# 100 Mile House Timber Supply Area
# Timber Supply Review

# Data Package

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# 1. Introduction

The data package for the Timber Supply Review (TSR) program is simply an organized and consistent format for supplying the basic inputs required for a timber supply analysis.

The completed data package contains those inputs that are a part of current performance for the timber supply area (TSA). For the purpose of the timber supply review, "current performance" can be defined:

- by the current forest management regime — the productive forest land available for timber harvesting, the silviculture treatments, the harvesting systems and the integrated resource management guidelines used in the area;
- in the standards used to approve or reject operational plans or prescriptions;
- in fully implemented land-use plans;
- in land-use decisions approved by Cabinet such as higher level plans;
- in other approved or agreed to natural resource forest management practices and policy.

This idea of current performance (the last five to ten years) should be kept in mind at all times when reviewing the data package. In other words, the purpose of the timber supply review program is to model "what is" not "what if". Changes in forest management objectives and data, when and if they occur, will be captured in future timber supply analyses.

Each section of this data package is generally organized in the following way:

1) A short explanation of the data used in the data table;
2) Data table;
3) Area for comments and the source of the data.

The data package is released for public review and comment. Significant comments that change data inputs or descriptions of current practices that influence the analysis will be noted in the final Timber Supply Review documents such as the Technical Report, Public Discussion Paper and Rationale.

# 2. Current Forest Management Considerations and Issues

## 2.1 Base case management assumptions

These assumptions reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and is used as a baseline term of reference for the analysis. While there may be uncertainty around the assumptions used in the base case, adjustments to test these assumptions are listed in Section 7, "Sensitivity Analyses".

## 2.2 Statement of major forest management considerations and issues

The major forest management issues and considerations are listed in the table below. Where issues are defined within legislation, regulations or standards, a timber supply assessment will be made. Issues and factors that are difficult to quantify or assess using a timber supply model may be either analyzed separately or noted as upward or downward pressure on the timber supply.

*Table 1. Major forest management considerations*

| Consideration/issue | Description |
|---|---|
| Cariboo-Chilcotin Land Use Plan | Government has accepted the Cariboo-Chilcotin Land Use Plan (CCLUP) and the objectives are reflected in a higher-level plan order. In addition, the Regional Resource Board and the Interagency Management Committee have accepted the CCLUP Integration Report. Strategies and practice requirements to meet the CCLUP objectives are provided in approved operational plans. |
| Strategic Resources Management Plan | Strategic Resources Management Plans (SRMP) are a spatial application of the CCLUP direction at the sub-regional planning level. There are 47 objectives in the plan to guide operational planners. Supporting strategies provide more detail regarding proposed practices for meeting objectives. Recommendations are also provided within the plan where planning advice was considered appropriate but not necessarily associated with a specific CCLUP requirement. |
| Landscape-level biodiversity | The CCLUP requires that landscape-level biodiversity be maintained by meeting or exceeding mature plus old (M+O) and old forest objectives for each landscape unit (LU). These units are defined by the natural disturbance type (NDT) and biogeoclimatic ecosystem classification (BEC) subunit.. The CCLUP Regional Biodiversity Conservation Strategy, Update Note #8, Strategy for Management of Mature Seral Forest and Salvage of Mountain Pine Beetle – Killed Timber, provides for one time seral stage drawdown. |
| Stand-level biodiversity | In December 2005, the chief forester released guidance on landscape and stand-level structural retention in large-scale mountain pine beetle (MPB) salvage operations (Snetsinger 2005). |
| 100 Mile House District enhanced retention strategy | In 2007, the 100 Mile House District released the District Enhanced Retention Strategy. The strategy is intended to support the goal of increasing stand level retention during MPB salvage operations. |
| MPB Impacts to age class 2 and 3 pure pine stands | Epidemic levels of MPB have resulted in extreme beetle behavior; various levels of mortality have been detected in stands younger than 60 years. |

*(continued)*

# 2. Current Forest Management Considerations and Issues

*Table 1. Major forest management considerations (concluded)*

| Consideration/issue | Description |
|---|---|
| Sensitive watersheds | Large salvage operations in sensitive watersheds may limit future harvest operations until after hydrologic green-up has been reached. This overlaps somewhat with landscape and stand-level biodiversity. |
| Ungulate winter range | Different harvesting and retention systems are specified for high, moderate and low snowpack areas and habitat classes. |
| Viewscapes | Visual quality objectives and visually effective green-up heights (VEG) are used to guide block layout and harvest timing. |
| Predictive ecosystem mapping | The 2007 Enhanced Type 2 Silviculture Strategy suggests that Predictive Ecosystem Mapping (PEM) when used with Site Index Estimates by BEC Site Series (SIBEC) might have significant impact on mitigating the possible mid-term deficit. |
| Candidate goal two protected areas | The CCLUP recognized that, of the commitment to include 12% of the regional land base in protected areas, 11.75% was resolved initially by the land use plan and that the balance (0.25%) remained to be allocated by protecting relatively small special feature areas. These small special feature areas, also referred to as "Goal 2" areas, were to be identified and designated through subsequent planning at sub-regional and local levels. |
| Transitional old growth areas | A transitional old-growth management area (OGMA) only exists until it is replaced by other old forest in the LU-BEC or until the year 2030. Transitional OGMA represent potential permanent OGMA in LU-BEC units deficient in old growth. Old and old plus mature targets will also be managed under biodiversity objectives, and therefore transitional OGMA will be included in the forest land base for the analysis. |

# 3. Inventories

## 3.1 Background information

Table 2 is a list of the inventories that will be used to determine the timber harvesting land base and the associated management themes to be used in defining forest management activities.

