicator questions answered after field data is collected and submitted, wildlife tree retention practices observed on the cutblock during the field data collection stage can help verify the final rating. Since the rating for Question #5 is based on recorded plot information that is compared against pre-defined benchmark levels, the outcomes may not always accurately reflect wildlife tree retention decisions made in a particular cutblock. The indicators and ratings are sensitive to both how the data in the field is collected and the pre-harvest benchmarks used. The following factors can affect the final rating:

1. **Sampling intensity** – The number of forest structure plots completed in the cutblocks is relatively low. In some cases, plots will miss large trees and snags by chance, particularly large snags and soft snags that are relatively rare in many stands.
2. **Pre-harvest conditions** – Some stands may not reflect the "average" pre-harvest conditions that were used. Second- and third-growth stands, or immature or early mature forest (40-80 years old) that is being commercially thinned may not have large trees and snags available for retention.

To ensure the ratings for Question #5 reflect what is observed on the cutblock, FREP evaluators should observe wildlife tree retention practices throughout the cutblock when collecting field data. In particular evaluators should visually inspect the interior of WTRAs, rocky outcrops, next to riparian areas, and outside of plot locations for large trees and snags that may have been targeted for retention. When completing plots, evaluators should consider:

- Do the plots capture a representative sample of large trees and snags in the strata?
- Are there large trees (such as veteran trees or snags) that a WTRA uses as an ecological anchor, but were missed by the plots?
- Would there have been opportunities to retain large trees through the cutblock, or was the pre-harvest stand young or lacking large trees?

When considering these questions in the field, a good practice is to record observations of notable wildlife tree retention practices on a separate piece of paper. If estimates of large live trees and snags at the plot locations appears to under-represent actual conditions, or notable retention practices are observed (e.g., a retention patch is anchored to a clump of veteran trees or large snags), evaluators can record a separate estimate of the large live tree and snag densities. In situations, where recorded field data may under-represent large wildlife tree densities relative to benchmark levels, estimates can be used to support a rationale to override the rating assigned based solely on the summarized field data and assign a different rating for that question. This step can be very important where recorded densities are close to the Meeting target category. The key is to ensure that the field data collected under the protocol does not unfairly penalize licensees where good wildlife tree retention practices are observed.

To assist in estimating large tree density (snags/ha), Tables 19 and 20 can be used to estimate the density of trees based on the number that would be found in a typical variable radius (prism) or fixed area plot. For variable radius plots, each tree 30 cm DBH would count as 71 stems/ha when using a basal area factor (BAF) of 5. In variable radius plots, larger trees are more likely to be included in the plot, and essentially increase the plot radius resulting in each large tree representing fewer stems/ha.

Table 19. *Density of trees by tree size (cm DBH) and basal area factor (BAF) commonly used in most variable radius (prism) plots*

BAF	# of stems/ha at different tree sizes						
	30cm	35cm	40cm	45cm	50cm	55cm	60cm
2	28	20	16	13	10	8	7
3	42	31	24	19	15	12.5	11
4	57	•	•	•	•	•	•
5	71	•	•	•	•	•	•
6	85	•	•	•	•	•	•
7	99	•	•		•		
8	113	•	•	•			
9	127	•	•				
10	142	•					

In fixed area plots, each tree counted in the plot contributes the same number of stems/ha regardless of tree size. For example, if a 5.64 m radius fixed area plot has two trees >30 cm DBH (one 31 cm and one 46 cm) each contribute as 100/stems/ha for a total of 200 stems/ha >30 cm DBH. A 5.64 m radius plot has the same area as a 10 m x 10 m square plot (100 m^2) which may provide an easier approach to visually estimating tree density where plots are not established.

Table 20. *Tree density (stems/ha) associated with each tree counted in a fixed area radius plot*

Fixed radius plot size (m)	Area (m^2)	Stems/ha trees >30 cm
3.99	**50**	**200**
5.64	**100**	**100**
7.98	**200**	**50**
11.28	**400**	**25**
12.62	**500**	**20**
17.84	**1,000**	**10**

Question #6 - Do stand-level retention practices retain wildlife trees to conserve important habitat features and minimize windthrow effects?

Managing post-harvest windthrow[11] in wildlife tree retention is an important management consideration to ensure the retention persists through the entire rotation of the managed stand. Maintaining wildlife trees can help ensure that the life-boating functions and structural complexity provided by wildlife trees are available to help organisms disperse into and re-colonize the regenerating stand. Retained standing wildlife trees can continue to develop many of the important wildlife attributes associated with larger older trees. Ensuring large live standing trees remain standing is also necessary to recruit large old snags and many structural attributes of snags that provide other important habitats. Ensuring standing live wildlife trees persist into the next rotations is particularly critical when harvesting second- or third-growth stands or younger mature growth stands where important wildlife tree attributes haven't had time to develop.

Forest harvesting can increase the susceptibility of residual trees to windthrow by exposing them to the effects of wind. Almost all forests experience some endemic windthrow, but some areas of the province are also more susceptible to windthrow due to higher or more frequent winds. In most cases, by recognizing prevailing wind patterns, topography, soils, forest structure and composition, and applying appropriate mitigation treatments during harvesting, windthrow of retained wildlife trees can be minimized (Mitchell 1995, Zielke et al. 2010).

Existing windthrow management guidance documents (Mitchell 1995, Zielke et al. 2010) do not provide quantitative minimum post-harvest windthrow target levels. Instead, forest managers can set acceptable levels of windthrow when conducting windthrow risk assessments that balance the trade-offs of harvesting and windthrow mitigation practices with the consequences of windthrow to timber or environmental values (Zielke et al. 2010).

Preliminary windthrow levels applied in this protocol, considered acceptable for biodiversity and wildlife habitat conservation purposes, recognize that some level of post-harvest windthrow can be expected, and even be desirable, as windthrow or breakage is an important process to create snags, downed wood, and structural diversity in forest stands. However, significant levels of post-harvest windthrow of wildlife trees will reduce the intended benefits of wildlife tree retention for the duration of the rotation, or longer. Thus, target levels specified here consider that >10% windthrow on average across all WTRAs, and >30% maximum windthrow in any one WTRA to be below acceptable levels.

Indicator Sub-questions for Question #6

The following two indicator sub-questions are used to evaluate Question #6:

- **Sub-question 6a – Average Windthrow** – *IS the average amount of windthrow across all WTRAs in the cutblock maintained at acceptable levels?*
- **Sub-question 6b – Maximum Windthrow** – *Is the maximum amount of windthrow in any one WTRA in the cutblock maintained at acceptable levels?*

Each sub-question is evaluated and categorized as either Exceeding, Meeting, Below, or Well Below the guidance targets. To answer the main Question #6, the average score for each category (Exceeding=4, Meeting=3, Below=2, and Well Below=1) across both sub-questions is used. The average score is rounded up or down to the nearest whole number. For example, if one sub-question is Meeting (score =3), and the other sub-question is Below (score =2), the arithmetic average is 2.5[(3+2=5), divided by the number of questions (2), so, 5/2=2.5)]. This value is then rounded up to the nearest whole number, which is 3, and the windthrow levels are rated as Meeting the recommended guidance targets.

[11] Mainly endemic windthrow and not catastrophic windthrow events.

Sub-question 6a – Average Windthrow

Is the average amount of windthrow across all WTRAs in the cutblock maintained at acceptable levels?

