Executive Summary

The mandate for this strategy came from the Cariboo-Chilcotin Land Use Plan (CCLUP) Implementation Report which identified the need for a regional biodiversity conservation strategy to maintain ecosystem function and species diversity. The report, which represents the first phase of the biodiversity strategy, deals with the relationship of biodiversity to the Short Term Timber Availability Assessment and provides guidance on the implementation of biodiversity management in sub-regional planning processes. It provides interpretation of the Biodiversity Guidebook relative to the ecological conditions of the Cariboo-Chilcotin and within the context of the CCLUP.

Principal results are as follows:

- **Landscape Units**

Draft landscape units (termed "landscape units" for brevity and consistency with guidebooks) were drawn for the Cariboo Forest Region using the size range recommended by the Forest Practices Code and topographical features, primarily watershed boundaries. A map was produced including 161 draft landscape units for the region with an average size of 36,655 ha in mountainous terrain and 68,403 ha in plateau terrain.

- **Biodiversity Emphasis**

Recommended biodiversity emphasis was allocated to each landscape unit in the region using the following primary criteria: ecosystem representation, habitat of selected red and blue listed species, and ecological sensitivity to forest development. Based on these criteria, a conservation priority was assigned to each landscape unit (map included). The conservation priority plus secondary criteria (the regional mosaic, CCLUP land use zonation, proximity to protected areas, and additional biological values) were used to derive the interim biodiversity emphasis. Recommended biodiversity emphasis was then derived by reviewing the interim emphasis with respect to current forest condition. In some cases the emphasis of a unit was changed due to current condition. The targets presented in the biodiversity guidebook of 10 % higher biodiversity emphasis, 45 % intermediate biodiversity emphasis, and 45 % lower biodiversity emphasis were met on a region wide basis. A map showing the recommended emphasis is included.

- **Forest Inventory Adjustment**

Comparison of age structure data derived from the forest inventory database with the expected age structure from landscape age structure models revealed a disproportionately low representation of old forests even on undeveloped landscapes. This low representation may be real (due for example to a greater frequency of wildlfires prior to the 1700s) an artifact of forest stand age inventory methodology, or result from a combination of both real causes and inventory methods. Although the cause of the low representation is not clearly known at this time, field observations and other considerations suggest that inventory methodology is a principal contributor, consequently a conservative approach was adopted in which the inventory area of old forests was adjusted. This adjustment reapportioned the inventory area of mature and older forests into mature forests and old forests based on the mathematical model used by the Biodiversity Guidebook to establish seral stage guidelines. The inventory area of combined mature and older forests was unchanged. This inventory adjustment method assumes that the

forest inventory more accurately distinguishes immature (<100 - 120 years) from mature seral stages (>100 - 120 years) than it does mature from old seral stages (>250 years). This is a widely accepted assumption.

- **Representation in Protected Areas to Calculate Old Forest Guidelines**

The Biodiversity Guidebook permits the use of actual percent biogeoclimatic representation in protected areas instead of the 12% assumption for calculating the old forest guideline. In the Cariboo-Chilcotin Land Use Plan area, 14 forested biogeoclimatic units larger than 15,000 ha. have less than 5% representation, four have 5 - 10% representation, five have 10 - 20% representation, and nine have more than 20% representation in protected areas. Using actual values would significantly increase old seral stage guidelines for most biogeoclimatic units of the central plateau portions of the region and decrease guidelines in some cases to 0% old forest in many units of the highland and mountainous portions of the region. This would be inconsistent with the Cariboo-Chilcotin Land Use Plan zonation and in the opinion of the Biodiversity Committee, would not represent an ecologically sound biodiversity strategy. Instead, ecosystem representation in protected areas was made a primary criterion for allocation of biodiversity emphasis. That is, proposed landscape units containing biogeoclimatic units with little representation in protected areas generally have a higher biodiversity emphasis, other attributes being equal.

- **Seral Stage Guidelines**

Regional forest inventory data (with old forest adjustment) were used to derive regional seral stage guidelines, using the same approach as that used by the Biodiversity Guidebook. The regionally derived guidelines were then compared to those in the Biodiversity Guidebook. They were found to be close, hence guidebook levels were used except in the Interior Douglas-fir Zone (IDF). Stands within this zone were divided into the Douglas-fir group and Lodgepole pine group and separate seral guidelines were developed using regional research databases. The targets for the pine group are less restrictive than those in the guidebook while the guidelines for the Douglas-fir group are more restrictive. Overall, the refinement of the Guidebook thresholds for the IDF zone are consistent with the Guidebook methodology but are a much better representation of the ecology of the IDF. In all other biogeoclimatic zones, the seral condition analyses used the seral stage distribution guidelines in the Biodiversity Guidebook.

- **Current (1996) Seral Condition**

At the present time (1996), 83% of the landscape units fully meet seral stage distribution guidelines for their recommended biodiversity emphasis. An additional 13 % meet guidelines for the landscape as-a-whole but fail to meet guidelines in one or more biogeoclimatic subunits (map included). In these latter units, failure in one or more biogeoclimatic subunits is balanced by an area larger than guideline minimums in other biogeoclimatic subunits. Present failures to meet seral stage distribution guidelines were mostly located in NDT 4-IDF, NDT 1,2,3-ICH and NDT1-ESSF.

- **Year 20 (2016) Seral Condition Using STTAA Option**

Using the STTAA harvest option projected to year 20 (2016), 85% of the landscape units would fully meet seral stage distribution guidelines for their recommended biodiversity emphasis. An additional 11% would meet guidelines for the landscape unit as-a-whole but fail to meet guidelines in one or more biogeoclimatic subunits (map included). Inability to meet targets is

still most prevalent in NDT4-IDF and NDT1-ESSF. Compared to present conditions, the proportion failing in the early, and mature plus old seral stages increases (46% to 60% and 53% to 64% for early, and mature plus old respectively) by year 20 while the proportion failing in the old seral stage decreases (23% to 4%).

- **Management Strategies to Meet Seral Stage Distribution Guidelines**

Recommended management strategies to meet seral stage guidelines include:

1) Reduce or relocate harvest planned for biogeoclimatic units that currently do not meet seral stage guidelines until these guidelines can be met due to forest growth. In nearly all cases where guidelines cannot be met, nearby biogeoclimatic units, sometimes within the same landscape unit, have seral stage representation well above guidelines and can sustain increased harvest rates and still meet seral stage guidelines.
2) Designate Old Growth Management Areas (OGMAs) in the few landscape units were old forest is lacking.
3) Identify biodiversity corridors and representative ecosystems as soon as possible in landscape units with limited mature plus old forest.

- **Connectivity and Spatial Concerns**

The spatial arrangement of forest patches at the landscape scale is a very important aspect of managing for biodiversity. Due to the strategic level of this analysis no assessment of the spatial distribution of seral stages was done. Consequently, potential distribution issues are not identified, and may occur even in landscape units that meet seral stage distribution guidelines. The sooner that comprehensive landscape planning can be done, the more options will remain for biologically effective temporal and spatial arrangement of the cut and leave areas and the lower the potential effect on timber flows.

- **Patch Size Distribution**

There is real urgency to move toward the patch size distribution recommended in the biodiversity guidebook. Larger block sizes (with appropriate structural retention to simulate natural disturbance patterns) and larger leave areas should result in more flexibility in meeting timber targets and greater success in maintaining regional biodiversity.

- **Integration with Mule Deer Strategy**

Several biodiversity objectives will be met with the implementation of the mule deer strategy. The location of most mule deer winter ranges is correlated with factors leading to higher biodiversity conservation priority. Therefore most landscape units containing mule deer winter ranges were recommended for intermediate or higher biodiversity emphasis. The greater mature and old seral requirements of landscape units with intermediate and higher biodiversity emphasis can be partially met by modified harvest on deer winter range. Intermediate and higher biodiversity emphasis is also complimentary to the CCLUP which specifies the maintenance of mule deer habitat values through the application of 'modified harvesting' regimes on winter range.

- **Integration with Caribou Strategy**

Biodiversity objectives would be partly met by implementation of the caribou strategy. The eastern caribou strategy will probably meet the majority of seral stage guidelines for landscape

units containing the ESSF biogeoclimatic zone because the CCLUP designates considerable "no harvest" area for caribou in this zone. However, there may be significant distributional concerns since these "no harvest" areas are primarily in the upper (ESSF wc3) part of the zone and offer little biodiversity conservation for the lower part (ESSF wk1) of the zone or the Interior Cedar Hemlock (ICH) biogeoclimatic Zone below the ESSF Zone. The western caribou strategy will satisfy much of the seral stage distribution guidelines for landscape units containing the Montane Spruce (MS) biogeoclimatic zone because the CCLUP designates a substantial percentage of this area as "no harvest" for caribou. Seral stage guidelines for the ESSF biogeoclimatic zone in this area will largely be satisfied in the Itcha/Ilgachuz Protected Area. Stand level management for caribou helps to maintain biodiversity attributes.

- **Interpretations of the Cariboo-Chilcotin Land Use Plan**

The achievement of biodiversity seral stage distribution, when combined with needs for mule deer and caribou may not be achievable in the SRDZ due to the constraint on extended forest rotations specified in the current interpretation of the 70-30 formula. The use of standardized minimum harvest ages for defining extended rotations should therefore be reviewed.

- **Further Work Required**

Further work is required to provide direction to landscape planning teams implementing biodiversity management. Issues and topics requiring attention include:

- completion of rare ecosystem lists
- specific recommendations on management for connectivity
- age plus attribute-based seral stage definitions
- more specific identification of no harvest areas
- development of a monitoring strategy.

Preface

This report was prepared using data acquired from the short term timber availability assessment (STTAA) through Inland Timber Management Ltd. At the time this report was prepared an audit of the data was being conducted by a team of analysts from the Ministry of Forests and the Ministry of Environment, Lands and Parks. The purpose of the audit is to ensure that the forest cover information is consistent with MOF and MELP databases respecting forest cover inventory and the size of the productive forest landbase within the Cariboo Forest Region. Also, since growth and harvesting projections were done by the STTAA for 20 years, the audit is also expected to validate the approach used to grow and harvest the forest over that time period.

That audit was not complete when this report was prepared, consequently all results and discussion in this report are based on the assumption that the data provided to us is correct. If the audit subsequently shows problems with that data, seral stage results and achievement of biodiversity guidelines could change.

The term *landscape units* is used throughout this report. The reason the this term is used in preference to *biodiversity units* which the IAMC had endorsed is simply for consistency with the Biodiversity Guidebook and the Higher Level Plans: Policy and Procedure document. Use of the term landscape units is not in any way intended to mean that these units are approved or will be approved in their current form by District Managers.

Acknowledgements

Members of the Biodiversity Conservation Strategy Committee included: Ordell Steen, Harold Armleder and Rick Dawson from the the Forest Sciences section of the Ministry of Forests, Ralph Spaans of the Planning/Inventory Section of the Ministry of Forests and Robin Hoffos (chair) of the Habitat Section of the Ministry of Environment, Lands and Parks. GIS support was provided by Mike Howard and Stacy Meech and preparation of the manuscript was largely done by Diane Mousseau.

The cover illustration is adapted from a photograph by John Thompson in "Birds of British Columbia, Volume I".

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1.0 Introduction

The CCLUP Implementation Report (p. 13, p. 153) identified the need for a regional biodiversity conservation strategy citing the need to maintain ecosystem function and species diversity. It further directs that biological diversity will be conserved "through the establishment of landscape units and objectives for retention of old growth, seral stage distribution, landscape connectivity, stand structure, species composition, temporal distribution of cutblocks, retention of coarse woody debris and retention of wildlife trees" (p. 153).

This report represents the first phase in the development of a biodiversity strategy for the Cariboo-Chilcotin Region. The principal objective of this report is to document the relationship of biodiversity objectives to the short term timber availability assessment, as directed by the Implementation Committee. A second objective is to provide guidance to sub-regional planning processes on implementation of biodiversity objectives. The document focuses on the establishment of landscape units, assignment of biodiversity emphasis to those units and assessment of seral stage representation. As such, this report is a cornerstone, not a comprehensive report since it does not address all relevant aspects of biodiversity in the region. **For example, issues of spatial distribution of seral stages within landscape units are critical to the successful implementation of biodiversity, but the time constraints and strategic level of this task does not permit spatial distribution to be addressed except at the regional level, through biodiversity emphasis assignment.**

The approach taken for landscape unit identification, biodiversity emphasis level setting and seral stage distribution assessment is primarily ecological, with application of key FPC guidebooks (Biodiversity, Riparian, draft Managing Identified Wildlife). Consistent with the terms of reference for the biodiversity conservation committee, this approach helps to clarify biodiversity requirements for subsequent consideration in the CCLUP integration process. Within the constraints of time and knowledge, the guidebooks have been interpreted relative to the ecological conditions of the Cariboo-Chilcotin to tailor the provincial level guidelines to this region.

The CCLUP targets and FPC guidebooks are linked and we have used that linkage as much as possible to address the targets of the CCLUP. Nevertheless, it should be noted that the geographical units of analysis for the CCLUP (land use zones) and the biodiversity guidebook (landscape units) are different. Direction to the biodiversity committee specifically identified the need to establish landscape units.

2.0 Landscape Units

2.1 Rationale

Landscape units, as described by the Forest Practices Code, are planning areas whose boundaries are based on topographic or other landscape geography features. As a general guideline, they range in size from 5,000 to 100,000 ha and encompass a single entire watershed or a series of small entire watersheds.

Landscape units, as described by the Forest Practices Code, are ecological units. Just as forest sites are useful for describing stand level ecological processes and for planning forest stand management, landscape units are useful for describing landscape ecological processes and planning landscape management. Landscape processes include disturbance patterns, the abundance and spatial arrangement of different kinds of wildlife habitat, hydrologic processes, animal movements, seed dispersal, and air and water movement.

The Cariboo Chilcotin Land Use Plan (CCLUP) calls for the establishment of landscape units and landscape unit objectives. Landscape units are essential for implementing a number of regional strategies, especially the biodiversity strategy which is closely linked to the short term timber supply analysis. The Forest Practices Code of BC provides guidelines for determining landscape units and setting landscape unit objectives. Under the Cariboo-Chilcotin Land Use Plan, these guidelines will apply, guided by the Land Use Plan and its targets.

The establishment of landscape units is a necessary step towards meeting the CCLUP and Forest Practices Code objectives of achieving at least a minimum level of biodiversity in all areas of the Cariboo-Chilcotin. Planning areas larger than landscape units (TSA's, Resource Management Zones) are too large to be sensitive to the unique attributes of specific landscapes or for ensuring that a minimum level of biodiversity is maintained across the region. Although these larger planning areas are essential for setting broad objectives, landscape units are required to effectively integrate conservation activities with resource development activities in a manner most appropriate to a specific area. Landscape units also allow effective integration of visual resource, tourism, recreation, and aesthetics values with those of biodiversity conservation and resource development.

2.2 Procedure

Landscape units, as described by the Forest Practices Code, have two important criteria, size and boundary location, as described below. These criteria were used to define the 161 proposed landscape units within the Cariboo Forest Region.

- **Size of Landscape Units Are 10,000 to 100,000 ha**

The size of landscape units should be sufficiently large to encompass the scale of ecological landscape processes but not so large as to limit the ability to integrate biodiversity and resource development objectives. The size range described by the Forest Practices Code is selected to correspond to the scale of predominant natural disturbances and the scale at which the different types of habitat present in an area, are adequately represented. This scale also encompasses the range of movement of many wildlife species and conforms to the scale of many hydrologic and riparian processes. At both larger and smaller scales, landscape planning for biodiversity objectives becomes less effective.

As a general guideline, landscape units should be smaller in areas of complex terrain and larger in areas of relatively uniform terrain. In complex mountainous terrain of the Cariboo, the scale of landscape processes such as natural disturbances and habitat representation, is generally smaller. In more uniform plateau terrain, the scale of landscape processes (eg. stand destroying wildfires) and habitat representation is larger. Guidelines for landscape unit size were applied as shown in table 1.

Table 1. Terrain classification and resulting landscape unit size for areas in the Cariboo-Chilcotin Region.

Terrain	Areas within Cariboo-Chilcotin*	Landscape Unit Size (ha)	
		Target	Range
Complex Mountainous	Cariboo Mountains Quesnel Highlands Shuswap Highlands Camelsfoot Range Marble Range Chilcotin Ranges Pacific Ranges Itcha Range Ilgachuz Range Rainbow Range	30,000	10,000 - 50,000
Plateau	all other areas of Cariboo-Chilcotin including Fraser Plateau, Fraser Basin, and Thompson Plateau	75,000	50,000 100,000

* For locations and definitions see Holland, S.S. 1976. Landforms of British Columbia, a Physiographic Outline. BC Dept Mines and Petroleum Resources Bulletin 48.

- **Significant Deviations from Target Sizes (30,000 and 75,000 ha) Are Based On Ecological Attributes.**

Before delineating landscape units near the limits of the recommended size, the ecological integrity of the unit was considered. If a unit was so small that it included only a small part of a watershed, not functionally distinct from other parts of the watershed or is so large that it contained several watersheds with little ecological interrelations, the appropriateness of the unit was questioned. Similarly, if a unit was so small that it allowed little or no flexibility for maintaining or achieving over time, minimum levels of biodiversity (eg. seral stage distribution and range of patch sizes), the appropriateness of the unit was questioned.

- **Boundaries of Landscape Units Are Topographic Features.**

Boundaries of proposed landscape unit boundaries were drawn on topographic features, primarily watershed boundaries (height-of-land) in order to encompass entire watersheds, groups of entire watersheds, or infrequently, hydrologically consistent subunits of watersheds. Landscape units were not be based on resource development or conservation values, past or present human use patterns, or administrative boundaries.

Landscape unit boundaries need to be determined prior to and independently of setting landscape unit objectives. They should provide the basis for examining ecological characteristics and resource development values within the bounds of a relatively stable, value-neutral management planning area. Once boundaries are established, objectives should then be determined for each landscape unit.

- **Large Rivers and Lakes Are Sometimes Used as Landscape Unit Boundaries.**

Large rivers and lakes were used as landscape unit boundaries when inclusion of the watershed of the river or lake would result in exceeding the recommended size limit for landscape units. For example, the Fraser River was used as the boundary of several landscape units since inclusion of the Fraser River watershed would greatly exceed the upper size limit of landscape units. Furthermore, large lakes and rivers do form ecological barriers and may bound natural disturbances.

Lakes that are larger than 5,000 ha and comprise a complete boundary between adjacent units are not considered as contributing area to either unit.

- **Mapped Man-Made Features and Administrative Boundaries Are Used to Refine Landscape Unit Boundaries Where Watershed Boundaries are Indistinct.**

Man-made features and administrative boundaries were not used as the primary basis for landscape unit boundaries. However, where topographic features are indistinct and the broad area within which a watershed boundary may be drawn includes man-made or administrative boundaries, these could be used to specifically locate the boundary. For example, a watershed boundary (height-of-land) was sometimes difficult to determine on a flat plateau landscape. In

this situation, a man-made boundary such as a main road was used to approximate the height-of-land. Similarly, biogeoclimatic, natural disturbance type, and resource management zone boundaries were be used for this purpose. In all cases, preference was given to the boundary that encompasses an ecologically functional landscape area.

2.3 Results

In total, 161 landscape units were drawn (Figure 1). The current line-work approximates landscape features such as heights-of-land. Final boundaries will be adjusted according to TRIM information which may result in very slight adjustments to boundaries and landscape unit areas.

Some landscape units are only or partly in the Cariboo Forest Region but the areas shown in Table 2 reflect the entire area within the unit, including area in parks and area outside the Region. The boundary criteria recognize natural features over administrative boundaries, hence units cross districts and cross regional boundaries. Furthermore, regions are at different stages in the development of landscape units, hence complete integration across regional boundaries was not possible at the time landscape units were drawn. Where landscape units crossed forest district boundaries, the unit was assigned for the purposes of analysis to the forest district containing the greatest proportion of the landscape unit area.

Two landscape units, Franklyn and Edmond occur entirely within Protected Areas. The only part of Betty Wendle Unit within the CCLUP area is within Bowron Park. Other units 90% within parks are Chilko, Rainbow and Niagara. Only 1203 ha. of Mahood unit occurs within Cariboo Region.

Consistent with the criteria for setting boundaries, landscape units are classified as either plateau or mountain units. This is based on the predominant terrain in the unit and was necessary to decide which size target was appropriate. In many units, more than one NDT occurs since NDT boundaries and watershed boundaries rarely match.

The average size of landscape units across the region is very near target levels; 68,403 ha. for plateau units and 36655 ha. for mountain units. The five forest districts in the region vary considerably in terms of size and terrain, hence the number of landscape units within districts varies. Williams Lake District has 18 units, Horsefly 19, 100 Mile House 26, Quesnel 39 and Chilcotin 59. Further details on the landscape boundary determination are located in Appendix 1.

Figure 1. RECOMMENDED LANDSCAPE UNITS OF THE CARIBOO FOREST REGION

(map to be inserted)

Table to be inserted

3.0 Biodiversity Emphasis

3.1 Rationale

The Biodiversity Guidebook provides for the use of three different biodiversity emphasis options to give resource managers the flexibility to match landscape management prescriptions to differing resource management priorities.

The Biodiversity Strategy Committee has compiled the following recommendations as guidance for the allocation of biodiversity emphasis options within the Cariboo Forest Region. The framework for allocation of emphasis options is presented to put the allocation criteria into the appropriate geographical and Forest Practices Code context.

3.2 Procedure

3.2.1 General Framework For Allocation of Biodiversity Emphasis Options

- **Forest Districts are used as the primary sub-regional areas for allocation of Biodiversity Emphasis Options**

  The biodiversity guidebook recommends that biodiversity emphasis options be allocated within subregional planning areas. Forest Districts provide the most workable sub-regional planning unit for this purpose for the following reasons:

  a) Forest Districts are the only existing sub-regional planning areas of an appropriate ecological size which, in total, encompass the whole region.

  b) Allocation by Forest District will ensure that all biodiversity emphasis options are distributed throughout the region and not concentrated in one or two areas.

  c) The use of Forest Districts also has an administrative advantage since District Managers are ultimately responsible for setting biodiversity objectives and District Manager authority is at the Forest District level.

- **Biodiversity Emphasis Options are allocated within Forest Districts using the Proportions Provided in the Biodiversity Guidebook.**

  This recommendation, from the Biodiversity Guidebook, resulted from Cabinet level direction which balanced risks to biodiversity against social and economic impacts on a provincial basis. The three emphasis options are to be allocated within Forest Districts in the following proportions:

Lower Emphasis	45% (30-55%)
Intermediate Emphasis	45% (35-60%)
Higher Emphasis	10% (no range)

To address potential differences in biodiversity conservation priority between Forest Districts in the Cariboo, there must be some flexibility in allocation. The approach of the biodiversity conservation committee is to meet the 45:45:10 apportionment at the regional level. Allocation within Districts must remain within the specified ranges for low and intermediate emphasis but will not necessary be the same in each District. The 10% high emphasis is applied purely at the District level as no range of flexibility is permitted.

Provincial policy has directed that these percentages will apply to the **timber harvesting crown land base** within the Forest District (see "The role of LRMPs in Recommending Biodiversity Options"). For this purpose the timber harvesting land base is calculated by subtracting the area of parks, alpine tundra, non-forested wetlands, non-productive brushlands and open grassland from the total crown forested area. Riparian reserves and inoperable areas were not netted out for this exercise due to lack of information at that level. The allocation of biodiversity emphasis options is based on that part of the crown landscape which is truly available for timber management.

The guidebook also recommends that the lower emphasis option should **not** be applied to more than approximately half of the areas of any biogeoclimatic subzone within each Forest District.

Allocation of Interim Biodiversity Emphasis to Individual Landscape Units

An interim biodiversity emphasis was assigned to each landscape unit prior to assessing the current seral stage condition of the landscape unit.

The first step in allocating interim biodiversity emphasis options to landscape units was to assign a conservation priority rating, from 1 to 10, to each landscape unit based on three primary criteria. These criteria are indices of the relative biodiversity attributes of the unit.

The primary criteria for assigning a conservation priority to each landscape unit are ecosystem representation, presence of known threatened or endangered species and sensitivity to forest development.

1. Ecosystem Representation

Several factors are included within the overall ecosystem representation criterion. These factors are:

a) Representation in Protected Areas.

Habitat representation in protected areas is an important component of a strategy to maintain regional biodiversity. Biogeoclimatic units with a lower degree of representation in protected areas require greater attention in the managed landscape to maintain regional biodiversity.

Biogeoclimatic subzones within each landscape unit were assessed according to the proportion of that subzone currently in Protected Areas within the CCLUP region (Appendix 2). In some cases, biogeoclimatic subzones that are ecologically similar were combined prior to determining the proportion within protected areas. Where representation in Protected Areas is low (less than or equal to 5%) the need for representation is considered high. Where representation is high (greater than 10%) the need is considered low. Representation between these two extremes is considered moderate.

b) Diversity of biogeoclimatic units (variant) and habitat types.

Landscape units containing a diverse mosaic of habitats will support a greater diversity of species than relatively uniform units. **The number of biogeoclimatic (BGC) variants** within a landscape unit is an indicator of relative climatic and broad level ecosystem **diversity** within a landscape unit. This broad level assessment of diversity is further developed by assessing the relative variety of **habitat types** across the entire landscape unit. The combination of the broad level and more detailed assessments were used to derive a diversity rating for each landscape unit according to the following relationship as shown in table 3. Only biogeoclimatic variants larger than 1,000 ha were counted in this assessment.

Table 3. Definition of diversity ratings for landscape units.

BGC Variants and Habitat Diversity	Diversity Rating
One BGC variant and low or moderate habitat diversity	Low
One or two BGC variants and high habitat diversity **or** Three BGC variants and low or moderate habitat diversity	Moderate
Three BGC variants and high habitat diversity **or** Four or more BGC variants	High

Habitat diversity was visually estimated from forest inventory maps and satellite imagery and assessed relative to other areas of the region. The diversity rating is then combined with the biogeoclimatic subzone representation need according to the relationship in the following table to arrive at the overall **ecosystem representation** rating (Table 4).

Table 4. Overall Ecosystem Representation Rating.

Representation Need		Ecosystem Diversity		
% of Total Area with Moderate or High Need	**% of Total Area with High Need**	**Low**	**Moderate**	**High**
< 25	< 15 15 - 25	Low Low	Low Low	Low Intermediate
25 - 50	< 25 25 or more	Low Intermediate	Intermediate Intermediate	Intermediate High
> 50	< 25 25 or more	Intermediate High	High High	High High

2. Presence of Threatened and Endangered Species

Some threatened or endangered species (blue and red listed species) are more sensitive to intensive forestry development than others. Those that are easily displaced by road development or require old forest or landscapes with low fragmentation will be most affected. Red and blue listed species found in the Cariboo Forest Region that have life requisites likely to be significantly affected by forest development at the landscape level include: grizzly bear, eastern caribou, flammulated owl and some forest dwelling bats. Western caribou are a provincially significant herd but are not blue listed at this time. Landscape units were classified as having or not having importance to these species based on the extent and quality of habitat available and the relative importance of the landscape unit to the species in question. Many other species have dependencies on attributes such as old forest but proper stand level management such as riparian and wildlife tree protection and recommendations from the Managing Identified Wildlife Guidebook were assumed to address their needs.

3. Sensitivity to Forest Development

Even when the biodiversity guidebook recommendations are fully applied, forestry development inevitably changes natural landscape attributes including patch size, amount and pattern of connectivity, seral stage distribution and amount of interior forest. The degree of change from natural landscape attributes resulting from forestry development is different in different natural disturbance types. Those landscapes which are more changed by development have a higher degree of risk to biodiversity and thus a higher sensitivity to development. The forested natural disturbance types used in the biodiversity guidelines can be ranked in order of this type of sensitivity to development as follows: NDT's 1 & 2 (Highly sensitive), NDT 4 (Moderately sensitive), NDT 3 (Least sensitive).

Biodiversity Conservation Rating

Ecosystem representation, presence of threatened or endangered species, and ecosystem sensitivity to disturbance were combined into an overall conservation priority rating through use of a decision tree (Figure 2). The conservation rating is relative, not absolute, and is useful only for helping to discriminate between groups of units with respect to emphasis.

The conservation priority ranges from 1 to 10 (10 being the highest conservation priority). The decision tree used to determine the conservation priority is dynamic, meaning that different pathways through the tree can lead to the same conservation priority and that the relative weighting given to a criterion is dependent upon the condition of the other criteria in that landscape unit. This allows the relative weighting of any criterion to change as extreme conditions for that criterion are approached.

