Conservation of Biological Diversity
An Assessment of the Application of Criteria and Indicators

In Co-operation with Canadian Forest Products Ltd.
Tree Farm Licence 37

FPB/SR/27

April 2006

Acknowledgements

The Board wishes to express sincere thanks to all those who participated in developing the criteria and indicators, for their valuable contributions of knowledge. Specifically, Canadian Forest Products Ltd. and its staff, and in particular, John Deal, who volunteered considerable time, resources and expertise to this project.

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Preface

Assessing Impacts of Forest Practices on Resource Values

Old growth forest in the Nimpkish Island ecological reserve

The 2004 *Forest and Range Practices Act* (FRPA) is intended to shift forest practices legislation from a prescriptive to a results-based approach. FRPA establishes objectives for various forest values, and requires licensees to develop forest stewardship plans that set out strategies, or results, consistent with these objectives.

Provincially, there is considerable work underway through various initiatives, such as the FRPA Resource Evaluation Program, towards interpreting and explaining FRPA's objectives in a way that can be understood and put into practice. The Board considers the development and application of assessment frameworks that incorporate criteria and indicators as one means to address this challenge.

The Board anticipates conducting results-based assessments of forest practices, and explaining the audit findings in a way that can be understood by the general public and by forestry professionals. Developing assessment frameworks that incorporate criteria and indicators is a key part of the process.

The main purpose of this assessment was to work with a volunteer licensee, Canadian Forest Products Ltd. (Canfor), as well as government agencies and others, to develop and test criteria and indicators that will help to assess the effectiveness of forest practices with respect to biological diversity on the ground. Subsequent to the audit, Western Forest Products Inc. took over management of Tree Farm Licence (TFL) 37. As an early effort to test auditing procedure in a results-based environment, it was not the Board's intention to render an audit opinion on the state of biological diversity in TFL 37.

The experience gained from this assessment and other pilot audits will be used to further the Board's approach under FRPA, so that future audits can provide assurance about the results of forest practices in relation to government's forest management objectives. The Board will also use these results to help develop assessment frameworks that incorporate criteria and indicators for all FRPA forest values.

Biodiversity Defined

FRPA defines biodiversity as, "the biological diversity of plants, animals and other living organisms in all their forms and levels of organization, including the biological diversity of genes, species and ecosystems."

This definition, while widely accepted, is broadly encompassing. Biodiversity is a concept, not a measurable attribute of the forest. Not only is it a concept, it is a multi-dimensional concept. Biological diversity is a state desired over time and at all times—it is the root of the balance between harvest volumes and methods, and environmental impacts that forestry operators strive to achieve.

It is difficult to derive measures that fully capture the meaning of biological diversity, and therefore biological diversity conservation. One of the core challenges in assessing the conservation of biodiversity is to find surrogates for biodiversity. These surrogates must be measurable, and representative of biodiversity.

What we use as surrogates for biodiversity are a function of what information is available to us at a given time, and the cost and time associated with gathering information about that surrogate.

For the purposes of this project, the surrogates for biodiversity that we assessed are:

- Ecologically distinct ecosystem types
- Habitat for species at risk and locally important species
- Sensitive plant communities
- Native tree species diversity
- Sensitive ecosystems
- Sites and structures of biological significance

The Canfor Model for Biodiversity Conservation

Canadian Forest Products has developed a sustainable forest management plan (SFMP) and have obtained certification under the Canadian Standards Association (CSA) for the Nimpkish defined forest area. The plan uses a criteria and indicators framework (C&I) to measure effectiveness in sustainable forest management. The criterion relating to biodiversity seeks to conserve biological diversity by maintaining integrity, function and diversity of living organisms and the complexes of which they are a part. Specific elements include ecosystem diversity, species diversity, genetic diversity, protected areas and sites of special biological significance. Specific values and indicators identified in the SFMP are:

Value	Objective	Indicators
A diverse landscape	**Manage forests to conserve ecosystem diversity.**	**Ecosystems in the Non-Harvestable Forest Landbase** 1. Percent non-harvestable forest by ecosystem groups. 2. Percent forest interior in the non-harvestable forest by BEC variant within LUs. 3. Percent OGMA by BEC variant within LUs. 4. Percent wildlife tree retention by BEC subzone within LUs. 5. Percent internal patch retention by LU, EMU and BEC subzone. 6. Number of single trees per hectare retained by EMU. 7. Percent forest influence by EMU.
Native species diversity	**Diversity of habitats to sustain a natural diversity of native species.**	**Ecosystems in the Non-Harvestable Forest Landbase** *(Indicators 1-7 noted above)* 8. Area conserved for potential black bear denning habitat. 9. Area conserved for black-tailed deer and Roosevelt elk critical winter range **Special Habitat Features** 10. Percent consistency with management practices to address special habitat features
	Maintain habitat for species at risk.	11. Area conserved for Queen Charlotte goshawk 12. Area conserved for Keen's long-eared bat hibernacula and maternity sites 13. Area conserved for marbled murrelet nesting habitat.
	Maintain native tree species diversity at the landscape level.	14. Percent of forest area surveyed as acceptable free-growing stands and proportion that indicates more than one suitable native tree species
	Minimize potential negative effects of resource development on aquatic habitat.	15. Number of medium to high significant non-compliances/ non-conformances with riparian management impacts
Genetic diversity	**Conserve genetic diversity across the Nimpkish DFA.**	**Ecosystems in the Non-Harvestable Forest Landbase (Indicators 1-7 noted above)** 16. Percent of trees planted from MOFR registered seed.
Protected areas and sites of special biological significance	**Conserve protected areas and sites of special biological significance.**	17. Percent consistency with established objectives to address WHAs, OGMAs, UWRs and PAs 18. Percent consistency with management practices to address rare plants and plant associations.

The entire SFMP can be found on Western's website (www.westernforest.com) under forest certification.

Executive Summary

This report by the Forest Practices Board sets out what the Board believes to be a comprehensive, verifiable and science-based framework within which to begin to assess the effectiveness of forest practices in conserving biological diversity.

Of the forest values identified in the *Forest and Range Practices Act* (FRPA), biodiversity is considered by many to be the most complex to manage and conserve. Biodiversity encompasses a variety of ecological conditions that change naturally over time and to be effective at conserving biodiversity, it is important that forest companies, agencies and government understand, manage and conserve the important elements of biodiversity over time.

The work by the Board identified that, while FRPA does provide a broad definition of biodiversity, it does not specify the particular elements of biodiversity conservation that are generally agreed upon by the resource management agencies, academia, forest industry and other professionals in this field. In order to audit and report on the "results" of forest planning and practices taken to meet biodiversity goals for a given area, it is necessary to articulate criteria and indicators against which performance can be measured. The Board is aware that provincial agencies are grappling with this issue through the FRPA Resource Evaluation Program, as they consider how to evaluate and monitor government's objectives for biodiversity conservation. Forest licensees pursuing third-party certification are also addressing this issue through their sustainable forest management plans.

Rather than develop its own criteria and indicators in a vacuum, the Board chose to develop and assess the application of a comprehensive set of criteria and indicators in co-operation with Canadian Forest Products Ltd. (Canfor) on Tree Farm Licence (TFL) 37, with input from numerous other agencies and parties

The criteria and indicators presented in this report reflect the critical need for forest companies, and government agencies, to understand both the pre-industrial and existing state of the forest, in order to inform the design and implementation of forest practices that will conserve important attributes of biodiversity over time. The criteria and indicators can be utilized by the Board, government policy makers and forest operators to frame and assess forest practices to help assure their effectiveness in conserving biodiversity.

An important element of 'biodiversity conservation' that is reflected in the criteria is keeping common species common so that they don't become at risk. It is generally understood that it is cheaper and more effective to keep species off the 'at risk' list than it is to try and recover them. Comprehensive monitoring is essential to figure out the priorities for efforts to keep species off the 'at risk' list—or to decide which species might be allowed to decline.

The key to moving forward in assessing biodiversity conservation is sustained applied research conducted jointly with universities, agencies and industry to develop and validate practicable comprehensive indicators.