*Table 2. Inventory information*

| Data | Source | Factor |
|---|---|---|
| F_OWN | BCGW | Ownership |
| DRA_DIGITAL_ROAD_ATLAS_LINE_SP | BCGW | Roads |
| WLS_COMMUNITY_WS_PUB_SVW | BCGW | Community Watersheds |
| RMP_STRGC_LAND_RSRCE_PLAN_SVW | BCGW | CCLUP Boundary |
| TA_PARK_ECORES_PA_SVW | BCGW | Protected Areas |
| PROT_CURRENT_FIRE_POLYS_SP | BCGW | Current Fire Polygons |
| PROT_HISTORICAL_FIRE_POLYS_SP | BCGW | Historical Fire Polygons |
| FTEN_RECREATION_POLY_SVW | BCGW | Recreation Polygons |
| FTEN_RECREATION_LINES_SVW | BCGW | Recreation Lines |
| WCP_UNGULATE_WINTER_RANGE_SP | BCGW | Ungulate Winter Range |
| WCP_WILDLIFE_HABITAT_AREA_POLY | BCGW | Wildlife Habitat Areas |
| VEG_COMP_LYR_R1_POLY | BCGW | Vegetation Cover |
| RMP_OGMA_LEGAL_CURRENT_SVW | BCGW | Legal OGMA |
| RMP_OGMA_NON_LEGAL_CURRENT_SVW | BCGW | Transitional OGMA |
| BEC_BIOGEOCLIMATIC_POLY | BCGW | Biogeoclimatic Polygons |
| TERRAIN_STABILITY_CAR_POLY | BCGW | Terrain Stability Polygons |
| RMP_PLAN_LEGAL_POLY | BCGW | CCLUP Legal Polygons |
| FTEN_CUT_BLOCK_POLY_SVW | BCGW | Cutblock Polygons |
| FADM_TSA | BCGW | TSA Boundary |
| RMP_PLAN_NON_LEGAL_POLY_SVW | BCGW | Resource Management Zones |
| RMP_LANDSCAPE_UNIT_SVW | BCGW | Landscape Units |
| TRIM_CONTOUR_LINES | BCGW | Contour Lines |
| BCMPB 2010 (Year 8) | FAIB | Mountain Pine Beetle Infestation |
| RESULTS Data | FAIB | Silviculture Activities History |
| Pending Community Forest Licence | DMH | Local Data |
| Pending First Nations Forest Licence | DMH | Local Data |
| Predictive Ecosystem Mapping | DMH | Local Data |
| DMH Operability Classes | DMH | Local Data |

# 3. Inventories

**Data source and comments:**

There are generally three sources of data for the analysis; corporate level data that resides in the provincial geographic data warehouse (BCGW), data maintained by the Forest Analysis and Inventory Branch (FAIB) and local data that is stored at the branch, region or district level. Two notable exceptions are RESULTS[1] information, this is maintained by Resource Practices Branch, and SIBEC which is also maintained by the Ministry of Forests, Lands and Natural Resource Operations (FLNR).

## 3.2 Forest cover inventory

The original forest cover inventory for 100 Mile House TSA is from 1972 and 1976. This has been updated annually to reflect changes to growth and disturbance (fire and harvesting) through electronic data submissions from licensees and government. Satellite imagery will be used to detect and update the inventory for any additional changes in forest cover not recorded in the data submissions.

In 1998, Lignum carried out a Phase 1 VRI on the chart area, also known as the IFPA (Innovative Forest Practices Agreement). In the non-IFPA area, VRI Phase 2 ground samples were completed in 2001-02. These adjustments were reflected in the 2006 TSR and will be applied in the current analysis.

Recent aerial photography over the entire TSA was completed in 2010/2011, and a VRI Phase 1 re-inventory is underway over all the 100 Mile House District with the exception of Wells Gray Park. This will not be completed until December 2013 and therefore will not be available for the current TSR. Effectively, the current inventory is of two vintages since 83% original forest cover inventory has been rolled over to VRI standards in 2003 and 17% has a complete or incomplete VRI done under the IFPA.

## 3.3 Predictive ecosystem mapping[2]

To be approved for use in timber supply analysis, PEM must meet rigorous standards for accuracy assessment. The accuracy of the PEM significantly affects the application of the SIBEC estimates and, in turn, the confidence in the site productivity estimates.

The PEM for the 100 Mile House TSA was completed in the spring of 2008. CDT-Core Decision Technologies Inc. and Timberline Natural Resources Group carried out an accuracy assessment. The accuracy assessment determined map accuracy to be 72.3% (by Ministry of Environment standards), well in excess of the required 65%. As a result, the PEM met the current (2009) standards for use in base case timber supply analysis.

[1] Reporting Silviculture Updates and Landstatus Tracking System.
[2] PEM/SIBEC for Site Index in 100 Mile House TSA; prepared for Nona Phillips Forestry Consulting Ltd. by Churlish Consulting Ltd., Victoria BC, and Jahraus & Associates Consulting Inc. Maple Ridge BC.

# 4. Division of the Area into Management Zones

## 4.1 Management zones and tracking of multiple objectives

The concept of management zones is used to differentiate areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objectives or wildlife consideration.

The forest cover dataset can be grouped by different variables. In addition, the non-THLB (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives. Grouping enables constraints to apply to different combinations of variables or zones and also can be used to enhance output reporting structures.

Groups may be thought of as layers of different objectives that must be tracked over time. Whether to put an objective into a group or a mutually exclusive management zone will be decided after data assessment with the timber supply analyst. For example, all management zones within a landscape unit may be grouped to track seral stage distribution in that landscape unit. This is an important feature as management activities within the management zones may lead to the creation of older forest characteristics. Not considering the combined effects of the management activities in the landscape unit could lead to an overestimate of the amount of older forest that needs to be maintained to meet landscape unit objectives.

Further information on the forest cover requirements to be applied to these areas can be found in Section 6.6, "Integrated Resource Management".

*Table 3. Objectives to be tracked*

| Objectives | Source | Issue |
|---|---|---|
| Landscape units (LU) and seral stage targets by BEC subzones | Non-standard map layer | Landscape-level biodiversity |
| Wildlife habitat areas | Non-standard map layer | General wildlife measures |
| Scenic areas | CCLUP | Visual quality objectives |
| Sensitive watersheds | Watershed management plan | Water quality and disturbance levels |
| Douglas-fir leading polygons | VRI | Silviculture systems |
| Spruce leading polygons | VRI | Spruce bark beetle impacts |
| Condition of young pine stands | VRI | Mountain pine beetle impacts |
| Operability classes | Non-standard map layer | Operable land base |
| Clinton community watershed | Watershed management plan | Harvest flow |
| Ungulate winter range | CCLUP | Silviculture systems |
| Site index by BEC site series | Non-standard map layer | Predictive ecosystem mapping and site productivity |

# 4. Division of the Area into Management Zones

**Data source and comments:**

Sources of information include both non-standard local map information in addition to provincial level GIS data stored in the corporate data warehouse. Origins of the data include higher-level plans, local resource management plans and ministerial orders.