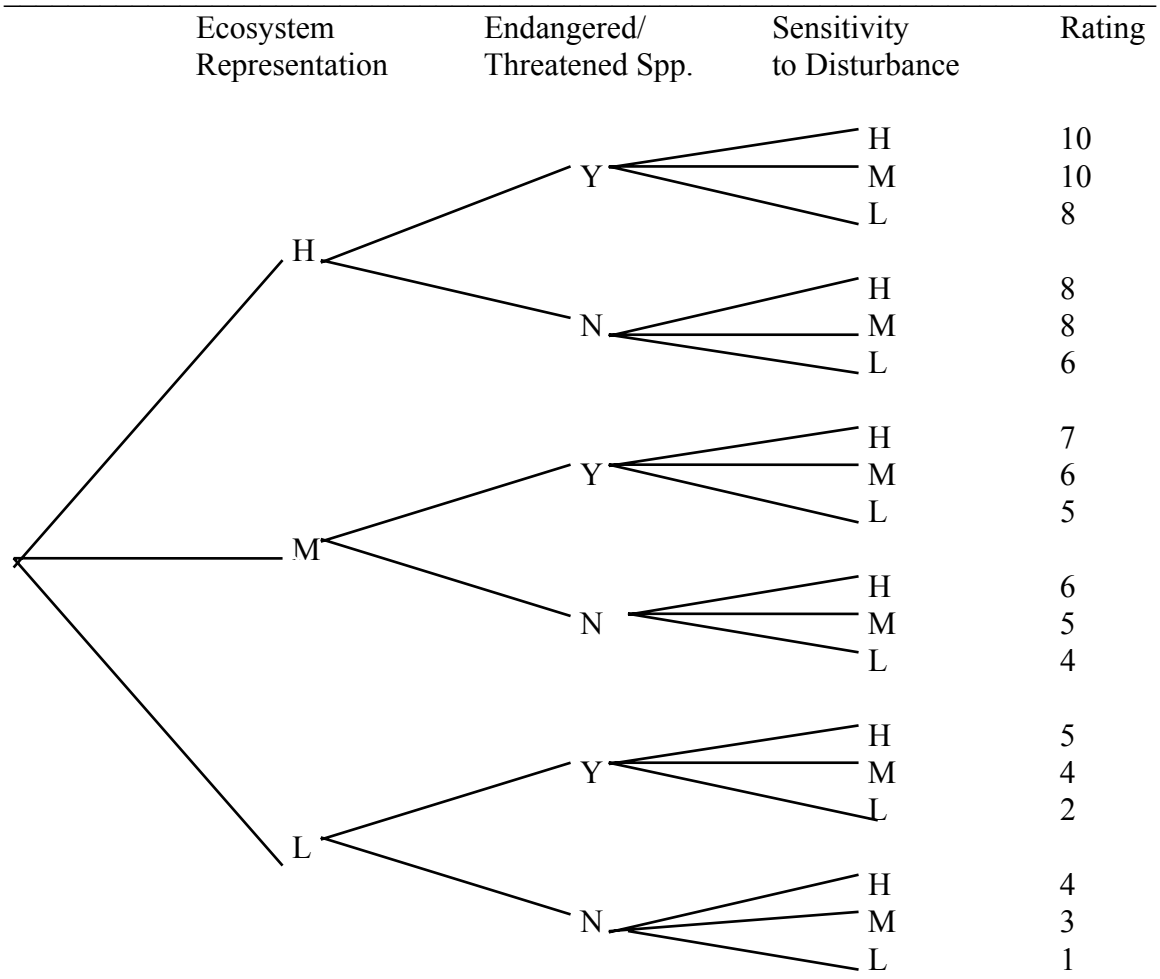

Figure 2. Decision tree used to determine landscape unit conservation rating from the three primary emphasis criteria.

Assignment of Emphasis

The conservation priority rating allows landscape units to be grouped into the categories of low, intermediate and high emphasis according to the targets (30-55% lower; 35-60% intermediate; 10% higher). For landscape units which have similar conservation priority ratings (differ by no more than one number), secondary criteria and a more detailed comparison of the primary criteria were used to assist in assigning biodiversity emphasis. Secondary criteria used for allocation of biodiversity emphasis levels in the CCLUP area include the regional mosaic, or CCLUP land use zonation, proximity to protected areas and presence of provincially or regionally significant wildlife species.

a) Regional Mosaic

Once emphasis is assigned individually to landscape units, a collective picture emerges. If all other factors are essentially equal, it is considered appropriate to modify allocations to produce a more ecologically sound regional biodiversity mosaic. Large areas of similar emphasis may or may not be desirable based on the collective achievement of things like ecosystem representation and connectivity. For example, where two units are similar based on the primary criteria, the one containing ecosystems not otherwise represented in intermediate or high emphasis might be selected for the greater emphasis.

b) CCLUP Land Use Zonation

Where units are essentially similar with respect to biodiversity conservation values, but occur in different CCLUP zones, the higher emphasis should be assigned to the unit lying in the zone where natural values are deemed to have increased importance. In order of descending importance for conservation priority, the apparent ranking of zones within the CCLUP report is Special > Integrated > Enhanced.

c) Proximity to Protected Areas

If all other factors are essentially equal, landscape units adjacent to protected areas were given higher biodiversity conservation priority in order to allow better buffering of the values contained within the protected area.

d) Additional or Overlapping Biological Values

Other factors being essentially equal, landscape units which have particularly high values for a regionally or provincially significant species (eg. mule deer, salmon, caribou) or contain exceptionally high ecosystem or habitat diversity influenced the allocation of biodiversity emphasis.

Allocation of Recommended Biodiversity Emphasis

The final step in assigning biodiversity emphasis to each landscape unit was based on an assessment of whether the landscape unit could meet the seral stage targets associated with the assigned emphasis. If it could, the emphasis level was unchanged. If it could not, other

landscape units with the same or very similar biodiversity values were evaluated as alternatives for the assigned emphasis level. In some cases another suitable landscape unit was not present and the assigned emphasis level was unchanged.

Seral stage distribution is a key landscape attribute for the maintenance of biological diversity. Forestry development will tend to increase the proportion of early seral stage forest and to decrease the proportion of mature and old forests. A number of species are mature and old forest specialists which require the conditions found in these older forests for their existence. Other species require an intermingling of various seral stages or a combination of specific attributes found in various seral stages.

The current seral stage condition of a landscape unit will influence the ease with which seral stage targets can be met as forestry development proceeds. If the current condition of the landscape is above targets, then planning of development to maintain the seral stages specified for high and intermediate emphasis can be achieved with limited constraints on forest development. Conversely, if the current condition is low compared to the targets, it will take significant time and harvesting constraints to produce a landscape which will meet high or intermediate targets.

Furthermore, the better the current seral stage condition is in relation to the targets, the more options will remain for spatial distribution of the harvest to produce the desired spatial pattern. This flexibility is important for the maintenance of ecosystem representation, connectivity and interior forest conditions which are important elements of landscape planning for biodiversity. Suitable connectivity and interior forest conditions can be developed over time in landscape units which currently have low proportions of mature and old forests. However, restoration of appropriate spatial patterns could take considerable time and impose significant constraints to harvesting in these units.

Where the current forest condition allows the targets to be met, the emphasis assigned prior to seral condition assessment was unchanged. Where targets cannot be met at this time, the next best unit was reviewed relative to the primary and secondary criteria to determine whether the higher emphasis can be shifted to that unit, assuming the seral stage targets can be met on that unit. In the absence of suitable replacement units, consideration was given to enhancement and protection measures that will allow achievement of targets over a specified period of time on the original unit.

3.3 Results

Figure 3 shows the conservation priorities within the Cariboo Region as derived from the primary criteria. The highest conservation priorities tend to be concentrated in the IDF zone with some additional areas in the Beeftrail (NDT 3 - MS/SBPS), Horsefly and McKinley (NDT 1, 3 - ICH) landscape units. The remaining parts of the plateau in NDT 3 - SBS or SBPS and most of the Cariboo mountains (NDT1 - ESSF, NDT2 - SBS) had moderate conservation priority. The lowest priority was generally associated with higher elevation areas in the NDT 2 - ESSF and NDT3 - MS portions of the Chilcotin mountains (Ottarasko, Nude, Middle Lake, Cheshi Strikelan, Beece Creek, Gunn Valley), the NDT 3-MS on the northeast shoulder of the Itchas mountains (Toil), and the NDT1 - ESSF and NDT 2 - SBS portions of the northern Cariboo mountains (Willow, Boyce, Wendle, Bowron).

A key contributor to this result is the imbalance in current ecosystem representation within Protected Areas (Figure 4 and 5). Biogeoclimatic subzones/variants associated with mountainous terrain tend to be well represented in protected areas. Conversely, biogeoclimatic units occurring on the plateau or in major river valleys tend to be poorly represented in protected areas.

Representation of red and blue-listed species of concern at the landscape level tends to further intensify this effect because many of them live in the IDF zone. A moderating influence is the presence of eastern caribou and grizzly who both occupy mountainous habitats. The high conservation priority associated with the IDF is also partly a function of the moderately high sensitivity to development of that forest type (Figure 6). Further details on the derivation of conservation priority for specific landscape units is located in Appendix 8.2.

The interim biodiversity emphasis shown in Figure 7 reflects the primary and secondary criteria in combination with the District and Regional context for meeting the 45:45:10 targets for lower, intermediate and higher biodiversity emphasis. The dispersion of the emphasis categories does not strictly mimic the conservation priorities. This is because of the inclusion of secondary criteria such as the regional mosaic as well as the framework for allocation by District. A summary of the emphasis assignment by landscape unit, as well as the rationale for assignment is included in Appendix 8.3.

Recommended biodiversity emphasis is shown in Figure 8. Differences between the interim and recommended biodiversity emphasis maps reflect consideration of current forest condition as it pertains to meeting the biodiversity guidelines. Rationale for the assignment of recommended emphasis is also included in Appendix 8.3.1.

In total, emphasis was changed for 10 landscape units due to current condition. Three units shifted from higher to intermediate, four from intermediate to higher, two from intermediate to lower and one from lower to intermediate. Horsefly Forest District had five units that shifted emphasis, 100 Mile District had three and Quesnel District had two. There were no changes between the interim and recommended emphasis warranted in Williams Lake and Chilcotin Forest Districts.

Figure 3 here

Figure 4 here

Figure 5 here

Figure 6 here

Figure 7 here

Figure 8 here

4. Analysis Of Seral Condition

4.1 Rationale and Background

Seral condition is a principal component of a biodiversity conservation strategy. The proportion of a landscape unit in each seral stage, from early seral to mature and old forest is a key indicator of biodiversity in the landscape unit. The importance of seral stage targets is clear in both the Biodiversity Guidebook and the Cariboo-Chilcotin Land Use Plan (CCLUP).

Guidelines for the proportion of early seral forest, mature forest and old forest on a landscape are provided in the Biodiversity Guidebook for each Natural Disturbance Type (NDT) and biogeoclimatic (BGC) zone. These guidelines are stated to be the minimum requirements considered to have a good probability of maintaining biodiversity within a landscape unit. Application of these Guidebook guidelines is supported by the CCLUP. The guidelines in the Biodiversity Guidebook were used for all seral condition analysis described below, except for analysis within the Interior Douglas-Fir (IDF) biogeoclimatic zone, where refinements were made. The refinements are described in Section 4.2.

Seral stage guidelines in the Biodiversity Guidebook are based on an estimation of the proportion of early, mature, and old forests in the pre-industrial landscape. The actual guidelines for each seral stage is a percentage of this proportion, depending on biodiversity emphasis. In addition, guidelines for old forests are reduced by the percent of the biogeoclimatic unit contained in parks and other protected areas. For purposes of setting seral stage guidelines, the Guidebook assumes that 12% of each biogeoclimatic unit is contained within protected areas but allows refinement of the seral stage guidelines based on the actual percent protected, when known. The approach for setting guidelines and its assumptions are described in greater detail in the Biodiversity Guidebook. The Guidebook also recommends that where seral condition guidelines cannot be met in the short or medium term, a strategy should be developed by landscape unit to achieve the guidelines over the longer term.

The Cariboo-Chilcotin Land Use Plan describes a range of seral stage guidelines for each land use subunit and states that the actual guidelines will be dependent on the Natural Disturbance Type and the biodiversity guidelines developed under the Forest Practices Code. The CCLUP directs that the seral stage guidelines of the Biodiversity Guidebook be applied, with guidance from the CCLUP, at the landscape unit level in all land use zones and polygons. Additional guidance in the CCLUP is contained in the timber targets, specifically in the percent of conventional, modified, and no-harvest area within each land use polygon.

The Biodiversity Strategy Committee was requested by the Cariboo-Chilcotin Land Use Plan Implementation Committee to assess the seral condition of draft landscape units at the current time (1996) and after 20 years (2016) based on current and projected inventory data provided by the Short Term Timber Availability Analysis. As part of this task, the Biodiversity Strategy Committee developed procedures to resolve technical issues surrounding application of the seral stage targets to the Cariboo-Chilcotin landscape.

4.2 Procedures

The principal features of the seral condition assessment procedures are summarized in the following table.

Principal Features of the Approach for Seral Condition Analysis
Inventory Data Base: • analysis of current (1996) seral condition was based on current forest inventory age data for productive forest crown lands • analysis of 20 year (2016) condition was based on projected inventory, incorporating projected harvest areas and forest growth (projections by Short Term Timber Availability Analysis Strategy) **Inventory Data Adjustment:** • proportion of old forests in the inventory data base was adjusted by reapportioning the area of mature plus old forests into mature forests and old forests based on a landscape age structure model used by the Biodiversity Guidebook to set seral stage guidelines • for Douglas-fir forests in the IDF, the proportion of old (>250 years) forests in the inventory data base was adjusted by reapportioning the area of forests older than 140 years into mature forests (<250 years) and old forests based on a landscape age structure model **Seral Stage Definitions and Guidelines:** • Biodiversity Guidebook ages were used to define seral stages in all forests except IDF Zone forests dominated by lodgepole pine, spruce, or deciduous species; Biodiversity Guidebook definitions for the SBS Zone were applied to these forests. • Biodiversity Guidebook seral stage guidelines (proportions of early, mature plus old, and old seral stages) were applied to all forests except the Douglas-fir forest group (Fd and PlFd stands) in IDF Zone; guidelines for these forests were derived from Cariboo-Chilcotin regional data. **Seral Condition Analysis:** • all forest types (leading species) are combined for seral stage assessment except in the IDF Zone where Douglas-fir and lodgepole pine forest groups were analyzed separately • basic units of analysis are biogeoclimatic zones within landscape units; analyses for landscape units as-a-whole are based on prorated biogeoclimatic zone analyses; • analysis of ability to meet seral stage targets is completed for the landscape unit as-a-whole and for each biogeoclimatic zone within the landscape unit • only biogeoclimatic zones larger than 5,000 ha within the landscape unit were required to meet seral stage guidelines unless the biogeoclimatic zone is a valley bottom unit (valley bottom units >1,000 ha were required to meet guidelines)

Inventory Data Base

- analysis of current (1996) seral condition is based on current forest inventory age data for productive forest crown lands
- analysis of 20 year (2016) seral condition based on projected inventory, incorporating projected harvest areas and forest growth (projections by Short Term Timber Availability Analysis Strategy)

The data base used for the current (1996) seral condition analysis was an updated forest inventory data base for the Cariboo Forest Region. Forest inventory data are not available for the Wells Gray, Bowron and Tweedsmuir parks portions of the CCLUP region. Landscape unit boundaries were digitally overlain on the inventory data base and the area of early, immature, mature and old forests were summarized for each landscape unit. Within landscape units, data were summarized by natural disturbance type (NDT), biogeoclimatic zone, and leading species. Only productive forest lands on crown land were included. Non-commercial forest lands and private lands were not included.

The data base for the 20 year (2016) assessment was similar to that of the current assessment except that areas of each seral stage were modified by projected harvest area and forest growth. This data base was provided by the Short Term Timber Availability Assessment Strategy.

Inventory Data Adjustment

- proportion of old forests in the inventory data base was adjusted by reapportioning the area of mature + old forests into mature forests and old forests (except as below);
- for Douglas-fir forests in the IDF, the proportion of old (>250 years) forests in the inventory data base was adjusted by reapportioning the area of forests older than 140 years into mature forests (<251 years) and old forests

Technical Background

A preliminary assessment of seral condition of each landscape unit was done to identify technical issues associated with applying the Biodiversity Guidebook guidelines to the inventory data base. The proportion of each seral stage in the inventory data base, prior to any adjustments, was compared to the Biodiversity Guidebook seral stage guidelines for lower, intermediate, and higher biodiversity emphases.

Approximately 50% (81 out of 161) of the landscape units as-a-whole failed to meet the lower biodiversity emphasis guidelines. Although some of the failed landscape units contain extensive timber harvesting, many have experienced little or no industrial activity and are in a natural condition. Approximately 57% of the biogeoclimatic subunits of landscape units also failed to meet lower biodiversity emphasis guidelines.

All failures of landscape units as-a-whole to meet lower biodiversity emphasis guidelines in this preliminary assessment were due to failures to meet old forest guidelines. No landscape units failed as-a-whole due to failure to meet early or mature + old guidelines. Similarly, all biogeoclimatic zones that failed to meet lower biodiversity emphasis did so because of failure to

meet old forest guidelines. Approximately 6% also failed to meet mature plus old guidelines. Among biogeoclimatic zones, the highest failures were associated with the IDF (>95%), ICH (86%), and ESSF (84%) zones. Failures were comparatively low in the SBPS (12%) and MS (16%) zones.

A comparison of the proportion of mature and old forests in the inventory data base to the expected proportion of these two seral stages based on the landscape age structure model use by the Biodiversity Guidebook indicates that the area of old seral stage forests is frequently much smaller than would be expected especially in those biogeoclimatic zones and NDT's where old is defined as greater than 250 years (IDF, ICH, ESSF). In these zones, the inventory data for landscape units with little or no logging repeatedly demonstrates a pattern with a very high proportion of mature forests and a very low proportion of old forests. Examples of such data are provided in Appendix 5.

The high percentage of unlogged landscape units that fail to meet old seral stage guidelines may be due to one or a combination of reasons. Application of the seral stage guidelines in the Biodiversity Guidebook assumes that the frequency of stand initiating disturbances (such as wildfire) have been relatively constant over the range of ages of stands within the area and that the inventory data correctly describes the actual proportion of forests on the landscape within each stand age category. Either or both of these conditions may not be met for the Cariboo-Chilcotin landscape.

The current forest inventory data base may not accurately describe the actual proportions of old forests on the landscape since the inventory was not designed to measure actual stand age, defined as the time since stand initiation. Underestimates of the proportion of old forests may be due to:

- a tendency to underestimate the age of trees older than about 150 years especially on sites with slow growth beyond 120 years;
- a tendency for air photo interpretation of stand age to conservatively estimate stand age where old stands occur with younger stands and appear little different from the younger stands,
- the difficulty of estimating stand age of old stands due to mortality and/or decay of trees established at the time of stand initiation;
- differences between the mean age of inventory ('top height') trees selected for inventory purposes and actual stand age as defined for purposes of seral stage assessment.

The frequency of stand initiating wildfires may also have been greater in the Cariboo-Chilcotin area prior to the 1700's than during the last 200 years. A decrease in fire frequency associated with the "Little Ice Age" has been interpreted from forest age data in other areas of western North America. If a significant decrease occurred in the Cariboo-Chilcotin area about 250 years ago, then the proportion of forests in age classes older than about 250 years would be less than expected based on the proportion of forests in younger age classes.

Whether the cause for the low proportion of old forests is natural (greater frequency of wildfires prior to 1700's) or artificial (inventory underestimates of stand age) or a combination cannot be determined with certainty at this time. However, on-site measures of stand age older than inventory map age are not uncommon in areas with slow tree growth or in the Interior Douglas-fir Zone and, as a result, inventory factors are considered likely to have a significant role in the high percent failure of landscape units. Therefore, the seral stage assessment was based on a conservative approach which assumes that the proportion of forests in the inventory data base

that is either older or younger than approximately 120 years is reasonably accurate but the proportion of stands older than 140 years and especially 250 years is not confidently known at this time. In practice, this assumption means that the inventory proportion of mature + old forests was assumed reasonably accurate but that the proportion of mature plus old forests which is actually old is not confidently known.

In order to provide an estimate of the proportion of old forests for purposes of this assessment, the negative exponential model, used to derive seral stage distribution guidelines in the Biodiversity Guidebook, was also used to estimate the proportion of mature plus old forests which is old. That is, the negative exponential model was used to derive an inventory adjustment factor which reapportioned the total area of mature plus old forests into mature forests and old forests. If the assumptions of this approach are correct, the low proportion of old forests in the inventory data base is due more to artificial than natural causes. If the assumptions are not correct, then the area of old forests has been overestimated. However, if additional data shows that the area of old forests has been overestimated, then the curve of age class distributions can be changed beyond some old age, as determined by the additional data, but will not need to be changed for ages younger than this old age. That is, the approach makes best use of current data and allows the greatest flexibility for correction. It is also, in the current opinion of the Biodiversity Strategy Committee, the interpretation likely to be most correct.

Inventory Data Adjustment for all Biogeoclimatic Zones Except the IDF Zone

The inventory adjustment consisted of apportioning the total area of mature and older forests in the forest inventory data base into mature forests and old forests and thereby creating a revised estimate of both mature forests and old forests. The combined proportion of mature forests and old forests remained unchanged from that in the inventory data. This apportionment was based on the well accepted mathematical (negative exponential) model used by the Biodiversity Guidebook as well as by several landscape ecology studies to estimate the age profile of forests on a natural landscape. The model is described in Appendix 4 of the Biodiversity Guidebook. In practice, the inventory correction factor for old forests was calculated by dividing the estimated proportion of old forests in Appendix 4 of the Guidebook by the estimated proportion of mature plus old forests. Details of the procedure used to calculate the adjustment for old forests are provided in Appendix 5. This model is not considered valid by the Biodiversity Committee for the Douglas-fir forests of the IDF biogeoclimatic zone and it was not applied there.

Inventory Data Adjustment For Forests of the IDF Zone

Background

The Interior Douglas-Fir (IDF) Biogeoclimatic Zone has unique ecological characteristics and disturbance regimes that significantly affect the application of seral stage targets. As a result, inventory data adjustments have been applied which differ from those in other biogeoclimatic zones.

Natural forests of the IDF consist primarily of two major forest types, Douglas-fir forests and lodgepole pine forests. Other types are much less common. Douglas-fir is the theoretical climax tree species of the IDF Zone and natural succession typically leads from lodgepole pine to

Douglas-fir dominated stands. However, at higher elevations of the IDF and in areas transitional to the SBPS Zone, many lodgepole pine stands are long-persisting seral stages or climax forests. These are most common on extensive frost-prone sites and on coarse textured soils. The length of time following stand destroying disturbances to develop old forest attributes in these pine stands is generally less than is required for the Douglas-fir climax stands and is similar to that in the SBS or SBPS. That is, the lower age limit of old pine forest is better estimated as 140 years than 250 years.

The relative proportion of lodgepole pine and Douglas-fir forests on the IDF landscape varies considerably. Climatically cold areas, such as higher elevations and areas near the SBPS boundary, are often dominated by lodgepole pine forests. In this climate, mature Douglas-fir stands occur primarily on sites freely drained of cold air. Although Douglas-fir regeneration is typically present in the pine stands, rates of Douglas-fir establishment are very slow. Climatically warmer areas, such as east of the Fraser River at low and middle elevations, are typically dominated by Douglas-fir forests. Lodgepole pine forests are also common here but are much more frequently seral stages leading to Douglas-fir dominance.

Natural disturbance regimes in the Douglas-fir forests are primarily stand-maintaining disturbances, consistent with the Biodiversity Guidebook concept of NDT4. Historically, fires in this type only infrequently destroyed stands and more often resulted in understory thinning and mortality of isolated canopy trees. As trees and stands aged, they became more resistant to fire and less likely to experience stand-destroying events. Insect attacks resulted in mortality of isolated trees, generally the older, larger dominant stems.

The natural disturbance regime in the lodgepole type is in strong contrast to that of the Douglas-fir type and is more consistent with that of NDT3. Stand destroying fires occurred relatively frequently while stand maintaining fires were much less common than in the Douglas-fir type. In contrast to Douglas-fir, as the pine trees and pine stands aged, their susceptibility to stand destroying events remained constant or increased. Insect attacks commonly resulted in extensive mortality of codominant stems. A single fire event, burning through both a Douglas-fir stand and a lodgepole pine stand could have very different results, in one case maintaining a typical stand structure and in the other case destroying the stand.

Forest inventory methodology adds an additional distinction between lodgepole pine stands and Douglas-fir stands. Since the pine stands are generally even-aged, the age class of pine stands is derived from relatively straight-forward aging methods. However, old Douglas-fir stands in this zone have a complex age structure that is not well reflected by the single age recorded in the forest inventory data base. The natural disturbance regime in Douglas-fir stands generally produces stands with trees ranging in age from those dating back to the origin of the stand, to those that have originated since the most recent surface fire, often less than 25 years. The forest inventory system does not determine stand age as time since initiation of the stand but rather as the age class containing the greatest volume. The biodiversity guidebook, on the other hand, assumes that stand age is the time that has occurred since stand initiation and sets targets based on the length of time from initiation that is required to achieve desired seral stage attributes. As a result, the inventory age of old Douglas-fir stands will usually be an under-estimate of the time since stand establishment used for determining the seral stage targets in the Guidebook.

The Biodiversity Guidebook states that stand attribute-based definitions of seral stage could be developed for the IDF Zone but that in the absence of these definitions, inventory age will be used. Attribute-based definitions will be required to fully implement a biodiversity strategy.

Inventory Adjustment Procedures for the IDF Zone

The IDF landscape was separated into two major forest types for purposes of seral condition analysis. The first type, the Douglas-fir group, includes all Douglas-fir leading stands as well as all lodgepole pine stands which contain a major Douglas-fir component (PlFd stands). The second type, the lodgepole pine group, includes all other stands including other lodgepole pine leading stands, spruce stands, and deciduous stands.

An adjustment was applied to the inventory data to provide a revised estimate of the percent of old stands on the IDF natural landscape. For the lodgepole pine forest group, this adjustment was calculated in the same manner as that used in all other biogeoclimatic zones except that the adjustment was based on the SBS Zone estimates in Appendix 4 of the Guidebook rather than on the IDF Zone estimates. The Biodiversity Strategy Committee believes that the Guidebook descriptions of the SBS Zone most appropriately match the disturbance cycle of lodgepole pine forests in the IDF. That is, the adjustment is based on the estimated proportion of stands >140 years rather than >250 years.

This approach was not used for Douglas-fir stands in the IDF since it assumes that the probability of stand destroying disturbances is constant over the range of stand ages. For Douglas-fir stands in the IDF this is not a valid assumption since Douglas-fir trees and stands become more resistant to fires as they age. The approach used to adjust the proportion of old Douglas-fir forests in the inventory data used a more general landscape ecology model which allows for changing susceptibility to disturbance with stand age. The methods for deriving the old forest adjustment for Douglas-fir stands is described in Appendix 5.

The old forest adjustment factors are presented in Table 5. Except for Douglas-fir stands in the IDF, the values in the table are the proportion of mature plus old forests that are estimated to be old forests. For Douglas-fir stands in the IDF, the values in the table are the percent of forests older than 140 years (age class 8 plus 9) that are estimated to be older than 250 years (age class 9). The values for Douglas-fir stands may also be interpreted as the percent of forests older than 140 years that would, in the natural landscape, be expected to meet an attribute-based definition of old forest.

Table 5. Factors used to adjust the area of old forests as a percentage of the area of mature plus old forests*.

NDT	BGC Zone	Conversion	NDT	BGC Zone	Conversion
1	ESSF	.69	3	ESSF	.87
1	ICH	.55	3	MS	.76
1	MH	.69	3	SBPS	.68
1	CWH	.43	3	SBS	.73
2	ESSF	.53	3	ICH	.76
2	ICH	.48	4	IDF - Fd and PlFd stands*	.74
2	SBS	.48	4	IDF - other stands	.73

*The conversion to estimate 250+ year old Douglas-fir stands and lodgepole pine stands with a major Douglas-fir component in the IDF is a percentage of 140 + year old stands rather than mature plus old (100+ year old) stands.