Data to answer this question is recorded on the Form B Stratum Card (or Form C Block Card Section 16 where multiple strata are assessed but no plots located). When a Form B Stratum card is completed for each WTRA and dispersed wildlife tree retention strata on the block, evaluators are asked to estimate (to the nearest 1%) the percent of each WTRA or dispersed strata that is windthrown. The average amount of windthrow across all WTRAs and/or dispersed strata is summarized to answer indicator sub-question 6a.

The District Retention Summary Tables provide outputs of average percent windthrow for all wildlife tree retention areas which is used to determine if average amounts of windthrow are Exceeding, Meeting, Below, or Well Below the recommended guidance target of 10%. The cutblock is automatically assigned to one of the four categories in the district summary spreadsheet. The categories Exceeding, Meeting, Below, or Well Below are assigned as per Table 21.

Table 21. *Ratings assigned to a cutblock for indicator sub-question 6a based on average percent windthrow across all WTRAs in a cutblock*

Average percent (%) windthrow	Assigned rating
<1%	Exceeding
1-10%	Meeting
11-30%	Below
>30%	Well Below

Sub-question 6b – Maximum Windthrow

Is the maximum amount of windthrow in any one WTRA in the cutblock maintained at acceptable levels?

To answer this sub-question, the same data on percentage windthrow recorded on the Form B Strata Card (or Form C Block Card) is summarized and used.

The District Retention Summary Tables provide outputs for each cutblock on maximum percent windthrow to evaluate whether the maximum amount of windthrow in any one wildlife tree retention area is Exceeding, Meeting, Below, or Well Below the recommended guidance target of 30% in any one WTRA or dispersed strata. The cutblock is automatically assigned to one of the four categories in the District Retention Summary spreadsheet. The categories Exceeding, Meeting, Below, or Well Below are assigned as per Table 22.

Table 22. *Ratings assigned to a cutblock for indicator sub-question 6b based on maximum percent windthrow in any one WTRA in a cutblock*

Average percent (%) windthrow	Assigned rating
<10%	Exceeding
11-30%	Meeting
31-50%	Below
>50%	Well Below

Verifying the Indicator Information and Ratings

Unlike other questions that rely on data summarized from randomly located plots, data used to answer Question #6 is an estimate of percent windthrow on 100% of each stratum. Thus, the possibility of missing important information due to low sampling intensity or other forms of sampling error is unlikely.

The key to verifying the results for this question is to ensure an accurate estimate for each stratum is provided which may require a thorough walk-through or perimeter evaluation during field data collection. Evaluators should also be aware of the 10% average across stratum and 30% maximum windthrow in a single stratum used as a benchmark to differentiate between assigning a rating of Meeting and Below recommended targets. When the percentage windthrow is close to benchmark levels, evaluators should take extra time to ensure an accurate estimate.

Category: Amount and Quality of Downed Wood Retention

Coarse woody debris (CWD) is an important structural component of forests that provides habitats for a broad range of wildlife species. The amount or volume of CWD is a key component to maintain biodiversity and habitats, but only one of many factors that determine how organisms utilize CWD. Several other important factors include (after Harmon et al. 1986):

- Physical orientation – birds and bats use standing snags, while many mammals, amphibians and reptiles use downed logs, CWD piles or windrows.
- Size – some organisms utilize larger diameter logs.
- Decay class and tree species – variable use by invertebrates and fungi based on decomposition characteristics.

In managed stands, pre-harvest planning is required to ensure adequate amounts and types of CWD habitats are available throughout the rotation. Much of the pre-harvest CWD, particularly advanced decay classes, may be lost during harvest operations. Also, by removing tree biomass from the site, less of the pre-harvest stand volume will be available to provide initial CWD volume in the regenerating forest. Thus, four factors that should be considered when planning harvests to manage the amount of CWD available through the full rotation of managed forests, include (after Harmon et al. 1986, Densmore et al. 2004):

1. The initial volume left at the time of harvest,
2. Input of new CWD as the new stand grows and experiences mortality,
3. Depletion of the initial and new inputs of CWD by various decay processes, and
4. Input of CWD from standing trees initially retained in reserves such as WTRAs or from dispersed aggregated retained trees in the harvested area.

Ensuring that adequate CWD volume is retained on site at the time of harvest is critical to maintaining CWD habitats in the first few decades following harvest. However, much of the initial CWD will decay by 30-40 years post-harvest. Thus, in addition to managing for initial CWD volume, certain practices can also help maintain and recruit specific CWD attributes in managed stands, including:[12]

- Retain larger (diameter and length) CWD pieces; large CWD pieces take longer to decay and thus persist longer into the regenerating stand.
- Maintain a full range of decay classes, diameters, and tree species to provide variability in post-harvest downed wood habitats.
- Maintain overlapping or elevated logs to provide more structural diversity. Debris piles and windrows have been shown to provide important interim habitats in regenerating stands (Sullivan and Sullivan 2019).
- Retain standing trees for CWD recruitment – a staggered input of CWD through downfall of live and dead standing trees will need to occur throughout the life of the stand. Retaining safe dead standing and live trees can provide downfall to recruit CWD in 50-80 years when deficits occur in later stages of managed stand development.

To evaluate the effectiveness of stand-level retention practices at maintaining CWD at the individual cutblock scale, the protocol utilizes two questions (Questions #7 and #8) related to the amount, type, condition, and spatial distribution of CWD:

> **Question #7. Amount and Spatial Dispersion of Downed Wood** – *Does the amount and dispersion of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?*
>
> **Question #8. Downed Wood Size and Condition** – *Does the size (diameter, length) and condition (decay class) of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?*

[12] See Chief Forester's Guidance on Coarse Woody Debris Management (2010), and Arsenault (2002).

Factors Affecting Coarse Woody Debris Retention

Forest managers may wish to modify the amount of CWD retained to achieve specific stand-level or landscape-level objectives. For example, low post-harvest CWD accumulations may be desired in areas where biomass utilization or forage management for livestock has been prioritized. Managing potential post-harvest fuel can also be a concern in high wildfire risk areas (e.g., adjacent to communities or infrastructure).[13] Higher CWD levels and large CWD pieces elevated in piles and windrows may be retained for specific wildlife species (e.g., mustelids, fisher[14] or marten). No single amount of CWD is "correct" for all sites and naturally high levels of variability in CWD amounts, sizes and condition mean that variability in post-harvest CWD is also acceptable.

Before answering these questions, evaluators should check site plans to determine if specific CWD management objectives have been identified for the harvested area. Based on the decision key below (Figure 13), evaluators can assign a CWD target for the harvested area (Low, Moderate or High CWD) based on any specified CWD objectives.

Where CWD objectives are not specified, the ratings in Question #7 for CWD volume automatically default to the Moderate category as a target post-harvest condition. Where CWD objectives have been specified, evaluators can override the results. For example, a cutblock may be rated as Below or Well Below guidance targets for CWD volume or large CWD pieces when using the Moderate category. However, if that cutblock was completed for wildfire risk reduction and CWD levels are purposefully managed to low levels to remove fuels, then an evaluator can override the results and assign a rating of Meeting CWD volume targets for the block.