## 4.2 Analysis units

An analysis unit represents a combination of stands with a specific timber growing capability that will be managed under a silviculture regime — as indicated by the leading species and site index. Each analysis unit is assigned its own timber volume projections (yield tables).

i) Yield tables for existing naturally established stands are derived using the variable density yield projection (VDYP7) growth and yield model.

ii) Existing managed stands will be modelled as already growing on the managed growth curve of the analysis unit. After a stand is harvested within the model forecast, it will be projected to grow following the managed growth curves assigned by table interpolation program for stand yields (TIPSY).

iii) Yield tables for recent plantations and future stands are also derived using TIPSY.

*Table 4. Definition of analysis units*

| Analysis unit | Label | Leading species | Site index class |
|---|---|---|---|
| 11 | Decid poor | Aspen, Birch | 0 < SI < 10 |
| 12 | Decid medium | Aspen, Birch | 10 <= SI < 15 |
| 13 | Decid good | Aspen, Birch | 15 <= SI < 20 |
| 14 | Decid very good | Aspen, Birch | 20 <= SI |
| 21 | Douglas-fir poor | Douglas-fir | 0 < SI < 10 |
| 22 | Douglas-fir medium | Douglas-fir | 10 <= SI < 15 |
| 23 | Douglas-fir good | Douglas-fir | 15 <= SI < 20 |
| 24 | Douglas-fir very good | Douglas-fir | 20 <= SI |
| 31 | Balsam poor | Balsam, Cedar, Hemlock | 0 < SI < 10 |
| 32 | Balsam medium | Balsam, Cedar, Hemlock | 10 <= SI < 15 |
| 33 | Balsam good | Balsam, Cedar, Hemlock | 15 <= SI < 20 |
| 34 | Balsam very good | Balsam, Cedar, Hemlock | 20 <= SI |
| 41 | Pine poor | Pine | 0 < SI < 10 |
| 42 | Pine medium | Pine | 10 <= SI < 15 |
| 43 | Pine good | Pine | 15 <= SI < 20 |
| 44 | Pine very good | Pine | 20 <= SI |
| 51 | Spruce poor | Spruce | 0 < SI < 10 |
| 52 | Spruce medium | Spruce | 10 <= SI < 15 |
| 53 | Spruce good | Spruce | 15 <= SI < 20 |
| 54 | Spruce very good | Spruce | 20 <= SI |

# 4. Division of the Area into Management Zones

**Data source and comments:**

- Site index classes were assigned using SIBEC site index values where they were available.
- Where leading species information was missing from recently harvested areas, the Biogeoclimatic Ecosystem Classification (BEC) was used to assign the dominant leading species of the BEC zone.
- Where site index information was also missing, stands were assigned to the good group as the average site index of recent harvesting falls within the range of the good site index class.
- No differentiation is made between existing and future managed stands as future silviculture management assumptions (Section 6.5.1) are based on recent current practice in existing stands as observed in RESULTS.
- No differentiation is made for partial harvest and variable retention silviculture systems (Section 6.1.5) as these regimes will be modelled spatially by the model.

# 5. Timber Harvesting Land Base Definition

## 5.1 Identification of the timber harvesting land base

This section outlines the steps used to identify the timber harvesting land base (the productive forest expected to support timber harvesting) within the timber supply area. Land may be unavailable for timber harvesting for three principal reasons:

- it is not administered by the B.C. Forests, Lands and Natural Resource Operations (FLNR) for timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes;
- it is unavailable for timber harvesting.

Land may also be added to the timber harvesting land base:

- by management activities which improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush);
- by the acquisition of productive forest land (e.g., timber licence reversions).

The timber harvesting land base for the TSA is determined by separating out the following categories of area that do not contribute to timber harvesting in the area. Please note, that this list is not exhaustive or mandatory thus issues may be added or removed as needed:

1. Land not administered by FLNR for the purpose of timber supply;
2. Non-forest types;
3. Roads, trails and landings;
4. Non-commercial cover;
5. Inoperable forest;
6. Sites with low timber growing potential;
7. Unmerchantable forest types or problem forest types;
8. Specific wildlife habitat areas considered unavailable for timber harvesting;
9. Specific cultural heritage resources that result in areas being unavailable for timber harvesting;
10. Riparian reserve area considerations; these may include riparian management zone considerations if warranted (see Section 5.2.16);
11. Specific, geographically defined areas.

The above categories will apply to land where no harvesting is anticipated to occur. Forest cover requirements may be applied to some of these areas in cases where forest management objectives are known.

After all areas that do not contribute to the timber harvesting land base have been identified, any additional lands that may be added at a later date to the timber harvesting land base are specified. The resulting productive forest land base is defined as the "current timber harvesting land base" for the TSA.

# 5. Timber Harvesting Land Base Definition

## 5.2 Details on land base classification

### 5.2.1 Land not administered by FLNR for timber supply purposes

Ownership codes are generally used to identify whether the land can be considered to contribute to timber supply. Ownership codes 62C and 69C indicate crown land in a forest management unit and miscellaneous reserves respectively. These are generally the only ownership codes that are considered to contribute to timber supply. All other ownership codes are excluded from the analysis.

#### 5.2.1.1 Woodlots

Woodlot allowable annual cuts are determined individually; these lands are excluded from the analysis.

#### 5.2.1.2 Clinton Community Forest Agreement

The Clinton Community Forest Agreement, which includes the Clinton Creek Community Watershed, is pending legal status. The AAC for the forest agreement will be determined under a separate process. These lands are excluded from the analysis.

#### 5.2.1.3 Canim Lake First Nations Replaceable Forest Licence

The Canim Lake First Nations Replaceable Forest Licence is pending legal status. The AAC for the forest licence will be determined under a separate process. These lands are excluded from the analysis.