When the adjustments were applied to the forest inventory data, the ability of landscape units to meet biodiversity guidelines changed substantially (Figure 9). Before the adjustment, approximately 50% of the landscape units as-a-whole failed to meet even lower biodiversity emphasis guidelines. After adjusting the percent old data, no landscape units as-a-whole failed to meet lower biodiversity emphasis. However, many biogeoclimatic units within landscape units still failed to meet lower biodiversity emphasis guidelines.

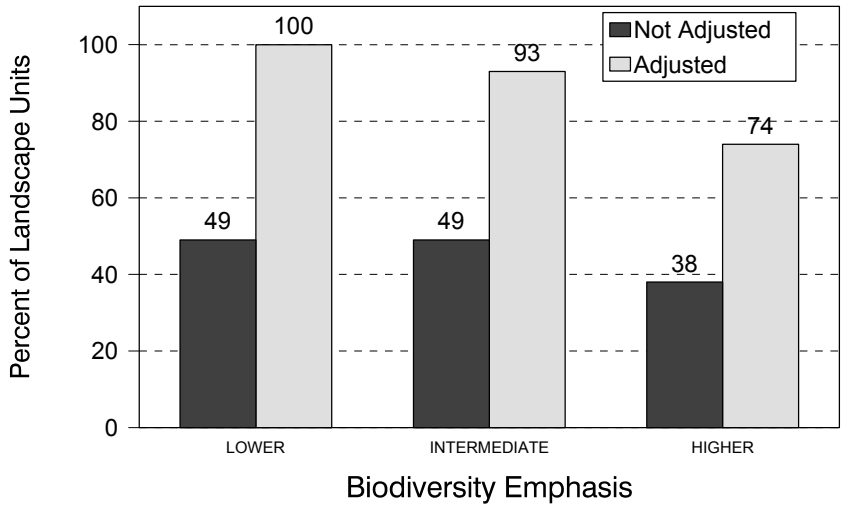

Figure 9. Percent of Landscape Units As-A-Whole Meeting Lower, Intermediate and Higher Emphasis with Nonadjusted and Adjusted Percent Old Forest.

Inventory Adjustment on 2016 Projected Database

The inventory correction factor was applied, as described above, to the 2016 projected data base. Although the old forest inventory correction factor was intended for use only on the unharvested portion of the land base, it had to be applied to age class 9 (251+ years) Douglas-fir blocks on mule deer winter ranges receiving 20% low volume selection harvest in order to complete the 2016 analysis. The rules provided to the STTAA by the biodiversity committee stated that 20% harvest on inventory age class 9 stands would result in a change in age to class 8 (140 - 250 years). Subsequent application of the adjustment factor results in 74% of the combined area being put back into the age class 9. Therefore, the 2016 data over-estimates the old seral stage in the IDF portion of landscape units in which 20% partial cuts were proposed on age class 9 Douglas-fir stands. Due to the relatively small area of age class 9 IDF stands, the overall effect of this mis-adjustment is relatively small. All other partial cutting prescriptions included in this analysis will drop the age into a class which will not be affected by the inventory adjustment.

Seral Stage Definitions and Targets

- Biodiversity Guidebook ages were used to define seral stages in all forests except IDF Zone forests dominated by lodgepole pine, spruce, and aspen; Biodiversity Guidebook definitions for SBS Zone seral stages were applied to these forests.
- Biodiversity Guidebook seral stage guidelines were applied to all forests except the Douglas-fir forest group (Fd and PlFd stands) in IDF Zone; targets for these forests are derived from Cariboo-Chilcotin regional data.

Seral Stage Definitions

Seral stage definitions used in the analyses are those in the Biodiversity Guidebook with the exception of those used for the lodgepole pine forest group in the IDF Zone. Definitions for SBS Zone were used for these forests. That is, old pine forests in the IDF are defined as greater than 140 years rather than greater than 250 years as described for the IDF Zone. Due to frequent stand destroying disturbances, very few lodgepole pine stands in IDF natural landscapes are older than 250 years. Stands greater than 140 years, with only a minor or no Douglas-fir component are relatively common, especially in the colder parts of the IDF where many lodgepole pine stands are climax or only very slowly successional to Douglas-fir dominance. For Douglas-fir stands in the IDF, seral stage definitions in the Biodiversity Guidebook (>250 years for old; >100 years for mature) have been used.

Seral Stage Guidelines

Seral stage guidelines (proportion of early, mature plus old, and old forests) in the Biodiversity Guidebook were evaluated for their applicability to the Cariboo-Chilcotin Region prior to conducting the seral condition analysis. This evaluation included calculation of regionally based seral stage guidelines for most biogeoclimatic zones and comparison of these guidelines to those in the Biodiversity Guidebook.

The Biodiversity Guidebook guidelines are based on estimates of the "natural" proportion of each seral stage on the pre-industrial landscape and on the percent of the biogeoclimatic zone area contained within protected areas. In order to evaluate these seral stage guidelines, the proportions of each seral stage on unlogged landscapes in the Cariboo-Chilcotin Region were calculated. Only landscapes with little or no commercial logging were used for these calculations. Due to extensive logging, regional estimates of seral stage proportions could not be calculated for some biogeoclimatic zones (ICH and SBS in NDT 2, ICH in NDT 3) and are based on only a small number of landscape units in the ICH in NDT 1. Methods for calculating the regional estimates of the areas of each seral stage on natural landscape and the resulting regionally based seral stage guidelines are described in Appendix 5.

Appendix 5 compares seral stage guidelines contained in the Biodiversity Guidebook with those based on regional estimates of natural seral stage proportions. In general, the guidelines derived from Cariboo-Chilcotin data are similar to those in the Biodiversity Guidebook. However, regional guidelines for minimum proportions of old and of mature plus old forests tend to be somewhat higher than those in the Guidebook while regional guidelines for maximum proportions of early seral forests tend to be lower than those in the Guidebook. That is, guidelines derived from Cariboo-Chilcotin inventory data would generally be more restrictive to development than those in the Biodiversity Guidebook.

Old forest guidelines in the Biodiversity Guidebook are also based on the proportion of each biogeoclimatic zone included in parks and other protected areas. The Biodiversity Guidebook subtracts 12% from the estimated proportion of old forests on the natural landscape before a percentage of this proportion is used to calculate the old forest guidelines. This is based on the assumption by the Guidebook that 12% of each biogeoclimatic zone is included within a park or other protected area. However, the Guidebook also allows the option of using actual percent in

protected areas when known. In the Cariboo-Chilcotin Region, the actual percent of biogeoclimatic zones in protected areas ranges from 0% to over 40%, as described in Section 3. In order to evaluate the implications of using actual percent protected area, old forest guidelines were recalculated using actual percent protected area data for the Cariboo-Chilcotin Land Use Plan area.

Table 6 compares old forest guidelines using an assumed 12% protected area versus using the actual percent protected. Using actual percent protected would significantly lower old forest guidelines in some biogeoclimatic zones (especially ESSF and ICH of NDT 1 and ESSF of NDT 2) and raise old forest guidelines in other zones (especially SBS, SBPS, and ICH of NDT3 and IDF of NDT 4).. Lower guidelines would be primarily for mountainous areas of NDT 1 and NDT 2 while higher guidelines would be primarily for the plateau landscapes of NDT 3 and NDT 4. Overall old forest guidelines would be decreased in 20% of the Region, largely unaffected in 14% of the Region and increased in 66% of the Region where seral stage guidelines apply (Alpine Tundra and Bunchgrass zones not included).

Seral stage definitions and guidelines used in the analyses are provided in Table 7. These guidelines are based on the Biodiversity Guidebook estimates of the proportion of seral stages on the "natural" landscape and on the assumption that 12% of each biogeoclimatic zone is included within a protected area. Biodiversity Guidebook estimates of the natural landscape were used for all biogeoclimatic zones, except the IDF, because regional estimates are generally similar to those in the Guidebook, they could not be calculated for some zones, and they are based on only limited data in other biogeoclimatic zones. For the IDF Zone, the regionally estimated proportions are used.

The assumption of 12% protected area for each biogeoclimatic zone was adopted in order to maintain greater consistency with the intent of the Cariboo-Chilcotin Land Use Plan and to avoid the large decreases and large increases of old forest guidelines associated with using actual values. Biogeoclimatic zones with greater than 12% protection (guidelines would be lowered if actual percent protected is used) are predominantly in the Special Resource Development Zone while zones with less than 12% protection (guidelines would be increased if actual percent protection is used) are predominantly in the Enhanced and the Integrated Resource Development Zones. Lower guidelines(<5% old forest for low and intermediate emphasis) would be applied to the ICH in NDT 1, the ESSF in NDT 2, and the IDF in the Coast Mountains and would provide minimal seral stage representation on landscapes outside of protected areas.

Table 6.. Comparison of old forest guidelines using 12% and actual percent protected area.

		Lower/Intermediate Emphasis		Higher Emphasis	
NDT	BGC	12%	Actual	12%	Actual
1	ESSF	19	13	28	20
1	ICH	13	4	19	5
2	ESSF	9	3*	13	3*
2	ICH	9	13	13	19
2	SBS	9	6	13	8
2	CWH	9	3*	13	3*
3	ESSF	14	9	21	13
3	MS	14	15	21	22
3	SBPS	7	11	10	17
3	SBS	11	17	16	25
3	ICH	14	19	21	29
4	IDF - Fd	21	26	32	38
4	IDF - Pl	9	14	14	23
4	IDFmw/u	13	3*	19	3*

* Guidelines are set at a minimum of 3% when the calculated guideline, using actual percent protected area, is less than zero.

Table 7. Seral stage definitions and targets used for seral condition analyses in the Cariboo- Chilcotin Region

NDT	BEC	Seral Stage Age Definition			Lower Emphasis Guidelines			Intermediate Emphasis Guidelines			Higher Emphasis Guidelines		
	Zone	Early	Mature	Old	Early max.	Mature + Old min.	Old min.	Early max.	Mature + Old min.	Old min.	Early max.	Mature + Old min.	Old min.
1	ESSF	<40	>120	>250	n/a	19	19	22	36	19	17	54	28
1	ICH	<40	>100	>250	n/a	17	13	30	34	13	23	51	19
1	MH	<40	>120	>250	n/a	19	19	22	36	19	17	54	28
2	CWH	<40	>80	>250	n/a	17	9	36	34	9	27	51	13
2	ESSF	<40	>120	>250	n/a	14	9	36	28	9	27	42	13
2	ICH	<40	>100	>250	n/a	15	9	36	31	9	27	46	13
2	SBS	<40	>100	>250	n/a	15	9	36	31	9	27	46	13
3	ESSF	<40	>120	>140	n/a	14	14	46	23	14	35	34	21
3	MS	<40	>100	>140	n/a	14	14	46	26	14	35	39	21
3	SBPS	<40	>100	>140	n/a	8	7	66	17	7	50	25	10
3	SBS	<40	>100	>140	n/a	11	11	54	23	11	40	34	16
3	ICH	<40	>100	>140	n/a	14	14	46	23	14	35	34	21
4	IDF - Fd Group	<40	>100	>250	n/a	22	21	12	43	21	9	65	32
4	IDF - Pl Group	<40	>100	>140	n/a	11	11	54	23	11	40	34	16

Biogeoclimatic Zones With Large Differences Between Regionally Estimated and Guidebook Guidelines

Some of the larger differences between the Guidebook and the Regionally estimated guidelines require explanation. First, the Regionally estimated old seral stage guidelines for the ICH are approximately 200% of those in the Guidebook. However, the Regionally estimated guidelines are derived from landscape units in the eastern, wettest portion of the ICH. These landscape units include Niagara, Penfold, East Arm, Eastside, and Westside. Calculated disturbance cycles for these landscape units ranged from 317 to nearly 1400 (Niagara) years. These landscape units are not considered to be representative of the ICH as a whole, but rather the wetter portions of the ICH. No landscape units from the eastern, drier portions of the ICH were sufficiently undisturbed that they could be used in the analysis. Therefore the Guidebook guidelines have been used as the best overall representation for the ICH Zone.

Secondly, old seral stage guidelines for the SBPS are 200% or more of the Guidebook guidelines. It is evident from the Regional data that the SBPS does not have a uniform disturbance cycle or fire return interval. Portions of the SBPS on the edges of the mountains appear to have a significantly longer disturbance cycle (190 year mean) than those well within the interior plateau (90 year mean). On the edges of the mountains, the continuity of SBPS forests is often interrupted by higher elevations (MS and ESSF zones) and by abundant wetland complexes. These may act as landscape level fire breaks, resulting in an increased fire return interval. In addition, insect attacks may be less severe and less extensive at these slightly higher elevations. Regionally estimated guidelines for these areas are significantly higher than those in

the Guidebook (18% vs 7% for low and intermediate emphasis; 27% vs 10% for higher biodiversity emphasis). Landscape units that are well within the interior plateau have a disturbance cycle slightly shorter than that in the Biodiversity Guidebook and as a result the Regionally estimated guidelines for old are slightly less than those in the Guidebook (5% vs 7% for low and intermediate emphasis; 7% vs 10% for higher emphasis). Since the Regionally estimated guidelines are both higher and lower than the Guidebook guidelines, the Guidebook guidelines have been used in the seral condition analyses.

Finally, there is a difference between the Regionally estimated guidelines and the Guidebook guidelines for the IDF when the Regional guidelines are derived separately for lodgepole pine stands and Douglas-fir stands as shown in Table 8. That is, guidelines for lodgepole pine stands are less restrictive to forest development than those of the Guidebook while guidelines for Douglas-fir stands are as or more restrictive to forest development than those of the Guidebook. Overall, the adjustments produce an end result similar to the Guidebook but more sensitive to the unique ecology of the IDF landscape. It must be remembered when comparing these guidelines that old lodgepole pine stands are defined as >250 years for the Guidebook guidelines and >140 years for the revised guidelines.

Table 8. Comparison of seral stage guidelines for the Cariboo-Chilcotin IDF Biogeoclimatic Zone

	Lower Emphasis		Intermediate Emphasis			Higher Emphasis		
	Mature + Old	Old	Early	Mature + Old	Old	Early	Mature + Old	Old
Biodiversity Guidebook Guidelines	>17	>13	<30	>34	>13	<23	>51	>19
Revised Guidelines for Lodgepole Pine Stands[1]	>11	>11	<54	>23	>11	<40	>34	>16
Revised Guidelines for Douglas-fir Stands	>22	>21	<12	>43	>21	<9	>65	>32

[1] Old lodgepole pine stands are defined as >250 years by the Guidebook but >140 years for the revised Guidelines.

Seral Condition Analyses

- all forest types (leading species) are combined for seral stage assessment except in IDF Zone where Douglas-fir and lodgepole pine forest groups were assessed separately;
- basic units of assessment are biogeoclimatic zones within landscape units; assessment for landscape unit as-a-whole are based on prorated biogeoclimatic zone assessments
- analyses of ability to meet seral stage guidelines were completed for landscape units as-a-whole and for each biogeoclimatic unit within the landscape unit
- only biogeoclimatic zones larger than 5,000 ha within landscape units were required to meet seral stage targets unless the biogeoclimatic zone is a valley bottom unit (valley bottom units >1,000 ha were required to meet seral stage guidelines)
- for landscape units extending into long established Parks, forest cover information was available only for that portion of the landscape unit outside the park.

Units for Assessment of Seral Condition

In all biogeoclimatic zones except the IDF, no distinction was made between leading tree species or forest types for purposes of the seral condition assessment. Only the inventory age of the forest, as adjusted, was assessed. In the IDF Zone, seral condition was assessed separately for the Douglas-fir forest group (Douglas-fir leading stands and lodgepole pine leading stands with a major Douglas-fir component) and the lodgepole pine forest group (all other stands).

The area of each seral stage as a proportion of the total productive forest land base was calculated for each biogeoclimatic zone/NDT combination within each landscape unit. For the IDF Zone, the area of each seral stage in the two forest groups was summed to derive proportions for the zone as a whole.

The proportions of each seral stage within biogeoclimatic units were prorated to derive the proportions of each seral stage for the landscape unit as-a-whole. All biogeoclimatic zones, regardless of size, were included in the prorated total for the landscape unit.

Analysis of Ability to Meet Seral Stage Targets

Landscape Units As-A-Whole

Each landscape unit was analyzed for the maximum biodiversity emphasis it could achieve overall by comparing the current and projected 20 year data to seral stage guidelines for each biodiversity emphasis. Seral stage guidelines for each biogeoclimatic unit were prorated to derive the seral stage guidelines for the landscape unit as-a-whole. That is, the guideline percentages for each biogeoclimatic subunit were rolled up into guideline percentages for the landscape units as-a-whole by prorating each subunit percentage by the area of the subunit. The maximum emphasis achieved was considered to be no greater than the maximum emphasis achieved by all seral stages. For example, if a landscape unit met lower, higher, and higher biodiversity emphasis for early, mature plus old, and old seral stages, the maximum emphasis achieved was lower.

Landscape units which meet prorated seral stage distribution guidelines as-a-whole are not considered to meet biodiversity seral stage guidelines if any biogeoclimatic subunit larger than 5,000 ha (or between 1,000 and 5,000 ha if a valley bottom subunit) within the landscape unit fails to meet seral stage distribution guidelines. However, landscape units have been assessed as-a-whole in terms of how well they meet prorated guidelines in order to identify those units where further harvesting within any portion (any biogeoclimatic subunit) of the landscape unit will further compromise biodiversity objectives. In contrast, additional harvesting may not further compromise biodiversity objectives in those landscape units which meet guidelines as-a-whole, even though one or more biogeoclimatic subunits fail to meet guidelines, as long as harvesting occurs in the appropriate biogeoclimatic units.

Biogeoclimatic Subunits Of Landscape Units

Biogeoclimatic subunits comprising less than 5,000 ha of a landscape unit were not required to meet seral stage guidelines unless they are a valley bottom unit. The Forest Practices Code Guidebook for Higher Level Plans and Standards identifies 5,000 ha as a minimum landscape unit size to which biodiversity objectives and guidelines should be applied. Portions of landscape units smaller than this are too small to adequately represent the full range of seral stages that occur across a landscape. However, these small biogeoclimatic zones are still included in the prorated seral condition analysis for the landscape unit as a whole and managers should still strive to maintain a range of seral stages in these biogeoclimatic units.

Valley bottom biogeoclimatic units are those which occur on the valley floor and no more than the lower third of the adjacent valley slopes. They have been given special consideration in this assessment due to their importance for many terrestrial and aquatic wildlife species. They have high primary production, restricted extent, are principal migration corridors, and typically contain large streams. They occur primarily in mountainous terrain but are also present in some hilly or rolling terrain on the plateau (Table 9). Only valley bottom units larger than 1000 ha were required to meet seral stage guidelines.

Table 9. Biogeoclimatic Subunits Between 1,000 and 5,000 ha Considered to be Valley Bottom Subunits.

Landscape Unit	Valley Bottom Subunits NDT - BEC Zone (BEC Subzone) - area
Black Creek	NDT 1 - ICH (ICHwk) - 3309 ha NDT 2 - ICH (ICHmk3) - 3319 ha
Cariboo Lake	NDT 1 - ICH (ICHwk) - 3443 ha
Clearwater	NDT 4 - IDF (IDFu) - 3022 ha
Colwell	NDT 3 - MS (Msu) - 2967 ha
Crazy Creek	NDT 2 - CWH (CWHds) - 1288 ha
Deception Mountain	NDT 2 - ICH (ICHmk) - 2458 ha
Franklyn	NDT 4 - IDF (IDFu) - 1520 ha
Hickson	NDT 2 - CWH (CWHds) - 2860
Jack of Clubs	NDT 2 - SBS (SBSwk) - 2508 ha
Lord River	NDT 2 - ESSF (ESSFxv) - 2642 ha
McKay	NDT 1 - ICH (ICHwk) - 1549 ha
Middle Lake	NDT 4 - IDF (IDFu) - 4945 ha
Nostetuko	NDT 4 - IDF (IDFu) - 4014 ha
Nude Creek	NDT 4 - IDF (IDFu) - 3039 ha
Rainbow	NDT 4 - IDF (IDFu) - 3285 ha
Taseko	NDT 3 - MS (Msu) - 2323 ha
Tete Angela	NDT 4 - IDF (IDFdk) - 4537 ha

Some adjacent landscape units have portions of the same biogeoclimatic zone that are individually smaller than 5,000 ha but in total are larger than 5,000 ha. In this situation, the seral stage targets should be met over the combined area of the biogeoclimatic unit across the landscape units. Figure 10 shows where seral stage targets apply over a wide range of situations.

Each biogeoclimatic subunit over 5,000 ha within the landscape unit was analyzed for the maximum biodiversity emphasis it could achieve using the current and 20 year data. Similar to the analysis for the landscape unit as a whole, the maximum emphasis achieved was considered to be no greater than the maximum emphasis achieved by all seral stages.

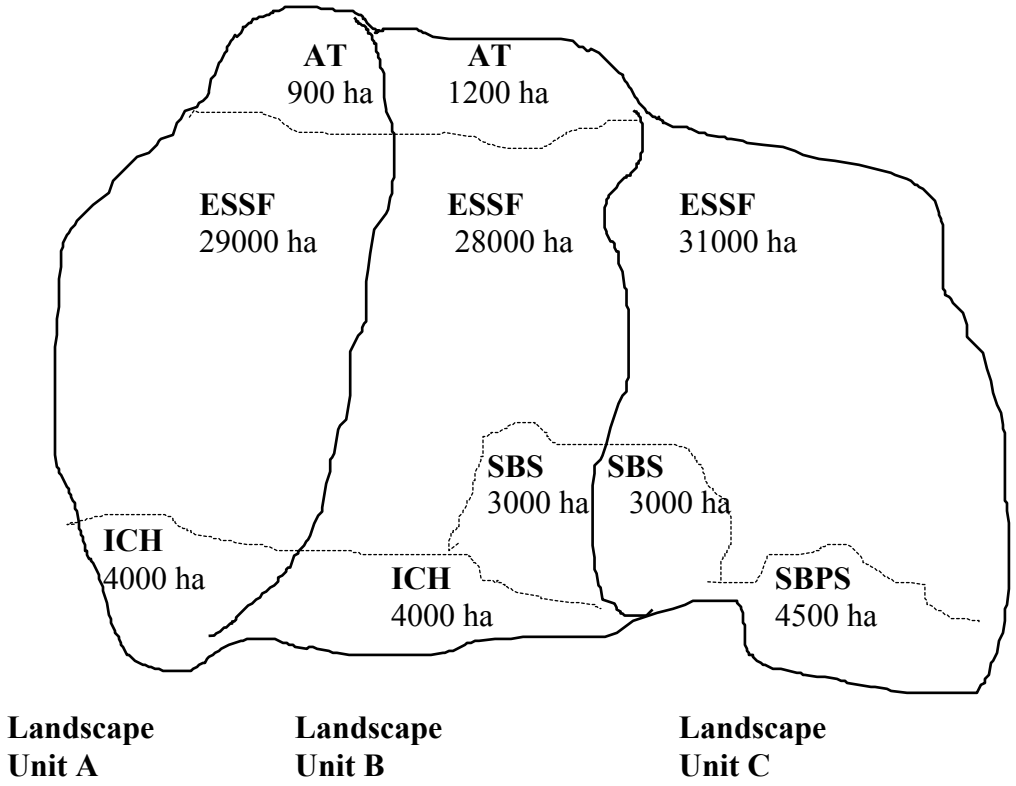

Figure 10. Examples of where seral stage targets apply.

Seral stage targets must be met for the following areas:

1. L.U. A total (excluding AT since it is not part of the forest landbase)
2. L.U. A ESSF (since >5000 ha)
3. L.U. A ICH (assuming this is the predominant valley bottom BEC unit)
4. L.U. B total (excluding AT since it is not part of the forest landbase)
5. L.U. B ESSF (since > 5000 ha.)
6. L.U. B ICH (assuming this is the predominant valley bottom BEC unit)
7. L.U. B SBS + L.U. C SBS (*recommended* since they total >5000 ha)
8. L.U. C total
9. L.U. C ESSF (since >5000 ha.)

Seral stage targets must not necessarily be met for the following areas:

1. L.U. B SBS (since < 5000 ha)
2. L.U. C SBS (since < 5000 ha)
3. L.U. C SBPS (since < 5000 ha)

Analyses of IDF seral condition is a special case due to the separate guidelines for the two forest groups. A combined analysis for the zone is desirable since the two forest groups are often intimately associated both in space and time on the landscape. They are both part of a larger ecological system. The maximum biodiversity emphasis achieved for the IDF Zone as-a-whole was determined as follows:

a) To meet combined IDF guideline for **old** seral stage of given biodiversity emphasis:

i)Total area of Fd group >250 years must = old target for Fd group x total area Fd group

AND

ii)Total area Pl group >140 years PLUS excess area of old Fd group above old guideline for Fd group must = old guideline for Pl group x total area Pl group

b) To meet combined IDF guideline for **mature+old** seral stage of given biodiversity emphasis:

i) Total area Fd group >100 years must = mature+old target for Fd group x total area Fd group >100 years

AND

ii) total area Pl group >100 years PLUS excess area of mature plus old Fd group above mature+old guideline for Fd group must = mature+old guideline for Pl group x total area Pl group

c) To meet combined IDF target for **early** seral stage of given biodiversity emphasis:

i) Total area Fd group <41 years PLUS total area Pl group < 41 years must be less than early seral stage guideline for Fd group x total area Fd group PLUS early guideline for Pl group x total area Pl group (i.e. do not distinguish stand type groups for early seral stage guidelines

Further rationale for these criteria are provided in Appendix 5.

Analysis of Overall Landscape Unit and Biogeoclimatic Zone Seral Condition

The seral condition of each landscape unit was then described in terms of the maximum biodiversity emphasis it could achieve overall and by noting any biogeoclimatic zones greater than 5,000 ha whose maximum biodiversity emphasis level was less than the maximum emphasis achieved for the landscape unit as-a-whole. For example a landscape unit which achieved an intermediate biodiversity emphasis but contained one biogeoclimatic unit which met only lower emphasis was described as intermediate/lower (IL).

The maximum biodiversity emphasis achieved within each seral stage by each biogeoclimatic zone and by the landscape unit as-a-whole was then evaluated in order to describe development options to maintain or restore seral condition objectives.

4.2.1 Rare Ecosystems

The Biodiversity Guidebook recommends that rare ecosystems be retained in old forest condition disproportionately greater than they occur on the landscape. That is, the proportion retained in old forest condition should be greater than the old forest guidelines for the biogeoclimatic zone. The Biodiversity Strategy Committee recommends that the proportion should be equal to at least the estimated proportion of old forest on the "natural" landscape.

Rare ecosystems are defined by the Guidebook as site series or surrogates of site series which occupy less than 2% of a landscape unit and are not common in adjacent landscape units. The rarity of an ecosystem should not be affected by the manner in which landscape unit boundaries are drawn. That is, to be considered rare, an ecosystem should be rare within the Region as a whole and should occupy less than 2% of the total area of a biogeoclimatic subzone within the Region.

Site series are appropriate units for assessing rarity since by definition they occur in only one biogeoclimatic subzone and their Regional rarity is unaffected by the abundance of similar site series in other biogeoclimatic subzones. For example, the rarity of the Sxw - Scrub birch - Fen moss site series within the Region is determined only by its abundance within the SBPSxc and is unaffected by the abundance of moist spruce forests with scrub birch in any other biogeoclimatic subzone.

If site series are not mapped, the Guidebook recommends that a combination of forest cover and site productivity or site index information should be used to determine rarity. In a manner similar to site series, rarity should be assessed only within the biogeoclimatic subzone (not variant) in which the forest type occurs. For example, the rarity of spruce stands with site index greater than 17 m within the SBPSxc should not be assessed relative to the abundance of spruce stands of similar site index in any other biogeoclimatic subzone.

Some examples of ecosystems considered to be regionally rare by the Biodiversity Strategy Committee are listed in the following table.