In the future, the Board intends to apply its criteria and indicators to assess forest companies,' and government's, forest planning and practices in conserving biological diversity and its associated values. Assessing the effectiveness of forest practices in conserving biodiversity is a complex undertaking and the Board anticipates that there is substantial learning and knowledge to be gained through future applications of this initial criteria and indicator set.

On TFL 37, the work conducted to test the application of a set of criteria and indicators proved to be successful. The audit team found it could determine whether or not legislative requirements have been met, and whether or not the forest practices are carried out consistent with commitments made in management plans. And they also found they could determine whether or not the criteria were achieved.

However, the science behind the indicators is still being debated in the scientific community. For example, the amount of habitat needed to sustain species health and populations is unknown. Given this level of uncertainty, the Board chose not to attempt to provide assurance in the form of audit conclusions. Instead, the Board has focused on the development aspect of this assessment.

The Board considers it important that, in the short-term, application of the criteria and indicators be formative in nature rather than judgmental. At this juncture, assuring the implementation of a comprehensive model for conserving biodiversity is paramount to passing judgment about any individual forest company's standard of performance.

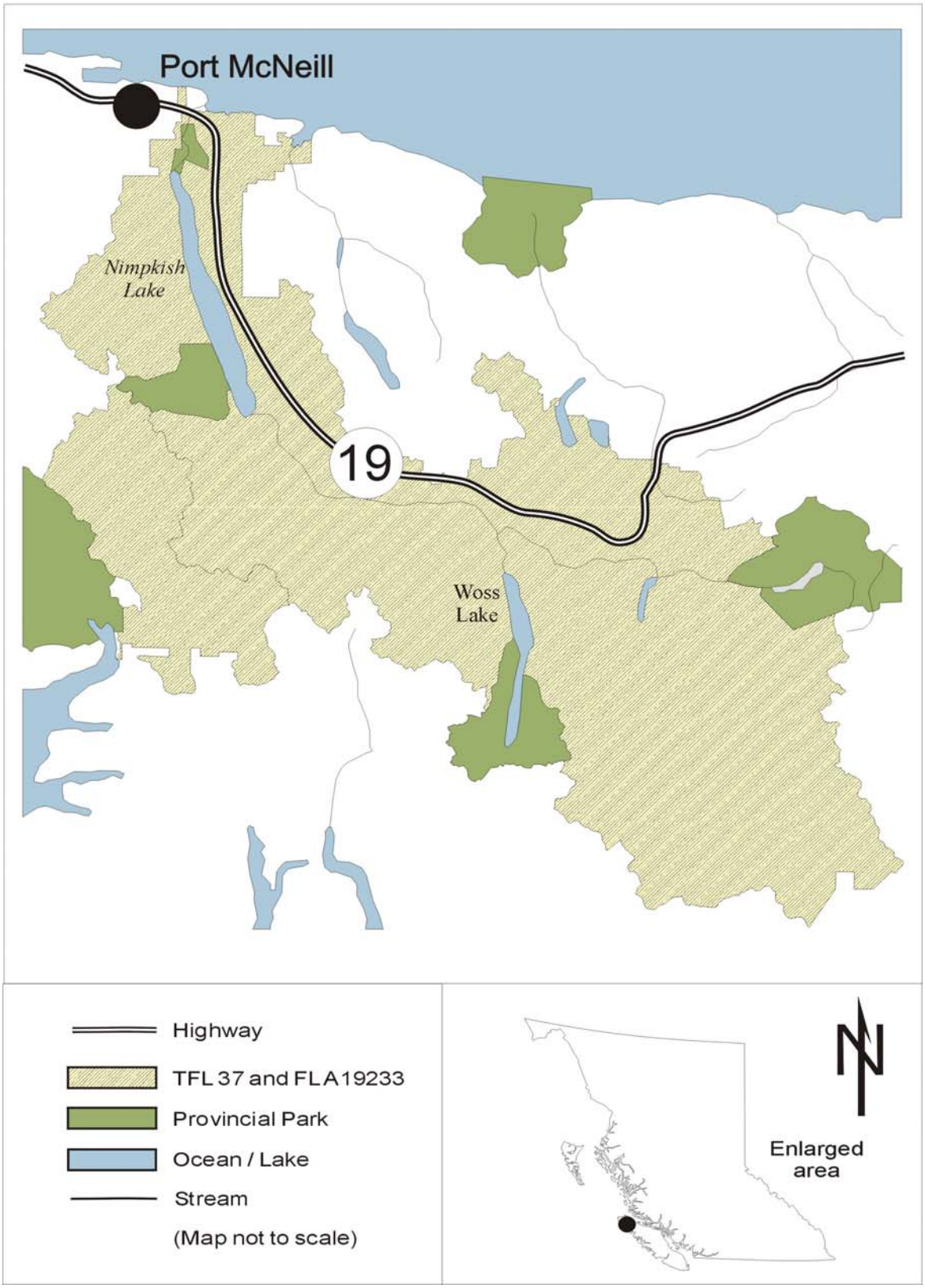
The Board has found that, through the development and testing of an assessment framework on TFL 37, its criteria appear to be workable for future Board audits. The reasons for this are:

- The criteria have been generally agreed to, by those people and agencies that have reviewed them as providing a reasonably complete description of the important aspects of conserving biological diversity.
- The evidence needed to support conclusions about the achievement of criteria can be gathered in an effective, efficient manner.
- Meaningful conclusions can be drawn about the state of biodiversity conservation that will allow further improvements to practices.

Fawn in the Klaklakama Lake recreation site and old growth management area.

It should be expected that these first criteria and indicators, as well as the underlying science behind them, may not be the final set utilized by the Board. However, as a result of this assessment of the application of criteria and indicators on TFL 37, the Board is confident that it will be able to meaningfully carry out its mandate to provide the public with assurance about forest practices and biological diversity in British Columbia in a results-based regulatory environment. Additional indicators may be identified and criteria refined as the Board encounters different models and practices for conserving biodiversity. There is much learning to take place through the application of this initial set.

Biodiversity Assessment Area



Introduction

In 2004, the Forest Practices Board (the Board) set out to develop and test criteria and indicators[i] to assess the effectiveness of forest practices in conserving biological diversity (biodiversity).

The Board's purpose for developing the criteria and indicators was to facilitate an approach to auditing forest practices in relation to government's objectives for biodiversity conservation established under the *Forest and Range Practices Act* (FRPA) and associated regulations.[ii]

A detailed review of FRPA identified that the objectives and default practices for biodiversity address primarily block size, spatial distribution (adjacency) and site-level retention practices. The Board determined that assessing forestry practices only in relation to FRPA's "default" practice requirements would not lead to comprehensive conclusions about the effectiveness of forestry practices in conserving biodiversity.

The criteria and indicators developed by the Board, in conjunction with others embody FRPA's objectives, as well as other fundamentally important aspects of biodiversity conservation. This initial set of criteria and indicators is based on a draft report[iii] commissioned by the Ministry of Forests and Range's FRPA Resource Evaluation Program[iv], a comprehensive literature review, and extensive consultation with professionals[v] recognized for their expertise in the field of biodiversity conservation.

Canadian Forest Products Ltd. (Canfor) volunteered to participate in the testing, validation and refinement of the criteria and indicators, by working collaboratively with the Board to develop and test the criteria and indicators in audit applications on Tree Farm Licence (TFL) 37.

The audit team assembled to conduct this work on behalf of the Board was:

- Kevin Edquist, RPF
- Laurie Kremsater, RPF, RPBio
- Alan Peatt, RPBio
- Steve Tribe, CA

This document sets out the criteria and indicators developed by the Board.

Objective of the Criteria and Indicators

The objective of the criteria and indicators is to represent a comprehensive set of conditions and processes that are important to the conservation of biodiversity in a managed landscape. The criteria and indicators encompass both quantitative and qualitative aspects of biodiversity conservation.

There are 5 main criteria and 13 associated sub-criteria. The first two criteria facilitate assessments of the current state of key aspects of biodiversity—ecosystem representation and wildlife habitat. Criterion 3 focuses on assessing the adequacy of forest plans. Criterion 4 verifies the extent of compliance with forest plans, and criterion 5 assesses whether site-level forest practices are adequately conserving key attributes of biodiversity.