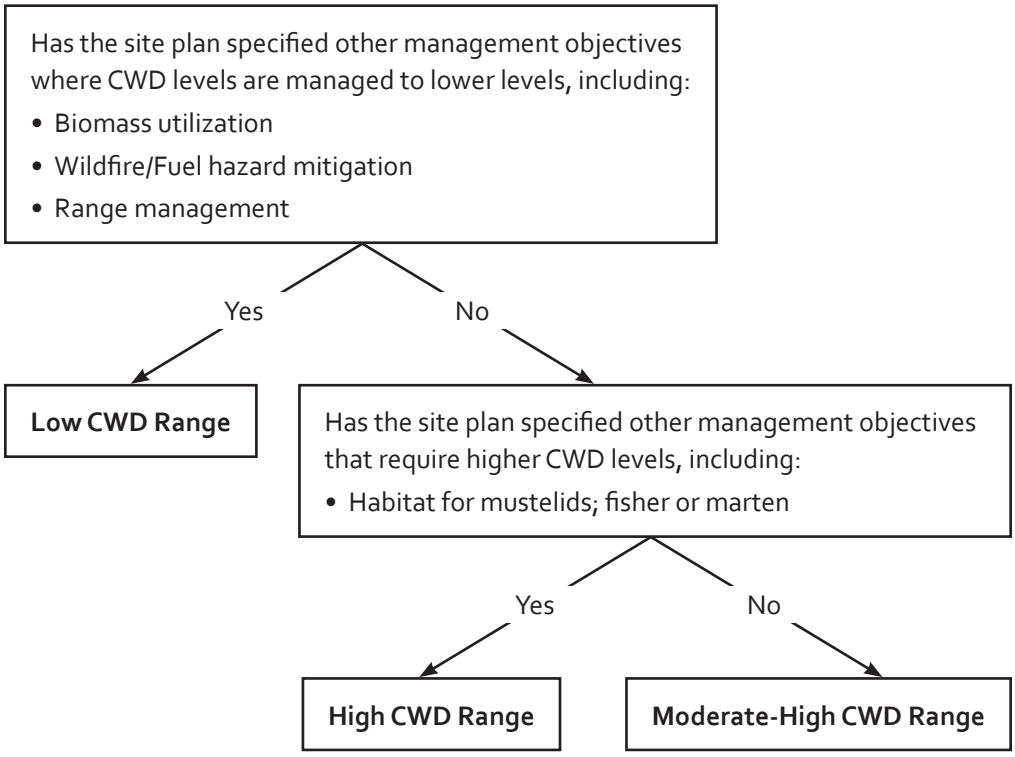


Figure 13. *Decision tree to determine the target post-harvest CWD volume range for evaluating measured CWD levels related to Question #7.*

[13] See: *A guide to fuel hazard assessment and abatement in British Columbia*. 2012. Wildfire Management Branch, BC Min. For., Lands, Nat. Res. Ops.
[14] Refer to fisher guidance: https://www.bcfisherhabitat.ca/

Question #7: Does the amount and dispersion of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?

The volume of CWD in any forest stand can vary substantially within an ecosystem but also between ecosystems based on factors such as productivity and disturbance history. Some work has been completed to identify CWD targets for different forest ecosystems. For example, in dry forests to lower subalpine forest ecosystems in the Northwestern United States, Brown et al. (2003) identified a range of optimal post-disturbance CWD levels based on wildlife habitat and soil productivity requirements, which also considered historic CWD levels and the contribution of CWD >3 inches diameter (>7.5 cm diameter) to wildfire hazard and soil heating. These ranged from approximately 35-70 m^3/ha, and 70-210 m^3/ha for Dry Forest and Cool Dry Forest-lower subalpine forests respectively, values that coincide well with the range of CWD reported from measured plots in mature forests across similar forest ecosystems in British Columbia[15] (Figure 14). The lower limit of the optimal range is determined based on ecological benefits while upper limits are determined by excessive fire hazard (Brown et al. 2003).

As a preliminary estimate, the results from Brown et al. (2003) are extrapolated to BC forest ecosystems. The lower end of the optimal range also coincides with approximately 50% of average pre-harvest CWD levels recommended in the Biodiversity Guidebook. The range of CWD volumes by BEC Group and forest type shown here is expected to maintain CWD volume within the optimal range for up to 40 years post-harvest, assuming most logs decay. Achieving the optimal range of CWD up to 50-80 years post-harvest will rely on staggered input of CWD through downfall of wildlife trees in the cutblock or from adjacent forest along the cutblock edge during that period.

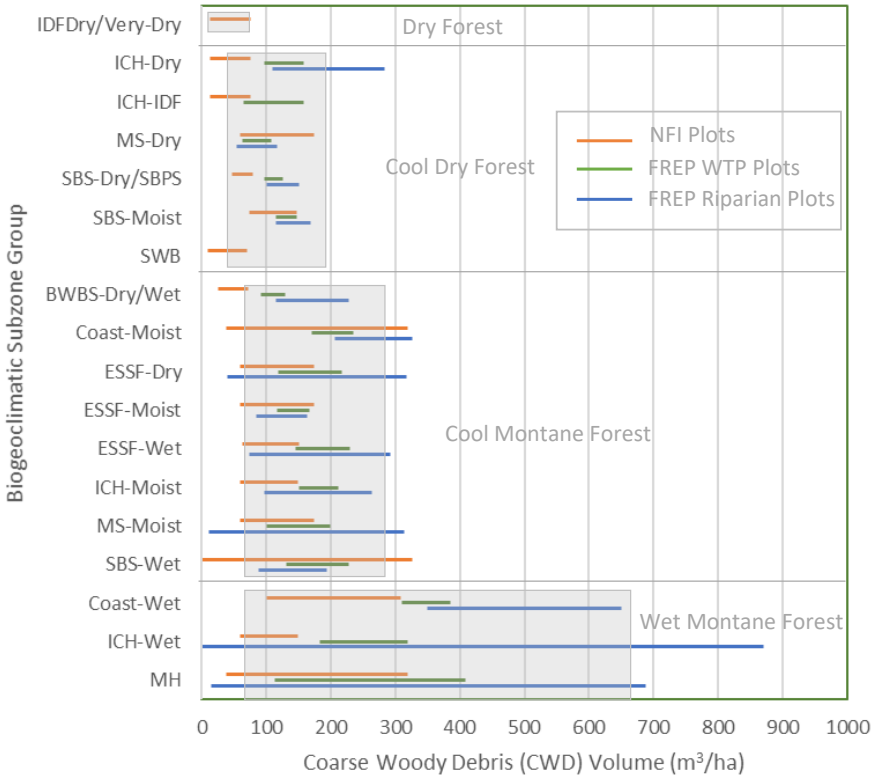


Figure 14. *Range of stand-level CWD volumes based on available National Forest Inventory (NFI) transects and Forest and Range Evaluation Program (FREP) transects in wildlife tree retention areas (WTRAs) and riparian reserves. Shaded areas show "optimal" CWD levels as interpreted from Brown et al. (2003) and adapted to BC forests.*

[15] Baselines for downed wood volume for BC in Figure 14 are based on FREP and National Forest Inventory (NFI) transect information for 1996-2015 and 2000-2006 (See Huggard, 2020).

By summarizing the preliminary estimates for Low, Medium, and High CWD volume targets based on the concept of an optimal range as applied to broad forest types based on the BEC Groups in Figure 14 above, we can then specify benchmark CWD levels. Table 23 outlines these benchmark levels for CWD for Low, Moderate and High CWD management target categories by BEC groups and forest types in BC.