Ecosystem	Comments
MSxv/05 Pl - Trapper's tea - Crowberry Site Series	Occurs locally on mesic to moist north-facing slopes in the MSxv, especially in the Kloakut-Gaspard area.
SBPSxc/03 Sxw - Scrub birch - Fen moss Site Series	Occurs locally in the SBPSxc at the margins of wetlands and in other moist areas where cold air accumulates.
ICHwk2/06 Sxw - Twinberry - Oak fern Site Series	Occurs locally on moist valley bottom sites where cold air accumulates.
SBSdw2/09 Sxw - Devil's club - Knight's plume Site Series	Occur locally on moist, rich sites on north-facing lower slopes in the SBSdw2
ICHwk4/03 CwSxw - Soopollalie Site Series	Occur on dry, thin soils underlain by calcareous bedrock at the crest of slopes
Cottonwood forests adjacent to streams in the SBSmw	Occur as small localized stands adjacent to medium and larger streams
Aspen forests on dry upland sites in the SBPSxc	Occur as isolated patches with poor or low productivity within coniferous forest matrix
Spruce forests on mid and upper slope seepage areas in the SBPSxc	Occur as isolated stands on moist, rich sites with near-surface seepage waters on slopes in the SBPSxc

A list of rare ecosystems of British Columbia has been prepared as an appendix to the Forest Practices Code Guidebook for Managing Identified Wildlife Species. This list includes about 70 BEC site series that are present in the Cariboo Forest Region. It is currently being reviewed by the Biodiversity Strategy Committee and Cariboo Forest Region Research Section staff.

4.3 Results and Management Recommendations

The following section is broken into three distinct parts:

- a regional overview of the results of the seral stage assessments,
- summaries by forest district of those landscape units not meeting guidelines, at the current time and year 20, given the STTAA projection of harvest and growth,
- recommended management strategies to meet seral stage guidelines in landscape units of concern, by forest district.

4.3.1 Regional Overview

Regional Results - Seral Stage Analysis

Current Seral Stage Condition:

- In 1996, 83% of the landscape units fully meet seral stage guidelines for their recommended biodiversity emphasis;
- Inability of BGC units to meet guidelines was highest for NDT4-IDF, followed by NDT1-ESSF, NDT1-ICH and NDT2-ICH;
- Of the BGC units not meeting guidelines, problems were most often associated with mature + old (53%) and early (46%) seral stages; 23% of the problems related to old forest;
- Five landscape units, all in the Chilcotin Forest District, meet guidelines but only because they have a large proportion (>15%) of mature + old pine forest that is considered problem forest type (stocking class 4).
- **Projected 20 Year Seral Stage Condition:**
- Using the projection done by the STTAA, 85% of the landscape units meet seral stage guidelines for their recommended emphasis in 2016;
- Inability to meet seral stage targets is still most prevalent in NDT4-IDF and NDT1-ESSF;
- For mature + old no overall regional trend is apparent, but Quesnel, Williams Lake and Horsefly forest districts show declines whereas 100 Mile House and Chilcotin districts show increases; old forest increases very slightly and early forest declines;
- Without directed harvesting or silvicultural treatment, problem pine (stocking class 4) stands will increasingly contribute to meeting the maure + old requiremnts in the Williams Lake TSA.

A total of 161 landscape units are proposed and mapped in the Cariboo Forest Region, as described in Section 2. Three of these (Edmond, Franklyn, Betty Wendle) do not occur outside of parks within the Cariboo Forest Region and were not included in the Regional seral stage analyses. Of the remaining 158 landscape units, 15 have a recommended biodiversity emphasis of higher, 66 have a recommended biodiversity emphasis of intermediate and 77 have a recommended biodiversity emphasis of lower, as described in Section 3.

The following assessment is based on how well landscape units and biogeoclimatic units meet seral stage distribution guidelines for the biodiversity emphasis level recommended for each proposed landscape unit.

Because spatial aspects of biodiversity conservation are not addressed in this analysis, even landscape units meeting guideline levels may have issues associated with biodiversity when sub-regional planning is conducted.

Current (1996) Seral Condition

At the present time (1996), 83% of the landscape units fully meet seral stage distribution guidelines for their recommended biodiversity emphasis level (Figure 11). That is, they meet guidelines in all biogeoclimatic subunits larger than 5,000 ha and in valley bottom units between 1,000 and 5,000 ha. An additional 13% meet guidelines for the landscape unit as-a-whole but do not meet guidelines in one or more biogeoclimatic subunits. In these latter units, not meeting guidelines in one or more biogeoclimatic subunits is balanced by an area larger than guideline minimums in other biogeoclimatic subunits. Although these landscape units are not considered to meet their recommended emphasis level targets, they have been identified to distinguish them from landscape units which do not meet guidelines as-a-whole and where further development within any portion of the landscape unit will further compromise biodiversity guidelines. Only 3% (4) of the landscape units do not meet guidelines as-a-whole. The location of landscape units which meet and those which do not meet seral stage guidelines is shown on Figure 12.

The percent of landscape units currently meeting recommended seral stage distribution guidelines is greatest for those with a recommended lower biodiversity emphasis level and least for those with a recommended higher biodiversity emphasis level (Figure 13). However, landscape units with a higher biodiversity emphasis meet seral stage distribution guidelines for higher and intermediate biodiversity emphasis better than those with a recommended intermediate or lower biodiversity emphasis because current forest condition was considered when assigning biodiversity emphasis.

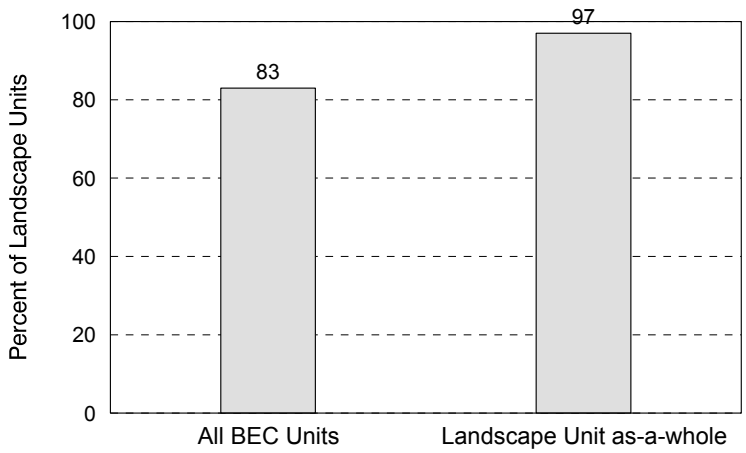

Figure 11. Percent of landscape units which currently (1996) meet seral stage distribution guidelines in all biogeoclimatic (BGC) subunits >5,000 ha (and in smaller valley bottom units) and in the landscape unit as-a-whole.

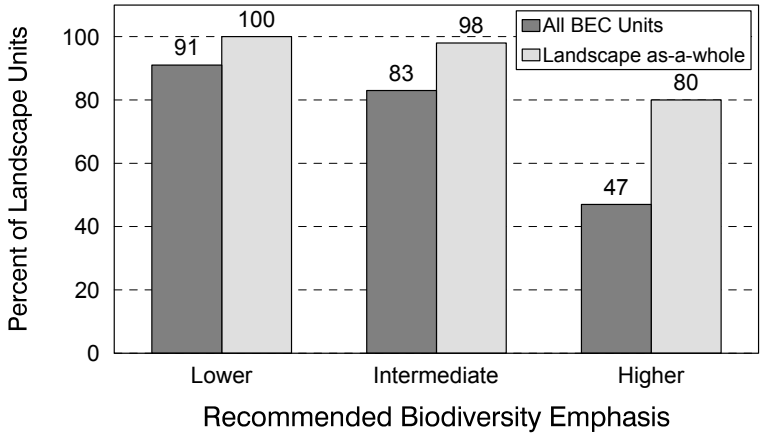

Figure 13. Percent of landscape units which currently meet their recommended seral stage distribution guidelines in all biogeoclimatic (BGC) subunits and in the landscape unit as-a-whole.

Current inability of landscape units to meet seral stage distribution guidelines is due most often to failure in NDT 4 - IDF subunits. A relatively large percentage of the failures were also in NDT 1 - ESSF subunits, NDT 1 - ICH subunits and NDT2 - ICH subunits. In only four cases (total of 12%) where seral stage distribution guidelines were not met, was it due to shortfalls in small (1,000 - 5,000 ha) valley bottom units. All are in the ICH, two in NDT 1 and two in NDT 2 (Figure 13).

insert Figure 12 here

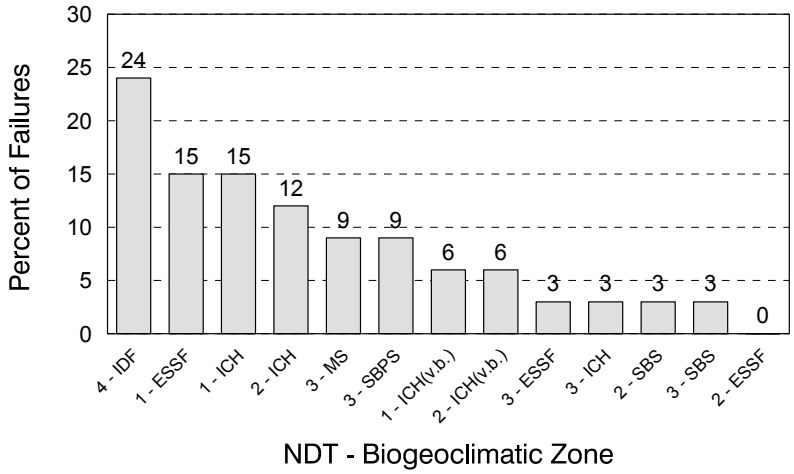

Figure 14. Percent of landscape unit seral stage failures resulting from failures in each NDT-biogeoclimatic zone unit. Only biogeoclimatic subunits larger than 5,000 ha within landscape units were included unless they are a distinct valley bottom "(v.b.)" subunit.

Although landscape units together with their included biogeoclimatic subunits are the principal unit of seral condition assessment, an assessment was also completed for the seral condition of each NDT - biogeoclimatic unit in the Region. This was done to identify any biogeoclimatic units with seral condition concerns which should be considered in setting landscape unit objectives. A biodiversity conservation strategy for the Region should ensure that all major ecosystems (NDT - biogeoclimatic units) are represented by the full range of seral stages, consistent with seral stage guidelines in the Biodiversity Guidebook.

A total of 91% (250/276) of all biogeoclimatic subunits larger than 5,000 ha within landscape units in the Region meet their recommended seral stage distribution guidelines. However, the ability to meet guidelines is not equal among the biogeoclimatic units. NDT-biogeoclimatic zone units which consistently (>95%) meet recommended seral stage distribution guidelines are NDT 2-ESSF, NDT 3-MS, NDT 3-SBPS, and NDT 3 - SBS (Figure 14). Biogeoclimatic units which meet recommended guidelines in 80 to 90% of their occurrences are NDT 2-SBS, NDT 1-ESSF, and NDT 4-IDF . Less than 80% of the occurrences of the ICH in NDT 1, NDT 2 and NDT 3 currently meet seral stage distribution guidelines. The ICH in NDT 2 meets seral stage distribution guidelines in only 40% of its occurrences and only in landscape units with an intermediate or lower biodiversity emphasis. The single occurrence of the ESSF larger than 5,000 ha in NDT 3 fails to meet recommended guidelines.

The largest proportion of the biogeoclimatic subunits that do not meet guidelines do not meet the early (46%) and mature plus old (53%) seral stage guidelines. Only 23% (6/26) do not meet guidelines in the old seral stage. Six biogeoclimatic subunits (23%) do not meet guidelines in more than one seral stage. Table 10 shows the number of occurrences by seral stage where guidelines were not met for each NDT-biogeoclimatic zone unit. This is represented graphically for selected biogeoclimatic units in Appendix 7.

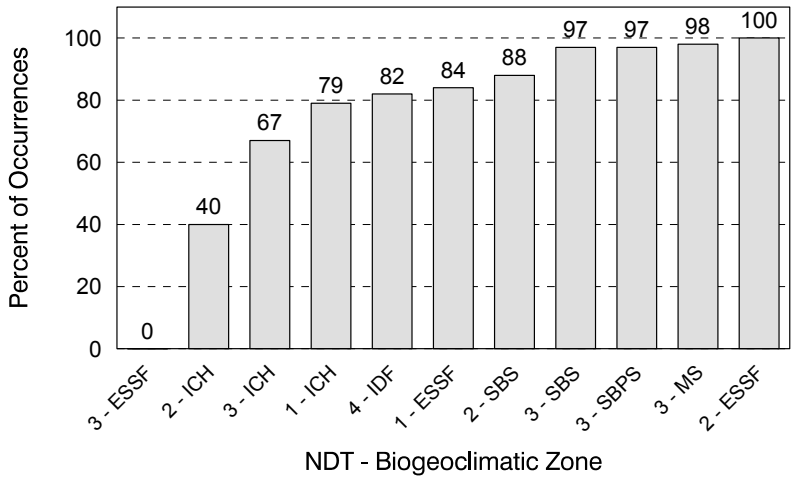

Figure 15. Percent of NDT-biogeoclimatic zone subunits that currently (1996) meet seral stage distribution guidelines of their recommended biodiversity emphasis level.

Table 10. Number of current occurrences where seral stage distribution guidelines are not met by seral stage in each NDT - biogeoclimatic zone. Only biogeoclimatic subunits larger than 5000 ha or that are identified valley bottom units are included. (The single occurrence of NDT 2 - CWH, which met seral stage guidelines, is not shown.)

	NDT - Biogeoclimatic Zone											
Seral Stage	3 ESSF	2 ICH	3 ICH	1 ICH	4 IDF	1 ESSF	2 SBS	3 SBS	3 SBPS	3 MS	2 ESSF	Total
Total	1/1	3/5	1/3	3/14	8/44	5/32	1/8	1/31	2/69	1/53	0/15	26/275
Early	0	3	0	2	3	3	1	0	0	0	0	12
Mature + Old	1	2	1	1	4	1	0	1	2	1	0	13
Old	1	0	1	0	3	1	0	0	0	0	0	6

Current biodiversity seral stage distribution recommendations are based on stand age without reference to other stand attributes. There can, however, be considerable variability in terms of biodiversity conservation value among stands of the same age class. A principal concern are lodgepole pine stands in which tree growth has stagnated at a very high density of small stems ("dog-hair" pine stands). Even though these stands may be sufficiently old to be included in the mature seral stage, they have relatively low biodiversity conservation values due to the absence of large trees and the strong dominance of the site by the forest canopy. Since these stands occur naturally on the unlogged landscape, a proportion, similar to that on the natural landscape, should be acceptable from a biodiversity conservation perspective in the managed landscape.

However, timber harvesting tends to increase the proportion of these stands by concentrating harvesting in those mature stands which have higher timber values. In order to conserve regional biodiversity, it is important to ensure that recommended mature and old seral stage proportions are met principally by stands with larger stems and less complete dominance of the site by the forest canopy.

Figure 16 shows the total area (ha) of mature plus old forests in excess of recommended minimums and the area (ha) remaining after excluding mature plus old forests in stocking class 4. Stocking class 4 is the best available estimate of the area of stands with dense, small diameter stems. It includes lodgepole pine leading stands in which fewer than 50% of the stems 7.5 cm dbh or larger are larger than 12.6 cm dbh. It also includes lodgepole pine stands with less than 311 stems/ha equal to or greater than 17.5 cm dbh.

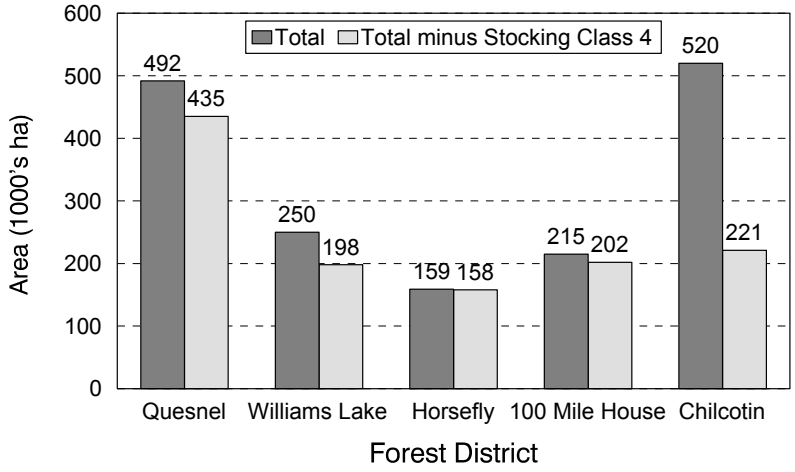

Figure 16. Total area (ha) of mature plus old seral stage in excess of recommended minimums and area with stocking class 4 mature plus old forest excluded. The difference between the two bars for each district is the total area of stocking class 4 stands.

The recommended minimum area of mature plus old seral stage forests can currently (1996) be met within each forest district as-a-whole by stands other than those in stocking class 4. However, five landscape units, all in the Chilcotin Forest District, currently cannot meet mature plus old minimum areas unless 15% or more of the total mature plus old requirement is stocking class 4 stands. These are identified below in the seral stage assessments for the Chilcotin Forest District.

Projected 20 Year (2016) Seral Condition

The projected area of each seral stage following 20 years of proposed timber harvesting was determined from a harvesting scenario developed by the Short Term Timber Availability Analysis (STTAA) Strategy and from projected tree growth/stand aging. The harvesting scenario is based on a projected harvest rate as shown in Table 11. This represents a drop from the current (1996) annual allowable harvest primarily due to assumed expiry of the mountain

pine beetle harvest in the western part of Williams Lake TSA. Projected areas of each seral stage were summarized by NDT-biogeoclimatic subunit within each proposed landscape unit. The potential effects of natural disturbances such as wildfire and insect damage were not included in the assessment. The approach used to assess the area data for seral condition at year 20 (2016) was the same as that used for the assessment of seral condition at the current year (1996). That is, the same inventory adjustments were applied. For purposes of actual monitoring or further analyses of seral stage distribution over time, this inventory adjustment should not be applied to any stand with any history of harvesting (see Section 4.4).

Table 11. STTAA Projected Harvest Volumes (m^3)

		Year		
TSA		1996	1997 - 2001	2002 - 2016
Quesnel		3,168,000	3,168,000	3,168,000
Williams Lake	Main	2,758,096	2,758,096	3,023,096
	Western Supply Blocks	1,200,000	350,000	350,000
100 Mile House		1,362,000	1,362,000	1,362,000
Subtotal		8,488,096	7,638,096	7,903,096
Number of Years		1	5	14
Total		8,488,096	38,190,480	110,643,344
Grand Total				157,321,920

All of the following analyses are based on the single 20 year harvesting scenario developed by the STTAA. Many other scenarios may be possible and may have different effects on seral stage distribution within individual landscape units and biogeoclimatic units.

The 20 year harvesting scenario has relatively little effect at year 20 on the percent of landscape units meeting recommended seral stage distribution guidelines (Figure 17). The actual landscape units and biogeoclimatic subunits meeting guidelines changes slightly but overall the percent of landscape units fully meeting guidelines is nearly unchanged. The percent of landscape units as-a-whole meeting guidelines decreases slightly (by 3 landscape units) over the 20 year period.

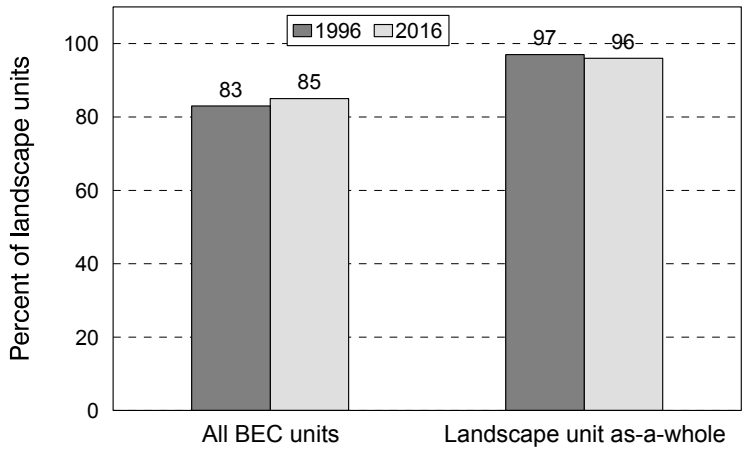

Figure 17. Percent of landscape units which currently (1996) and are projected at year 20 (2016) to meet seral stage distribution guidelines in all biogeoclimatic (BEC) subunits >5,000 ha (and in smaller valley bottom subunits) and in the landscape unit as-a-whole.

The current inability of landscape units to meet seral stage distribution guidelines in all BEC units at year 20 is most often due to failures in NDT 4-IDF and NDT1-ESSF (Figure 18). Compared to current (1996) year conditions (see Figure 14), the proportion of landscape units not meeting guidelines increased in the IDF Zone, ESSF Zone of NDT 1, and the SBS Zone of NDT 2. The largest proportional increases are in NDT 1 ESSF Zone and in NDT 2 SBS Zone. The number of landscape unit failures due to problems in the ICH Zone in NDT's 1, 2 and 3 and in the SBPS Zone decreased.

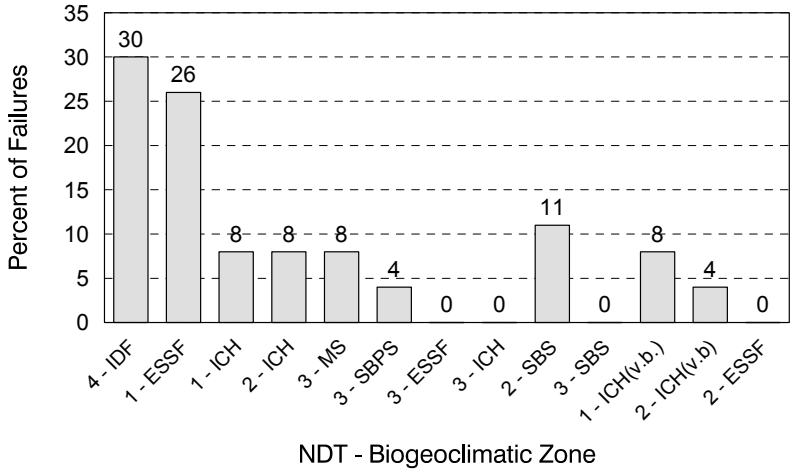

Figure 18. Percent of landscape units not fully meeting seral stage distribution guidelines at year 20 (2016) resulting from problems in each NDT - Biogeoclimatic zone unit. Only biogeoclimatic subunits larger than 5,000 ha within landscape units are included unless they are a distinct valley bottom ("v.b.") subunit.

As was done for the current (1996) seral condition assessment, an assessment was also completed on the seral condition of each NDT - biogeoclimatic unit in the Region. A total of 25 biogeoclimatic subunits of landscape units are projected to not meet seral stage distribution

guidelines in year 20 (2016). This compares with 26 at the present time (1996). The largest proportion have problems in the early (60%) and in the mature plus old (64%) seral stages (Table 12). The proportion not meeting the old seral stage is very low (4%). Seven biogeoclimatic subunits (28%) do not meet seral stage guidelines in more than one seral stage. Compared to current conditions, the proportion not meeting the early and the mature plus old seral stage guidelines increases (46% to 60% and 53% to 64% for early and mature plus old respectively) by year 20 while the proportion not meeting the old seral stage decreases (23% to 4%). That is, the frequency with which early seral forests exceed guidelines and mature plus old seral forests are below guidelines increased while the frequency with which old forests are below guidelines decreased.

Table 12. Number of projected (year 20) occurrences where seral stage distribution does not meet guidelines by seral stage in each NDT - biogeoclimatic zone unit. (The single occurrence of NDT 2 - CWH, which met seral stage guidelines, is not shown). NDT -biogeoclimatic zone units are ordered as in Table 10.

	NDT - Biogeoclimatic Zone											
Seral Stage	3 ESSF	2 ICH	3 ICH	1 ICH	4 IDF	1 ESSF	2 SBS	3 SBS	3 SBPS	3 MS	2 ESSF	Total
Total	0/1	2/5	0/3	2/14	7/44	8/32	3/8	0/31	1/69	2/53	0/15	25/275
Early	0	2	0	2	0	8	3	0	0	0	0	15
Mature + Old	0	2	0	0	7	3	1	0	1	2	0	16
Old	0	0	0	0	1	0	0	0	0	0	0	1

Projected 20 Year Trends

The absolute area (ha) of each seral stage above seral stage distribution guidelines was compared between the present time and year 20 in order to examine the projected magnitude and direction of change in area of seral stages over the 20 year period. Although the previous comparison of the present (1996) and 20 year (2016) ability of landscape units and biogeoclimatic units to meet seral stage distribution guidelines suggests substantial stability in seral stage proportions, this assessment does not discriminate magnitude and direction of changes very well unless they are very large.

Figure 19 shows the actual area in thousands of hectares of early, mature plus old, and old forest seral stages over the entire Region at the present time and year 20. It must be noted that the area of early seral stage is the area less than maximum guideline percentages while the area of mature plus old and old seral stages is the area greater than minimum guideline percentages. That is, for all seral stages, a zero value represents seral stage distribution guidelines whether minimum or maximum. Although the total area of early seral forests has increased (area above guideline minimums has decreased) over the entire Region, the area of mature plus old forests and old forests is relatively stable.

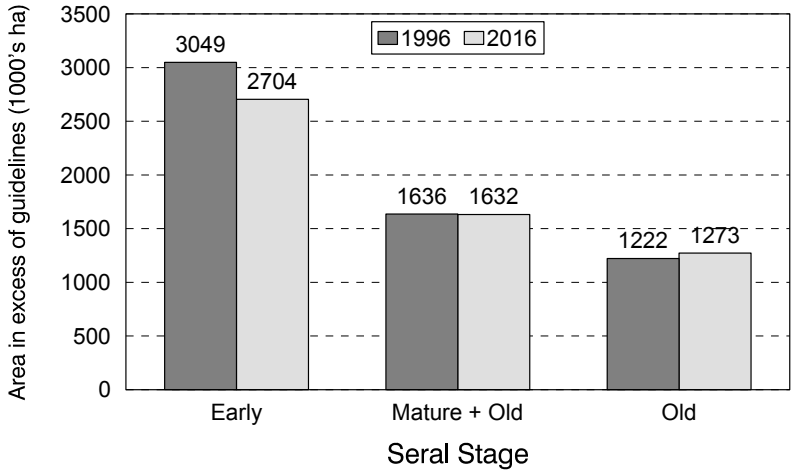

Figure 19. Area (1000's of ha) of each seral stage below or in excess of seral stage distribution guidelines over the entire Regional landscape. The area of early seral stage is the area below recommended maximum limits and the area of mature plus old and old seral stages is the area in excess of the recommended minimum limits.

Although the total area of mature plus old forests is predicted to remain relatively constant during the 20 year period, the proportion that is stocking class 4 stands is likely to increase. Figure 20 shows the area of stocking class 4 stands in 20 year age classes. Stands aged 81-100 (approximately 260,000 ha) are currently within the immature seral stage but, if not harvested, would be projected to all move into the mature seral stage by year 20. **That is, if the harvest and treatment of stocking class 4 stands over the next 20 years is small, the proportion of mature plus old seral stage in densely stocked, small diameter lodgepole pine stands would likely increase substantially. This would significantly lower the biodiversity conservation value of the mature seral stage forests**.

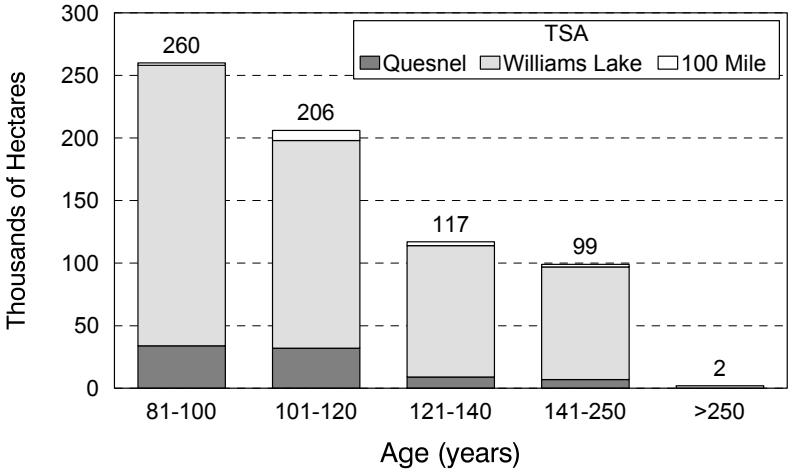

Figure 20. Total area (1996) by age of stocking class 4 stands in each TSA

The projected 20 year trend in seral stage areas varies significantly between different parts of the Region. In some areas, mature plus old forests and old forest are projected to increase while in other areas they are projected to decrease. Figure 21 shows the area of mature plus old forests in each of the five forest districts at the present time and projected at year 20. The area of this combined seral stage is projected to significantly increase in the Chilcotin (FD5) and 100 Mile

House (FD4) forest districts but decrease in the Quesnel (FD1), Horsefly (FD3) and Williams Lake (FD2) forest districts. The greatest absolute increase is in the Chilcotin Forest District (76,000 ha) and the greatest absolute decrease is in the Horsefly Forest District (-45,000 ha).