Criteria and Indicators for Biodiversity Conservation

Criterion #1

Ecologically distinct ecosystem types are sufficiently represented in unmanaged state across the landscape.

Criterion #2

Sufficient habitat exists across the landscape for species at risk and locally important species.

Criterion #3

Forest planning adequately supports the conservation of biological diversity and fosters continuous improvement in biodiversity conservation.

Sub-criteria:

- Pre-industrial condition and natural disturbance regimes across the landscape have been identified.
- Responsibility for biodiversity conservation across the landscape has been established in relation to the scale and scope of forestry practices.
- Objectives for biodiversity conservation have been developed that take into consideration natural disturbance regimes, ecosystem diversity, maintenance of habitat and licensee responsibility.
- Strategies have been developed at appropriate scale in relation to objectives, and include measurable and verifiable targets for ecosystem representation and wildlife habitat retention.
- Landscape and site plans are developed that describe the operational implementation of strategies.

- Inventory data is sufficient to support objectives, strategies and plans, and includes forest cover, ecosystems, wildlife habitat and riparian areas.
- The achievement of objectives is evaluated using appropriate spatial and temporal scales, including ecosystem function and species populations.
- Strategies and plans are adapted in relation to effectiveness monitoring results, including recruitment and/or restoration of ecosystems, structures and habitat.

Criterion #4

The results of forest practices reflect intended results established in strategies and plans.

Criterion #5

Stand-level forest practices conserve important elements of biological diversity.

Sub-criteria:

- Sensitive plant communities, ecosystems, sites and structures of biological significance are conserved.
- Wildlife habitat is conserved.
- Native tree species diversity is maintained.
- Aquatic species' habitat is conserved.
- Botanical species are conserved.

Testing the Criteria and Indicators on TFL 37

Having developed an initial set of criteria and indicators, the Board set out to validate and refine the set through testing them in an audit application.

Because applying the indicators entails understanding and assessing licensees' underlying management systems within which forestry practices are employed, for the testing of the indicators, the Board determined that it was preferable to select an area of land where one licensee is predominant. The Board also reasoned that forestry should be the primary industrial activity in the area selected for testing, and that a licensee recognized to have in place a mature forest management system was preferable.

In collaboration with Canfor, TFL 37 was identified as an ideal candidate for the Board's test application.

TFL 37 is located in the north central portion of Vancouver Island, south of Port McNeill along Nimpkish Lake, and southeast to the headwaters of the Nimpkish River toward Gold River.

Canfor considers the TFL area together with its associated landscape units, which include some protected areas, as the defined forest area (DFA) for which Canfor's management plan applies. This area, referred to as the Nimpkish DFA, encompasses 196,485 hectares and includes all of the lands within the Upper Nimpkish and Lower Nimpkish Landscape Units. Approximately 80 percent of the area is productive forest and 50 percent is available for timber harvesting operations. The area is dominated by forests within the Coastal Western Hemlock Biogeoclimatic Zone, comprised of mostly of western hemlock leading stands that also include western red-cedar, Amabilis fir and Douglas-fir.

Next, the Board needed to develop detailed audit tests, and determine whether applying the audit tests would lead to performance assessments in relation to each indicator, and facilitate credible conclusions for each criterion.

Documentation Review

As a first step, the Board conducted a comprehensive documentation review that included all of Canfor's recent forestry plans, including TFL management plans, forest development plans, sustainable forest management plans, conservation plans for species at risk and applicable higher-level plans such as the Vancouver Island Land-Use Plan.

The key aspects of these plans that related to biodiversity conservation were summarized, and the Board developed a preliminary list of ten elements (surrogates) of biodiversity considered important on TFL 37. These surrogates were identified as potential candidates for detailed audit testing. The first five are likely to be encountered in most audits of biodiversity. The latter five were identified as important elements of biodiversity on TFL 37.

- Ecosystem representation
- Old growth representation
- Native tree species diversity
- Landscape and site level structure
- Protection of rare ecosystems and sites of biological significance
- Queen Charlotte Goshawk habitat
- Marbeled Murrelet habitat
- Keens Long-eared Myotis habitat
- Black bear habitat
- Ungulate winter range

Murrelet and goshawk were chosen because they are identified by the provincial Identified Wildlife Management Strategy, 2004 (IWMS) as requiring specific management actions, identified as a threatened species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and identified by the BC Conservation Data Centre (CDC) as red-listed. Keens Long-eared Myotis is on the IWMS list, red-listed (CDC) and data deficient (COSEWIC).

Black bear is abundant in the forests on TFL 37. Ungulate winter range was identified because of the presence of approved ungulate winter range areas on TFL 37.

Detailed Systems Review

The auditors visited Canfor's office in Campbell River for two days, where Canfor provided a detailed overview of its sustainable forest management system. The auditors then prepared detailed system descriptions, including Canfor's objectives, strategies and targets for each of the elements of biodiversity selected for detailed audit testing. At this stage, the auditors identified a preliminary list of audit verification steps that could be performed, in relation to each of the ten elements of biodiversity and Canfor's associated management system.

Overview Flight

The auditors visited Canfor's office in Woss for two days, and conducted an overview flight of TFL 37 to confirm their understanding of the area, including the important elements of biodiversity.

Office-based Audit Procedures

Detailed audit programs were prepared for each of the ten elements of biodiversity selected for audit testing and the auditors performed those audit verification steps that could be performed off-site. Detailed maps were prepared that included locations of Canfor's recent and projected harvesting activity, reserved areas, parks, etc. Specific cutblocks and reserved areas were selected for field verification, based on their specific attributes in relation to highest-risk aspects of the elements selected for detailed audit testing—for example, audit testing for ecosystem representation and old growth representation was greatest in the CWHxm2 and CWHmm1, because these were the variants most heavily modified by past-decades harvesting.

Additional Analysis

The Board also requested some additional/refined analysis that Canfor provided (e.g., seral stage distribution, land base summary according to the Board's table structure, forest interior analysis—including timber harvesting land base).

Field Testing

The audit team visited Canfor's office in Woss for five days to conduct detailed field-testing by helicopter and on the ground. Audit testing focused on recently harvested cutblocks, and areas permanently reserved from harvesting for biodiversity conservation reasons, such as wildlife habitat or old growth structural retention. In total, over 30 cutblocks were examined as well as numerous reserve areas.

Audit Analysis

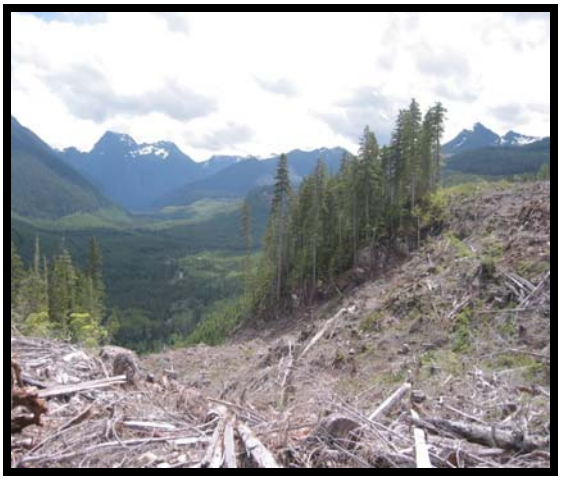
The audit team analyzed the evidence obtained through office and field-testing to determine the extent to which the audit work would facilitate assessments and conclusions in relation to the criteria and indicators applied. The results of this analysis were documented for discussion with Canfor.

Exit Workshop

A workshop was held with participants from the Board, Canfor, the Ministry of Forests and Range, Ministry of Environment and Ministry of Agriculture & Lands. Through presentation and discussion of the criteria and indicators, and the results derived from their pilot application on TFL 37, the objective of the workshop was to seek input into the scientific validity and utility of the criteria and indicators as an assessment tool.

Refinement of the Criteria and Indicators

Based on the results of the pilot application and exit workshop processes, the audit team refined the criteria and indicators. The resulting set of criteria and indicators is presented in this report.