Table 23. *Benchmark levels for CWD for Low, Moderate and High CWD management target categories by BEC groups and forest types in BC*

Forest type	BEC Group	Optimal CWD volume range (m^3/ha)[a]		
		Low	Moderate	High
Dry Forest	IDF-Dry and Very Dry	30-50	50-70	>70
Cool Dry Forest	ICH/IDF, ICH-Dry, MS Dry SBS-Dry/SBPS, SBS Moist, SWB	50-100	70-150	>150
Cool Montane Forest	BWBS-Dry/Wet, Coast-Moist, ESSF Dry/ Moist/Wet, SBS-Wet, ICH-Moist	70-150	150-250	>250
Wet Montane Forest	Coast-Wet, ICH-Wet, MH	70-150	150-350	>350

[a] CWD volume is measured from a database of CWD for each biogeoclimatic zone or subzone group.

Indicator Sub-questions for Question #7

The following two sub-questions are used to answer Question #7:

- **Question 7a – CWD Volume** – *Is the total volume of CWD measured at transects equal to or greater than the specified target range for that forest type and considering stated objectives for the cutblock?*
- **Question 7b – CWD Recruitment** – *Is at least 45% of the area of the cutblock under forest influence able to contribute to future CWD recruitment through downfall of standing trees?*

Each sub-question is evaluated and categorized as either Exceeding, Meeting, Below, or Well Below the guidance targets. To answer the main Question #7, the average score for each category (Exceeding=4, Meeting=3, Below=2, and Well Below=1) across both sub-questions is used. The average score is rounded up or down to the nearest whole number. For example, if one sub-question is Meeting (score =3), and the other sub-questions is Below (score =2), the arithmetic average of scores is = (3 + 2) ÷ 2 questions = 2.5. This value is then rounded up to the nearest whole number, which is 3, and therefore for this example, the CWD volumes are rated as Meeting the recommended guidance targets.

Sub-question 7a – CWD Volume

The indicator sub-question #7a is related to the total volume of CWD retained on the site in WTRAs and the NAR.

To answer the question, data collected along CWD transects in all stratum types is used. The CWD data is area-weighted when summarized to provide average values across the cutblock. The average CWD volume is compared against benchmark levels depending on the forest type in which the cutblock resides. (Table 23).

The rating categories of Well Below, Below, Meeting, or Exceeding guidance targets (Table 24) were interpreted from Table 23. The Meeting rating category is assigned based on the optimal CWD levels in the Moderate range for each forest type.

Table 24. *Rating categories based on CWD volume (m^3/ha) by forest type*

Forest Type	Rating Category			
	Well Below	Below	Meeting	Exceeding
	Course Woody Debris Volume (m^3/ha)			
Dry Forest	<10	10-30	30-80	>80
Cool Dry Montane 1 & 2	<25	25-50	50-175	>175
Cool Montane 1 & 2	<50	50-100	100-300	>300
Wet Montane	<100	100-200	200-500	>500

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the Moderate CWD target level. For example, the category Meeting is set slightly below the optimal range. If the optimal CWD range is 50-70 m^3/ha for the Dry Forest type, the Meeting guidance target category is set at 30-80 m^3/ha. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

Sub-question 7b – Future CWD Recruitment

Sub-question 7b is related to the area of the cutblock that can contribute future CWD recruitment.

To answer the sub-question, the protocol uses the Percent Forest Influence indicator provided in the District Retention Summary Table as applied in Question #4 of the protocol (See overview of Question #4 for a description of the GIS analysis used). This indicator utilizes outputs of both the GIS analysis and results of the field sampling for dispersed strata.

The rating categories of Well Below, Below, Meeting, or Exceeding guidance targets (Table 25) are assigned based on the target of 50% forest influence.

Table 25. *Assigned ratings for the area of the cutblock available to recruit future CWD based on the percent of the cutblock in forest influence (covered by retention or within 1 tree length of wildlife tree retention or adjacent forest edge)*

Percent (%) Forest Influence	Assigned rating
<30%	Well Below
30-45%	Below
45-60%	Meeting
>60%	Exceeding

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the target of 50%. For example, the category Meeting is set slightly below the target at 45-60%. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

Question #8: Does the size (diameter, length) and condition (decay class) of CWD provide habitat refugia and structural complexity in the regenerating stand now and in the future?

Benchmarks for large CWD piece size are based on the 2010 Chief Forester guidance (Province of British Columbia 2010) that asked for a 20% increase in the median density of large CWD pieces in the net area to be reforested (NAR) across harvested cutblocks within a biogeoclimatic zone or subzone.[16] The following table (Table 26) is an updated estimate for average numbers of large CWD pieces across measured transects within a cutblock.[17] The target levels in Table 26 are based on a 20% increase relative to the difference between the density of large CWD in wildlife tree retention areas and at the biogeoclimatic subzone level. The underlying assumption is that as the average density increases within a cutblock, the median density across sampled blocks would correspondingly increase. Reported densities are based on FREP data from sampled cutblocks harvested up to 2010.

Table 26. *Mean density at the cutblock level of long (>10 m) and large (>20 cm diameter and >10 m long) CWD pieces from FREP samples on baseline pre-2010 cutblocks, and target levels with a 20% increase over baseline levels*

BEC Group	Mean density (CWD pieces/hectare) >10 m long and large pieces (>20 cm diameter and 10 m long)					
	Net area to be reforested (Pre-2010 FREP data)		Wildlife tree retention areas (Pre-2010 FREP data)		Target levels in NAR with 20% increase	
	>10 m	>20 cm and >10 m	>10 m	>20 cm and >10 m	>10 m	>20 cm and >10 m
BWBS - Dry	32	15	118	48	49	22
BWBS - Wet	39	15	104	32	52	18
Coast - Moist	39	21	82	48	48	26
Coast - Wet	60	39	92	69	67	45
ESSF - Dry	45	19	161	59	68	27
ESSF - Moist	40	19	137	60	59	27
ESSF - Wet	43	25	129	83	60	37
ICH - Dry	46	15	136	54	64	23
ICH - Moist	65	29	119	58	76	35
ICH - Wet	62	41	86	61	67	45
ICH/IDF	50	17	106	50	61	24
IDF - Dry	34	7	115	33	50	12
IDF - Very Dry	33	4	46	13	35	5
MH	58	41	68	50	60	43
MS - Dry	20	4	146	34	45	10
MS - Moist	46	11	160	61	69	21
SBS - Dry/SBPS	46	11	178	49	72	19
SBS Moist	48	16	165	60	72	25
SBS Wet	50	19	186	85	77	32
SWB	32	15	118	48	49	22

[16] Median densities across sampled cutblocks within a district or BEC group as per the Chief Forester's 2010 guidance can be reported elsewhere such as in district MRVA reports.

[17] Recognizing that due to variability in measurements, some evaluations may not record any large CWD pieces along any transect, or measured values may be highly variable between transects within a cutblock.

Sub-question for Question #8

The sub-question required to answer Question #8 asks: *Is the average density of large CWD pieces (>10 m length and >20 cm diameter) found in the NAR equal to or greater than the benchmark number for that ecosystem?*

To answer this question, the average number of large CWD pieces/ha recorded on CWD transects in the NAR is referred to in the District Retention Summary Table.

The rating categories of Well Below, Below, Meeting, or Exceeding guidance targets for large CWD pieces in the NAR are interpreted by forest type (Table 26).