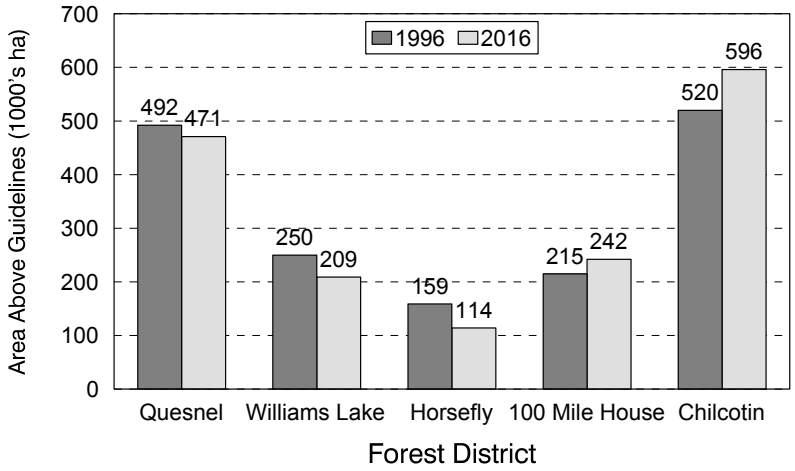

Figure 21. Area (1000's of ha) of mature plus old forests in excess of seral stage guidelines by forest district at present time (1996) and projected at year 20 (2016).

The trend in area of old forests among forest districts is similar (Figure 22).

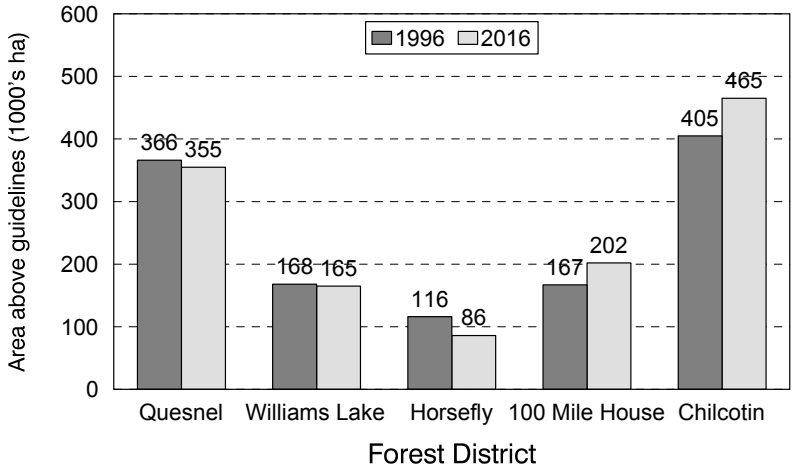

Figure 22. Area (1000's of ha) of old forests in excess of minimum seral stage guidelines by forest district at present time (1996) and projected at year 20 (2016).

The projected 20 year trend in area of seral stages also varies among biogeoclimatic units. Figure 23 shows the area (1000's ha) of mature plus old forests in excess of minimum seral stage guidelines for the principal NDT - biogeoclimatic zone units in the Region. The ICH Zone in NDT's 2 and 3 and the SBS Zone in NDT 2 have only a small area of mature plus old forests above minimum seral stage guidelines. The area of mature plus old forest above minimum guidelines is projected to increase slightly in the ICH Zone of NDT's 2 and 3, the SBS Zone of NDT 3 and the MS Zone of NDT 3. Decreases are projected for the SBS Zone in NDT 2, ICH Zone of NDT 1 and ESSF Zone of NDT 1. The greatest absolute increases are projected for the

MS Zone of NDT 3 (39,000 ha) while the greatest decreases in absolute area are projected for the ESSF of NDT 1 (-49,000 ha) and the SBS of NDT 2 (-11,000 ha).

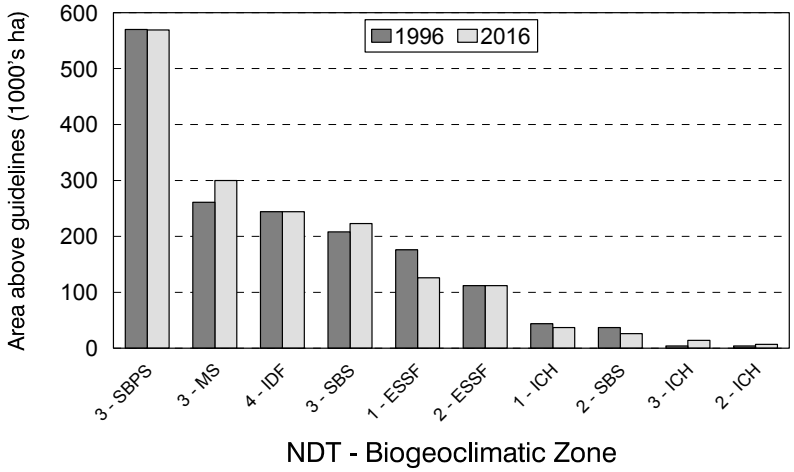

Figure 23. Area (1000's of ha) of mature plus old forest seral stage in excess of minimum seral stage guidelines by NDT - biogeoclimatic zone at present time (1996) and year 20 (2016).

Seral Stage Trends Beyond 20 Years

While the area of mature plus old seral stage appears relatively stable over the 20 year period it will start to drop significantly in the time period from 40 to 80 years from now if the same rate of harvest is applied. The lower limit for mature forest for most of the region is 100 years (age class 6). The inputs into age class 6 will begin to drop 40 years from now as a result of the dip in the current regional age structure in age class 2 and 3 (Figure 24). While some landscape units and biogeoclimatic units will not experience this drop at all, others will experience a very significant drop. The effect of this dip in the age profile on the long term maintenance of biodiversity seral stages needs to be considered at the TSA level by the timber supply review process and at the landscape level by local planning processes.

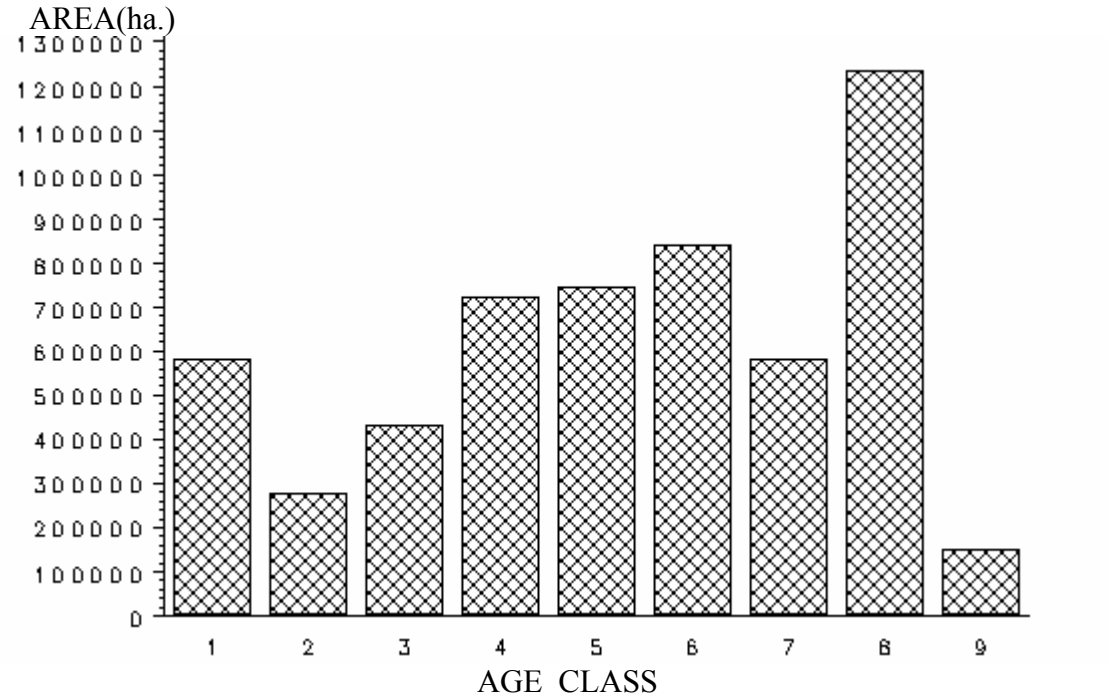

Figure 24. Distribution of forested area by age class for the Cariboo Forest Region.

Another longer term consideration is the cumulative effect of potential avoidance of certain timber types and site types. The CCLUP considers all productive forest land as potentially harvestable. However if types such as problem forest types, steep slopes and unstable soils, are harvested at a lower rate than expected based on their abundance, they will be increasingly over-represented as part of the unharvested landbase. For some types such as deciduous and cedar/hemlock "problem forest types" this could be advantageous for biodiversity management. However, in general, this would likely hinder representation of full range of forest types in old seral condition as recommended in the biodiversity guidebook.

4.3.2 Forest District Summaries

4.3.2.1 Quesnel Forest District

Within the Cariboo Forest Region, a total of 40 proposed landscape units occur entirely or primarily within the Quesnel Forest District. Three have a recommended biodiversity emphasis of higher, 14 have a recommended emphasis of intermediate, and 23 have a recommended emphasis of lower (Table 13). Current seral condition of these landscape units are summarized in Table 13 and projected 20 year seral condition (according to the STTAA exercise) is summarized in Table 14. Appendix 6 summarizes the absolute areas of each seral stage above guidelines for all landscape units in the district.

Table 13. Current (1996) seral condition of landscape units in Quesnel Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Current Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Baker	H	H		33			
Victoria	H	H		35			
Twan	H	H		3	**3-SBS**	I	M+O
					4-IDF	<L	O
						L	M+O
Chine	I	H		31			
Coglistiko	I	H		40			
Eliguk	I	H		19			
Gerimi	I	H		20			
Kluskus	I	H		33			
Pantage	I	H		27			
Pelican	I	H		20			
Snaking	I	H		20			
Pan	I	H		22	**3-SBPS**	L	M+O
Antler	I	I		11			
Dragon	I	I		7			
Umiti	I	I		6	**2-SBS**	L	E
Clisbako	I	I		5	**3-MS**	L	M+O
Mathew	I	L	**E**	29	**1-ICH**	L	E
Abhau	L	H		39			
Cunningham	L	H		52			
Euchiniko	L	H		40			
Marmot	L	H		40			
Tako	L	H		31			
Toil	L	H		50			
Whittier	L	H		31			
Baezaeko	L	H		32			
Lightning	L	H		55			
Narcosli	L	H		31			
Ramsey	L	H		30			
Swift	L	H		64			
Tibbles	L	H		29			
Jack of Clubs	L	H		48			
Wentworth	L	H		33			
Big Valley	L	I		47			
Willow	L	I		55			
Kluskoil	L	I		15			
Boyce	L	L		45			
Indianpoint	L	L		39			
Sandy	L	L		33			
Wendle	L	L		35			
Bowron	L	L		9			
Betty Wendle	Park	H		n/a			

Table 14. Projected 20 year (2016) seral condition of landscape units in Quesnel Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Projected Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Baker	H	H		23			
Victoria	H	I	E	19	**2-SBS**	L	E
Twan	H	H		2	**4-IDF**	L	M+O
						I	O
Chine	I	H		27			
Coglistiko	I	H		37			
Eliguk	I	H		26			
Gerimi	I	H		30			
Kluskus	I	H		52			
Pantage	I	H		14			
Pelican	I	H		22			
Snaking	I	H		17			
Pan	I	H		31			
Antler	I	I		15	**2-SBS**	L	E
Dragon	I	H		26			
Umiti	I	I		8	**1-ESSF**	L	E
					2-SBS	L	E, M+O
Clisbako	I	H		12			
Mathew	I	L	E	25	**1-ICH**	L	E
Abhau	L	H		30			
Cunningham	L	I		45			
Euchiniko	L	H		29			
Marmot	L	H		36			
Tako	L	I		16			
Toil	L	H		69			
Whittier	L	H		41			
Baezaeko	L	H		30			
Lightning	L	I		44			
Narcosli	L	H		32			
Ramsey	L	H		27			
Swift	L	I		50			
Tibbles	L	H		23			
Jack of Clubs	L	I		24			
Wentworth	L	H		31			
Big Valley	L	L		36			
Willow	L	L		43			
Kluskoil	L	I		11			
Boyce	L	L		39			
Indianpoint	L	L		21			
Sandy	L	L		26			
Wendle	L	L		21			
Bowron	L	L		10			
Betty Wendle	P	H		n/a			

Principal Biodiversity Seral Stage Issues - Current (1996)

Twan Landscape Unit:

- principal seral stage issues involve NDT 3 - SBS and NDT 4 - IDF;
- mature plus old forest within NDT 3 - SBS is below minimum guideline by 4% (320 ha);
- NDT 4 - IDF (Douglas-fir group) has several issues:
  - early seral forests exceed maximum guideline by 12% (877 ha);
  - mature plus old forest is below minimum guidelines by 30% (2265 ha);
  - old forest is below minimum guidelines by 17% (1326 ha).

Pan Landscape Unit:

- principal seral stage issue involves NDT 3 - SBPS;
- mature plus old forest within NDT 3 - SBPS is below minimum guideline by 5% (603 ha).

Umiti Landscape Unit:

- principal seral stage issue involves NDT 2 - SBS;
- early seral forest within NDT 2 - SBS exceeds maximum guidelines by 19% (2145 ha);
- flexibility for mature plus old biodiversity corridors and conservation of representative ecosystems is low since the landscape unit as-a-whole is only 3% above the minimum guideline for mature plus old.

Clisbacko Landscape Unit:

- principal seral stage issue involves NDT 3 - MS;
- mature plus old forest within NDT 3 - MS is below minimum guideline by <1% (27 ha);
- flexibility for mature plus old biodiversity corridors and conservation of representative ecosystems is low since the landscape unit as-a-whole is only 6% above minimum guideline for mature plus old.

Mathew Landscape Unit:

- landscape unit as-a-whole does not meet the recommended biodiversity emphasis due to an excess (5% or 1118 ha) of early seral forest above maximum guidelines;
- principal seral stage issue involves NDT 1 - ICH;
- early seral forest within NDT 1 - ICH exceeds maximum guideline by 22% (2039 ha).

Dragon Landscape Unit:

- flexibility for mature plus old biodiversity corridors and representative ecosystems is limited since the landscape unit as-a-whole is only 7% (3896 ha) above the minimum guideline for mature plus old.

Bowron Landscape Unit:

- flexibility for mature plus old biodiversity corridors and conservation of representative ecosystems is limited since the landscape unit as a whole (outside of park) is only 9% (559 ha) above the minimum guideline for mature plus old forest.

Principal Biodiversity Seral Stage Issues Arising From Projected 20 Year Harvest Scenario

Projected 20 year harvest levels have a relatively small negative impact on seral stage proportions in the Quesnel Forest District. Over the projected 20 year period, the area of old forest in excess of minimum seral stage guidelines is projected to decline by 3% (366,000 ha to 355,000 ha) and that of mature plus old forest by 4% (492,000 ha to 471,000 ha). The area of early seral forest below maximum seral stage guidelines is projected to decrease by 16% (954,000 ha to 798,000 ha).

Victoria Landscape Unit:

- this unit would change from 9388 ha below maximum to 1473 ha above maximum guidelines for early seral forest;
- the landscape unit as a whole would not meet the recommended biodiversity emphasis level due to an excess (2%) of early seral forests above maximum guidelines;
- principal seral stage issue involves NDT 2 - SBS;
  early seral forests within NDT 2 - SBS would exceed maximum guidelines by 13% (1473 ha).

Twan Landscape Unit:

- seral stage distribution would improve from 1996 but substantial issues still involve NDT 4 - IDF (Douglas-fir group);
- old forest would be below minimum guidelines by 10% (759 ha) but better (by 7%) than in 1996;
- mature plus old forest would be below minimum guideline by 28% (2125 ha) but slightly better (by 2%) than in 1996;
- early seral forest would exceed guidelines by 12% (910 ha) virtually unchanged from 1996.

Antler Landscape Unit:

- this unit would change from having no seral stage issues to having an issue involving NDT 2 - SBS ;
- early seral forests within NDT 2 - SBS would exceed maximum guidelines by 2% (285 ha).

Umiti Landscape Unit:

- principal seral stage issues would involve NDT 1 - ESSF (not an issue in 1996) and NDT 2 - SBS;
- early seral forests within NDT 1 - ESSF would exceed maximum guidelines by 15% (814 ha);
- early seral forests within NDT 2 - SBS would exceed maximum guidelines by 17% (1920 ha) compared to 10% in 1996;
- mature plus old forests within NDT 2 - SBS would be below minimum guideline by 4% (452 ha) which was not an issue in 1996.

Mathew Landscape Unit:

- area of early seral forest in the landscape unit as-a-whole would be increased from 5% (1003 ha) above maximum to 10% (2006 ha) above maximum guidelines;
- the issue with early seral forest within NDT 1 - ICH would worsen from exceeding maximum guidelines by 22% (2006 ha) to exceeding maximum guidelines by 26% (2371 ha).

4.3.2.2 Williams Lake Forest District

Within the Cariboo Forest Region, a total of 18 proposed landscape units occur entirely or primarily within the Williams Lake Forest District. Two have an emphasis of higher, eight intermediate and 8 lower (Table 15). Current seral condition of these landscape units are summarized in Table 15 and projected 20 year seral condition is summarized in Table 16. Appendix 6 summarizes the absolute areas (ha) of each seral stage above guidelines for all landscape units in the district.

Principal Biodiversity Seral Stage Issues - Current (1996)

Chimney Landscape Unit:

- Principal seral stage issues involve NDT 4 - IDF which encompasses the whole landscape unit.
- Early seral forest within NDT 4 - IDF exceed recommended maximum guidelines by 2% (660 ha).
- Within NDT 4- IDF, the Pine group exceeds the maximum guideline for early by 24% (1515 ha) and is below the recommended target for mature + old forest by 5% (291 ha).
- In the landscape unit as-a-whole, the mature + old forest is above the recommended level by only 1% (689 ha) constraining the ability to establish mature plus old forested corridors and conserve representative ecosystems

Hawks Creek Landscape Unit:

- Principal seral stage issues involve NDT 4 - IDF.
- Early seral forest within NDT 4 - IDF exceed recommended maximum guidelines by 1% (252 ha).
- The excess early seral forest within NDT 4 - IDF occurs within the Douglas-fir group which is 4% (1016 ha) above the recommended level. For the Douglas-fir group, the old forest is only 1% (325 ha) above the recommended target.
- The area of mature + old above guidelines is 21% (12,339 ha) which should allow good opportunities for landscape design in all BGC zones

Principal Biodiversity Seral Stage Issues Arising from Projected 20 Year Harvest Scenario

The projected 20 year harvest leads to a moderate erosion of seral stage representation in Williams Lake District as-a-whole although the number of landscape units meeting recommended guidelines increases by one. Overall, the early forest increases by about 15% (55,453 ha) while mature + old decreases by 17% (41385 ha) and old forest decreases by 2% (2993 ha). The NDT 4 - IDF remains the most problematic biogeoclimatic zone.

Table 15. Current (1996) seral condition of landscape units in Williams Lake Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Current Seral Condition: Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Koster-Lone Cabin	H	H		22			
Chimney	H	I	E	1	**4-IDF**	I	E
Churn	I	H		43			
Gaspard	I	H		21			
Hawks Creek	I	H		21	**4-IDF**	L	E
Williams Lake	I	H		30			
Alkali	I	I		22			
Farwell	I	I		8			
Meldrum	I	I		2			
Riske	I	I		17			
Bambrick	L	H		50			
Beaver Valley	L	H		44			
Dash	L	H		49			
Nadila	L	H		53			
Upper Big Creek	L	H		54			
Upper Churn	L	H		52			
Big Creek	L	H		45			
Mackin	L	H		37			

Table 16. Projected 20 year (2016) seral condition of landscape units in Williams Lake Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Projected Seral Condition: Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Koster-Lone Cabin	H	H		21			
Chimney	H	I	M+O	1	**4-IDF**	I	M+O
Churn	I	H		39			
Gaspard	I	H		15			
Hawks Creek	I	H		17			
Williams Lake	I	H		22			
Alkali	I	I		8			
Farwell	I	I		14			
Meldrum	I	I		1	**4-IDF**	L	M+O
Riske	I	H		18			
Bambrick	L	H		47			
Beaver Valley	L	H		39			
Dash	L	H		44			
Nadila	L	H		65			
Upper Big Creek	L	H		52			
Upper Churn	L	H		39			
Big Creek	L	H		37			
Mackin	L	H		30			

Chimney Landscape Unit:

- The NDT 4 - IDF still does not meet recommended levels for seral stage representation.
- The mature + old component is projected to fall 4% (1783 ha) below recommended levels for the IDF compared to being 1% (689 ha) above in 1996. The Douglas-fir group is 4% below (765 ha) and the lodgepole pine group is 11% (2153) below minimum guidelines.
- Early forest still exceeds recommended levels for pine by 30% (1900 ha) compared to 24% previously, but the IDF as a whole meets the early target because of improvements in Douglas fir.
- This decline in mature + old forest further erodes the ability to maintain forested corridors and representative ecosystems.

Meldrum Landscape Unit:

- Meldrum is entirely NDT 4 - IDF and the 20 year trend shows improvement in seral representation for early (6% improvement) and old (11% improvement) but a decline in mature + old.
- The decline in mature + old results in under achievement of the mature + old target for IDF by 1% (277 ha) due to a decline in the area of the Douglas-fir component of 2%.
- The small amount of mature + old forest at both time periods limits flexibility to maintain forested linkages and representative ecosystems.

4.3.2.3 Horsefly Forest District

Within the Cariboo Forest Region, a total of 19 proposed landscape units occur entirely or primarily within the Horsefly Forest District. Two have a recommended biodiversity emphasis of higher, nine have a recommended emphasis of intermediate, and eight have a recommended emphasis of lower (Table 17). Current seral condition of these landscape units are summarized in Table 17 and projected 20 year seral condition is summarized in Table 18. Appendix 6 summarizes the actual areas (ha) of each seral stage above guidelines for all landscape units in the district.

Principal Biodiversity Seral Stage Issues - Current (1996)

Polly Landscape Unit:

- principal seral stage issues involve NDT 2-ICH (ICHmk3);
- early seral forests within NDT 2 - ICH exceed maximum guidelines by 7% (1710 ha) although over the landscape unit as-a-whole, early seral forest are below maximum guidelines by 4% (1591 ha);
- mature plus old forests within NDT 2-ICH are below minimum guidelines by 3% (603 ha) although over the landscape unit as-a-whole, the area of mature plus old forests is 6% (2309 ha) above minimum guidelines;
- with only 6% mature plus old forests above guidelines within the entire landscape unit, flexibility for establishing mature and old forest corridors and conserving representative ecosystems is poor.

McKinley Landscape Unit:

- landscape unit as-a-whole does not meet the recommended biodiversity emphasis level due to a slight excess (2% or 620 ha) of early seral forests above maximum guidelines;
- NDT 1 - ESSF and NDT 2 - ICH (ICHmk3) both have a slight excess of early seral forests above maximum guidelines: 1% (165 ha) in the ESSF and 3% (560 ha) in the ICH;
- due to the small area of mature plus old forests above minimum guidelines (1% or 198 ha), there is currently very little flexibility for establishing mature and old forest biodiversity corridors or representative ecosystems beyond normal leave areas.

Black Creek Landscape Unit:

- early seral forests in NDT1-ESSF exceed maximum guidelines by 16% (2275 ha);
- principal issues in this landscape unit focus on two valley bottom subunits, each about 3300 ha in size:
- In NDT 1-ICH (ICHwk), maximum early seral guidelines are exceeded by 38% (1267 ha) and in NDT 2-ICH (ICHmk3) they are exceeded by 5% (158 ha);
- area of mature plus old forest in both valley bottom subunits is below minimum guidelines by approximately 10% (350 ha);
- area of old forests in NDT 1-ICH valley bottom unit is below old seral stage minimum guidelines by less than 1% (9 ha);
- since the area of mature plus old forest is only 3% (1391 ha) above minimum guidelines over the landscape as-a-whole, there is very little flexibility for establishing mature and old forest corridors or conserving representative ecosystems.

Table 17. Current (1996) seral condition of landscape units in Horsefly Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Current Seral Condition: Landscape Unit as-a-whole — Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	Biogeoclimatic Units not meeting recommended Guidelines — NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Polly	H	H		6	2-ICH	I	E, M+O
McKinley	H	I	E	1	2-ICH	I	E
					1-ESSF	I	E
East Arm	I	H		44			
Eastside	I	H		42			
Mitchell Lake	I	H		50			
Niagara	I	H		58			
Penfold	I	H		57			
Westside	I	H		54			
Black Creek	I	I		3	1-ESSF	L	E
					2-ICH (v.b.)	<L	O
						L	E, M+O
					2-ICH (v.b.)	L	E, M+O
Horsefly	I	I		7	1-ESSF	L	E
					1-ICH	L	M+O
Little River	I	I		12	1-ICH	L	E
Big Lake	L	H		32			
Moffat	L	H		47			
Cariboo Lake	L	L		38			
Likely	L	L		33			
Lower Cariboo	L	L		34			
McKuskey	L	L		37			
Wasko/Lynx	L	L		25			
McKay	L	L		46	1-ICH (v.b.)	<L	O

Table 18. Projected 20 year (2016) seral condition of landscape units in Horsefly Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Projected Seral Condition: Landscape Unit as-a-whole — Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	Biogeoclimatic Units not meeting recommended Guidelines — NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Polly	H	I	M+O	-1	2-ICH	I	E, M+O
McKinley	H	L	E, M+O	-8	2-ICH	I	E, M+O
					1-ESSF	L	E
						I	M+O
East Arm	I	I		29	1-ESSF	L	E
Eastside	I	I		29			
Mitchell Lake	I	H		45			
Niagara	I	H		41			
Penfole	I	I		36			
Westside	I	H		34			
Black Creek	I	I		4	1-ESSF	L	E, M+O
					1-ICH (v.b.)	<L	O
						L	M+O
					2-ICH (v.b.)	L	M+O
Horsefly	I	I		15	1-ESSF	L	E
Little River	I	L	E	8	1-ICH	L	E
Big Lake	L	H		30			
Moffat	L	I		33			
Cariboo Lake	L	L		20			
Likely	L	L		21			
Lower Cariboo	L	L		17			
McKuskey	L	I		20			
Wasko/Lynx	L	I		25			
McKay	L	L		26	1-ICH (v.b.)	<L	M+O, O

Horsefly Landscape Unit:

- early seral forests in NDT1-ESSF subunit exceed maximum guidelines by 2% (224 ha); (areas of mature plus old forests and old forests in the ESSF are well above minimum guidelines);
- principal focus of biodiversity issues is the ICHwk (NDT1-ICH) where the area of mature plus old forests is below minimum guidelines by 2% (510 ha) and the area of old forests only slightly exceeds minimum guidelines;
- in the ICHwk, there is very little flexibility for identifying current mature and old forest biodiversity corridors or conserving representative old forest ecosystems.

Little River Landscape Unit:

- early seral forests in NDT1-ICH (ICHwk) exceed maximum guidelines by 3% (159 ha); mature plus old and old forest seral stage guidelines are currently met in this subunit
- overall, the area of mature plus old forests is sufficient (12%) to allow moderate flexibility for establishing mature and old forest corridors and representative ecosystems.

McKay Landscape Unit:

- area of old forests in the valley bottom ICH subunit (1519 ha) is <1% below minimum guidelines;
- (most of this landscape is within the NDT1-ESSF subunit where seral stage distribution guidelines are currently fully met).

Principal Biodiversity Seral Stage Issues Arising From Projected 20 Year Harvest Scenario

Projected 20 year harvest levels have a greater impact on seral stage proportions in the Horsefly Forest District than in other forest districts, as described in Section 4.3.1. Over the projected 20 year period, the area of old forests in excess of minimum seral stage guidelines is projected to decrease by 26% (116,000 ha to 86,000 ha) and that of mature plus old forests by 28% (159,000 ha to 114,000 ha). The area of early seral forests below maximum seral stage guidelines is projected to decrease by 15% (216,000 ha to 183,000 ha). Greatest impacts would be in the ESSF Zone. The seral condition of the ICH Zone in NDT 2 and NDT 3 would generally improve over this period.