Overview showing recent harvest in foreground, valley bottom harvest pattern in background

View south down Nimpkish Lake illustrating historical harvest pattern

Criterion #1:

Ecologically distinct ecosystem types are sufficiently represented in unmanaged state across the landscape.

Indicators

- Hectares of distinct ecosystem types in unmanaged condition.
- Hectares of distinct ecosystem types in interior condition.
- Hectares of distinct ecosystem types in old seral condition.
- Pre-industrial ecosystem structure and representation across the landscape.

Rationale

An important element in biodiversity conservation is ensuring that the ecosystems that occur naturally across the landscape are represented in unmanaged condition. Unmanaged ecosystems contribute to the maintenance of the many species, and biological processes, for which so little is known that it is not possible to manage them on an individual basis. They also provide a safeguard against the uncertainty inherent in maintaining species in managed areas and can serve as ecological baselines against which to compare the effects of forest practices on the managed landbase. Representation of unmanaged ecosystems is especially important in complex but poorly studied areas of the province and where less understood organisms are of concern.

Ensuring that the variety of distinct ecosystem types across the landscape are sufficiently represented in an unmanaged state is a cornerstone for the conservation of biodiversity and is usually considered the coarsest filter in biodiversity management.

Application of this criterion, and its associated indicators, is intended to result in a description of what ecosystem attributes currently exist across the landscape and an assessment of their sufficiency through comparison to pre-industrial landscape attributes. Such an assessment is important to identify the level of inherent risk to biodiversity conservation from the existing landscape condition. It is also important that forest companies understand the existing condition of the landscape if important attributes of biodiversity are to be conserved.

Assessment Considerations

While there is general agreement about the importance of ecosystem representation to biodiversity conservation, there is also agreement that no firm basis of knowledge exists to assess the adequacy of representation (how much is enough?). Similarly, there is no single appropriate basis to determine representation (what constitutes an ecosystem?). In British Columbia, ecosystems can be defined in many ways through several different systems. If the

biogeoclimatic ecosystem classification model is used, then should representation be determined at the zone level (e.g., coastal western hemlock) or at the subzone level (e.g., coastal western hemlock very dry maritime)? Other options are by variant, site series or site series grouping levels.

On TFL 37, Canfor has analyzed representation by variant and by groupings of similar site series. Both can be used to determine the extent of ecosystem representation across the landscape in order to help frame forest practices—for example, Canfor's analysis of the current ecological representation at the variant level indicates that old seral representation is weakest in the CWHxm2 (11 percent old) and CWHmm1 (14 percent old), due to the long harvest history. Therefore, to effectively conserve biodiversity on TFL 37, one challenge is to conserve as much existing old seral forest as possible and recruit mature forest in these variants, while at the same time maintaining viable forest operations.

Canfor has delineated (and permanently reserved from harvest) a non-harvestable land-base that captures over 60 percent of the existing old seral forest in these variants, as well as greater than 20 percent of the productive forest in both variants. In addition, Canfor's stand-level retention is highest when operating in these variants. Consequently, in the long-term, the combination of permanently reserved areas and high levels of structural retention in these variants will provide for increased old growth, and old growth attributes. Historically, TFL 37 was dominated by old forest and retaining and developing old growth across the TFL is important to conserving biodiversity.

Once the basis for determining *ecosystem* representation has been established, it is necessary to determine how much to retain in an unmanaged state. There is currently not a clear science-based answer. Thresholds of habitat needed to sustain species range from 10 percent to 70 percent of original habitat levels (discussed under criterion 2), but they don't address the question of how much unmanaged forest is appropriate in a managed forest landscape. Therefore, it is not intended at this time to definitively conclude whether current representation levels are adequate. What some persons may view as adequate others may not. However, there is general agreement among those consulted that levels of 10 percent or less than pre-industrial levels pose a high risk to biodiversity conservation. On TFL 37, Canfor uses 15 percent to 30 percent (depending on the provincial listing of the ecological community) as a threshold for unmanaged ecosystems under which management practices are aimed to reduce risk. This approach highlights risks and helps to identify where management practices need to focus to address high risks to biodiversity conservation.

It is also necessary to consider the qualitative aspects of ecosystem representation—i.e., the quality of the ecosystems retained. There is general agreement that two relevant attributes of quality are the amount of old seral representation and the amount of forest in interior condition. Again, there is little science-based knowledge to facilitate assessments. On TFL 37, landscape unit plans establish objectives for old seral representation ranging from 9 percent to 19 percent.

The 1995 Biodiversity Guidebook suggests that between 10 percent and 25 percent of these old seral forests should be in interior condition. The 1995 Clayoquot Sound Scientific Panel suggested as much as 50 percent of old forest reserved should be in interior condition.

On TFL 37, Canfor has met the legal old growth targets without the need to draw down in the low biodiversity emphasis option landscape unit. Recruiting interior forest in the CWHxm2 and CWHmm1 is one of the biggest challenges that Canfor is in the process of addressing. Canfor's non-harvestable landbase captures all of the existing interior forest in the CWHxm2 and 50 percent in the CWHmm1, however the resultant levels are quite low in relation to pre-industrial condition (under 10 percent), resulting from harvesting since 1908 in these low-elevation variants. These percentages do not include contributions from provincial parks or immediately adjacent forests.

In drawing conclusions about the current state of biodiversity conservation across a landscape, ecosystem representation should generally be considered collectively with habitat for known species (criterion 2). Together, these criteria facilitate assessment of the existing level of habitat for both known and unknown species, as well as ecosystem diversity across a landscape.

Mossy platform on large old Douglas-fir tree suitable for marbled murrelet nesting

Queen Charlotte Goshawk nest in a second growth Douglas-fir stand

Criterion #2

Sufficient habitat exists across the landscape for species at risk and locally important species.

Indicators

- The amount of suitable habitat across the landscape for species at risk and locally important species.
- The distribution of suitable habitat across the landscape for species at risk and locally important species.
- Species' population trends.
- Pre-industrial habitat attributes across the landscape.
- Critical habitat thresholds.
- Legally established habitat conservation requirements.

Rationale

Maintaining productive populations of species, well distributed throughout their range of habitat, is an important and complex goal of biodiversity conservation. If all species' populations are stable and viable, and predicted to remain so in the future, then conservation practices can be presumed effective. Conserving habitat for species is the primary means by which species populations are maintained.

Criterion 1 addresses ensuring sufficient representation of ecosystems in an unmanaged state, to maintain the many species for which so little is known that it is not possible to manage them on an individual basis (a coarse filter).[vi] Another important element in biodiversity conservation is ensuring the maintenance of habitat for those species known to be at risk, and for species recognized as locally important. In biodiversity management, this is considered a fine filter.

This criterion is about understanding and assessing the existing state of habitat across the landscape for species at risk and locally important species. It is important that forest companies have knowledge of the existing habitat attributes across the landscape in order to provide a basis for understanding species/habitat relationships, prescribing sound forest practices and facilitating effectiveness monitoring for species at risk and locally important species (this knowledge is important for managing all species, but that is discussed later under the criterion for effectiveness monitoring).

Application of this criterion and its associated indicators is intended to result in a description of the existing habitat attributes across the landscape, and an assessment of their sufficiency, through comparison to information known about population trends for species at risk, pre-industrial habitat attributes and critical thresholds for habitat. Such an assessment is

important in order to identify the level of inherent risk associated with the existing state of habitat across the landscape for species at risk and locally important species. It is also important that forest companies have knowledge about the existing state of habitat across the landscape, and the associated risks, in order that important habitat attributes for these organisms can be conserved.

Assessment Considerations

Similar to ecosystem representation, there is no single basis of information or science-based knowledge upon which to draw to assess the sufficiency of habitat (how much habitat is enough?). At this time, how much is enough is known for very few species, and none of those in BC. For some species, research results suggest a non-linear relationship between habitat supply and species persistence. This means that as original habitat is reduced to some critical threshold (e.g., 30 percent of the original habitat), there is little or no corresponding population decline. However, once a critical threshold is exceeded, the population decline can be extensive and may not be reversible. Depending on how habitat is defined and for which species, critical thresholds for habitat can range from 10 percent to 70 percent of original habitat (for known species).