Table 27. *Target categories for large CWD pieces/ha by forest type*

Forest type	Large CWD pieces/ha			
	Well Below	Below	Meeting	Exceeding
Dry Forest	<5	5-10	10-20	>20
Dry Montane 1	<5	5-15	15-30	>30
Dry Montane 2	<5	5-15	15-30	>30
Montane 1	<10	10-20	20-30	>30
Montane 2	<15	15-25	25-40	>40
Wet Montane	<15	15-25	25-45	>45

Note: The categories of Exceeding, Meeting, Below, or Well Below recommended guidance targets are interpreted around the minimum guidance target set by BEC Group in Table 26. For example, the category Meeting is set slightly below the minimum guidance target. So, if the recommended minimum guidance target is 23-27 large CWD pieces/ha, the Meeting guidance targets category is set at 20-30 large CWD pieces/ha. This accounts for situations where:

- Measured or recorded retention amounts may underestimate actual retention levels, and
- Forest licensees have attempted to achieve close to the minimum recommended guidance.

Verifying the Indicator Information and Ratings

The verification step provides an evaluator the opportunity to verify the outputs of field data collection and the ratings assigned to wildlife tree retention practices. This is an important step because field data are summarized and indicator questions answered after field data are collected and submitted, therefore wildlife tree retention practices observed on the cutblock during the field data collection stage can help verify the final rating for this question. Since the rating for Questions #7 and #8 is based on recorded CWD transect information that is compared against pre-defined benchmark levels, the outcomes may not always accurately reflect CWD retention decisions made in a particular cutblock. The indicators and ratings are sensitive to both how the data in the field are collected and the pre-harvest benchmarks used. The following factors can affect the final rating:

1. Sampling intensity – the # of CWD transects completed in the NAR is relatively low. In some cases, transects will miss large CWD pieces by chance, or large logs may have been moved into piles or windrows.
2. Pre-harvest conditions – some stands may not reflect the "average" pre-harvest conditions that were used. For example, second- and third-growth stands, or immature or early mature forest (40-80 years old) that is being commercially thinned, will likely not have significant CWD volume or large CWD pieces remaining from the previous stand or may not have recruited enough trees during harvest to create large CWD pieces.

3. Management objectives – as discussed earlier, management practices that remove large woody debris for wildfire hazard risk reduction, or biomass utilization, can create situations where less CWD volume and few large CWD pieces remain.

To ensure the ratings for Questions #7 and #8 reflect what is observed on the cutblock, FREP evaluators should observe CWD retention practices throughout the cutblock when collecting field data. In particular, evaluators should visually inspect the NAR for large CWD pieces, windrows and CWD piles that have been purposefully retained and not piled for future burning. When completing transects, evaluators should consider:

- Do the transects capture a representative sample of CWD volume and large CWD pieces in the strata?
- Are there large CWD pieces available in CWD piles or windrows that have been retained for wildlife habitat purposes?
- Would there have been opportunities to retain large CWD pieces through the cutblock, or was the pre-harvest stand young or lacking CWD volume or large trees to recruit as CWD?

When considering these questions in the field, a good practice is to record observations of notable CWD retention practices on a separate piece of paper. If estimates of CWD volume or large CWD pieces at the transect locations appear to under-represent actual conditions, or notable CWD retention practices are observed (e.g., CWD pile or windrows connected to a retention patch or adjacent forest edge), evaluators can record a separate estimate of the CWD volume and large CWD pieces. In situations, where recorded field data may under-represent large CWD volume or large CWD pieces/ha relative to benchmark levels, estimates can be used to support a rationale to override the rating assigned based solely on the summarized field data and assign a different rating for that question. This step can be very important where recorded densities are close to the Meeting target category. The key is to ensure that the field data collected under the protocol does not unfairly penalize licensees where good wildlife tree retention practices are observed.

Evaluators should also record if specific CWD management objectives were identified based on the site plan for the block. After visiting the cutblock, if you are unsure, contact the licensee to confirm if any specific CWD management objectives exist.

To assist in estimating large CWD pieces/ha, it is important to note how each large CWD piece encountered on a transect contributes to calculations of pieces per hectare. Log length affects the probability a log will be encountered on a transect and affects the # pieces/ha that log represents in the calculation, such that longer logs encountered on a transect contribute fewer pieces/ha as a longer log would have an increased probability of being encountered on a transect. For example, one log (>20 cm and 10 m length) encountered on a 30 m transect = 52 pieces/ha. As the length of the piece increases, the number of corresponding pieces/ha represented by that piece declines, where:

- 11 m length = 47 pieces/ha
- 12 m length = 44 pieces/ha
- 13 m length = 40 pieces /ha
- 14 m length = 37 pieces/ha
- 15 m length = 35 pieces/ha

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APPENDIX 1. BIG BLOCK SAMPLING

Purpose

To design a sampling scheme for blocks larger than 100 hectares that limits the number of plots established – but still captures the general variability of retention on the block – and confirms the size, type, and existence of every separate retention patch.

Methodology for Determining the Number of Plots and Plot Location

Patch Retention

Make at least three lists (i.e., stratification by like features):

- All retention polygons that are riparian or wetland,
- All non-riparian retention polygons, and
- All retention polygons that are temporary or immature.

Note: The purpose of the first two lists is to compile reasonably similar timber types.

This would generally be a mapping exercise; however, use additional information (such as aerial photos) if available to identify similar timber types. If time allows – and you determine there is sufficient variability to warrant it – you may decide to create an additional list of polygons to sample from. For example, subdivide the list of non-riparian polygons into large and small patches.

For the riparian or wetland list:

- Sum up the area in each list.
- The number of plots to sample is one per hectare for the first 5 hectares of retention, and then one additional plot per 10 hectares. After that (round up) to a maximum of 15 plots to be sampled in that retention strata.
- Locate the plots within the polygons by using a grid overlay to determine potential plots and randomly select from them.
- It is not necessary to force a potential plot into each polygon on the list – as long as the overlay of a dot grid (or other such method) captures an equal or greater number of potential plots than your number of sample plots.
- Each contiguous stratum (stand-alone patch) still requires a Form B (or Section 16 if no plots established).

For the non-riparian list:

- Same as for the riparian or wetland list above.

For the temporary or immature list:

- Don't establish plots unless you have extra time on the cutblock.
- Fill out Form B or Section 16 for each non-contiguous polygon.

Harvest Area

Number of plots: three plots for the first 60 ha, plus one plot per each additional 20 ha after that to a maximum of 15 plots.

Maximum Number of Plots for a Large Block

The maximum number of plots is likely 45 (30 patch plots if two lists of similar timber types are to be sampled and 15 harvest area plots).

APPENDIX 2. HOW TO DETERMINE IF A STRATUM IS DISPERSED RETENTION

Issue: Each stratum is given a designation as either; patch retention (P), dispersed retention (D) or clearcut (CC). When does the presence of a few trees in a harvest area change the designation from CC to D?

Background: The data collected is entered into the FREP Information Management System (FREP IMS). If a stratum is designated as a clearcut then please only record high-level information about any trees present in the plots, into the comments section. Tree data cannot be entered in FREP IMS if the stratum is designated as clearcut.

However, trees are considered to have "little" or "some" biodiversity value is if all the retained trees within the harvest stratum add up to equal or greater than 0.1 ha basal area equivalent area (i.e., if all the dispersed trees were added together, they would make up a patch of at least 0.1 ha). If there is at least 0.1 ha of basal area equivalent area, then we can call the stratum "dispersed". Smaller amounts of trees would have negligible impact on the percent area retained indicator.