The Forest Agreement and Forest Licence are both currently in the referral process. A sensitivity will be done (Section 7) to examine the possible contribution these lands may have on the broader TSA harvest opportunities.

### 5.2.2 Land classified as non-forest

Non-forest areas such as alpine, lakes, rocks etc. are removed from the land base considered for timber supply. Non-forest areas can be identified descriptively using the BC Land Classification System attributes within the VRI. However, for the analysis, any areas not classified as Forest Management Land Base (FMLB) within the VRI will be excluded as non-forest. FMLB takes into account site index and harvest history to ensure that recently harvested areas are not erroneously classified as non-forest.

### 5.2.3 Roads, trails and landings

The purpose of this section is to identify that portion of the land base that will be occupied by roads, trails and landings constructed to access and facilitate harvest operations.

Separate estimates are made to reflect the loss in productive forest land due to existing and future roads, trails and landings (RTL). Existing RTL estimates are applied as reductions to the current productive forest considered available for harvesting and future RTL reductions are applied after stands are harvested for the first time in the timber supply model. The estimates in Table 5 represent only the area that will be permanently removed from the forested land base and will not contribute to timber supply or biodiversity objectives.

# 5. Timber Harvesting Land Base Definition

*Table 5. Estimates for existing and future roads, trails, and landings*

| Location | Road class | Road width (m) | Reduction area (%) |
|---|---|---|---|
| Existing RTLs | All | ~10 | ~2.25 |
| Future RTLs | All | ~10 | ~1.00 |

**Data source and comments:**

- The estimated deduction for existing roads, trails and landings is based on a GIS raster approach in which the TSA is divided into 100 m x 100 m (one hectare) rasters. Each raster contains 100 smaller 10 x 10 m sub-units. The road (line) network is then overlaid; those 0.01 hectare sub-units[3] that are intersected by the mapped road network are used to calculate the percentage of that hectare to be removed from the forest land base.
- Future RTL are calculated on the approach described above but the road deduction is only made when a harvest area intersects an unroaded raster. The deductions for future RTL will taper off as the timber harvesting land base becomes "fully roaded". The one percent noted in Table 7 is believed a fair estimate; the actual deduction will be calculated during the analysis.
- This approach provides a good representative outcome that is easily repeatable in future TSR calculations.

### 5.2.4 Non-commercial cover

Those areas that the VRI shows as having non-commercial species growing on them are considered unlikely sites for timber production and will be excluded from the timber harvesting land base. Within the 100 Mile House TSA these are juniper, whitebark pine and cottonwood. Ponderosa pine is partially excluded under Section 5.2.12.

These areas, and all following classification factors, will remain in the Crown Forested Management Land Base (CFMLB) and will contribute to forest management objectives.

### 5.2.5 Old growth management area

The objectives for Old Growth Management Areas (OGMA) are to retain old forests and natural successional processes within unharvested areas. OGMA contribute to biodiversity objectives and will be managed as per the CCLUP. It is expected that OGMA will overlap with other resource management values such as wildlife habitat area (WHA), goal 2 protected area, and grassland benchmark area.

Conditional harvesting is allowed in OGMA as described in the CCLUP[4] and Section 7 of the 100 Mile House SRMP. A one-time drawdown (i.e., seral stage levels temporarily below desired CCLUP targets) to allow salvage of the epidemic levels of MPB mortality in pine and mixed-pine stands was approved by the Regional Biodiversity Conservation Committee.. The *Strategy for Management of Mature Seral Forest and Salvage of Mountain Pine Beetle Killed Timber* is provided in the Biodiversity Conservation Strategy Update Note #8. The strategy recognizes that in some landscape units, MPB mortally may result in mature and old seral stage deficits and sets out harvest criteria as well as mature and old recruitment strategies. To reflect this, rotational and permanent OGMA will only be excluded by 90%.

[3] The entire 10 $m^2$ subunit area is deducted when intersected by an existing road line.
[4] Ministry of Agriculture and Lands Integrated Land Management Order: Land use Objectives for the Cariboo-Chilcotin Land Use Plan (CLUP) Area, April 18, 2011.

# 5. Timber Harvesting Land Base Definition

Transitional OGMA only exist until replaced by older forest in a LU-BEC unit or until the year 2030 at which time they will be available for harvest[5]. For the analysis, transitional OGMA will be included in the timber harvesting land base. The equivalent area of transitional OGMA, and any additional area required to meet old-growth objectives, will be dynamically reserved by the timber supply model in order to meet seral stage distribution targets (see Section 6.6.2).

### 5.2.6 Goal 2 protected areas

These areas address the Goal 2 objectives of the Protected Area Strategy of British Columbia to protect special features within the region. The candidate areas proposed for establishment are pending legal status (expected in the fall of 2011) and will be excluded from the timber harvesting land base.

### 5.2.7 Areas considered inoperable

Operability and inoperability codes are generally used to describe the presence or absence of physical barriers or limitations to harvesting, logging methods (e.g. cable), and the merchantability of stands. Changing technology and economic conditions can affect both physical and economic operability.

Table 6 lists the operability classes derived for the 100 Mile House District.

*Table 6. Description of inoperable areas*

| Description | Class | Reduction (%) |
|---|---|---|
| Slope <= 50% (ground skidding) | 1 | 0 |
| Slope > 50% and <= 70% (cable yarding) | 2 | 50 |
| Slope > 70% inoperable | 3 | 100 |

**Data source and comments:**

- Operability classes within the 100 Mile House District were originally mapped in 1998 prior to TSR 2.
- Discussion with district staff indicates that criteria for the classifications are still valid.
- Operability will be redrawn during the analysis using current GIS technology and map information.
- Class 1 fully contributes. Class 3 does not contribute.
- Class 2[6] has some potential for operations. However, thus far harvesting is limited in these areas. As such, its inclusion will be limited to 50% for the analysis.
- A sensitivity analysis (Section 7) will examine the impact of fully including Class 2.

### 5.2.8 Sites with low timber growing potential

Sites may have low productivity either because of inherent limiting site factors (nutrient availability, exposure, excessive moisture, etc.) or because they are not fully occupied by commercial tree species. Typically, these stands are inter-mixed with other stands within the forested land base. As these stands are not considered economically harvestable, they are identified for removal from the timber harvesting land base.