Effectiveness monitoring (discussed later in this document) can provide important information about species population trends to consider in assessing the sufficiency of existing habitat.

It is not the intent of applying these criterion and indicators to definitively conclude whether the current level of habitat for species at risk and locally important species is sufficient to sustain such species. Such assessments of habitat would entail considerable species population monitoring over numerous years, and over an area greater than that which any one forest company exercises management control. Rather, the application of this criterion is intended to confirm that forest companies have knowledge about the existing state of habitat across the landscape, and are utilizing their knowledge to highlight those areas and attributes of habitat on which to focus their conservation efforts.

As an example, TFL 37 is known to include habitat used by marbled murrelet (MAMU). The following factors are applicable in understanding and assessing the sufficiency of existing MAMU habitat in TFL 37.

- MAMU is red-listed by the BC government.
- MAMU is listed as threatened on Schedule 1 of the *Federal Species at Risk Act*.
- MAMU are protected by the *Canadian Migratory Birds Convention Act* (1994) and the *BC Provincial Wildlife Act*.
- MAMU are the focus of a national recovery team. The recovery team's objective is to limit the decline of MAMU to a maximum 31 percent on the western and northern areas of Vancouver Island by 2032.

- The provincial *Identified Wildlife Management Strategy* (2004) identifies general stand features and landscape conditions for MAMU (biogeoclimatic units and preferred elevations).
- Under Section 7 of FRPA's *Forest Planning and Practices Regulation*, the Minister of Environment has issued a notice of the amount, distribution and attributes of wildlife habitat required for the survival of MAMU in the North Island – Central Coast Forest District. Under this notice, a total of 7,100 hectares of suitable nesting habitat are to be reserved from harvest within TFL 37.

Recognizing its responsibility for the conservation of MAMU habitat within TFL 37, and the importance of understanding the existing state of habitat for MAMU within TFL 37, Canfor has inventoried and mapped existing suitable MAMU habitat, by habitat quality classes, through interpreting air photos and carrying out low level aerial reconnaissance by helicopter to verify the suitability of the existing habitat. Canfor has also carried out forest surveys to estimate potential nesting platform densities and to determine the extent to which habitat classes actually differ in terms of densities of nesting platforms. Audio-visual surveys have been conducted to identify areas of highest use by MAMU and to target key watersheds for conservation. Annual radar surveys are conducted to track population changes and confirm areas of use.

This knowledge of the existing habitat attributes for MAMU provides Canfor a strong basis for demonstrating the sufficiency of existing habitat across TFL 37, and to prescribe forest practices that conserve suitable MAMU habitat across TFL 37. Canfor's target in its sustainable forest management plan is to maintain $\geq$14,000 hectares of suitable habitat across the Nimpkish defined forest area (DFA).Canfor's recent Marbled Murrelet Nesting Habitat Conservation Plan conserves nearly 24,000 hectares of potential nesting habitat within the DFA, with the objective of meeting the population targets outlined by the Canadian Marbled Murrelet Recovery Team (CMMRT 2003). Approximately 17,000 hectares of this total was within TFL 37.

In drawing conclusions about the current state of biodiversity conservation across a landscape, habitat for species known to be at risk (or recognized as locally important) should generally be considered collectively with ecosystem representation (Criterion #1). Together, these criteria facilitate assessment of the existing level of habitat for both known and unknown species, as well as ecosystem diversity across a landscape.

Criterion #3

Forest planning adequately supports the conservation of biological diversity and fosters continuous improvement in biodiversity conservation.

Rationale

Conserving biodiversity requires sound forest planning that takes into consideration the historical, current and future condition of the landscape. Among other things, forest planning must interpret or establish objectives for biodiversity conservation, identify factors critical to the achievement of objectives and prescribe appropriate forest practices. To have any chance to be effective at conserving biodiversity, it is important that forest planning understands and manages the important elements of biodiversity *over time*.

Application of this criterion, and its associated sub-criteria, is intended to result in assurance that important elements of biodiversity are being comprehensively managed and conserved.

Assessment Considerations

This criterion is assessed through application of the eight sub-criteria and associated indicators set out below. These criteria are intended to facilitate assessments of the extent to which forest planning takes into consideration the historical and current condition of important elements of biodiversity across the landscape, and prescribes appropriate practices that, to the extent practicable, conserve these landscape attributes over time.

3.1 Pre-industrial condition and natural disturbance regimes across the landscape have been identified.

Indicators

Identification of the following pre-industrial landscape attributes and natural disturbances:

- Forest ecosystems and structure.
- Historical rate and distribution of fire and wind disturbances.
- Relevant locally important attributes or disturbances.

Rationale

Conserving biological diversity involves understanding the impacts and relationships of forestry practices within the historical context of the landscape, and considering the history of landscape condition and disturbances in setting management objectives that adequately conserve these landscape attributes in future forests. In order that the many elements of biological diversity be conserved, it is important that the pre-industrial condition of the forest and natural disturbance patterns be identified, so they can inform choices of structures and patterns to maintain in future forests.

Harvest in mid-elevation gap dynamic forest

Valley bottom second growth

Assessment Considerations

The Ministry of Forests and Range has classified BC's forests by their natural disturbance patterns and these classifications are readily available in publications by the Ministry of Forests and Range, such as the Biodiversity Guidebook.

The biogeoclimatic classification system employed in BC reflects natural disturbance patterns—for example, on TFL 37 the CWHxm and CWHmm subzones are prevalent in the fire dominated lower elevation forests (NDT 2), whereas the CWHvm and MHmm (NDT 1) are prevalent in the gap dynamic mid- and upper-elevation forests. These classification systems can readily enable licensees to identify basic natural disturbance patterns as well as native ecosystems.

Canfor utilizes the biogeoclimatic ecosystem classification (BEC) system. In addition, Canfor has information and maps of differences in historical fire return intervals. This information is sufficient to understand typical stand dynamics and structure on TFL 37—for example, pre-industrial landscape structure would be dominated by abundant old growth with small-scale natural disturbances. Forests would have high levels of interior habitat connected along valleys and from valley bottom to upslope. Openings would be smaller in gap-driven areas and larger where fire plays a more dominant role. Stands driven by gap dynamics would have multiple age classes and complex vertical canopy structure, while those in areas more frequented by fires would have more even aged canopies.

3.2 Responsibility for biodiversity conservation across the landscape has been established in relation to the scale and scope of forestry practices.

Indicators

- The existence of a defined area over which responsibility for biodiversity conservation applies.
- Responsibility is established reflecting the scale and scope of operations.
- Responsibility is defined in terms of contributions to regional biodiversity conservation objectives.
- The existence of joint communication, data sharing, research, etc. between forest companies that share responsibility for biodiversity conservation within a defined area.

Rationale

Most aspects of biodiversity expand beyond the scope of an individual company's area of operations. Adjacent areas often have an important role to play in conserving biodiversity. In order for forest companies to conserve biodiversity, they must understand their responsibilities—over what area is a company responsible for conserving biodiversity and for which aspects of biodiversity? It is important that responsibility be established in terms of the area over which conservation measures will apply, joint roles and responsibilities where more than one company operates in an area, and in relation to broader regional conservation objectives.

Application of this sub-criterion is intended to result in assurance that forest companies have taken reasonable steps to establish their responsibility for biodiversity conservation, and integrate with adjacent operators.

Assessment Considerations

For area-based tenures, such as TFL 37, the area under the licence is a logical area on which to establish responsibility.

For volume-based tenures within a timber supply area, the logical area is less apparent. Depending on the number and size of the companies operating in the TSA, a logical area on which to establish responsibility could range from the entire TSA to one or more forest districts' boundaries or landscape units. The absence of compelling logical areas is less of a problem so long as each area, and participant, understands the broader biodiversity conservation objectives and takes responsibility for contributions to the broader objectives.

Irrespective of the licence type, the Canadian Standards Association Z809-02 Sustainable Forest Management certification standard requires a defined forest area on which the certification standard is applicable. For companies certified to the CSA standard, or other standards that require a defined forest area, the defined forest area is a logical basis to establish responsibility.