Discussion: Basal area equivalency can be done by:

1. Estimating the total basal area left in the dispersed stratum,
2. Estimating the average basal area/hectare that was present on the cutblock pre-harvest, or
3. Dividing the total basal area in the dispersed stratum by the average pre-harvest basal area/ha to get the equivalent hectares.

The following table gives an example of the number of total trees (of differing diameters) that are required (compared to two different average basal area/ha) to be equivalent to a 0.1 ha patch.

		# of trees equivalent to a 0.1 ha patch	
DBH	**BA/tree**	**Interior 30 m^2/ha**	**Coast 50 m^2/ha**
12.5	0.01	245	408
15	0.02	170	283
20	0.03	95	159
30	0.07	42	71
40	0.13	24	40

Conclusion: The total number of dispersed trees retained in the harvest area required to add up to at least the equivalent of a 0.1 ha patch is dependent on:

- The average basal area/hectare of a fully stocked stand, and
- The total (i.e., – NOT m^2/ha, but TOTAL m^2 in the stratum) basal area of the retained trees.

APPENDIX 3. SAMPLE COMPLETED FORMS

Plot Information – Form A Side 1

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Plot Information – Form A Side 1

1 Plot Identification Page _____ of _____

Date (Y/M/D) 2023 / 07 / 21 Opening ID 175899

Assessed by KH / CF

Plot # 1 Stratum ID WTP2 Stratum Type PW

UTM Zone 10 E 658171 N 5999213

2 Plot Information (trees) Trees Exist ☑ Yes ☐ No

Fill in one of:

BAF 6 Fixed area radius (m) _____ Full Count Area (ha) _____

3 Stand Table

Tree #	Spp.	WT Class	DBH* (cm)	HT* (m)	Comments (Tree)
1	Pli	1	35.9	29.7	
2	Pli	1	38	27	
3	Pli	1	35	29	
4	Pli	3	41	28	
5	Pli	3	38	32	Cavity nest @ 18m
6	Pli	1	40	34	
7	Pli	2	44	30	MPB scaling
8	Pli	1	44	36	
9	Sx	1	21	13	

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* Decimal place means measured

Plot Information – Form A Side 2

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Plot Information – Form A Side 2

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

Coarse Woody Debris (30 m transect) CWD in transect ☑ Yes ☐ No

1st Leg 300° 2nd Leg 30°

Log #	Spp.	Decay Class	Dia.* (cm)	Length* (m)	Comments
1	X	3	13	3	
2	Pli	1	9.8	15.6	
3	Pli	4	16	6	
4	Pli	2	16	8	end leg 1
5	Pli	2	15	9	
6	Xh	3	8	3	

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* Decimal place means measured

Stratum Summary – Form B Side 1

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Stratum Summary – Form B Side 1

5 Stratum Summary (one card per Stratum)

Date Y 2023 / M 07 / D 12 Opening ID 1836001

Assessed by ME / ER

Stratum ID WTP2 Stratum Type PR

# of plots in stratum 3 Mapped stratum size (ha) 3·1

BEC subzone variant and site series SBS mc2 01

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) 120

Patch location: ☐ Internal to block ☑ Edge of block ☐ External/not touching block ☐ NA

% of total trees in reserve windthrown: 7 %

Distribution of windthrow: ☑ Edge ☑ Internal ☐ NA

Windthrow treatment: ☐ Feathering ☐ Topping ☑ Both ☐ None ☐ Other _____

7 Reserve Constraints	% of reserve	Ecological Anchors		stratum estimate
None	☐	None		☐
Wetsite		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	1
Non (or low) merch timber		Cavity nest	stratum count	
Sensitive terrain or soil		Large hollow tree	stratum count	
UWR / WHA		Large witches broom	stratum count	
OGMA		Karst feature		Y N
Visuals		Largest tree for site (not Vets)		Y N
Cultural heritage feature		CWD heavy natural concentration		Y N
Recreation feature		Active wildlife trails		Y N
Other:		Active WLT/CWD feeding		(Y) N
		Uncommon tree species		Y N
Total constrained	15	Other:		

Comments:

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Block Information – Form C Side 1

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Block Information – Form C Side 1

11 Opening Identification

Opening # 93L 018 112 Opening ID 1847544

Licence # A16828 CP # 473 Block PARRSX10

Licensee Canfor District DND

Location Description 24km Parrott West

NAR 47.7 Gross area (ha) 67.6 Override

12 Innovative Practices

Were any innovative and/or unique forest practices used on this block?

Please describe:

No

13 Invasive Plants

Were invasive plant species present on this block? ☑ Yes ☐ No ☐ Don't know

If Yes, please complete the Invasive Plants Field Card (FS 1316)

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 ☐ Very Well ☐ Don't know

Rationale:

Good amount, plus number of patches - primarily the wet areas. S3 reserve mostly dead or windthrown.

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Block Information – Form C Side 2

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Block Summary – Form C Side 2

15 Photo Notes

16 Stratum Summary When No Plots Established (S.16 or Form B, not both for each stratum ID)

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 Species Y/N	Other	None	
WTP1	PW	0.6	SBSmc2 06	✓			50								✓	<5
WTP1	PW	0.6	SBSmc2 06	✓			50								✓	5-15

17 Quality Check: Sum of patch area + Sum of dispersed + CC + NP + Other = Cutblock gross area

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APPENDIX 4. CWD MEASUREMENTS

Field procedures for measuring CWD were adapted from the CWD field procedures, as found in the RISC Vegetation Resources Inventory – British Columbia, Ground Sampling Procedures (2018). Excerpts are included here to clarify and guide protocol fieldwork.

CWD Defined

Coarse woody debris (CWD) 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.

CWD includes:

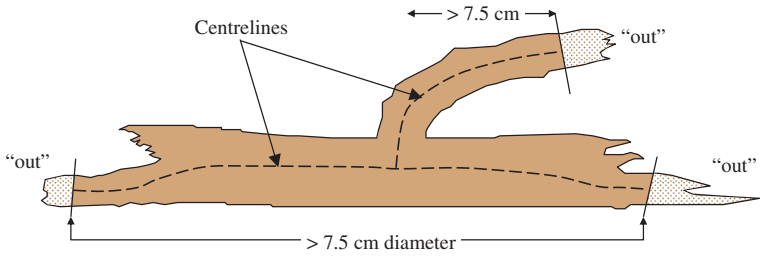
- Downed horizontal or suspended (not self-supporting) dead tree boles, with or without roots attached;
- Fallen trees that still have green foliage if they no longer have roots attached (no living cambium) to the ground to keep them alive;
- Woody pieces greater than 7.5 cm at the point where the sampling 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 treetops that may be horizontal or leaning, or large fallen branches; and
- Recently cut logs.

CWD **does not** include:

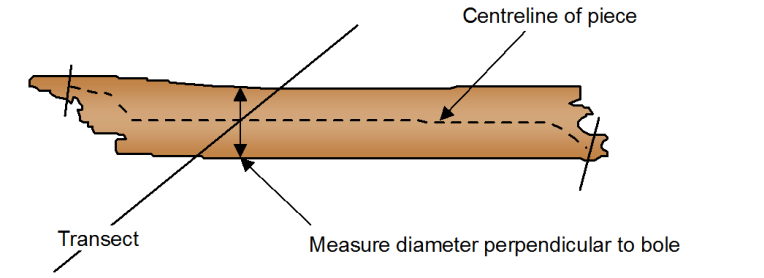
- Dead branches still connected to standing trees;
- Self-supporting (not overturned) stumps;
- Exposed roots of self-supporting trees or stumps;
- Material that is buried beneath organic or mineral soil layers, or has decomposed enough to be part of the forest floor; and
- Live or dead trees (still rooted) which are self-supporting.