[5] ILMB Ministerial Order, Land Use Objectives for the Cariboo-Chilcotin Land use Plan Area, dated April l8, 2011.
[6] Ground skidding may occur on slopes over 50% where critical site factors are favourable.

# 5. Timber Harvesting Land Base Definition

*Table 7. Description of sites with low timber growing potential*

| Zone/ group | Inventory type group | Age | Characteristics | | | |
|---|---|---|---|---|---|---|
| | | | Height | Volume | Site index | Reduction (%) |
| All | Py | All | All | All | | 50 |
| All | Pli | > 80 | N/A | < 65 | | 100 |
| All | Fdi, Sx/Se, Bl | > 120 | N/A | < 65 | | 100 |
| All | Deciduous | > 120 | N/A | < 65 | | 100 |

**Data source and comments:**

- Py: ponderosa pine, Pli: lodgepole pine, Fdi: interior Douglas-fir, Sx/Se: spruce, Bl: subalpine fir.
- The 50% reduction for ponderosa pine recognizes that it is not actively sought as a commercial species in the TSA but does contribute to the harvest profile — and stocking levels — in mixed-species stands.
- Discussion with district staff indicates no change to the description of sites with low timber growing potential from previous timber supply reviews.
- Site index will be evaluated using SIBEC site index to ensure old growth stands are not misrepresenting the growth potential of the site.

### 5.2.9 Wildlife habitat reductions

Wildlife habitat reductions may be identified and managed through several processes including the Identified Wildlife Management Strategy, identification and approval of ungulate winter range (UWR), and management practices specified in plans such as the CCLUP that establish legal wildlife habitat objectives. Management practices may include no harvesting in core areas as well as modified harvesting in associated management zones.

A number of approved wildlife habitat areas (WHA) are found within district boundaries. The associated general wildlife measures (GWM) established by ministerial order under the Government Actions Regulations (GAR) guide harvest practices in WHA.

*Table 8. Estimates for wildlife habitat excluded areas*

| Identifying inventory variables (location descriptors) | | | Excluded area (%) | Species/habitat under consideration |
|---|---|---|---|---|
| WHA | 5-117 | No Harvest | 100 | Mountain Caribou |
| WHA | 5-115 | No Harvest | 100 | Mountain Caribou |
| WHA | 5-073 | No Harvest | 100 | Data sensitive[7] |
| WHA | 5-875 | No Harvest | 100 | Badger |
| WHA | 5-895 | No Harvest | 100 | Great Basin Spadefoot |

[7] The information is not available to the public.

# 5. Timber Harvesting Land Base Definition

**Data source and comments:**

- It is expected that many of the *no harvest areas* will overlap with OGMA, WTRA and other ecological and environmental management areas with harvest constraints. *No harvest areas* are excluded from the timber harvesting land base but will contribute towards landscape-level biodiversity and scenic objectives.
- Modified harvesting is allowed i*n some wildlife* habitat areas with the objective of enhancing or restoring habitat values. These areas are accounted for and dis*cussed under Sec*tion 6.1.5, "Silviculture Systems".

### 5.2.10 Cultural heritage resource reductions

An Archaeological Overview Assessment (AOA) and band specific Traditional Use Studies (TUS) have been completed within the 100 Mile House TSA. Site-specific First Nations consultation occurs during the cutting permit adjudication process.

Most known archeological sites are small and many are found in areas with additional ecological or environmental constraints. These sensitive lands are typically removed from the timber harvest land base through the placement of reserve or *no harvest zones*. Discussion with district staff indicates that additional area over and above that already excluded is anticipated to be minimal (see Section 6.6, "Integrated Resource Management"). Therefore, no specific additional land base reduction will be applied for cultural heritage resources.

### 5.2.11 Riparian reserve zones

A comprehensive riparian classification inventory is not available for the TSA. Current practice, in keeping with the *100 Mile House Enhanced Retention Strategy*, is to locate wildlife tree retention areas (WTRA) where there are ecological and environmental constraints; this generally includes streams and wetlands.

*Table 9. Riparian reserve zones as per TSR 2*

| Location (e.g. zone) | Reserve area (%) | Management area (%) | Reduction percent |
|---|---|---|---|
| All | 1.3 | 0.7 | 2.0 |

**Data source and comments:**

- The permanent riparian reserve aspatial netdown from the previous two reviews will be carried forward for the current analysis.
- The aspatial riparian netdown is based on GIS analysis of 12 randomly chosen mapsheets completed in 1997[8].
- The TSR 2 netdown included 7442 hectares for lakeshore buffers. This is based on 200 metres management zone with 50% accessibility. This is estimated as an area that is 0.7% of the managed forest land base. This deduction will be carried forward for use in the current analysis.A separate reduction for stream riparian management zones is deemed unnecessary due to the overlap with WTRA (Section 6.6.3).

[8] Source: TSR 2 data package.

# 5. Timber Harvesting Land Base Definition

### 5.2.12 Recreation trails

The CCLUP Recreation Corridor Management Strategy was developed in 1996 and provides guidance for trail management planning. The locations of important trails were incorporated into the plan based on public input. The trail buffer area defined in the CCLUP will be excluded by 50%.

*Table 10. Trail management zone*

| Location (e.g. zone) | Zone width (m) | Excluded (%) |
|---|---|---|
| All | 100 | 50 |

**Data source and comments:**

- The CCLUP permits 15 percent of the basal area within trail management zones to be removed for insect control, salvage and trial maintenance.
- There is also an assumption that trial management zones will overlap with other constrained areas and will be placed within reserve patches during harvest operations.
- In practice, the actual buffer is determined by a combination of site factors, stand conditions, and local trail management objectives.

# 6. Current Forest Management Assumptions

## 6.1 Harvesting

### 6.1.1 Utilization levels

The utilization levels define the maximum stump height, minimum top diameter (inside bark) and minimum diameter at breast height by species and are used in the analysis to calculate merchantable volumes.