On TFL 37, Canfor's operations are certified under the CSA standard. Canfor considers the TFL area, together with its associated landscape units (Upper and Lower Nimpkish), which include some provincial park lands, as the defined forest area for which Canfor's management plan applies and for which Canfor is responsible for the conservation of biodiversity.

To ensure Canfor understands its responsibility in relation to regional biodiversity conservation objectives, among other measures, Canfor participated on the Marbled Murrelet Recovery Team, whose mandate is at a broader level than TFL 37. Canfor's participation on the recovery team assisted Canfor in ensuring that its responsibility for MAMU habitat retention within TFL 37 reflects and contributes to broader objectives for MAMU recovery established by the recovery team.

Canfor is also one of several Vancouver Island forest companies that recently contributed to a joint regional representation analysis, based on site-series groupings, to assist in identifying local responsibilities for contributions toward broader ecological representation objectives.

These are good examples of how to establish responsibility for biodiversity conservation at a local level in relation to the broader context.

3.3 Objectives for biodiversity conservation have been developed that take into consideration natural disturbance regimes, ecosystem diversity, maintenance of habitat and licensee responsibility.

Indicators

- Legal objectives and the extent that legal objectives have been adopted or expanded.
- Objectives developed by forest companies in the absence of legal objectives.
- Objectives reflect the scale and scope of operations.
- Objectives are consistent with established responsibility for biodiversity conservation.
- Objectives reflect natural disturbances, habitat for species at risk and ecosystem representation.

Rationale

In order for forest companies to conserve biodiversity, they must adopt or establish objectives that set out specifically what it is that they are striving to achieve. These objectives guide forest planning and practices and provide an important basis against which forest practices can be assessed— i.e., to what extent have objectives been achieved. The make up of objectives is important and should address natural disturbance, habitat for species at risk and ecosystem representation.

Application of this sub-criterion is intended to result in assurance that forest companies have taken reasonable steps to develop suitable objectives to guide forest practices in conserving biodiversity.

Assessment Considerations

It is necessary to consider the extent to which legal objectives for biodiversity conservation are in place. FRPA establishes the following objectives.

- *The objective set by government for wildlife and biodiversity at the landscape level is, without unduly reducing the supply of timber from British Columbia's forests and to the extent practicable, to design areas on which timber harvesting is to be carried out that resemble, both spatially and temporally, the patterns of natural disturbance that occur within the landscape.*

- *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.*

- *The objective set by government for water, fish, wildlife and biodiversity within riparian areas is, without unduly reducing the supply of timber from British Columbia's forests, to conserve, at the landscape level, the water quality, fish habitat, wildlife habitat and biodiversity associated with those riparian areas.*

It is important to recognize that FRPA is legislation intended to govern forest planning and practices. FRPA does not establish legislation about the state of biodiversity itself. One of the most significant challenges faced by government in introducing results-based forestry legislation is the establishment of objectives for forest values, including biodiversity, that are seen to adequately conserve forest values while at the same time providing appropriate legislative governance over forest practices—for example, although referred to in FRPA as the objective set by government *for wildlife and biodiversity*, designing areas on which to carry out timber harvesting that *resemble the patterns of natural disturbance* relates more to governing the design and implementation of forest practices than to the conservation of important elements of biodiversity.

In this example, FRPA's objective may more accurately be described as a strategy, which may help to achieve certain, as yet unstated, objectives for biodiversity conservation. Examples of objectives that relate to conserving biodiversity are to maintain productive populations of native species, maintain species' ranges, and maintain ecosystem function. However, these objectives bear little relation to governing forest practices—and therein lies the challenge. There is currently no single correct solution to this challenge. However, this is an important issue that needs to be addressed in order that biodiversity be effectively conserved across a landscape.

In order for forest companies to conserve biodiversity, they must adopt or establish objectives that set out specifically what it is that they are striving to achieve. There is a need to establish objectives for biodiversity conservation that address which aspects of biodiversity are to be

conserved, and why. Is it to protect ecosystem resilence or to maintain species persistence for all native species? Is it to save endangered species? Or is it some combination of these?

One means to help bridge the gap between objectives for biodiversity conservation and legislation governing forest practices is certification. Certification standards such as CSA generally require forest companies to establish forest management objectives, often with input through a public advisory process—for example, on TFL 37, in its sustainable forest management plan (prepared as part of Canfor's CSA certification), Canfor establishes seven objectives related to four values associated with the conservation of biological diversity, set out below.

Value	Objective(s)
A Diverse Landscape	• Manage forests to conserve ecosystem diversity
Native Species Diversity	• Diversity of habitats to sustain a natural diversity of native species • Maintain habitat for species at risk • Maintain native tree species diversity at the landscape level • Minimize potential negative effects of resource on development on aquatic habitat
Genetic Diversity	• Conserve genetic diversity across the Nimpkish DFA
Protected Areas and Sites of Special Biological Significance	• Conserve protected areas and sites of special biological significance

Canfor's model may differ in form and terminology from other models, but achieves the desired result—the establishment of specific objectives for biodiversity conservation in sufficient detail to provide a basis on which to design, implement and measure forest practices.

Irrespective of the basis for establishing or adopting objectives, objectives need to be specific and relevant to forest companies' practices.

When drawing conclusions about the adequacy of biodiversity conservation objectives, it is important to consider whether a forest company's objectives, in conjunction with regional conservation efforts, provide a strong basis for the conservation of biodiversity.

3.4 Strategies have been developed at appropriate scale in relation to objectives, and include measurable and verifiable targets for ecosystem representation and wildlife habitat retention.

Indicators

- Strategies are linked to objectives and address all objectives.
- Strategies encompass appropriate scales to meet objectives, establish measurable and verifiable targets, and take into consideration habitat, landscape and stand characteristics over time.

- Strategies take into consideration:
  - Ecosystem representation
    - Recruitment of under-represented ecosystems
    - Restoration strategies where requirement is not viable
  - Species at risk and associated habitat retention
  - Riparian management and aquatic species
  - Old growth structure and landscape patterns
  - Native tree species diversity
  - Botanical species

Rationale

Strategies set out details of how an objective will be achieved, which provides the basis for landscape and stand-level plans. Translating high-level objectives—through strategies and operational plans—into effective stand-level practices is one of the significant challenges to ensuring forest practices are effective in conserving biodiversity.

Assessment Considerations

Under FRPA, forest companies are required to prepare forest stewardship plans that set out intended results or strategies consistent with FRPA's objectives. Some certification standards require indicators that are measured to assess the achievement of objectives.

Irrespective of the framework and terminology of different models, it is important that strategies are in place for each objective and that they include measurable and verifiable targets.

On TFL 37, Canfor's SFMP establishes indicators, which are in substance strategies, to achieve the objectives. As an example, Canfor has established seven indicators to assess the objective to conserve ecosystem diversity. The indicators establish targets for each of the following.

- ecosystem representation in the non-harvestable landbase
- old growth forest management
- forest interior condition
- wildlife tree retention
- internal patch retention
- single tree retention
- forest influence

When drawing conclusions about the adequacy of biodiversity conservation strategies, it is important to consider whether a forest company's strategies provide a strong basis for the achievement of stated objectives.

3.5 Landscape and site plans are developed that describe the operational implementation of strategies.

Indicators

- Landscape plans incorporate the relevant aspects of strategies and include landscape patterns over time.
- Species-specific management plans are in place for species at risk and address the maintenance of habitat across the landscape.
- Site plans incorporate the relevant aspects of strategies and include the regeneration of sites, conservation of rare ecosystems and maintenance of stand structure.

Rationale

Stand- and landscape-level plans set out specific operational requirements to implement a forest company's strategies for biodiversity conservation and form an important basis against which to monitor forest practices for compliance. As mentioned previously, translating high-level objectives through strategies and operational plans into effective stand-level practices is one of the biggest challenges for forest companies to overcome in order to effectively conserve biodiversity.

Assessment Considerations

Under FRPA, forest companies are required to prepare site plans that identify how the intended results or strategies described in the forest stewardship plan apply to the site. FRPA does not require landscape- or species-specific plans.