Rules for Sampling Coarse Woody Debris

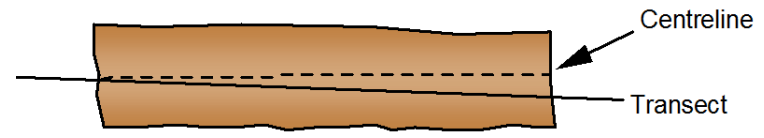
1a



1b



1c



1d

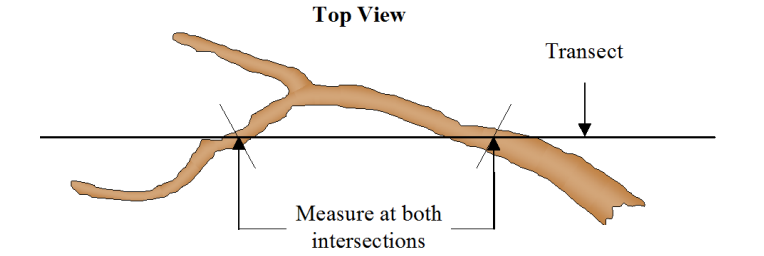


Figure A4.1. *Rules for sampling CWD.*

- Coarse woody debris must be greater than 7.5 cm in diameter (or equivalent) at the line intersect point (see 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 abovethe 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.

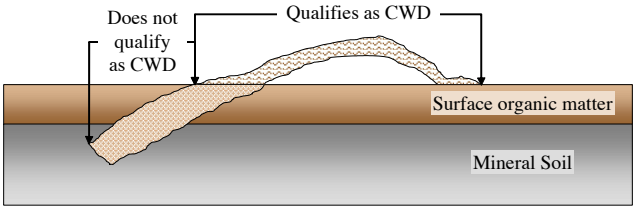
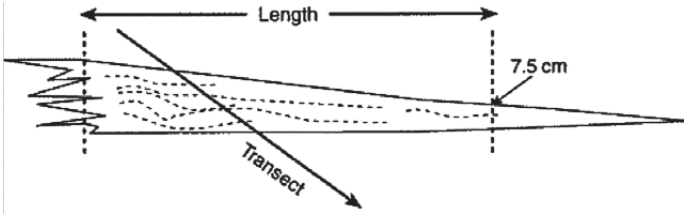


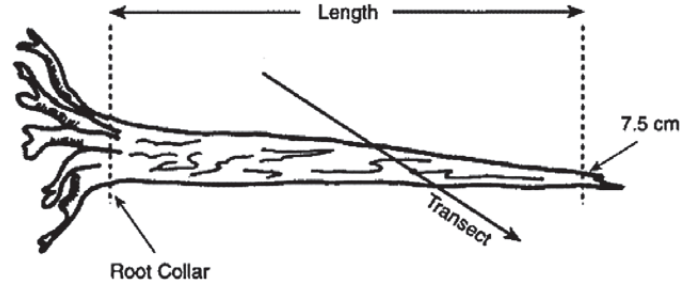
Figure A4.2. *Tally only CWD that lies above the soil.*

CWD Length

3a



3b



3c

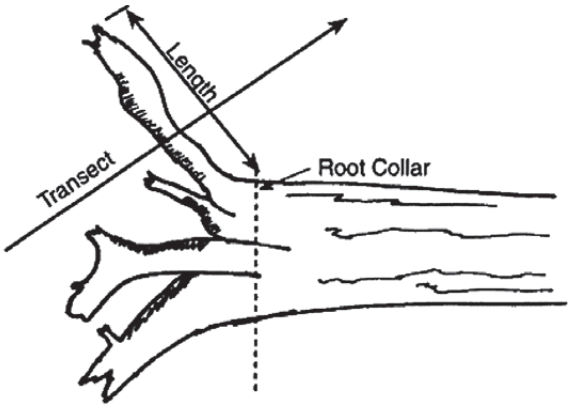


Figure A4.3. *Rules for measuring the length of CWD.*

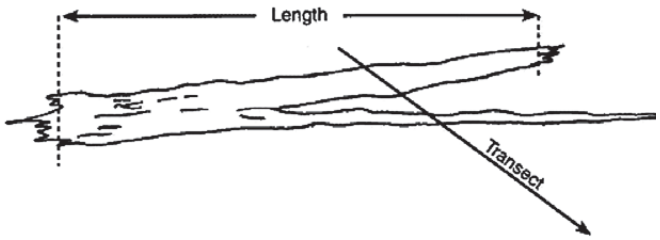
Record the length of each piece to the nearest 0.1 m (see 3a).

- 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.

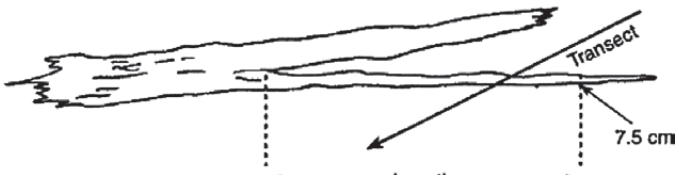
Measurement of stems from attached roots:

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

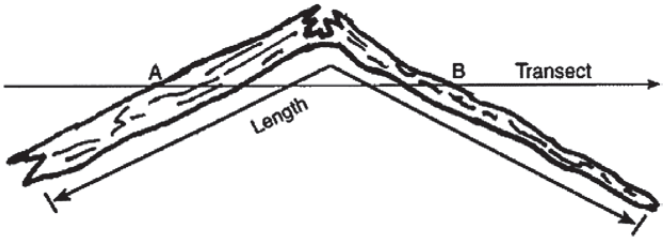
3d



3e



3f



3g

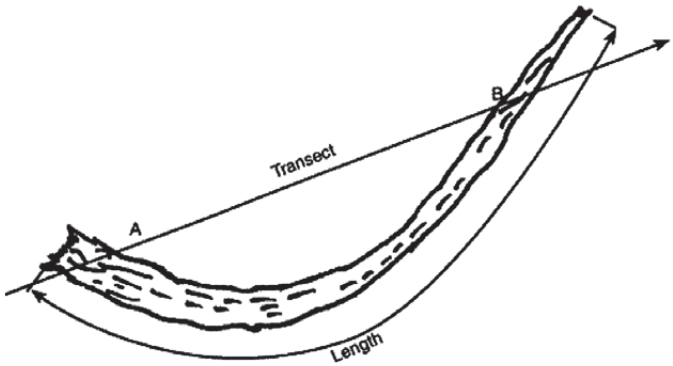


Figure A4.4. *Rules for measuring length of CWD (cont.).*

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.