Polly Landscape Unit:

- area of mature plus old forests over landscape unit as-a-whole would be reduced from the current 6% above minimum guidelines to 1% below minimum guidelines;
- in NDT2-ICH (ICHmk3), the area of mature plus old forests would decrease from 3% (695 ha) below minimum guidelines to 9% (2100 ha) below minimum guidelines;
- no opportunities for establishment of mature and old forest corridors or representative ecosystems beyond normal leave areas would be available.

McKinley Landscape Unit:

- seral stage distribution in the McKinley Unit would be significantly affected
- the landscape unit as-a-whole, which has a recommended higher biodiversity emphasis, could only meet lower biodiversity emphasis
- the area of early seral forests over landscape unit as-a-whole would be increased from 2% (620 ha) above maximum guidelines to 10% (3700 ha) above maximum guidelines

- the area of mature plus old forests over the entire landscape unit would be reduced from 1% (200 ha) above minimum guidelines to 8% (3000 ha) below minimum guidelines
- the ESSF Zone would be especially affected, with the area of early seral forests increasing from 1% (150 ha) above maximum guidelines to 18% (2600 ha) above maximum guidelines;
- no opportunities for mature and old forest corridors or conservation of representative ecosystems beyond normal leave areas would be available.

East Arm Landscape Unit:

- the area of early seral forests in the ESSF Zone would increase from 8% (1300 ha) below maximum guidelines to 5% (810 ha) above maximum guidelines;
- the area of mature plus old forests and old forests would continue to meet seral stage distribution guidelines

Black Creek Landscape Unit:

- the area of ESSF early seral forests would be somewhat improved relative to seral stage guidelines, from 16% above maximum guidelines to 11% above maximum guidelines;
- the area of ESSF mature plus old forests would be reduced from <1% below minimum guidelines to 8% (1125 ha) below minimum guidelines;
- current (1996) inability of valley bottom ICH subunits to meet seral stage guidelines for mature plus old forests and old forests would be worsened;
- current (1996) inability of valley bottom ICH subunits to meet early seral stage guidelines would be improved (area of early seral forests decreased);
- flexibility for mature plus old biodiversity corridors and representative ecosystems remains very low.

Horsefly Landscape Unit:

- seral condition of ICH in NDT 1 would generally improve over 20 year period: the area of mature plus old forests would increase from current 2% below minimum guidelines to 13% (3500 ha) above minimum guidelines;
- in ESSF, the area of early seral forests would increase from 2% above maximum guidelines to 9% (820 ha) above maximum guidelines.

Little River Landscape Unit:

- the area of early seral forests in NDT 1-ICH (ICHwk) would increase from current 3% (185 ha) above maximum guidelines to 20% (1250 ha) above maximum guidelines;
- the landscape unit as-a-whole would no longer meet recommended intermediate biodiversity emphasis guidelines due to increase of early seral forests to 1% (255 ha) above maximum guidelines.

McKay Landscape Unit:

- seral condition of ICHwk valley bottom unit (1550 ha) would be eroded due to decrease of mature plus old forests from current 6% above minimum guidelines to 1% below minimum guidelines and decrease of old forests from current <1% below minimum guidelines to 4% (62 ha) below minimum guidelines.

4.3.2.4 100 Mile Forest District

Within the Cariboo Forest Region, a total of 26 proposed landscape units occur entirely or primarily within the 100 Mile Forest District. Two have a recommended biodiversity emphasis of higher, thirteen have a recommended emphasis of intermediate, and eleven have a recommended emphasis of lower (Table 19). Current seral condition of these landscape units are summarized in Table 19 and projected 20 year seral condition is summarized in Table 20. Appendix 6 summarizes the actual areas (ha) of each seral stage above guidelines for all landscape units in the district.

Principal Biodiversity Seral Stage Issues - Current (1996)

Big Bar Landscape Unit:

- early seral forests within IDF Douglas-fir Group exceed maximum guidelines by 3% (766 ha) although over the landscape unit as-a-whole, early seral forest is below maximum guidelines by 3 % (1481 ha);
- with only 3% mature plus old forests above guidelines within the entire landscape unit, flexibility for establishing mature and old forest corridors and representative ecosystems is small.

Spanish Landscape Unit:

- mature plus old forests in NDT 1 - ESSF are below minimum guidelines by 3% (328 ha) although over the landscape unit as-a-whole, mature plus old forests exceed minimum guidelines by 2% (377 ha);
- due to the very small area of mature plus old forests above minimum guidelines (2% or 377 ha), there is currently very little flexibility for establishing mature and old forest biodiversity corridors or representative ecosystems beyond normal leave areas.

Hendrix Lake Landscape Unit:

- early seral forests in NDT 2-ICH exceed recommended maximum guidelines by 6% (341 ha) although over the landscape unit as-a-whole, early seral forest is below maximum guidelines by 8 % (2731 ha);
- mature plus old forests in NDT 2 -ICH are below minimum guidelines by 10% (507 ha) although over the landscape unit as-a-whole, mature plus old forests exceed minimum guidelines by 18% (5401 ha);

Meadow Lake Landscape Unit:

- early seral forests within IDF Douglas-fir Group exceed recommended maximum guidelines by 11% (2419 ha) although over the landscape unit as-a-whole, early seral forest is below maximum guidelines by 1% (425 ha);
- mature plus old forest in the IDF Douglas-fir Group is 4% (980 ha) below the minimum guideline;
- with only 3% mature plus old forests above guidelines within the entire landscape unit, flexibility for establishing mature and old forest corridors and conserving representative ecosystems is small.

Table 19. Current (1996) seral condition of landscape units in 100 Mile House Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Current Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Big Bar	H	H		3	4-IDF	I	E
Spanish	H	H		2	1-ESSF	I	M+O
Bonaparte	I	H		53			
Bridge Lake	I	H		22			
Clinton	I	H		42			
Deadman	I	H		28			
Kelly Lake	I	H		48			
Nehallistan	I	H		17			
108 Mile Lake	I	H		19			
Cunningham Lake	I	H		26			
Hendrix Lake	I	H		18	2-ICH	L	E, M+O
Chasm	I	I		13			
Dog Creek	I	I		16			
Loon	I	I		14			
Meadow Lake	I	I		3	4-IDF	L	M+O
Mahood	L	H		30			
Canimred Creek	L	H		26			
Forest Grove	L	H		29			
Bonaparte Lake	L	H		42			
Bridge Creek	L	H		31			
Green Lake	L	H		34			
Murphy Lake	L	H		31	1-ESSF	<L	O
Bradley Creek	L	I		15	3-ICH	<L	M+O, O
Canim Lake	L	I		23	3-ESSF	<L	M+O, O
Deception Mt.	L	I		22	2-ICH (v.b.)	<L	M+O, O
Helena Lake	L	I		20	4-IDF	<L	O

Table 20. Projected 20 year (2016) seral condition of landscape units in 100 Mile House Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Projected Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Big Bar	H	H		3	**4-IDF**	I	M+O
Spanish	H	H		10	**1-ESSF**	I	E, M+O
Bonaparte	I	H		33			
Bridge Lake	I	H		31			
Clinton	I	H		42			
Deadman	I	H		20			
Kelly Lake	I	H		53			
Nehallistan	I	H		45			
108 Mile Lake	I	H		24			
Cunningham Lake	I	I		20			
Hendrix Lake	I	I		15	**1-ESSF**	L	E
Chasm	I	I		13	**4-IDF**	L	M+O
Dog Creek	I	I		10			
Loon	I	I		9	**4-IDF**	L	M+O
Meadow Lake	I	I		4	**4-IDF**	L	M+O
Mahood	L	H		63			
Canimred Creek	L	H		43			
Forest Grove	L	H		45			
Bonaparte Lake	L	H		38			
Bridge Creek	L	I		26			
Green Lake	L	H		41			
Murphy Lake	L	H		39			
Bradley Creek	L	H		43	**4-IDF**	<L	O
Canim Lake	L	H		44			
Deception Mt.	L	H		33			
Helena Lake	L	H		20			

Murphy Lake Landscape Unit:

- old forests in NDT 1 - ESSF are below minimum guidelines by 4% (387 ha) although over the landscape unit as-a-whole, old forests exceed minimum guidelines by 19% (9513 ha);

Bradley Creek Landscape Unit:

- mature plus old forests in NDT 3 - ICH are below minimum guidelines by 4% (523 ha) although over the landscape unit as-a-whole, mature plus old forests exceed minimum guidelines by 15% (7245 ha);
- old forests in NDT 3 -ICH are below minimum guidelines by 6% (880 ha) although over the landscape unit as-a-whole, old forests exceed minimum guidelines by 7% (3490 ha);

Canim Lake Landscape Unit:

- mature plus old forests in NDT 3 - ESSF are below minimum guidelines by 5% (644 ha) although over the landscape unit as-a-whole, mature plus old forests exceed minimum guidelines by 23% (9138 ha);
- old forests in NDT 3 - ESSF are below minimum guidelines by 7% (776 ha) although over the landscape unit as-a-whole, old forests exceed minimum guidelines by 13% (5243 ha);

Deception Mountain Landscape Unit:

- mature plus old forests in NDT 2 -ICH valley bottom are below minimum guidelines by 10% (236 ha) although over the landscape unit as-a-whole, mature plus old forests exceed minimum guidelines by 22% (3451 ha);
- old forests in NDT 2 -ICH valley bottom are below minimum guidelines by 6% (157 ha) although over the landscape unit as-a-whole, old forests exceed minimum guidelines by 11% (1697 ha);

Helena Lake Landscape Unit:

- old forests in IDF Douglas-fir group are <1% (94 ha) below the minimum guideline although over the landscape unit as-a-whole, old forests exceed minimum guidelines by 6% (2828 ha);

<u>Principal Biodiversity Seral Stage Issues Arising From Projected 20 Year Harvest Scenario</u>

The 20 year projection shows an overall increase in old and mature plus old seral stages and a decrease in the early seral stage in the 100 Mile House Forest District. Over the projected 20 year period, the area of old forests in excess of minimum seral stage guidelines is projected to increase by 21% (167,277 ha to 201, 815 ha) and that of mature plus old forests by 13% (214,769 ha to 242,640 ha). The area of early seral forests below maximum seral stage guidelines is projected to decrease by 8%.

Big Bar Landscape Unit:

- mature plus old forests in the Douglas fir group within the IDF would be below minimum guidelines by 1% (238 ha) while the IDF pine group matched guidelines exactly. Over the landscape as-a-whole, mature plus old would remain at 3% above targets as in 1996;

- early seral forests in the landscape as-a-whole would decrease from 3% above minimum guidelines in 1996 to 4% below minimum guidelines in 2016;

Spanish Landscape Unit:

- mature plus old forests in NDT 1 - ESSF would decrease by 10% from 1996 to 13% (1307 ha) below minimum guidelines in 2016;
- early seral forests in NDT 1 - ESSF would increase by 4% to exceed maximum guidelines by 4% (402 ha); over the landscape unit as-a-whole, early seral forests would be below maximum guidelines by 7 % (1495 ha);

Hendrix Lake Landscape Unit:

- early seral forests in NDT 1-ESSF would increase by 14% to exceed maximum guidelines by 10% (1586 ha) although over the landscape unit as-a-whole, early seral forests would exactly meet maximum guidelines;
- early seral forests in NDT 2-ICH would increase by 6% to exactly match maximum guidelines;

Chasm Landscape Unit:

- mature plus old forests within IDF Douglas fir Group would be below minimum guidelines by 2% (492 ha). This would be a decrease from 1996 when mature plus old forests within the IDF Fir group exceeded minimum guidelines by 5%. Over the landscape unit as-a-whole, mature plus old forests would exceed minimum guidelines by 13% (8292 ha);
- the early seral forest situation in the IDF Douglas fir group would improve from 10% above maximum guidelines in 1996 to 4% below maximum guidelines in 2016.

Loon Landscape Unit:

- mature plus old forests within IDF Douglas fir group would be below minimum guidelines by 2% (456 ha). This would be a deteriation since 1996 when mature plus old forests within the IDF Fir group exceeded the minimum guidelines by 3%. Over the landscape unit as-a-whole, mature plus old forests would exceed minimum guidelines by 9 % (3915 ha).

Meadow Lake Landscape Unit:

- mature plus old forests within IDF Douglas fir group would be below minimum guidelines by 4% (896 ha). This would be a deteriation since 1996 when mature plus old forests within the IDF Douglas fir group. Over the landscape unit as-a-whole, mature plus old forests would exceed minimum guidelines by 4 % (1701 ha).

4.3.2.5 Chilcotin Forest District

Within the Cariboo Forest Region, a total of 57 proposed landscape units occur entirely or primarily within the Chilcotin Forest District. Two (Franklyn and Edmond) of these are entirely within Ts'yl-os Park and have not been assigned a proposed biodiversity emphasis. Of the remaining 55 units, six have a recommended biodiversity emphasis of higher, 22 have a recommended emphasis of intermediate and 27 have a recommended emphasis of lower (Table 21). Current seral condition of these proposed landscape units is summarized in Table 21 and

projected 20 year seral condition is summarized in Table 22. Appendix 6 summarizes the area in hectares of each seral stage in excess of recommended minimum and maximum proportions in the Biodiversity Guidebook. All but four of the 55 proposed landscape units currently meet seral stage distribution guidelines in all biogeoclimatic subunits and in the landscape as-a-whole.

A high proportion (average 33%, ranging from 0% to 78% by landscape unit) of the mature plus old seral stage in this district is classed in the forest inventory data base as stocking class 4 stands. These are largely dense, small diameter lodgepole pine stands. The biodiversity value of these stands is significantly less than that of other forests within the mature plus old seral stages.

Principal Biodiversity Seral Stage Issues - Current (1996)

Nemiah Landscape Unit:

- landscape unit as-a-whole is slightly (350 ha) short of recommended minimum area of mature plus old forests;
- principal issue is mature plus old lodgepole pine forests in IDF subunit; area of mature plus old lodgepole pine forests is about 1350 ha short of recommended minimum; area of mature plus old Douglas-fir forest is above recommended minimum (large portion of IDF is within Ts'yl-os Park);
- area of mature plus old forests is slightly (<50 ha) short of recommended minimum in SBPS
- there is currently insufficient mature plus old forests to allow flexibility for defining mature and old forest biodiversity corridors and representative areas;
- approximately 15% of the minimum area of combined mature plus old seral stages currently consists of stocking class 4 stands.

Minton Landscape Unit:

- principal issue is mature plus old forests in IDF which are slightly (525 ha) short of recommended minimum area;
- IDF shortfall is due to shortfall of mature plus old Douglas-fir forests; mature plus old lodgepole pine forests are well above recommended minimum area.

Chilko Landscape Unit:

- area of mature plus old forests in IDF is below recommended minimum; due primarily to shortfall (about 590 ha) in area of mature plus old lodgepole pine forests;
- area of mature plus old forests above minimum guideline is small (635 ha or 5%) and as a result, there is very little flexibility for identifying mature and old forest biodiversity corridors or representative ecosystems beyond normal leave areas.

Table 21. Current (1996) seral condition of landscape units in Chilcotin Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Current Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Beeftrail	H	H		44			
Corkscrew	H	H		20			
Telegraph	H	H		16			
Westbranch	H	H		19			
Minton	H	H		14	4-IDF	I	M+O
Nemiah	H	I	M+O	-2	4-IDF	I	M+O
					3-SBPS	I	M+O
Alexis	I	H		28			
Alplands	I	H		42			
Atnarko	I	H		33			
Christonson	I	H		30			
Doran Creek	I	H		65			
Downton	I	H		50			
Holtry	I	H		23			
Hotnarko	I	H		32			
Kliniklini	I	H		39			
McLinchy	I	H		41			
Punky Moore	I	H		26			
Rainbow	I	H		18			
Sisters	I	H		27			
Siwash	I	H		24			
Tusulko	I	H		58			
Upper Dean	I	H		46			
Anaham	I	H		13			
Bidwell/Lava	I	H		12	4-IDF	L	M+O
Clusko	I	H		14			
Palmer/ Jorgenson	I	H		14			
Upper Tatlayoko	I	H		18			
Brittany	L	H		30			
Chilko	L	I		5			
Chilanko	L	H		37			
Clearwater	L	H		23			
Colwell	L	H		41			
Gunn Valley	L	H		19			
Haines	L	H		32			
Hickson	L	H		68			
Lord River	L	H		54			
Middle Lake	L	H		24			
Nude Creek	L	H		57			
Nuntzi Elkin	L	H		33			
Puntzi	L	H		31			
Pyper	L	H		28			
Tatla Little Eagle	L	H		30			
Tautri	L	H		33			
Tchaikazan	L	H		41			
Tete Angela	L	H		30			
Tiedemann	L	H		83			
Crazy Creek	L	H		40			
Nazko	L	H		35			
Nostetuko	L	H		50			
Ottorasko	L	H		43			
Taseko	L	H		38			
Nimpo	L	H		27			
Beece Creek	L	I		18			
Big Stick	L	I		23			
Chesi Stikelan	L	I		30			

Edmond	Park	H	n/a
Franklyn	Park	H	n/a

Table 22. Projected 20 Year (2016) seral condition of landscape units in Chilcotin Forest District

Landscape Unit	Recommended Biodiversity Emphasis Level	Projected Seral Condition					
		Landscape Unit as-a-whole			Biogeoclimatic Units not meeting recommended Guidelines		
		Emphasis Level Met	Limiting Seral Stages	% Mature+Old Above Minimum	NDT-Biogeo-climatic Unit	Emphasis Level Met Overall	Limiting Seral Stage
Beeftrail	H	H		34			
Corkscrew	H	H		29			
Telegraph	H	H		15			
Westbranch	H	H		19			
Minton	H	H		11			
Nemiah	H	I	M+O	-5	4-IDF	I	M+O
					3-MS	I	M+O
					3-SBPS	I	M+O
Alexis	I	H		30			
Alplands	I	H		40			
Atnarko	I	H		29			
Christonson	I	H		29			
Doran Creek	I	H		65			
Downton	I	H		60			
Holtry	I	H		22			
Hotnarko	I	H		37			
Kliniklini	I	H		41			
McLinchy	I	H		44			
Punky Moore	I	H		40			
Rainbow	I	H		20			
Sisters	I	H		30			
Siwash	I	H		24			
Tusulko	I	H		51			
Upper Dean	I	H		39			
Anaham	I	H		19			
Bidwell/Lava	I	H		18	3-MS	L	M+O
Clusko	I	H		28			
Palmer/ Jorgenson	I	H		20			
Upper Tatlayoko	I	H		23			
Chilko	I	I		6	4-IDF	L	M+O
Brittany	L	H		26			
Chilanko	L	H		45			
Clearwater	L	H		43			
Colwell	L	H		56			
Gunn Valley	L	H		46			
Haines	L	H		35			
Hickson	L	H		71			
Lord River	L	H		53			
Middle Lake	L	H		47			
Nude Creek	L	H		65			
Nuntzi Elkin	L	H		32			
Puntzi	L	H		41			
Pyper	L	H		40			
Tatla Little Eagle	L	H		39			
Tautri	L	H		27			
Tchaikazan	L	H		58			
Tete Angela	L	H		28			
Tiedemann	L	H		83			
Crazy Creek	L	H		44			
Nazko	L	H		30			
Nostetuko	L	H		55			
Ottorasko	L	H		47			
Taseko	L	H		45			
Nimpo	L	H		36			
Beece Creek	L	H		33			
Big Stick	L	H		39			
Chesi Stikelan	L	H		26			
Edmond	Park	H		78			
Franklyn	Park	H		63			

Bidwell/Lava Landscape Unit:

- area of mature plus old seral stages in IDF is below recommended minimum; due primarily to shortfall (about 600 ha) in area of mature plus old seral stages of lodgepole pine forests;
- more than 50% of the mature plus old seral stage requirement for this landscape unit currently consists of stocking class 4 stands (primarily dense, small diameter lodgepole pine stands).

Palmer/Jorgenson Landscape Unit:

- nearly 50% of the mature plus old seral stage requirement for this landscape unit currently consists of stocking class 4 stands (primarily dense, small diameter lodgepole pine stands).

Clusko Landscape Unit:

- nearly 20% of the mature plus old seral stage requirement for this landscape unit currently consists of stocking class 4 stands (primarily dense, small diameter lodgepole pine stands).

Westbranch Landscape Unit:

- approximately 15% of the mature plus old seral stage requirement currently consists of stocking class 4 stands.

Principal Biodiversity Seral stage Issues Arising From Projected 20 Year Harvest Scenario

The projected 20 year harvesting scenario impacts to biodiversity, as indicated by seral stage distribution, are less in the Chilcotin Forest District than in other districts. Over the 20 year period, the area of old forests in excess of recommended minimum areas is projected to increase by about 15% (405,000 to 465,000 ha) and the area of mature plus old forests by about 15% (520,000 to 596,000 ha). The area below recommended maximums of early seral forests is projected to decrease by about 6% (1,093,000 ha to 1,023,000 ha). This projected trend contrasts with other districts, especially the Horsefly Forest District where old and mature plus old forest are projected to significantly decrease. The area of mature plus old forests in each biogeoclimatic unit in the Chilcotin Forest District is projected to increase or decrease only slightly. Increases occur in the MS and ESSF while slight decreases occur in the IDF.

Nemiah Landscape Unit:

- the shortfall in area of mature plus old forests in this landscape unit as-a-whole is projected to increase from 2% to 5% (350 to 1300 ha) below minimum;
- principal issue continues to be area of mature plus old lodgepole pine forests in IDF subunit, which remains relatively unchanged from current area;
- the shortfall in area of mature plus old forests in SBPS is projected to increase slightly (from <50 ha to 250 ha);
- mature plus old forest area in MS subunit is projected to decrease to about 6% (460 ha) below the recommended seral stage minimum;
- the increased shortfall in mature plus old forests decreases the flexibility for establishing mature and old forest biodiversity corridors and representative ecosystems.

Bidwell/Lava Landscape Unit:

- mature plus old forest area is projected to fall slightly (<50 ha) below minimum guidelines in the MS subunit;
- the small area of mature plus old forests in the MS would allow little flexibility for establishing mature and old forest biodiversity corridors and representative areas;
- a high proportion (63%) of the mature plus old forests in this landscape unit currently (1996) consists of stocking class 4 stands; projected harvesting of mature plus old stands may significantly increase the proportion of these stands within the total area of mature plus old forests.

Chilko Landscape Unit:

- area of mature plus old seral stages in IDF is projected to improve but remain below recommended minimums due to shortfall (about 490 ha) in area of mature plus old seral stages of lodgepole pine;
- area of mature plus old forests in excess of recommended minimum is projected to improve slightly (5% to 6%) but remains small and as a result, the projected flexibility for identifying mature and old forest biodiversity corridors or representative old forest ecosystems remains small.

Seral stage condition of Minton Landscape Unit is projected to generally improve; all biogeoclimatic subunits are projected to meet seral stage distribution guidelines by year 20.

4.3.3 Management Recommendations for Meeting Seral Stage Guidelines

Seral stage guidelines can be met in the short to medium term throughout most of the Cariboo Forest Region without large reductions in proposed timber harvest levels. However, to meet these guidelines, it will be necessary to redistribute a portion of the proposed 20 year harvest and very quickly develop landscape level plans for meeting seral stage distribution objectives in the short to medium term where they are not currently met. As noted previously, achievement of these guidelines does not guarantee spatial distribution of forest types is appropriate within any given landscape unit.

General Recommendations
• all biogeoclimatic subunits which currently meet seral stage distribution guidelines should be managed to continue meeting guidelines, • a landscape level management plan should be developed for all biogeoclimatic subunits which currently do not meet seral stage distribution guidelines; this plan should specify strategies to meet guidelines within as short a period as is reasonable, most often within one rotation; these strategies may include partial cutting systems, old growth management areas or other practices; • landscape units should be ranked according to planning priority at the district level, based on risks to biodiversity of delayed planning (planning priority recommendations are provided in the forest district recommendation tables below); • within Districts, landscape units that meet seral stage guidelines within 10% or less of the recommended level for mature and old forest should be reviewed with respect to connectivity and interior forest conditions so that problematic units can be highlighted for accelerated planning; • moving a portion of the proposed 20 year harvest away from biogeoclimatic subunits which do not meet seral stage distribution guidelines to those with significant area in excess of guidelines will help maintain biodiversity conservation objectives with minimal effect on overall timber harvest levels.

The following tables present management recommendations by forest district for meeting seral stage distribution guidelines in landscape units which currently do not meet guidelines or are projected to not meet guidelines under the 20 year harvesting scenario.

Table 23. Recommended Management Strategies to Meet Seral Stage Guidelines in the Quesnel Forest District

Landscape Unit	Planning Priority	Recommended Seral Stage Management Strategies
General		• seral stage issues in this district involve relatively few landscape units scattered throughout the district and typically neighbouring units have seral stage areas in excess of guidelines. Relatively small changes in the distribution of the timber harvest among landscape units or among the biogeoclimatic units within landscapes would reduce the impact on biodiversity • Landscape Units less than 10% above mature plus old seral stage minimum guidelines require immediate attention to plan for maintenance of ecosystem representation and connectivity. This need is especially urgent if any biogeoclimatic zone(s) within such a unit is failing to meet minimum guidelines for mature plus old. • where mature plus old forest contains surplus old, some low volume, partial cutting can occur in that surplus old and still meet minimum guidelines for mature plus old and for old.
Twan	High	• Most of the issue in this unit focuses on NDT 4 - IDF (Douglas-fir group) which is a relatively small proportion (18%) of the unit. Minimizing further harvesting in the short and medium term would speed recovery to meet the biodiversity emphasis. Neighbouring landscape units offer more flexibility. Designate Old Growth Management Areas to address deficit of old forest.
Pan	Moderate	• The slight short-fall in mature plus old forest in the unit is the result of natural disturbance history. Recovery will take place with proposed levels of timber harvest.
Umiti	High	• Most of the issue in this unit focuses on NDT 2 - SBS which covers only 25% of the unit. Minimizing further clearcut harvesting in the short - and medium - term would speed recovery to meet biodiversity emphasis. Nearby landscape units offer more flexibility. • A somewhat reduced rate of clearcut harvest or a shift to low volume partial cutting in NDT 1 - ESSF over the projected 20 year scenario would maintain the area of early seral forest below maximum guidelines.
Clisbacko	Moderate - High	• Since this unit is very close to meeting emphasis, a small shift in harvest from NDT 3 - MS to NDT 3 - SBPS within the unit would speed recovery to meet the biodiversity emphasis.

Mathew	High	• Most of the issue with this unit involves NDT 1 - ICH which covers 45% of the total forest • Minimize further clearcut harvesting over the short and medium - term or use low volume partial cutting within ICH until early seral stage guidelines can be met. • Nearby landscape units offer more flexibility.
Victoria	Moderate to High	• A slightly reduced harvest rate over the projected 20 year scenario in NDT 2 - SBS would maintain the area of early seral forest below maximum guidelines
Antler	Moderate	• A slightly reduced harvest rate over the projected 20 year scenario in NDT 2 - SBS would maintain the area of early seral forest below maximum guidelines.

Table 24. Recommended Management Strategies to Meet Seral Stage Guidelines in the Williams Lake Forest District		
Landscape Unit	**Planning Priority**	**Recommended Seral Stage Management Strategies**
General		• Landscape Units less than 10% above mature plus old seral stage minimum guidelines require immediate attention to plan for maintenance of ecosystem representation and connectivity. This need is especially urgent if any biogeoclimatic zone(s) within such a unit is failing to meet minimum guidelines for mature plus old. • where mature plus old forest contains surplus old, some low volume, partial cutting can occur in that surplus old and still meet minimum guidelines for mature plus old and for old.
Chimney	High	• Reduce harvest of pine and Douglas-fir in the IDF over the short and medium term until mature + old forest meets or exceeds recommended levels. This will contribute to some recovery of pine with respect to meeting early seral levels as well. • Implement landscape level planning to establish required biodiversity corridors and conserve representative ecosystems.
Hawks Creek	Moderate	• Improving trends in early and old forest allow for projected harvest to occur. Any harvest incremental to this, particularly Douglas-fir, could result in excessive early forest.
Meldrum	High	• Reduce harvest in IDF, particularly in Douglas-fir, to stay within the mature + old guideline. • Implement landscape level planning to establish required biodiversity corridors in mature + old IDF.