On TFL 37, Canfor prepares site plans as required by FRPA and has also developed landscape plans for old growth management, species at risk and locally important species, including:

- Marbled Murrelet
- Queen Charlotte Goshawk
- Keens Long-eared Myotis
- Ungulate Winter Range
- Black Bear
- Sensitive Plant Communities

When drawing conclusions about the adequacy of stand and landscape planning, it is important to consider whether a forest company's plans set out sufficient operational requirements to provide a strong basis that strategies will be put into practice effectively.

3.6 Inventory data is sufficient to support objectives, strategies and plans, and includes forest cover, ecosystems, wildlife habitat and riparian areas.

Indicators

- The extent and quality of inventory data. Examples include:
  - Forest cover inventory
  - Ecosystem mapping
  - Fish and fish habitat mapping
  - Stream networks
  - Species populations—species at risk and locally important species
  - Habitat abundance and distribution

Rationale

The data collected through inventories forms the basis for knowledge through analysis, interpretation and comparison of data over time. It is this knowledge that facilitates the development of meaningful objectives, strategies and plans to conserve biodiversity.

Application of this sub-criterion is intended to result in assurance that forest companies have made reasonable efforts to identify and collect sufficient inventory data to facilitate their objectives, strategies and plans for conserving biodiversity.

Assessment Considerations

Developing and maintaining inventories is an ongoing process. Forest companies must make reasonable efforts to collect sufficient inventory data over time. Some inventories may be applicable to areas larger than any one forest company's area of responsibility. In these situations, forest companies may participate in joint inventory processes.

Most forest companies participate in the provincial Forest Investment Account (FIA) program. Under this program, forest companies are able to access funding for a variety of forestry-related projects, including collecting certain inventory data.

On TFL 37, over a number of years Canfor has, through its own efforts and through participation in various provincial programs such as FIA, commissioned a number of important inventories—for example, in recent years Canfor has completed several projects focused on improving forest cover information within the TFL. These projects include:

- ***Photo Interpretation (Phase I)*** – Classification completed in June 1998 to MoF 1992 standard.
- ***Ground Sampling (Phase II)*** – Sampling forest cover polygons and compiling the data was completed in February 2002 to vegetation resources inventory (VRI) standard.

- ***Adjustment*** – Statistical analysis and adjustment of the forest cover inventory was completed in June 2004 to VRI standard.
- ***Terrestrial Ecosystem Mapping/Terrain Stability*** – completed in 2000 to provide an ecological framework for developing reliable site index data for timber supply analysis and land-use decision-making.
- ***Net Volume Adjustment Factors (NVAF)*** – Sampling trees from the Phase II project, compiling, analyzing and adjusting the forest cover inventory was completed in June 2004 to VRI standard.

Canfor's inventory work illustrates the ongoing nature of collecting sufficient inventory data.

When drawing conclusions about the adequacy of inventory data, it is important to consider whether a forest company's inventories will provide sufficient, current and relevant data to provide a strong basis for supporting stated objectives, strategies and plans.

3.7 The achievement of objectives is evaluated using appropriate spatial and temporal scales, including ecosystem function and species populations.

Indicators

- The existence of an effectiveness monitoring plan that addresses, as required:
  - Ecosystems with low levels of representation
  - Extent of representation in the non-harvestable landbase
  - Edge-contrast length and forest interior
  - Distribution of patch age and size classes, broken down by breakpoints meaningful to organisms
  - Seral stage distribution
  - Road densities and distribution in relation to streams and wildlife habitat
- The current condition of old seral representation is evaluated in relation to the range of natural variability.
- Stand-structure is evaluated in relation to pre-harvest or benchmarks.
- Monitoring of actual species or groups of species and organisms.

Rationale

Evaluating the achievement of objectives through monitoring is a key component of biodiversity conservation. A properly designed effectiveness monitoring program demonstrates that forest planning and practices are effective in conserving biodiversity—for example, monitoring and reporting the extent to which stand-level retention (in its landscape context) is contributing to species maintenance (an important objective of stand-level retention), and which retention practices optimize the achievement of this objective. It is these types of questions that are the basis of effectiveness monitoring.

Application of this sub-criterion is intended to result in assurance that forest companies have made reasonable efforts to implement effectiveness monitoring programs, appropriate to the scale and scope of forest activities carried out.

Assessment Considerations

Effectiveness monitoring assesses whether practices have met their intended objectives. For biodiversity there are a variety of levels of objectives, the broadest objective being the maintenance of species across the defined forest area. The ultimate effectiveness monitoring would assess if species are being maintained across the tenure. However, both stand- and landscape-level practices combine to affect species and, as such, both these levels need to be included in monitoring programs.

Monitoring species persistence is a complex undertaking. Clearly there is not sufficient time, and professional resources to monitor all species, habitat and associated functions. The choices made about what to measure are important. It is preferable through these choices to monitor a few things adequately, rather than many things inadequately. There is little utility in embarking on effectiveness monitoring that provides highly uncertain results about many elements of biodiversity.

Monitoring the persistence of key species is obviously important. As well, more tractable objectives should be assessed through effectiveness monitoring—for example, if the management paradigm is that the closer conditions are too natural the more likely that species will be maintained, then monitoring should assess whether stand level retention is capturing the components that would be expected in natural stands. Does stand retention capture the same percentage of snags that would be found in the stand before it was harvested? Species monitoring would be needed to assess whether the retention across the landscape is sufficient to maintain the most vulnerable species.

Stand-level effectiveness monitoring can address questions that provide immediate feedback to management—for example, what type of retention (dispersed, group, etc.) is most effective at maintaining various stand structures. Information can then be linked back to management practices to adjust how retention is practiced.

At the landscape level, effectiveness monitoring is more complicated. Landscape-level effectiveness monitoring is most useful as part of a trend analysis that considers historic, current and potential future harvest patterns—for example, forest age, intact habitat, and species composition should be spatially depicted over the long-term planning horizon. Clearly, stand-level retention contributes to landscape pattern and should be included in assessment models that link habitat pattern to species. As well, the unmanaged landbase contributes to landscape condition. To assess the contribution of unmanaged lands to biodiversity it is necessary to understand the types of structures expected in those habitats. Does non-commercial deciduous forest contribute useful habitat for species of concern? Quite likely, but often forest attributes are largely unknown for non-commercial forest types.

Landscape-level effectiveness monitoring is still under development and it is not reasonable to expect companies to be applying it widely at this time. However, monitoring the habitat attributes provided by the unmanaged landbase and projecting important characteristics such as edge, interior, amount of unmanaged, and old growth are important steps that can be addressed in the short term and form the basis for effectiveness monitoring. At the landscape level, links back to management would result from comparing potential scenarios and choosing ones with most beneficial (or least harmful) expected impacts on key species or key habitats.

Some questions apply to both stand and landscape levels, but also should be addressed by effectiveness monitoring—for example, to determine what size of patch allows forest-adapted species to persist involves examining the depth of edge effects for various organisms. The results of such monitoring would assist in the design of unmanaged areas and stand-level retention patches.

The ultimate indicator of effectiveness is productive populations of species, distributed throughout the range of their habitat. Effectiveness monitoring of such species populations entails direct species monitoring. Canfor has embarked on monitoring species populations. Canfor's monitoring of marbled murrelet and goshawk involves tracking over time the numbers of birds coming into the TFL. For Goshawk, productivity of known nests is tracked. Consideration is being given as to how to separate effects of local habitat from effects of broader population trends.

As well as monitoring these high profile species at risk, Canfor monitors forest birds, amphibians and other organisms to determine species' responses to patch size, retention, and landscape context. Canfor has produced data for landscape-level assessments by projecting unmanaged, edge, interior, and old growth for their expected management scenario.

When drawing conclusions about the adequacy of effectiveness monitoring, it is important to consider whether a forest company's monitoring activities will provide sufficient and relevant data to provide a strong basis for assessing the achievement of key biodiversity conservation objectives.

3.8 Strategies and plans are adapted in relation to effectiveness monitoring results, including recruitment and/or restoration of ecosystems, structures and habitat.

Indicators

- The existence of processes that facilitate management review of effectiveness monitoring results.
- The extent to which practices are altered as a result of effectiveness monitoring results.