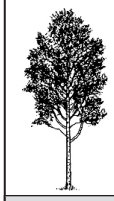
APPENDIX 5. REFERENCE – FORM D SIDE 1

BRITISH COLUMBIA Forest and Range Evaluation Program

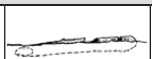
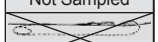
Stand-level Retention
Routine Effectiveness Evaluation
Reference – Form D Side 1

Wildlife Tree Class

Live		Dead						Dead Fallen
		Hard →			Spongy	→ Soft		Not Sampled
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
		Hard →	Spongy	→ Soft	Not Sampled
1	2	3	4	5	6
					

CWD Decay Class

 Log class 1	 Log class 2	 Log class 3	 Log class 4	Not Sampled  Log class 5
Hard	Sap rot (but still hard)	Advanced decay (spongy)	Extensive decay (crumbles/mushy)	Many small pieces, soft
Bark firm	Loose bark	Bark trace/absent	Bark absent	Bark absent
Elevated	Sagging	Sagging to settled on ground	Fully settled on ground	Partly sunken in ground
Hard branches with twigs	Soft branches	Branches stubs/ absent	No branches	No branches
Supports person	May not support person	Breaks easy	Shape collapses when stepped on	Collapsed oval
No invading roots	No invading roots	Roots in sapwood	Roots in heartwood	Roots in heartwood

Plot Radius Factor

$$PRF = \frac{1}{2\sqrt{BAF}}$$

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

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APPENDIX 6. REFERENCE – FORM D SIDE 2

BRITISH COLUMBIA Forest and Range Evaluation Program

Stand-level Retention
Routine Effectiveness Evaluation
Reference – Form D Side 2

British Columbia Tree Code List

NATIVE CONIFERS

Cedar	**Thuja**	**C**
western redcedar	*T. plicata*	Cw
Cypress	*Chamaecyparis*	Y
yellow-cedar	*C. nootkatensis*	Yc
Douglas-fir	**Pseudotsuga**	**F**
Douglas-fir	*P. menziesii*	Fd
coastal Douglas-fir	*P. menziesii* var. *menziesii*	Fdc
interior Douglas-fir	*P. menziesii* var. *glauca*	Fdi
Fir (Balsam)	**Abies**	**B**
amabilis fir	*A. amabilis*	Ba
grand fir	*A. grandis*	Bg
subalpine fir	*A. lasiocarpa*	Bl
Hemlock	**Tsuga**	**H**
mountain hemlock	*T. mertensiana*	Hm
western hemlock	*T. heterophylla*	Hw
mountain x western hemlock hybrid	*T. mertensiana* x *heterophylla*	Hxm
Juniper	**Juniperus**	**J**
Rocky Mtn. juniper	*J. scopulorum*	Jr
Larch	**Larix**	**L**
alpine larch	*L. lyallii*	La
tamarack	*L. laricina*	Lt
western larch	*L. occidentalis*	Lw
Pine	**Pinus**	**P**
jack pine	*P. banksiana*	Pj
limber pine	*P. flexilis*	Pf
lodgepole pine	*P. contorta*	Pl
lodgepole pine	*P. contorta* var. *latifolia*	Pli
lodgepole x jack pine hybrid	*P.* x *murraybanksiana*	Pxj
ponderosa pine	*P. ponderosa*	Py
shore pine	*P. contorta* var. *contorta*	Plc
western white pine	*P. monticola*	Pw
whitebark pine	*P. albicaulis*	Pa
Spruce	**Picea**	**S**
black spruce	*P. mariana*	Sb
Engelmann spruce	*P. engelmannii*	Se
Sitka spruce	*P. sitchensis*	Ss
white spruce	*P. glauca*	Sw
spruce hybrid	*Picea cross*	Sx
Engelmann x white	*P. engelmannii* x *glauca*	Sxw
Sitka x white	*P.* x *lutzii*	Sxl
Sitka x unknown hybrid	*P. sitchensis* x *?*	Sxs
Yew	**Taxus**	**T**
western yew	*T. brevifolia*	Tw

NATIVE HARDWOODS

Alder	**Alnus**	**D**
red alder	*A. rubra*	Dr
Apple	**Malus**	**U**
Pacific crab apple	*M. fusca*	Up
Arbutus	**Arbutus**	**R**
Arbutus	*A. menziesii*	Ra
Aspen, Cottonwood, or Poplar	**Populus**	**A**
poplar	*P. balsamifera*	Ac
balsam poplar	*P. b.* ssp. *balsamifera*	Acb
black cottonwood	*P. b.* ssp. *trichocarpa*	Act
hybrid poplars	*P.* ssp.	Ax
trembling aspen	*P. tremuloides*	At
Birch	**Betula**	**E**
Alaska paper birch	*B. neoalaskana*	Ea
Alaska x paper birch hybrid	*B.* x *winteri*	Exp
paper birch	*B. papyrifera*	Ep
water birch	*B. occidentalis*	Ew
Cascara	**Rhamnus**	**K**
cascara	*R. purshiana*	Kc
Cherry	**Prunus**	**V**
bitter cherry	*P. emarginata*	Vb
choke cherry	*P. virginiana*	Vv
pin cherry	*P. pensylvanica*	Vp
Dogwood	**Cornus**	**G**
Pacific dogwood	*C. nuttallii*	Gp
Maple	**Acer**	**M**
bigleaf maple	*A. macrophyllum*	Mb
vine maple	*A. circinatum*	Mv
Oak	**Quercus**	**Q**
Garry oak	*Q. garryana*	Qg
Willow	**Salix**	**W**
Bebb's willow	*S. bebbiana*	Wb
Pacific willow	*S. lucida*	Wp
peachleaf willow	*S. amygdaloides*	Wa
pussy willow	*S. discolor*	Wd
Scouler's willow	*S. scouleriana*	Ws
Sitka willow	*S. sitchensis*	Wt

UNKNOWNS

Unknown	X
Unknown conifer	Xc
Unknown hardwood	Xh

OTHERS

Other tree, not on list	Z
Other conifer	Zc
Other hardwood	Zh

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APPENDIX 7. DATA CLEANING OF FIELD CARDS

Suggested Methodology

- Put your cards in order, to make it easier to review — Form C then each Form B with related plot cards.
- Check RESULTS for the opening ID. See if NAR and gross areas agree (cards to RESULTS) if they don't then investigate. Generally, accept the RESULTS NAR if only a few hectares difference and adjust the cards as necessary (i.e., make sure the sum of harvest strata area equals NAR). If the gross area is different, determine if it is due to external retention that was not included in the gross area for RESULTS. That is a legitimate change – which should show up as an "override" area.
- Confirm that all retention acknowledged in the site plan or RESULTS is accounted for on the cards (check forest cover in RESULTS screen – MAT/NAT usually means a reserve). If some retention seems to be missing, then look for evidence of its existence in photos. If you have confirmation of its existence – and it is not a big component of the retention – then add it in as unsampled strata (using known info such as area, location of retention).
- Confirm that separate (non-contiguous) patches are not clumped together on one Form B. If they are, they need to be separated.
- Check the list of strata that are unsampled. None of them should be a dispersed stratum. Make sure there is no duplication between Section 16 and Form Bs.
- Confirm all stratum ID meets the rules (maximum of three letters followed by maximum of two numbers). If a stratum is the entire area of NAR – it should have a stratum ID of "NAR".
- Pay close attention to make sure all retention strata are correctly differentiated between rotation length strata and temporary strata. Temporary strata are those where there is evidence that harvesting will occur before a full rotation is over. Retention left after a partial-cut silvicultural system (e.g., commercial thinning or shelterwood) will be considered temporary unless there is a statement that contradicts that in the site plan.
- Add up all the stratum areas to make sure they don't exceed the gross area (or override areas).
- Review every card for complete information.
- Review plot cards for correct species codes and any anomalies in tree size.
- Make sure the same BAF or fixed area is used on all plots in a single stratum.
- If a full count area – all standing trees show up on the first plot. The CWD data should be on separate plots.
- When you've finished checking the cards, then re-order the plots for data entry (Form C, all Form Bs, all Form As).


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