*Table 11. Utilization levels*

| Analysis unit | Utilization | | |
|---|---|---|---|
| | Minimum dbh (cm) | Maximum stump height (cm) | Minimum top dib (cm) |
| Pine | 12.5 | 30 | 10 |
| Non-pine coniferous | 17.5 | 30 | 10 |
| Deciduous | 17.5 | 30 | 10 |

**Data source and comments:**

- The Pulpwood Agreement (PA) 16 utilization specifications allow harvesting to a 10 cm diameter at stump height for conifers and 15 cm for deciduous.
- Discussion with district staff indicates that most of PA 16 development is in the lower end of the sawlog profile. While the bulk of the lumber utilized is sawlog reject, all tenure holders within the TSA are currently operating in these stands.
- The need for an updated definition for an interior problem forest type (PFT) was raised as a concern by both 100 Mile House district staff and the PA 16 tenure holder. Historically PFT were defined as a forest stands incapable of producing significant sawlog volumes within normal rotation periods. Experience has shown that these stands often contain a mix of diameter classes with sufficient, albeit lower, sawlog volumes that in fact do contribute to the sawlog profile. Current practice finds all tenure holders operating in these stand types.
- A further concern expressed regarding the current PFT definition is that the lower utilization standards may promote early harvesting in potential sawlog stands that, if left growing, might help mitigate the anticipated mid-term deficit.
- Because the PFT stands in PA 16 are not well defined with respect to actual utilization, the creation of separate PFT analysis units is not deemed practicable or necessary.

# 6. Current Forest Management Assumptions

### 6.1.2 Volume exclusions for mixed-species stands

One or more species in mixed-species stands may be unmerchantable. For example, the deciduous species in a predominantly coniferous stand may not be harvested, or may only be partially harvested. The unharvested portion should not contribute to the estimated stand volume, but may contribute to biodiversity objectives. The species that do not contribute will be excluded from merchantable stand volumes are shown in Table 12.

*Table 12. Volume exclusions for mixed-species types*

| Inventory type group | Species | Volume exclusion (%) |
|---|---|---|
| Conifer leading | All deciduous | 0 |
| All | Py | 50 |

**Data source and comments:**

- Discussion with 100 Mile House district tenure and revenue staff indicates that hardwoods are not specifically targeted for harvesting and that the bulk of aspen is being retained on site (see Section 6.1.5). Furthermore, RESULTS *Previous Leading Species* reports indicate no Aspen-leading stands in those reported as harvested in 2010.
- This is also supported by a review of 100 Mile House district volume tracking data that shows that hardwoods constitute approximately two percent of the standing volume in mixed-pine leading stands. Volume purchased data provided by Ainsworth Lumber[9] gives a five year average of 15 582 $m^3$ for hardwoods (< 1% of the current AAC). The monthly district scaling report for the first six months of 2011 shows the billed deciduous volume as 0.43% of the total volume being tracked against the annual cut.
- Hardwood volume is reaching the mills. However, this volume is a relatively minor and largely incidental component of the current harvest profile.
- However, aspen is a managed species within the TSA and, as it is included in the appraisal when identified in the cruise, it should be included in the timber supply analysis even though it constitutes less than one percent of the total harvest volume. This differs from previous TSR in which both ponderosa pine and deciduous species were fully excluded.
- Sensitivity analysis (Section 7) will examine the effects of full exclusion of aspen on the timber supply.

[9] Ainsworth being the primary user of deciduous in the TSA.

# 6. Current Forest Management Assumptions

### 6.1.3 Minimum harvestable age criteria

The purpose of this section is to identify the minimum stand criteria an analysis unit must meet to be eligible for harvest. To become eligible for harvest both age and volume requirements must be met.

*Table 13. Minimum harvestable age criteria*

| Analysis unit | Minimum criteria | | | Minimum harvest age (years) |
|---|---|---|---|---|
| | Height class | Diameter | Volume | |
| Pine | All | 12.5 | 65 | 60[10] |
| Non-pine | All | 17.5 | 100 | 80[11] |

**Data source and comments:**

- While harvesting may occur in stands when the minimum requirements are achieved in order to meet forest level objectives (e.g., maintaining overall harvest levels for a short period of time or avoiding large inter-decadal changes in harvest levels), some stands may not be harvested until well past *optimal* timber production ages when management of other resource values takes precedence (e.g., requirements for the retention of older forest).
- The optimal harvest management objective is to avoid harvesting stands until culmination age[12] to maximize merchantable volumes.
- During the analysis, the criteria may be adjusted to meet a desired harvest flow objective; this will be discussed in the analysis report.

### 6.1.4 Harvest scheduling

For various reasons, it may be important to set priorities or harvest levels on certain management zones or analysis units to reflect insect infestations, salvage operations or other forest management objectives. Setting harvest levels on individual management zones will also facilitate the determination of an AAC that may be partitioned by these management zones. Table 14 describes suggested harvest scheduling priorities and limitations within the 100 Mile House TSA for use in the analysis.

[10] Age class 4: 60-80 years in age.
[11] Age class 5: 80-100 years in age.
[12] The age at which the mean annual volume production begins to decline.

# 6. Current Forest Management Assumptions

*Table 14. Priorities for scheduling the harvest*

| Priority | Location or analysis unit | Description or objective |
|---|---|---|
| 1 | > 70% Pli | Beetle salvage in pine-leading stands |
| 1 | > 70% Sx/Se | Beetle salvage in moderate to high risk infestation |
| 2 | 50-70% Pli | Beetle salvage in mixed-pine stands |
| 3 | 50-70% Fdi | Conserve Growing Stock |
| 3 | 50-70% Sx/Se | Conserve Growing Stock |
| 3 | All others | Conserve Growing Stock |

Data source and comments:

- Beetle affected pure-pine, mixed-pine and pure-spruce stands are viewed as the priority to maximize salvage volumes (see Section 6.2.2, "Condition of MPB dead pine") and convert these stands to regenerating managed stands.
- Ongoing damage from epidemic Spruce Bark Beetle populations identified during the 2011 aerial overview survey suggests that timely salvage is needed in spruce-leading stands to both reduce spruce bark beetle populations and maximize future stand productivity (see Section 6.2.1, "Unsalvaged losses").
- Conserving the productive green component of the harvest profile in the near-term will serve to help mitigate the anticipated mid-term timber deficit. Additionally, conversion of beetle-killed stands to regenerating stands will help increase the long-term timber supply.
- During the analysis harvest scheduling criteria may be adjusted to meet a desired volume flow objective; this will be discussed in the analysis report.