Table 25 Recommended Management Strategies to Meet Seral Stage Guidelines in the Horsefly Forest District		
Landscape Unit	**Planning Priority**	**Recommended Seral Stage Management Strategies**
General		• a reduced harvest rate in this district, especially in the ESSF, would reduce overall Regional biodiversity impacts: • Landscape Units less than 10% above mature plus old seral stage minimum guidelines require immediate attention to plan for maintenance of ecosystem representation and connectivity. This need is especially urgent if any biogeoclimatic zone(s) within such a unit is failing to meet minimum guidelines for mature plus old. • where mature plus old forest contains surplus old, some low volume, partial cutting can occur in that surplus old and still meet minimum guidelines for mature plus old and for old.
Polly	High	• minimize harvesting over short- and medium-term within ICHmk3; harvest opportunities may be available in the SBS of this unit; • harvest rates within the entire landscape unit should be limited to relatively low levels to maintain early seral and mature plus old seral stages within guidelines over the landscape unit as-a-whole (see Appendix 6 for areas); • identify biodiversity corridors and representative ecosystems as soon as possible; some early and immature forests may need to be included and managed to establish mature and old forest attributes as soon as possible (establish OGMA's).
McKinley	High	• in ICH and ESSF, minimize further harvesting other than low volume partial harvesting until early seral stage guidelines can be met. • identify biodiversity corridors and representative ecosystems as soon as possible; some early and immature forests may need to be included and managed to establish mature and old forest attributes as soon as possible (establish OGMA's).
Black Creek	High	• avoid large areas of clearcut harvest in the ESSF over the short to medium term until the area of early seral forest is within guidelines; • minimize harvesting over short- and medium-term in ICHwk and ICHmk3 until area of early seral forests is reduced and area of mature plus old and old seral forests is increased in these valley bottom subunits; • develop long-term plan for mature and old forest biodiversity corridors and representative ecosystems, especially in the ICH valley bottom subunits

Table 25 (continued). Horsefly Forest District

Landscape Unit	Planning Priority	Recommended Seral Stage Management Strategies
East Arm	Moderate	• reduce projected harvest rate in ESSF Zone or use low volume partial harvesting to maintain area of early seral forests below maximum guideline.
Horsefly	High	• in ESSF subunit, minimize or delay harvesting over short term or use low volume partial harvesting system to reduce area of early seral forests below maximum guideline; • in ICHwk subunit, limit clearcut harvesting over short term until area of mature plus old and old seral stages is above minimum guidelines; a small area of low volume partial harvesting and intensive stand-level biodiversity management may be used to harvest timber from old forests while maintaining total area of mature plus old forests; • develop long-term plan for mature and old forest biodiversity corridors and representative ecosystems, especially in the ICH, but also over the entire landscape unit
Little River	Moderate to high	• in ICHwk subunit, delay or reduce harvesting over short- to medium-term or use low volume partial harvesting systems in order to reduce area of early seral forests; opportunities for recovering the reduced harvest may be available in other subunits of the Little River unit as well as in other nearby units • develop plan for maintaining biodiversity corridors and representative ecosystems; this is recommended as a high priority for ICH subunit but not necessarily for other portions of landscape unit.
McKay	Moderate	• in the small (1500 ha) ICHwk subunit, minimize harvesting of mature and old forests over the medium term until minimum guidelines for mature plus old and old are achieved.

Table 26. Recommended Management Strategies to Meet Seral Stage Guidelines in the 100 Mile Forest District		
Landscape Unit	**Planning Priority**	**Recommended Seral Stage Management Strategies**
General		• Landscape Units less than 10% above mature plus old seral stage minimum guidelines require immediate attention to plan for maintenance of ecosystem representation and connectivity. This need is especially urgent if any biogeoclimatic zone(s) within such a unit is failing to meet minimum guidelines for mature plus old. • where mature plus old forest contains surplus old, some low volume, partial cutting can occur in that surplus old and still meet minimum guidelines for mature plus old and for old.
Big Bar	High	• reduce the amount of harvesting in mature and old IDF Douglas-fir stands and /or modify prescriptions to include more low volume selection harvesting which will maintain some mature forest characteristics. • identify biodiversity corridors and representative ecosystems as soon as possible.
Spanish	High	• reduce the planned rate of clearcut harvest in the NDT1- ESSF to ensure that guidelines for early seral and mature plus old can be met; low volume partial harvesting may be used in NDT1- ESSF to harvest some volume while maintaining the proportion of mature plus old seral stage; • identify biodiversity corridors and representative ecosystems as soon as possible.
Hendrix	Moderate	• reduce the projected rate of clearcut harvest in the NDT1- ESSF to ensure that guidelines for early seral can be met; low volume partial harvesting may be used in NDT1- ESSF to harvest some volume while not increasing the area of early seral stage;
Chasm	High	• reduce projected harvest rate in IDF Douglas fir and Douglas fir-pine stands and/or use low volume partial harvesting to maintain mature forest characteristics to meet minimum mature plus old seral stage guidelines; • identify biodiversity corridors and representative ecosystems as soon as possible.

Loon	High	• slightly reduce projected harvest rate in IDF Douglas fir and Douglas fir-pine stands and/or use low volume partial harvesting to maintain mature forest characteristics to meet minimum mature plus old seral stage guidelines; • identify biodiversity corridors and representative ecosystems as soon as possible.
Meadow Lake	High	• slightly reduce projected harvest rate in IDF Douglas-fir and Douglas-fir-Pine Stands and/or use low volume partial harvesting to maintain mature forest characteristics to meet minimum mature plus old seral stage guidelines; • identify biodiversity corridors and representative ecosystems as soon as possible;

Table 27. Recommended Management Strategies to Meet Seral Stage Guidelines in the Chilcotin Forest District		
Landscape Unit	**Planning Priority**	**Recommended Seral Stage Management Strategies**
General		• thinning of densely stocked, small diameter lodgepole pine stands, which are common in this district would enhance their biodiversity value and may improve residual tree growth rates. • Landscape Units less than 10% above mature plus old seral stage minimum guidelines require immediate attention to plan for maintenance of ecosystem representation and connectivity. This need is especially urgent if any biogeoclimatic zone(s) within such a unit is failing to meet minimum guidelines for mature plus old. • where mature plus old forest contains surplus old, some low volume, partial cutting can occur in that surplus old and still meet minimum guidelines for mature plus old and for old. • identify biodiversity corridors and representative ecosystems as soon as possible in landscape units with limited mature plus old.
Nemiah	high	• harvesting of lodgepole pine stands should be minimized in the IDF and over the short to medium term in the SBPS and MS until the area of mature plus old forests meets recommended seral stage minimums; • biodiversity linkages and representative old forest ecosystems should be defined as soon as possible in all biogeoclimatic units in order optimize opportunities.
Minton	high	• the projected low level of timber harvest in this unit is appropriate for restoration of seral condition over the next 20 years; • biodiversity linkages and representative old forest ecosystems should be defined as soon as possible in all biogeoclimatic units in order optimize opportunities.
Chilko	high	• harvesting of lodgepole pine stands in the IDF should be minimized over the short to medium term until the area of lodgepole pine mature plus old seral stages meets recommended minimums (increase area by about 500 ha); • biodiversity linkages and representative old forest ecosystems should be defined as soon as possible in all biogeoclimatic units in order optimize opportunities.

Bidwell/Lava	moderate	• harvesting of non-stocking class 4 lodgepole pine stands should be minimized until the area of stocking class 4 stands can be better assessed and it can be determined that the recommended minimum area of mature plus old forests is met by at least 70% other than stocking class 4 stands; thinning, harvesting or rehabilitation of stocking class 4 stands should improve biodiversity values and possibly tree growth rates.
Palmer/ Jorgenson	moderate	• (see Bidwell/Lava)
Clusko	moderate	• thinning, harvesting or rehabilitation of stocking class 4 stands should improve biodiversity values and possibly tree growth rates.
Westbranch	moderate	• thinning, harvesting or rehabilitation of stocking class 4 stands should improve biodiversity values and possibly tree growth rates.

4.4 Seral Stage Monitoring

The seral condition of landscape units must be monitored over time if managers are to ensure that biodiversity conservation objectives are being met. In order to monitor seral condition, the seral age of a forest area following timber harvesting must be recorded and maintained in a data base. Where the clearcutting system is used, seral age immediately following harvesting is clearly nil. However, where partial harvesting systems are employed, the seral age following harvesting is less clear and not necessarily reflected in the inventory age assigned to the residual forest stand.

Tables 28, 29 and 30 provide a means to assess biodiversity seral age where partial harvesting is used. The seral age indicated in the tables can be the basis for assessing seral condition in all future assessments when used in combination with assigning a seral age of nil to clearcut areas and completing an inventory adjustment for old forests on the unharvested landbase.

The ages used to define seral stages in the Biodiversity Guidebook are based on expert opinion regarding the time required for natural forest succession to produce mature and old forest stand level attributes following a stand replacing disturbance. Similarly, the values in the following tables represent the minimum time that the biodiversity committee considers will be required for natural succession to return stand level attributes to levels characteristic of mature and old forests following a specified level of partial harvesting.

The distinction between seral age and inventory age must be clear when using these tables. Seral age is an interpretation of the residual attributes of the stand and the minimum time that will be required for the stand to develop, through natural processes, a full set of ecological attributes characteristic of old stands as defined by the Biodiversity Guidebook. The time required is measured against the age definition for old stands. For example, if a stand in NDT 1 ESSF Zone will require an additional 150 years to fully develop old forest attributes, then the seral age of the stand is 251 minus 150 or 101 years. 251 years is the minimum age used to define old in NDT 1 - ESSF by the Biodiversity Guidebook.

The Biodiversity Guidebook provides some guidance on the effects of partial harvesting practices on seral age. Specifically the Guidebook states that old forests become mature forests following partial harvesting provided the residual stand volume and stand attributes are at least 70% of those of the natural stand. That is, all tree diameter classes, wildlife trees, coarse woody debris, and other attributes are represented in proportion to the average stand profile for the biogeoclimatic subzone and site unit. The values in the following tables are based in part on interpolation between the ages and attributes used to define seral stages in the Guidebook.

Each of the three tables represents a different combination of age definitions in the Biodiversity Guidebook for mature and old forests. Table 28 applies to NDT - biogeoclimatic zone units where old is defined as >250 years and mature as 141 - 250 years. Table 29 applies to NDT - biogeoclimatic zone units where old is defined a >250 years but mature as 101 - 250 years. Table 30 applies to NDT - biogeoclimatic zone units where old is defined as >140 years.

For stands with no previous logging history, seral age should be the age of the stand as determined by on-site aging of the oldest non-veteran trees and not the inventory map label. For stands with a previous logging history, seral age should be determined through the tables following consideration of stand age prior to any logging as well as the residual volume and attributes following logging.

Table 29, which includes NDT 4 - IDF, only applies to the Douglas-fir Group of the IDF as defined in this report. The Lodgepole pine Group within NDT 4 - IDF is treated as NDT3 - SBS which is described in Table 30.

The treatments outlined in the tables include both percent volume removal and stand attributes remaining after harvest. Clearly, for a given stand age and percent volume removal, post-harvest biodiversity seral age is strongly affected by the harvesting prescription. Consequently, there are significant opportunities to achieve biodiversity and timber targets under the CCLUP by carefully planning modified harvest to optimize retention of stand-level biodiversity attributes.

Stand-level attributes remaining after harvest are measured as a percent of their average level in natural old stands of the same forest type, biogeoclimatic unit, and site unit. These levels have not yet been clearly defined although most forest managers have an appreciation of their general level. Further refinement of these attributes is considered an important task by the Biodiversity Committee. Attributes which should be included in the assessment of seral age are those indicated in the Biodiversity Guidebook and are:

numbers of standing dead trees;
coarse woody debris volume and sizes;
density of large (for the site) living trees;
tree species diversity;
structural diversity, both vertical and horizontal, including patchiness;
forest floor thickness and form; and
soil structure.

Among the attributes, the overall level achieved is determined by the one with the lowest value. For example, if coarse woody debris achieves only 60% of the old forest level while all the other attributes attain >70%, the overall classification would fall into the 50-70% category.

For stands less than age class 7, the old forest attributes are sufficiently immature that the stand age is considered equivalent to those of age class 7 stands with <50% of old forest attributes. Post-harvest seral age is therefore determined by volume removal only.

The categories of volume removal in the table are intended to approximate various known partial cutting scenarios in the Cariboo Region and to provide a reasonable spread amongst the prescriptions. Volume removals of 10% or less are most pertinent to harvesting where individual and small groups of trees are removed, as in sanitation logging for Douglas-fir bark beetle. The category of 11-20% approximates the handbook approach to mule deer logging in Douglas fir and the 21-30% category is similar to current recommendations for group selection harvesting in caribou winter range. Harvest levels greater than 85% are considered equivalent to clearcutting with stand level biodiversity retention only.

In all cases the post-harvest seral age of a stand must be less than the pre-harvest age. The tables are consistent with this with one exception. For age class 8, with 1-10% volume removal and >70% of attributes remaining, biodiversity seral age is 175. Since age class 8 ranges from 141-250 years, some stands could potentially be <175 years prior to harvest. Where pre-harvest age is <175, the post-harvest age should drop to 145 years.

The following is an example of how the tables would be used to track the seral age of a partially harvested stand over time for purposes of monitoring biodiversity seral stages. An unlogged stand in NDT 1 - ESSF Zone was found to be 160 old by measurement of its oldest “non-vet” trees. It was harvested in year zero with a carefully designed prescription which removed 30%

of the gross volume and maintained 70% of its old growth attributes. Table 28 would be used. Going across on the row for age class 8 to the >70% attribute column under the set of columns for 21 - 30% volume removal, we find that the seral age of the resulting stand would be 100 years. Therefore, the seral stage would be immature and would take 20 years to reach the mature seral stage and 150 years to reach old seral stage since the Biodiversity Guidebook definitions of mature and old are 120+ and 250+ years respectively. If the stand was again harvested in 45 years after the first entry, its pre-harvest seral age would be 100 + 45 = 145 years which would put it in age class 8. Therefore the post-harvest seral age would again be found in the age class 8 row. If this time the harvest prescription was to remove 45% of the volume while maintaining between 50 and 70% of the old forest attributes, the resulting seral age would be 60 years and it would be 60 years before the stand would again be considered mature for biodiversity purposes.

Table 28. Seral Age for Stands Following Partial Cutting (Ecosystems with Mature Defined as >120 Years and Old Defined as >250 Years).

Ecosystem	Seral Age Class[1]	Percent Volume Removed																	
		1 - 10			11 - 20			21 - 30			31 - 45			46 - 65			66 - 85		
		Post Harvesting Attributes as % of Level in Natural Old Stands[2]																	
		>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50
NDT1-ESSF	9 (>250)	215	90	80	175	85	75	130	80	70	n/a	70	60	n/a	50	40	n/a	n/a	15
NDT2-ESSF	8(141-250)	175[3]	90	80	130	80	70	100	70	60	n/a	60	50	n/a	40	30	n/a	n/a	10
	7(121-140)	110	80	60	90	70	50	70	60	40	n/a	50	30	n/a	30	15	n/a	n/a	5
	6,5,4(<120)	60	60	60	50	50	50	40	40	40	n/a	30	30	n/a	15	15	n/a	n/a	5

1. For stands with no logging history seral age is the on-site measured true stand age reflecting time since a stand destroying disturbance. For stands with a previous logging history, seral age is the age in the table determined immediately after the last harvest.
2. Attributes of old forest remaining after harvest. Assignment of category is determined by attribute with least % of old forest characteristics.
3. Use this age if measured age is >175. If measured age is <175, use 145.
4. No differentiation of old growth attributes are linked to % volume removals for age classes 5 and 6.

Table 29. Seral Age for Stands Following Partial Cutting (Ecosystems with Mature Defined as >100 Years and Old Defined as >250 Years).

Ecosystem	Seral Age Class[1]	Percent Volume Removed																
		1 - 10			11 - 20			21 - 30			31 - 45			46 - 65			66 - 85		
		Post Harvesting Atributes as % of Level in Natural Old Stands[2]																
		>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50
NDT1-ICH	9(>250)	215	90	80	175	85	75	130	80	70	n/a	70	60	n/a	50	40	n/a	n/a	15
NDT2-ICH	8(141-250)	175[3]	90	80	130	80	70	100	70	60	n/a	60	50	n/a	40	30	n/a	n/a	10
NDT2-SBS	7(121-140)	110	80	60	90	70	50	70	60	40	n/a	50	30	n/a	30	15	n/a	n/a	5
NDT4-IDF Fir Group Only	6,5,4(<121)	60	60	60	50	50	50	40	40	40	n/a	30	30	n/a	15	15	n/a	n/a	5

1. For stands with no logging history seral age is the on-site measured true stand age reflecting time since a stand destroying disturbance. For stands with a previous logging history, seral age is the age in the table determined immediately after the last harvest.
2. Attributes of old forest remaining after harvest. Assignment of category is determined by attribute with least % of old forest characteristics.
3. Use this age if measured age is >175. If measured age is <175, use 145.
4. No differentiation of old growth attributes are linked to % volume removals for age classes 5 and 6.

Table 30. Seral Age for Stands Following Partial Cutting (Ecosystems with Mature Defined as >100 Years and Old Defined as >140 Years).

		Percent Volume Removed																
	Seral	1 - 10			11 - 20			21 - 30			31 - 45			46 - 65			66 - 85		
	Age	**Post Harvesting Atributes as % of Level in Natural Old Stands[2]**																
Ecosystem	Class[1]	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50	>70	70-50	<50
NDT3-MS	9(>250)	185	90	75	140	80	65	100	70	55	n/a	60	45	n/a	40	35	n/a	n/a	15
NDT3-SBPS	8(141-250)	175[3]	85	70	130	75	60	100	65	50	n/a	50	40	n/a	30	20	n/a	n/a	10
NDT3-SBS[5]	7(121-140)	110	80	60	90	70	50	70	60	40	n/a	50	30	n/a	30	15	n/a	n/a	5
NDT3-ICH	6,5,4(<121)	60	60	60	50	50	50	40	40	40	n/a	30	30	n/a	15	15	n/a	n/a	5

1. For stands with no logging history seral age is the on-site measured true stand age reflecting time since a stand destroying disturbance. For stands with a previous logging history, seral age is the age in the table determined immediately after the last harvest.
2. Attributes of old forest remaining after harvest. Assignment of category is determined by attribute with least % of old forest characteristics.
3. Use this age if measured age is >175. If measured age is <175, use 145.
4. No differentiation of old growth attributes are linked to % volume removals for age classes 5 and 6.
5. Includes pine group from NDT4-IDF.

4.5 The Relation of Problem Forest Types to Seral Stage Distribution

Seral stage distribution as described in the Biodiversity Guidebook is based only on age without consideration for additional stand attributes. However, stands of similar age do not necessarily have equivalent biodiversity conservation value. The principle on which the guidebook is based is that the closer management can emulate natural disturbance patterns the better biodiversity can be conserved. This means that stands of a given age should have the range of characteristics found on the natural landscape.

Stands referred to as 'Problem Forest Types' make up a significant area of the Cariboo Forest Region. For example, in the Williams Lake TSA problem forest types comprise 20% of the total area of land. These stands include: pine stands with a very high number of stems per hectare, deciduous forest types, and many sites which are currently showing low timber growing potential.

Problem forest types are not necessarily a problem for biodiversity. For example, the many thousands of hectares of 'decadent' redcedar/hemlock stands are not a detriment to biodiversity conservation. Many of these stands have higher levels of coarse woody debris and wildlife trees than is typical of stands more desirable for timber harvesting. Having a portion of mature and old redcedar/hemlock in this condition is beneficial for biodiversity because it represents the natural condition in which some of these forests are found. The same is true of deciduous and spruce/subalpine fir 'problem' forest types. The biodiversity guidebook discourages the large-scale conversion of these types since, from the biodiversity standpoint, they are not in need of rehabilitation.

The situation is somewhat different in densely stocked (stocking class 4) pine. Currently, these stands cover an estimated 684 000 ha within the Cariboo Forest Region. Stands of this type are a natural result of succession following fire, especially in NDT 3. However, high proportions of dense, stagnant, overstocked pine within the mature and old forest component is not natural and compromises biodiversity values. Prior to fire control many of these overstocked stands would have been burnt before reaching the mature or old seral ages. Additionally, ground fires would have reduced the stocking of a portion of these overstocked stands. With effective fire control and preferential logging of other stands, these dense, stagnant stands make up increasingly larger proportion of mature and older age classes. Clearly a pine stand composed of small, densely stocked trees with their associated dense canopy is not ecologically equivalent to an old pine stand composed of large trees and canopy gaps.

Managing for the proportion of these stands that occurred naturally in the various seral stages could be part of a biodiversity landscape goal. However, forest management is currently increasing the contribution of these stands by concentrating timber harvesting in the mature and old stands which have the highest values. Additionally, as section 4.3.1describes, the proportion of stocking class 4 stands in the mature category is projected to substantially increase over the next 20 years because of the age class distribution of stocking class 4 stands. The combined effect of these two factors would be a substantial negative impact on biodiversity conservation.

Priority should be given to distribute the timber harvest proportional to the occurrence of all stand types within the mature plus old component of each landscape unit, especially stocking class 4 pine. For landscape units with high proportions of overstocked pine (see section 4.3.2.5), harvesting in other stands should be limited until the minimum guideline for mature plus old forest can be met by at least 70% non-stocking class 4 stands. Spacing, thinning,

harvesting or rehabilitation of a portion of stocking class 4 stands would improve biodiversity conservation.

5.0 Other Issues

5.1 Connectivity and Other Spatial Concerns

The spatial arrangement of forest patches at the landscape scale is a very important aspect of managing forest landscapes for biodiversity. Landscape level spatial objectives for biodiversity include minimizing the fragmentation of mature and older seral stages and maintaining mature and old forests in specific strategic habitats. The importance of these objectives is highlighted in the FPC Biodiversity Guidebook by the prominence of recommendations for connectivity, interior forest, ecosystem representation, block size distribution, harvest aggregation and landscape design.

Spatial concerns are best addressed through spatially explicit, long term, operational planning at the sub-regional level, developed by a multi-disciplinary team. **While the STTAA harvesting scenario did not explicitly address landscape spatial objectives, the question of their potential impact on timber availability still must be considered.**

The biodiversity guidebook directs that in lower biodiversity emphasis units, no additions to the old seral stage targets for the provision of connectivity are permitted However, the biodiversity guidelines state that in intermediate and higher emphasis units, old seral linkages may be incremental to the areas required to just meet seral stage targets. In this case, some constraint to timber flows over and above that required to meet seral targets might be required. The possibility of additional constraints will depend on the degree of overlap between required linkages and existing or planned old forest patches. The higher the current landscape proportion in mature and old seral stages, the more flexibility remains for meeting landscape level spatial objectives without imposing significant additional constraints on timber flows. **Therefore, the sooner that comprehensive landscape planning can be done, the more options will remain for biologically effective temporal and spatial arrangement of the cut and leave areas and the lower the potential effect on timber flows.**

The biodiversity guidebook recommends the maintenance of connectivity in managed forest ecosystems by simulating the type and degree of connectivity found in similar natural sytems. The characteristics of this natural connectivity depend on biogeoclimatic unit, physiography and other ecosystem specific variables. The recommendations provided in the biodiversity guidebook are quite general in nature and require significant innovation and creativity to translate into an operational context. More specific recommendations and options for managing for connectivity in the ecosystems found in the Cariboo Forest Region should be developed to aid landscape planning teams.

5.1.1 Patch Size

The entire biodiversity guidebook is founded on the concept that the closer we can emulate natural disturbance patterns the better we can ensure the maintenance of biodiversity. Natural patch sizes created by disturbance factors such as fire, insects, disease, and wind created a

characteristic range of patch sizes in each Natural Disturbance Type (NDT). Patch sizes naturally ranged from fractions of a hectare to many thousands of hectares.

Since patch size distribution is such an important component of biodiversity it has received specific attention in the Forest Practices Code. Section 21 (1) of the Operational Planning Regulations (OPR) states that cutblock design, including size, shape, and pattern, must be consistent with the objectives established under a higher-level plan, including objectives for biodiversity.

The Forest Practices Code specifies a typical maximum cutblock size of 60 ha for the Cariboo Forest Region. However, larger maximum cutblock sizes may be allowed by the district manager for specific reasons. The biodiversity guidebook recommends a range of cutblock sizes specific to each NDT. In all NDT's the maximums are much higher than 60 ha. This is necessary to emulate the size distribution of natural disturbance events. Where larger cutblocks are specified, the cutblock design must be consistent with the structural characteristics, and the temporal and spatial distribution of natural openings. This would include leaving Wildlife Tree Patches, coarse woody debris and other stand level features (see Section 7.0).

Patch size should not be thought of as only cutblock size. The biodiversity guidebook makes it clear that patch size includes patches of mature and old forest. It specifies that patches of mature and old forest be identified as leave areas when large harvest patches are being considered. Through time harvested patches will become mature patches and some can be left to become old forest patches. At that time the leave areas can be harvested.

There is real urgency to start to move toward the patch size distribution recommended in the biodiversity guidebook. Our landscapes are increasingly becoming a fragmented mosaic of small to medium sized cutblocks separated by narrow leave strips which is very different than the landscapes produced through natural processes. Even with prompt action, it will take many years to more closely simulate the natural landscape pattern.

The STTAA proposed harvest does not reflect the patch size distribution in the biodiversity guidebook. Application of the full range of block sizes recommended for biodiversity should result in more flexibility in meeting timber targets since adjacency and green-up will be less of an issue.

5.2 Biodiversity Indicators

Over time, it is necessary to monitor a set of indicators to assess whether biodiversity objectives are being achieved. The indicators used would focus on both coarse and fine filter approaches in meeting those objectives. It is assumed that *compliance* monitoring to assess whether prescribed measures are actually being implemented properly is a separate task that would be done as an operational requirement of FPC implementation.

When the Protected Areas Strategy is completed for the Province, analyses at the BGC zone and subzone/variant level should be undertaken at both the provincial and regional levels. This would provide a more complete understanding of the level of ecosystem representation in

protected areas a provincial context and consequently the emphasis required in the CCLUP to meet ecosystem needs.

Seral stage representation relative to biodiversity targets is a major indicator of biodiversity. Monitoring of current seral condition should be done on a regular basis to determine whether objectives are being achieved over time. Reporting in Forest Development Plans should be coupled with GIS analysis by landscape unit to derive an annual approximation of seral condition and trend.

The current analysis represents a "snapshot" of seral condition irrespective of the spatial distribution of the various seral classes within a landscape unit. With the formal establishment of landscape units, additional indicators need to be developed to monitor the distributional aspects of seral stage representation and how they are being achieved over time. The establishment of Forest Ecosystem Networks will contribute to this goal as they represent a spatially distributed network of forest types with accompanying guidance on location and condition of linkages over time.

In addition to seral stage condition, indicators of biodiversity should include indices of fragmentation within landscape units or sub-regional planning areas. Reported road and cutblock developments can be assessed in a spatial context to determine changes to the index over time.. One measure of fragmentation is the patch size distribution within each landscape unit. Annual assessment of patches would provide input needed for comparison to guidebook targets. For example, if past management has created a landscape with many medium sized patches, the annual target may be to create more large and small patches to better achieve the patch size distribution specified in the biodiversity guidebook.

The condition of riparian management areas may also be used as an indicator for biodiversity. The Forest Practices Code specifies reserve and management zones according to the class of stream, lake or wetland. There is some uncertainty regarding the long term effectiveness of these prescriptions in achieving riparian protection. At minimum, a subset of riparian management areas should be monitored to indicate whether the habitat structure (condition of the riparian management zone) remains over time to perform the expected function. More detailed research regarding effectiveness of the prescriptions in protecting aquatic and terrestrial organisms would have to be assessed against other competing priorities.

Seral stage condition, fragmentation and riparian condition are coarse filter indicators of biodiversity. Fine filter mechanisms are required as well which apply to red and blue listed species as well as species of provincial or regional significance. Existing and planned inventory with respect to population and habitat status can be used as rudimentary indicators of condition. More specific indicators may be developed on a site specific or species specific basis.

5.3 Stand Level Management for Biodiversity

5.3.1 Wildlife Trees

The Forest Practices Code Timber Supply Analysis (Feb. 1996) estimates that the provincial harvest impacts for stand level biodiversity, in the short term, is 1.8%. This increases by 1% in the absence of landscape level objectives and management. The provision for designating Wildlife Tree Patches (WTP's) is a major component of stand level management for biodiversity and the only stand level component that was assumed to have an impact on harvest levels. Only when WTP's are greater than 2 ha. in size do they contribute to meeting seral stage requirements for a landscape unit. Management for coarse woody debris (CWD) was assumed to have no present impact on harvest levels. Since the interior has a lower frequency of riparian areas than the coast, the analyses assumed only 50% (versus 75% on the coast) of the WTP area, on an interior-wide average, would be found in otherwise constrained areas.