Rationale

This sub-criterion is about continuous, timely and appropriate improvements to forest planning and practices based on knowledge gained about the effectiveness of forest practices in achieving biodiversity conservation objectives.

It is important that forest companies have a process for adapting strategies and plans based on experiences and results of effectiveness monitoring—for example, where effectiveness monitoring of ecological representation identifies that retention practices are not optimizing the retention of poorly represented ecosystem types, stand-level retention practices are changed as required in order that retention of the applicable ecosystem types is optimized.

Assessment Considerations

Adapting forest planning and practices based on results achieved is an ongoing long-term process. Forest companies must make reasonable efforts to develop and implement adaptive management processes.

Existing certification standards generally require adaptation processes be in place through management feedback, including documentation of management consideration and actions taken in relation to feedback. As an example, as part of its CSA certification on Canfor's TFL 37 operations, Canfor conducts regular periodic management reviews of the results of forest practices.

As part of its CSA certification, Canfor has developed and implemented an adaptive management strategy for Queen Charlotte goshawk. Canfor's approach to goshawk habitat management and monitoring is robust and, over time, will facilitate adaptation of future management practices—such as adjustment to conservation area size and connectivity to foraging habitat. Results to date indicate variation in territory occupancy and nest success and adaptation is already apparent relative to Canfor's effectiveness monitoring program. A 2003 nest failure prompted review of weather records and a recommendation that weather also be monitored annually as part of Canfor's effectiveness monitoring program.

When drawing conclusions about the adequacy of adaptation in forest planning and practices, it is important to recognize that adaptive management is an ongoing process. It is important to consider whether management feedback processes will provide a strong basis for management to identify deficiencies in practices and take appropriate action in a timely manner.

Criterion #4

The results of forest practices reflect intended results established in strategies and plans.

Indicators

- Landscape and harvest patterns are consistent with established targets, including ecosystem representation, wildlife habitat and natural disturbances.
- Stand-level retention is consistent with site plans and retention strategies, including ecological representation and wildlife habitat targets.
- The existence of an implementation and compliance monitoring plan establishing monitoring responsibilities.
- The extent of compliance monitoring performed.
- Landscape- and stand-level retention targets are monitored and reported.

Rationale

Ensuring that practices reflect intended results as set out in strategies and plans are an important aspect of biodiversity conservation. This criterion is about complying with approved plans. It is not adequate to develop sound plans and then not implement them as intended. Whereas criterion 3 assesses the planning continuum, criterion 4 assesses on-the-ground compliance with plans and strategies.

Assessment Considerations

To assess compliance with established strategies and plans, it is necessary to assess practices at the landscape and stand levels. At both levels, a key assessment consideration is the extent to which actual retention reflects desired retention. This consideration is more involved that simply considering whether the number of hectares or stems retained is consistent with stated targets. Rather, this assessment considers both the quantity and quality of retention in relation to stated strategies and plans.

Recent harvest between previously harvested areas illustrates old growth retention patch and wildlife tree patches

It is also important to consider whether there is sufficient monitoring infrastructure in place to provide a high likelihood of compliance, and prompt detection in situations of non-compliance.

Criterion #5

Stand-level forest practices conserve important elements of biological diversity.

Rationale

Actual changes to stand structure and landscape pattern are a result of harvesting cutblocks. In order to effectively conserve biodiversity, the important elements of biodiversity need to be conserved at the stand level and landscape level. Criterion 3 and 4 address the conservation of biodiversity at the landscape level. This criterion assesses the conservation of biodiversity at the stand level.

Assessment Considerations

This criterion is assessed through the five sub-criteria and associated indicators set out below. These criteria facilitate assessments of the extent to which forest practices conserve important elements of biodiversity at the stand level.

5.1 Sensitive plant communities, ecosystems, sites and structures of biological significance are conserved

Indicators

- Percentage of sites and structures of biological significance protected.
- Percentage of sensitive plant communities protected.
- Percentage stand-level retention within distinct ecosystem types.
- Percentage of poorly represented ecosystem types protected.

Rationale

It is important to biodiversity conservation that areas recognized as requiring special management, such as rare ecosystems, sites of biological significance and sensitive plant communities are maintained.

Assessment Considerations

In assessing the extent of conservation of these biodiversity elements it is important to consider both pre-harvest and post-harvest stand attributes—for example, to assess whether 500+ year—old structures are being adequately conserved, it is necessary to consider how many such structures are being protected and how many are not.

Valley bottom harvested in the CWH mm1 showing dispersed retention to achieve forest influence targets.

Retained wildlife tree patch in valley bottom harvest in the CWHmm1.

5.2 Wildlife habitat is conserved

Indicators

- Percentage wildlife trees reserved within stands.
- Attributes of wildlife trees reserved within stands.

Rationale

It is important to biodiversity conservation that some areas of wildlife habitat within stands are conserved. The appropriate amount depends largely on the landscape context.

Assessment Considerations

In assessing the extent of conservation of wildlife habitat it is important to consider both pre-harvest and post-harvest habitat attributes—for example, to assess if appropriate structures are being retained it is important to know what structures were available pre-harvest for retention. Appropriate retention may also depend on needs of particular species of concern. As mentioned in the rationale, no single percentage or set of ecological characteristics is necessary in each stand; appropriate amounts and characteristics depend on landscape context and particular species of concern.

5.3 Native tree species diversity is maintained

Indicators

- Percentage of sites regenerated with a mix of native tree species.

Rationale

It is important to conserving biodiversity to maintain a diversity of tree species and structures and the native composition of forest stands.

Assessment Considerations

In assessing whether native tree species diversity is being maintained, it is important to determine whether a mix of native tree species is being regenerated on harvested sites.

5.4 Aquatic habitat is conserved[vii]

5.5 Botanical species are conserved[viii]

[i] A criterion as applied in forest practices assessments by the Board is a category of conditions or processes by which sound forest management may be assessed. An indicator is a measure of a criterion to assess the application of a process or the condition of a forest resource, which may be monitored periodically to assess change.

[ii] Under FRPA, the objective set by government for wildlife and biodiversity at the landscape level is, without unduly reducing the supply of timber from British Columbia's forests and to the extent practicable, to design areas on which timber harvesting is to be carried out that resemble, both spatially and temporally, the patterns of natural disturbance that occur within the landscape.

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.

FRPA's objectives apply once a licensee has an approved forest stewardship plan in place that sets out strategies or results consistent with FRPA's objectives. In the absence of an FSP, FRPA establishes default practices requirements that:

- restrict cutblocks to less than 40 or 60 hectares (depending on where in the province the cutblock is located);
- prohibit harvesting adjacent to other cutblocks, except where all adjacent cutblocks are sufficiently re-stocked to prescribed stocking standards and tree height;
- require a minimum 7 percent wildlife tree retention at the landscape level and 3.5 percent at the cutblock level;
- restrict the harvesting of wildlife trees, except where the surrounding trees in the cutblock have developed attributes that are consistent with a mature seral condition; and
- require coarse woody debris to be retained in accordance with prescribed volume and size.

[iii] *Effectiveness Monitoring for FRPA Stand and Landscape Biodiversity Values*, Kremsater, Holt and Huggard, November 2004.

[iv] Since the introduction of FRPA, the Board has been working in conjunction with the FRPA Resource Evaluation Program—a joint project of the Ministry of Forests and Range and the Ministry of Environment (formerly Water, Land & Air Protection and Sustainable Resource Management) to facilitate the development of effectiveness indicators for each of the forest values identified in FRPA.

[v] A number of professionals provided input into the criteria and indicators, including representatives from Canfor, the Board, accredited certifiers (ISO, CSA, SFI and FSC), academia and government ministries—Forests and Range as well as Environment (formerly Water, Land & Air Protection and Sustainable Resource Management). The David Suzuki Foundation was invited to review the criteria and indicators, but unfortunately was not available during the period of this work.

[vi] Harvest patterns and stand retention in the managed forest also contribute habitat for many species (considered a medium filter and discussed later in this report).

[vii] This criteria was not assessed through this project.

[viii] Detailed indicators for aquatic and botanical species have not been developed. References are included only to identify that a complete set of criteria and indicators would include aquatic and botanical species.