### 6.1.5 Silviculture systems

#### 6.1.5.1 Integrated resource management zones

There are two primary silviculture systems in use within the integrated resource management (IRM) zone of the TSA. Clearcut with reserves is predominant in all non-Douglas-fir leading stands. A variable retention system is common in Douglas-fir leading stands.

*Table 15. Silviculture systems IRM zone*

| Silviculture system | Eligible analysis units or locations | Dispersed retention (%) | # of entries | Time between entries |
|---|---|---|---|---|
| Clearcut with reserves | Pli leading | 7 | 1 | 80 |
| Clearcut with reserves | Sx/Se, Bl leading | 7 | 1 | 100 |
| Variable retention | Fdi leading | 25 | 1 | 100 |

# 6. Current Forest Management Assumptions

**Data source and comments:**

**Clearcut with reserves**

- Clearcut with reserves is the predominant system in all non-Douglas-fir leading stands in the TSA. Forest and Range Evaluation Program (FREP) sampling indicates seven percent dispersed retention is common practice in these stands. The cutting cycles are generally 80 years for pine stands and 100 years for all non-pine stands.

**Partial cut variable retention**

- Variable retention partial cutting is the predominant system in all Douglas-fir leading stands. The level of retention varies with stand and site conditions. For the analysis, the estimated average cutting cycle is 100 years.
- The 25% retention level shown in Table 15 represent trees being retained on site for biodiversity, silviculture or visual objectives. They are expected to persist over time and do contribute — subject to any limitations within approved stocking standards — to both current stocking and future harvest volumes. For the analysis the 25% retention will be modelled as an area reduction.

**Time between entries**

- The time between entries shown in Table 15 for the clearcut and variable retention systems represent a *desired* minimum time between harvest entries. This with the other harvest criteria are used to derive a possible harvesting profile. During the analysis, the criteria may be adjusted to meet a harvest flow objective; this will be discussed in the analysis report.

#### 6.1.5.2 Ungulate winter range

Two variants of the selection system are used within the ungulate winter range (UWR[13]). A single tree selection system is used in the shallow and moderate snowpack zones. In the transition and deep snowpack zones, an uneven-aged group or small patch selection system is the preferred method.

*Table 16. Silviculture systems UWR*

| Silviculture system | Eligible analysis units or locations | Dispersed retention (%) | # of entries | Time between entries (years) |
|---|---|---|---|---|
| Single tree selection | UWR shallow and moderate snowpack > 40% Fdi | 65-85 | 1 | 30 (120)[14] |
| Group selection | UWR transition and deep snowpack > 40% Fdi | N/A | 3-5 | 40[14] (120-200) |
| Clearcut with reserves | UWR transition and deep snowpack < 40% Fdi | All Fdi | 1 | 80 |

**Data source and comments:**

- Silvilculture systems within the UWR are prescribed by General Wildlife Measures (GWM) established in 2007 by Ministerial Order under the Government Actions Regulation.

[13] Also referred to in the CCLUP as Mule Deer Winter Range (MDWR).
[14] Effective rotation age.

# 6. Current Forest Management Assumptions

**Single tree selection ungulate winter range**

- The GWM for shallow and moderate snowpack zones identifies five different types of stands and treatments. Numerous variations are possible dependent on BEC and Stand Structure Habitat Class. For the analysis, these will be approximated as described below.
- Stands with > 40% Douglas-fir will be modelled in the analysis under a clumpy single tree selection system. Retention levels will vary by stand structure habitat class as described below.
- As per variable retention outside the UWR, the retention will be modelled in the analysis as an area removal.
- Understory regeneration will be modelled using the variable retention adjustment factor in TIPSY to reflect growth loss due to overstory shading.

*Table 16a. Retention levels by habitat class*

| Stand structure habitat class | % clumped retention | Minimum time between entries (years) |
|---|---|---|
| Low | 65 | 30 |
| Moderate | 75 | 30 |
| High | 85 | 30 |

**Group selection ungulate winter range**

- The GWM for transition and deep snowpack zones identifies six different stands and treatments. Numerous variations are possible dependent on BEC and stand structure habitat class. For the analysis, these will be approximated as described below.
- Small patch or group selection is the desired treatment in stands having > 40% Douglas-fir with the goal of producing a mosaic of age classes across the landscape.

*Table 16b. Harvest cycles by habitat class*

| Stand structure habitat class | Harvest area (%) | Minimum cutting cycle (years) | Effective rotation period (years) | # stand age classes after one rotation |
|---|---|---|---|---|
| Low | 33 | 40 | 120 | 3 |
| Moderate | 25 | 40 | 160 | 4 |
| High | 20 | 40 | 200 | 5 |

**Clearcut with reserves ungulate winter range**

- Stands with < 40% Douglas-fir will be modelled under a clearcut with reserve system as described above. The long-term goal is to convert these stands to the multi-aged single tree selection system.

# 6. Current Forest Management Assumptions

#### 6.1.5.3 Caribou habitat

The silviculture system within that portion of the caribou wildlife habitat area where modified harvesting is allowed is prescribed by ministerial order. For the analysis, this will be approximated as described below.

*Table 17. Caribou habitat harvest cycles*

| Silviculture system | Eligible analysis units or locations | Volume removal | # of entries | Min. time between entries (years) | Effective rotation age (years) |
|---|---|---|---|---|---|
| Group selection | Caribou WHA 5-116 | 33 | 3 | 80 | 240 |

**Data source and comments:**

- The GWM for WHA 5-116 prescribes group selection harvesting up to 33% of each stand by area on an 80-year cutting cycle. Openings must not exceed 1.0 ha with an average opening size of 0.5 ha. Additionally, the pre-harvest proportion of balsam to spruce must be maintained post-harvest.