The Quesnel TSA was one of several TSA's that the Forest Practices Code Timber Supply Analysis examined in detail. This analysis concluded, "The riparian and biodiversity FPC requirement do not have an effect on the short-term timber supply forecast since the existing inventory of mature timber in the Quesnel TSA is very large. Even with the increased exclusions for riparian reserves and reduced timber availability due to biodiversity requirements, there are enough alternative areas available for harvesting to sustain the current rate of harvest over the short term. However, the initial rate of harvest cannot be maintained as long as in the Timber Supply Review (TSR) base case". The long term level is 4% below the long term harvest level in the TSR base case.

The TSR revealed a far less flexible base case scenario in the Williams Lake and 100 Mile House TSA's. The impact of stand level management for biodiveristy would logically be greater and the impact felt sooner.

5.4 No-Harvest Areas

The CCLUP document identifies three levels of timber availability, one of which is no harvest. Further, the plan stipulates that this timber target has been derived specifically to address non-timber values, (p10) " The portion of the total forest that, due to other resource values, is not presently available for harvest under current forest management regimes." The interpretive letter from IAMC (February 1, 1996) expands upon this, "These CCLUP targets only include netdowns for land use or non-timber resource management purposes; they do not include netdowns for economic or operability factors such as problem forest types, steep slopes, roads, and rights-of-way or non-satisfactorily restocked areas."

These no-harvest targets will be required to meet a range of non-timber values in each CCLUP sub-unit. Specific no-harvest areas are already identified for caribou and some may be described for mule deer. In turn, there are significant biodiversity values requiring the application of no-harvest areas. Some of these are immediately apparent and some will be more fully described as planning and inventory is carried out in the region over time.

Riparian reserves, wildlife habitat areas for identified species, wildlife tree patches and rare ecosystems will all require some no harvest prescription. Classification of these various features is not completed in the Cariboo-Chilcotin Region. A listing of rare ecosystems will be produced as part of the biodiversity strategy including specific attention to deciduous components where they comprise a minority element within a stand. The complete list of rare ecosystems is identified as work remaining to be done (Section 7.0).

In some landscape units, Old Growth Management Areas may be required where current forest condition does not permit the achievement of old forest targets (Biodiveristy Guidebook; p59). Old growth management areas identified for this reason would be reserved from harvesting with the possible exception of removal of trees at risk of infecting adjacent stands with forest pests. The Old Growth Management Area would remain in effect until replacement stands are available to meet the old forest category in the landscape unit.

5.5 Managing Identified Wildlife

The CCLUP provides guidance for the management of a number of specifically identified wildlife species and species groups. For mule deer and caribou it calls for the development of specific strategies and provides targets for no-harvest and modified harvest areas within specific CCLUP polygons. For widespread species and species groups of high management interest it provides the following objective which is almost identical for all polygons: *" To manage for grizzly bear, moose, furbearer, species at risk, and other sensitive habitats within the areas identified as riparian buffers, recreation areas, caribou habitat, mule deer winter range and lakeshore management zones* ***and throughout the polygon under the biodiversity conservation strategy"*** (emphasis added). Table 31 summarizes the species or habitats for which direction is given within the polygon targets in Appendix 3 of the CCLUP report.

For species and habitats at risk the plan calls for the following actions:

- *undertake forest inventory to identify species and habitats at risk and management needs*
- *prepare and implement recovery plans for rare and endangered species*
- *consistent with targets, establish Wildlife Habitat Areas, Sensitive Areas and other appropriate classifications as required under the FPC to protect these species and habitats*
- *consistent with targets, provide buffers of at least 200m and limit human disturbance around Pelican feeding lakes.* These lakes are specified.

The Forest Practices Code guidebook on Managing Identified Wildlife will provide recommendations for the establishment and management of Wildlife Habitat Areas (WHAs) for red and blue listed and regionally significant species. The Managing Identified Wildlife Guidebook also provides direction on how application of the Biodiversity Guidebook can be tailored to meet the needs of selected species. The Managing Identified Wildlife Guidebook is expected to be available in the summer of 1996. Since it was not available in the summer of 1995, its recommendations were not incorporated into Short Term Timber Availability Assessment 20 year harvesting plan. **Therefore any impacts of these recommendations on timber availability will likely be over and above any of the integrated management considerations incorporated into the STTAA. The Chief Forester's recent timber supply**

analysis of Forest Practices Code impacts has estimated the impact of this guidebook to be 1% of the provincial timber supply over both the short and long term. The report states that this 1% does not include the impacts for species with high individual impacts including the grizzly bear, caribou and northern goshawk. These potential impacts described in the Chief Forester's report need to be considered when evaluating the achievability of the Short Term Timber Supply Availability Assessment and in the upcoming Timber Supply Review.

Table .31. Summary of species and special habitats for which special direction is provided in CCLUP targets. Since the CCLUP directs that moose, furbearers, species at risk and other sensitive habitats be managed for in all subunits, these are not included in the table below.

CCLUP Polygon	Species or special habitat
Boss Deception	salmon, grizzly bear, caribou
Brittany Triangle	salmon, mule deer
Charlotte Alplands	salmon, grizzly bear
Flat Lake	salmon, grizzly bear
Interlakes	salmon, grizzly bear, mule deer
Itcha /Ilgachuz	salmon, grizzly bear, caribou
Lang/Schoolhouse	mule deer
Lower Blackwater	aspen stands, mule deer
Marble	salmon, rare limestone plant associations, bighorn sheep, mule deer
Niut	Dolly varden, grizzly bear, mule deer
Potato Range	mule deer, grizzly bear
Quesnel Highlands	salmon, grizzly bear, caribou
Quesnel Lake	salmon, grizzly bear, mule deer caribou
South Chilcotin	bighorn sheep, Dolly Varden, grizzly bear
Taseko Lake	spruce stands, grizzly bear, mountain goat
Upper Blackwater	White Pelican, grizzly bear, caribou
Kluskus	spruce stands, caribou
Anahim Lake	salmon, white pelican, spruce stands, grizzly bear, pine mushroom
Chezacut	salmon, spruce stands, white pelican, grizzly bear, caribou, mule deer
Kleena Kleene	spruce stands, grizzly bear
Eagle	spruce stands, grizzly bear, mule deer
Grassland	salmon, key grassland habitats, white pelican, grizzly bear, Beecher Prairie pothole habitat, mule deer
Clinton	salmon, grizzly bear, mule deer
Baezaeko	salmon, grizzly bear, caribou, mule deer
Nazko	salmon, white pelican, grizzly bear, mule deer
Quesnel	salmon, deciduous stands, grizzly bear, mule deer
Cottonwood	salmon, grizzly bear, mule deer, caribou
Beaver Valley	salmon, deciduous stands, mule deer
Williams Lake	salmon, White Pelican, mule deer
Palmer	spruce stands, white pelican, grizzly bear, mule deer
Canim	salmon, grizzly bear, caribou, mule deer
Rail	mule deer
Gustafson	salmon, grizzly bear, mule deer
Loon	salmon, grizzly bear, mule deer
Bonaparte	salmon, grizzly bear, mule deer
Gaspard	bighorn sheep, mule deer
Batnuni	grizzly bear

5.6 Integration With Other Strategies

The CCLUP Implementation report specifies a percent no harvest and modified harvest for caribou and mule deer as well as overall percentages for each CCLUP polygon. The difference between these specified and overll values reflects what the plan suggests is available for riparian and biodiversity plus any other non-timber resource values.

5.6.1 Mule Deer

The biodiversity and mule deer strategies both have regional, landscape and stand-level components. A brief summary of the approach taken in the mule deer winter range strategy at each of these scales is presented in the paragraph as background for discussion of the relationship between the two strategies.

At the regional level, the mule deer strategy identifies winter ranges within the region which are to be managed to maintain their habitat value for mule deer. These winter ranges are landscapes dominated by Douglas-fir stands in areas and topographic positions which result in reduced snow depths. A landscape management strategy designed specifically for mule deer is then developed for each identified winter range. This strategy specifies the proportions of the landscape to be maintained in each of three different forested crown closure classes. This landscape strategy then guides the application of a stand management regime including specialized harvesting, spacing and access prescriptions to selected stands within each winter range. Harvesting prescriptions seek to maintain mixed-age Douglas-fir stands with some attributes of old forests such as a high degree of vertical and horizontal structural diversity.

The regional allocation of biodiversity emphasis options recommended by the Biodiversity Strategy Committee generally compliments the Mule Deer strategy. The presence of mule deer winter range was not included as a primary criteria for the determination of biodiversity emphasis since mule deer are not a rare and endangered species. However, because the location of mule deer winter ranges is correlated with other factors which determined conservation priority (eg. the degree of biogeoclimatic representation in protected areas, the presence of rare and endangered species sensitive to landscape level forestry development), most landscape units containing mule deer winter ranges were recommended for intermediate or higher emphasis by the Biodiversity Strategy Committee. This is complimentary to the mule deer strategy since the winter range requirement for high proportions of forest with old forest structural characteristics and high levels of connectivity would be easier to meet in landscape units with intermediate and high biodiversity emphasis. It is also complimentary to the CCLUP which calls for the maintenance of mule deer values through the application of modified harvesting regimes on winter ranges.

Landscape management for mule deer winter range can have both positive and negative effects on management for biodiversity. The positive effects result from the relatively large area of high crown closure, mixed age stands which would be managed to provide some of the old forest attributes required for biodiversity conservation. However, these positive effects are restricted to the relatively small area which is covered by mule deer winter ranges. The potential negative effects result from allocation of a large proportion of modified and no-harvest area to winter

range, with insufficient area remaining uder CCLUP to meet biodiversity conservtion values on a range of ecosystems occurring outside of mule deer winter ranges. For example, wetland complexes are an important component of biodiversity in IDF landscapes in the Cariboo Forest Region. Maintaining mature and old forest connectivity within and between these wetland complexes will require some extended rotation and no-harvest areas. To ensure that all important biological values are considered, the distribution of modified and no-harvest will have to be carefully balanced in the integration process.

The stand level management prescriptions recommended for Douglas-fir stands on mule deer winter ranges will maintain some, but not all, of the old forest attributes important for conservation of biodiversity. The extended rotation, low volume, group selection harvesting approach described in the *Handbook for Timber and Mule Deer Management Coordination in the Cariboo Forest Region* will maintain a diverse vertical and horizontal stand structure including a significant number of the large, old trees. The juvenile spacing guidelines developed for mule deer winter ranges will maintain some of the natural clumpiness of stand structure while returning the understory to more natural densities. Use of these harvest and spacing recommendations for mule deer will produce stands with many of the attributes required for biodiversity management if additional provisions are made for the maintenance of wildlife trees and coarse woody debris (CWD). Management for wildlife trees and CWD are discussed in the Biodiversity Guidebook. Additional guidance on the management of CWD for biodiversity will be forthcoming.

5.6.2 Caribou

Landscape Level

Caribou occur in two distinct areas of the region. Both of these areas are mostly within Special Resource Development (SRD) zones with small parts in Integrated Resource Management (IRM) and Enhanced Resource Development (ERD) zones.

In the east, the biogeoclimatic subzones within the caribou winter habitat are well represented in protected areas (>10%; figure 5). Since ecosystem representation is a primary criteria for conservation priority, the biodiversity emphasis tends to be lower. Conversely, eastern caribou are part of the mountain caribou ecotype which are 'blue' listed, therefore, this tends to increase the conservation priority. The net result of the application of these criteria is that about 50% of the landscape units in eastern caribou habitat have a proposed higher or intermediate biodiversity emphasis (Table 32).

The situation is somewhat different with the Itcha/Ilgachuz caribou in the western part of the region. The biogeoclimatic subzones in the caribou winter range in this areas are only moderately represented (>5-10%; figure 5) resulting in a higher conservation priority. As a result, all except two landscape units have a proposed higher or intermediate biodiversity emphasis (Table 32).

The proposed eastern caribou strategy will probably meet the majority of the biodiversity seral stage guidelines for the ESSF biogeoclimatic zone since the CCLUP designates significant "no harvest" areas for caribou. However, there may be significant distributional concerns since the upper elevations of the ESSF zone (ESSFwc3) contain most of the caribou habitat and therefore

will receive most of the "no harvest" allocation while the majority of the cut might be concentrated in the lower elevations of the zone (ESSFwk1).

The western caribou strategy will meet much of the seral stage guidelines for the MS biogeoclimatic zone within landscape units since the CCLUP designates a substantial percent of "no harvest" for caribou. The Itcha/Ilgachuz protected area will largely meet the seral stage requirements for the ESSF zone in this area.

Stand Level

The caribou strategy goal of maintaining some old seral stand structure for eastern caribou may help to meet the mature seral guidelines of the biodiversity strategy if consideration for other attributes is included. The caribou strategy specifies maximum 33% volume removal of all merchantable size classes. With this prescription the stand could meet the definition of immature after timber harvesting if other stand attributes were maintained. With less than 30% volume removal and maintenance of other stand attributes, the stand could meet mature seral status. In both cases, requirements for attributes like coarse woody debris would have to be added to the stand prescription for caribou. Forthcoming age plus attribute definitions for old seral will help to project when these partial cut stands can again be considered old (Section 4.4).

The same situation may apply to western caribou in stands managed for arboreal lichen habitat since a maximum 33% volume removal selection system is being advocated. Of course, specific stand attribute targets would have to be developed since these stands in MS and SBPS are very different than those in eastern caribou habitat. On terrestrial lichen sites, which are far more common, the 50% partial retention prescription suggested by the caribou strategy will shift old or mature stands into mid-rotation stands between early and immature seral. Again, forthcoming attribute definitions for mature and old seral will help to project when these partial cut stands can again contribute to the targets for these seral stages.

Table 32. Landscape Units with Significant Caribou Habitat Concerns and their Biodiversity Emphasis.

WESTERN CARIBOU	
LANDSCAPE UNIT	**EMPHASIS**
Beeftrail	Higher
Corkscrew	Higher
Downton	Higher
Chine	Intermediate
Christenson Creek	Intermediate
Clisbako	Intermediate
Clusko	Intermediate
Coglistiko	Intermediate
Eliguk	Intermediate
Holtry	Intermediate
Kluskus	Intermediate
Palmer Jorgenson	Intermediate
Pan	Intermediate
Punky Moore	Intermediate
Tusulko	Intermediate
Upper Dean	Intermediate
Baezeko	Lower
Toil	Lower

EASTERN CARIBOU	
Antler	Higher
Horsefly	Higher
Spanish	Higher
Bowron	Intermediate
East Arm	Intermediate
Eastside	Intermediate
Mathew	Intermediate
McKinley	Intermediate
Mitchell Lake	Intermediate
Niagara	Intermediate
Sandy	Intermediate
Penfold	Intermediate
Westside	Intermediate
Victoria	Intermediate
Big Valley	Lower
Cariboo Lake	Lower
Cunningham	Lower
Deception	Lower
Jack of Clubs	Lower
Lightening	Lower
Likely	Lower
Little River	Lower
Lower Cariboo	Lower
McKay	Lower

McKuskey	Lower
Swift	Lower
Wasko Lynx	Lower
Willow	Lower

6.0 CCLUP Targets for the Special Resource Development Zone

The CCLUP Report provides two types of targets for the Special Resource Development Zone (SRDZ). The first is a "top down" target which states that *"the forest industry will have access to 70% of the timber from the productive forest land base averaged over the zone"*. The second, which was developed to address the site specific characteristics of each land use polygon, is a set of targets for all major forest resource values for each polygon. The CCLUP states that the specific targets developed for each zone and polygon will provide the key direction to sub regional planning processes (Page 151, point 4).

Subsequently, the Inter-Agency Management Committee (Feb. 1, 1996) provided interim direction to limit the amount of land area which would be available for extended rotation management regimes in the SRDZ. The direction included a mathematical formula to determine the proportion of modified harvest to be made available for timber harvest over one rotation and a statement that defined "extended rotation" as any management regime which resulted in rotations longer than this minimum harvestable age. The average minimum harvestable age was set at 80 years for lodgepole pine stands and 120 years for all other species. No range of values was specified to account for variability in productivity or management objectives in various parts of the region.

The February 1, 1996 direction may seriously limit the achievability of non-timber CCLUP polygon targets in the SRDZ for which rotations beyond the minimum harvest age are required. The CCLUP targets for which rotations beyond the minimum harvest age would be required include: mule deer winter range management, caribou habitat management and biodiversity seral stage targets. Mule deer winter ranges requiring extended rotations of approximately 250 years on the Douglas-fir dominated portions of winter ranges cover approximately 45,814 ha. within the SRDZ (3.1% of the forested area of the SRDZ). Caribou habitat requiring rotation ages of between 140 -250 years in various habitats cover 152,790 ha. within the SRDZ (10.4 % of the forested area within the SRDZ). Biodiversity seral stage requirements will require rotations above the minimum harvest age for mature and old seral stages throughout the entire SRDZ. The areas required and the required rotation age will vary with the Natural Disturbance Type, Biogeoclimatic Zone and Biodiversity Emphasis option. In addition, some additional "extended rotation" management regimes may be required to meet CCLUP targets for species at risk and other sensitive habitats, backcountry condition, and visual quality for tourism and recreation.

A quantitative analysis of the compatibility of the February 1, 1996 direction with achievability of specific polygon targets was not done at this time for at least two main reasons. First, many of the assumptions that would be required to do such an analysis would be difficult to provide at this time but will become apparent as the more detailed subregional planning processes proceed.

For example, some degree of geographic overlap will exist between the "extended rotation" requirements for meeting the various non-timber CCLUP targets. The degree and nature of this overlap will vary depending on specific ecological characteristics and social expectations within a subregional planning area. Also, the rotations required to achieve timber objectives may exceed the stated minimum harvest ages in some forest types. As a result, the need for additional "extended rotation" requirements for non-timber values could be reduced, depending on the degree of overlap. A meaningful analysis needs to be based on site specific realities and was therefore considered premature at this time.

A second, currently unresolved factor required for this analysis is the long term management strategy which will be used to maintain the landscape requirements for the old forest seral stage. Old forest can be maintained using a range of strategies. At one end of the range, enough area to just meet old forest requirements could be permanently excluded from the cut and only recruited from younger seral stages at a rate required to replace losses from natural disturbance. Under this strategy, the old forest areas would not move except when they had to be replaced because of loss by natural disturbance. At the other end of the range, we could manage the entire landscape unit on an extended rotation, thereby continuously harvesting old forest and replacing it by planned recruitment from mature seral stages. Under this strategy, the old growth patches would move over time as current old aeas were harvested and new ones were recruited to replace them. Some alternative strategies between these two extremes may be available as well. Because many landscape units currently have a large area of old forest in excess of minimum guidelines, an immediate decision on the old forest maintenance strategy is only required for some landscapes. However, the sooner a decision is made, the greater the flexibility to achieve both timber and non timber targets over time without major disruptions. The particular strategy adopted to maintain old forest will affect the amount of extended rotation area required over the long term to meet old seral stage minimum guidelines. Since these strategies have not yet been considered for the CCLUP area, an analysis of extended rotation requirements for old seral forests would be difficult.

A number of questions can be raised about the use of minimum harvest ages for defining "extended rotations". Minimum harvest ages are defined for timber supply analysis purposes to serve as default where no other management regime is specified. They were not developed for the purposes of defining extended rotations and their use for this purpose is inappropriate for the following reasons.

First, the standardized regional minimum harvest age values for pine and non-pine do not provide the flexibility required to adapt extended rotations to a variety of site productivities. For example, a significant proportion of the pine stands in the SRDZ are found in the Montane Spruce very dry, very cold biogeoclimatic subzone (MSxv). Available data, although limited, suggest that growth is very slow. Using data from a single growth and yield plot near Thunder Mountain and increasing its site index to allow for increased growth rates in a managed stand, the MOF variable density yield prediction model predicted that trees with an average DBH of 20 cm and height of 18m would require 140 years of growth. A significant proportion of the SRDZ is in high elevation stands which may require longer than the minimum rotation age to meet timber and other objectives. Since the minimum harvest age is to be applied as an average, a significant area with lower than minimum rotations would be required. It is unlikely that such areas exist in sufficent proportion to balance those requiring the longer rotation.

Second, the approprite harvest age for an area is intimtely linked to the set of timber and non-timber objectives applicable to that area. Arguably the most useful of the many definitions of rotation age is **"the number of years following harvest required for a forest stand to develop the attributes required to meet the stated management objectives"**. Use of a single fixed rotation to determine a standard definition of "extended rotation" violates the basic requirement to grow the forest long enough to achieve the objectives that we set for the stand.

Minimum Harvest Age

Given the above discussion, the Biodiversity Committee recommends re-evaluation of the use of minimum harvest age for defining extended rotations as modified harvest. This re-evaluation should include a realistic assessment of the number of years required after harvest to meet the forest management objectives. The evaluation should consider:

- biogeoclimatic variations in growth rate and regeneration delay,
- prescriptions and cutting cycles required to produce the stand structure objectives to meet CCLUP non-timber targets.

According to the CCLUP, " the Special Resource Development Zone was designated where significant fish, wildlife, ecosystem, backcountry recreation and tourism values exist. Timber harvesting mining and grazing will take place in this zone in a manner that respects these values." Great care should be exercised to ensure that a minimum harvest age definition is not used which will result in so little extended rotation that the goals for which the SRDZ was established are no longer attainable.

7.0 Major Recommendations

The following is a summary of major recommendations from this first phase in the development of a Cariboo-Chilcotin Biodiversity strategy.

1. Establish landscape unit boundaries as soon as possible.

Landscape units are fundamental to the development and implementation of a biodiversity strategy. They should be established as soon as possible to facilitate the setting of landscape unit objectives and optimization of timber and non-timber values. The landscape units documented in Section 2 of this report are developed consistent with provincial direction and provide a well rationalized ecological set of boundaries for landscape units for the entire Cariboo Forest Region.

2. Rank landscape units with respect to planning priority.

For logistical reasons, landscape planning cannot be done immediately for all landscape units in the region. Therefore, planning priorities should be established to ensure that landscape units with the greatest threats to biodiversity are identified and dealt with expeditiously. Section 4.3 of this report provides recommendations for landscape units in each forest district which should receive high priority for landscape planning.

3. Develop and implement landscape biodiversity objectives as soon as possible.

The sooner that biodiversity objectives are implemented, the more options will exist for doing good biodiversity management and the greater will be the flexibility to meet the guidelines without impacting timber flows. Also, once landscape biodiversity objectives are in place, stand level biodiversity recommendations become less onerous. The selection of a biodiversity emphasis option is an important first step in the development of landscape biodiversity objectives. This report provides biodiversity emphasis option recommendations for landscape units across the entire Cariboo Forest Region (see section 3). These recommendations resulted from a systematic process which considered the major factors important for assessing conservation priority from a regional perspective. Planning for the maintenance of mature and old forest reserves and corridors is another aspect of landscape planning which needs immediate attention in many landscapes so that valuable options and flexibility are not lost.

4. Re-distribute timber harvest in identified Landscape Units to meet biodiversity seral stage guidelines.

Detailed recommendations are provided in section 4.3. These recommendations provide a strategy for meeting biodiversity seral stage guidelines over time in all landscape units in the Cariboo Forest Region by directing harvest away from BGC units with shortfalls and designation of Old Growth Management Reserves where appropriate. These recommendations also acknowledge the value of current partial cutting practices in some ecosystems to maintain a level of mature and old forest attributes after harvest and encourage innovation in the use of partial cutting practices to maintain these attributes in specific ecosystems.

5. Distribute timber harvest over all stand types to ensure that mature and old leave areas are not concentrated in "problem forest types" and on steep slope areas.

The CCLUP has included in its definition of "productive forest" many types of areas which are currently netted out of the harvestable forest land base for timber supply analysis purposes. Two of these types are "problem forest types" (which comprised approximately 20% of the forested area of the Williams Lake Timber Supply Area) and areas of steep slopes. While many of the stands in these types provide valuable attributes for the maintenance of biological diversity, excessive concentration of mature and old leave areas in these types would mean that other types would be seriously under-represented in mature and old seral stages. Therefore, if these types are to be included in the harvestable land base, they should form a representative part of the harvest profile according to their estimated natural occurrence..

6. Implementing all aspects of the Biodiversity Guidebook is integral to the success of the CCLUP Strategy.

The various recommendations found in the biodiversity guidebook were designed to work together as a package to maintain biodiversity in managed forests. The recommendations have already undergone major adjustments to incorporate social and economic concerns and have been approved at the highest levels of government. Important elements of the guidelines which were only briefly touched on in this report include the spatial distribution of cut and leave areas and management for biodiversity at the stand level.

7. Implement the patch size recommendations found in the biodiversity guidebook as soon as possible.

The biodiversity guidebook recommends a distribution of patch sizes for cut and leave areas in each of the major natural disturbance types across the province. These recommendations encourage creation and maintenance of a range of patch sizes from smaller than the 60 ha. to significantly larger than the 60 ha.. The use of larger patch sizes on a significant proportion of the landscape is important to minimize the fragmentation of mature and old forests at the landscape scale. This larger patch size refers to both cut areas and leave areas. Large cut blocks will have to retain structural elements such as snags, coarse woody debris and green tree islands to mimic the natural disturbances specific to the ecosystem where it is located.

8. Consider the potential impact of all FPC biodiversity related guidelines on timber availability over time.

The numerical analysis contained in this report addresses the achievability of the biodiversity seral stage guidelines at the current time and potential trends for the next 20 years. Future timber supply analyses need to consider the achievability of these seral stage requirements over longer time frames. They also need to consider other essential biodiversity related elements of the FPC for which no numerical analyses were included in this report. These include landscape spatial planning guidelines (connectivity and representation), stand level biodiversity guidelines, riparian guidelines and identified wildlife guidelines. These FPC guidelines are supported by the CCLUP and are an essential part of the CCLUP and therefore need to be carefully considered when planning potential timber flows.

9. Review the use of standardized minimum harvest age for the determination of extended rotations when applying "modified harvest" timber targets in the Special Resource Management Zone.

The use of standardized minimum harvest ages for this purpose may not allow for the rotation periods required to grow sawlogs or to meet the CCLUP subzone non-timber targets. However, a "bottom up" approach which defines rotation age based on the number of years required to meet all stated objectives would ensure that CCLUP subzone targets for both timber and non-timber values could be met. According to the CCLUP, the Special Resource Development Zone was designated where significant fish, wildlife, ecosystem, backcountry, and tourism values exist. Timber harvesting, mining and grazing will take place in this zone in a manner that respects these values." Great care should be exercised to ensure that a minimum harvest age definition is not used which will result in so little "extended rotation" that the goals for which the SRDZ was established are no longer attainable.

10. Develop regional guidance on application of landscape connectivity guidelines.

The biodiversity guidebook recommends the maintenance of connectivity in managed forest ecosystems by simulating the type and degree of connectivity found in similar natural systems. The characteristics of natural connectivity depend on biogeoclimatic unit, physiography and other ecosystem specific variables. The recommendations provided in the biodiversity guidebook are quite general in nature and require significant innovation and creativity to be translated into an operational context. More specific recommendations for connectivity management in Cariboo Forest Region ecosystems would be useful to landscape planning teams.

11. Develop and implement a biodiversity monitoring strategy.

Both compliance and effectiveness of the biodiversity strategy implementation need to be monitored to provide the feedback required to keep the implementation on track. Compliance monitoring should be built into the development planning process. Section 4.4 of this report provides recommendations for the tracking of seral stages when partial cut harvesting is applied. Monitoring the effectiveness of the biodiversity strategy should be ongoing and include both operational and biological aspects of the implementation. This type of monitoring could be done through a combination of operational trials and research studies and other less formal methods. Regional coordination of this monitoring would be beneficial.

12. Continue with technical work required to translate provincial guidelines into the Cariboo Regional context.

This would include further work on defining rare ecosystems and "no-harvest" requirements for biodiversity, guidance on application of connectivity and coarse woody debris guidelines to Cariboo ecosystems, and development of any required strategies relating to grassland biodiversity and the maintenance of species at risk. The relationship of forest inventory age to stand age needs to be more fully assessed in order to better evaluate the inventory adjustment assumptions and procedures.