#### 6.1.5.4 Wildlife habitat restoration

Within the forested land base, some areas have been designated having non-timber primary management objectives. While some modified harvesting is allowed, the long-range goal is to manage for wildlife values such as those in Table 18 below. As habitat restoration is not a recognized silviculture system and timber production is not a management objective in these areas, the silvicultural system is single entry harvest. Once harvested in the analysis, these areas will be removed from the forested land base.

*Table 18. Habitat restoration objectives*

| Management objective | Eligible analysis units or locations | # of entries | Post-harvest management objective | Post-harvest exclusion (%) |
|---|---|---|---|---|
| Restoration | Benchmark Grassland Area | 1 | Grassland | 100 |
| Restoration | American Badger WHA | 1 | Badger | 100 |
| Restoration | Great Basin Spadefoot WHA | 1 | Spadefoot | 100 |

# 6. Current Forest Management Assumptions

**Data source and comments:**

**Benchmark Grasslands**

- Maintain modified harvesting as the recommended best management practice within Grassland Benchmark Areas;
- Maintain 5-10% as contiguous forested area (retention portion);
- In the 90-95% grassland portion, maintain 90-100% of all trees > 140 years of age;
- Maintain one to four recruitment trees greater than 12.5 cm dbh for each large veteran tree up to a maximum of 75 recruitment stems per hectare (sph);
- Reduce the stem density to 100 sph in layers 2-4;
- Where a 5-10% area retention is required, retain 15-25 $m^2$/ha of the largest trees and 1/3 of live stems in the existing diameter distribution within the reserve area.

**American Badger**

- Modified harvesting is allowed in WHA 5-874 and in WHA numbered 5-876 to 5-883;
- Harvest activities must not result in the construction of roads or landings;
- Harvest activities must result in stocking densities < 75 sph and a target of 20 free-growing sph (post harvest) to support ecological restoration.

**Great Basin Spadefoot**

- Modified harvesting is allowed in the WHA numbered 5-884 to 5-894 and in WHA 5-897;
- Harvest activities must not result in the construction of roads or landings;
- Harvest activities must result in stocking densities < 75 sph (stem per hectare) and a target of 20 sph at free growing (post harvest) to support ecological restoration.

## 6.2. Volume reductions

### 6.2.1 Unsalvaged losses

Unsalvaged losses provide an estimate of the average annual volume of timber that will be damaged or killed on the forested land base and not salvaged or accounted for by other factors. These losses result from atypical events related to a number of factors that cause tree mortality, including insects, disease, blowdown, snowpress, wildfires, etc. The values shown in the unsalvaged loss column of the tables below represent estimated annual volume that will not be recovered or salvaged.

The impacts from Mountain Pine Beetle mortality are discussed separately. Endemic pest losses are considered natural processes within stands and are accounted for within the growth and yield models.

# 6. Current Forest Management Assumptions

*Table 19. Annual unsalvaged losses*

| Location | Analysis unit | Species | Cause of loss | Annual unsalvaged loss ($m^3$/year) |
|---|---|---|---|---|
| TSA | All | All | Fire | 53 892 |
| TSA | All | All | Windthrow | 4 540 |
| TSA | All | Fdi | Douglas-fir Bark Beetle | 14 474 |
| TSA | All | Fdi | Spruce Budworm | 14 770 |
| TSA | All | Sx/Se | Spruce Bark Beetle | 10 537 |
| TSA | All | All | Small Scale Salvage | (15 000) |
| **Total annual loss ($m^3$/year)** | | | | **82 213** |

**Data source and comments:**

**Wildfire**

- The annual unsalvaged loss due to fire is based on all recorded fires from the last 15 years. All fires regardless of size are included in the calculation. Non-THLB (e.g., parks, OGMAs, etc.) as well as any salvaged areas have been deducted from this area. The figure in Table 19 represents unsalvaged loss only.

**Windthrow**

- Windthrow numbers are based on aerial survey data averaged over the years 2006-2010. As smaller patches are often overlooked during aerial surveys, the figure given in Table 19 is believed to be conservative.

**Insects**

Douglas-fir Bark Beetle

- The 2010 Douglas-fir beetle population in the TSA has dropped considerably from previous years. The area of red attack fell by 88% to about 2800 hectares, most of which was classified as trace.
- The TSA Small Scale Salvage program recovers approximately 15 000 $m^3$ of beetle-killed Douglas-fir annually. However, recent wildfire-damaged Douglas-fir trees have increased the population of Douglas-fir bark beetle in those local areas.
- This unsalvaged Douglas-fir volume was calculated by the revised "Henigmann method", whereby patches of infestation that are categorized as trace, light, moderate, severe or very severe, are overlaid onto forest cover polygons. The mid-point of each infestation category (e.g., 40% killed in the severe category) is applied as a percent deduction to the volume that would correspond to the polygon's inventory label.

# 6. Current Forest Management Assumptions

Spruce and Balsam Bark Beetles

- Spruce and balsam stands account for about nine percent of the TSA and are mainly located in the northeastern portions of the TSA.
- Balsam bark beetle is not included in the unsalvageable calculation as it is currently considered endemic within the TSA.
- The area of Spruce Bark Beetle infestation within the TSA is an extension of the epidemic population out of the Central Cariboo District. The infestation levels and area estimates used in the unsalvaged calculation are from aerial overview surveys.
- Spruce beetle infestations are cyclical; therefore volume losses will mainly occur during infestations, but not between them. It is assumed that infestations last 5-10 years, and occur every 30 years. This annual loss was based on the volume loss observed in this current infestation, then averaged out over the 30-year period to get an overall annual average loss for modelling purposes.
- This unsalvaged spruce beetle volume was calculated by the revised "Henigmann method" as described above.

*Table 19a. Area of infestation for Douglas-fir, Spruce and Balsam bark beetles (averaged from 2006 – 2010)*

| Agent | Average area of infestation (ha) | | | | | Total area |
|---|---|---|---|---|---|---|
| | Trace | Light | Moderate | Severe | Very severe | |
| Douglas-fir Bark Beetle | 7634.3 | 2539.8 | 264.6 | 30.4 | 0 | 10 470.2 |
| Spruce Bark Beetle | 3165.5 | 2618.5 | 1334.8 | 493.4 | 7.6 | 7619.8 |
| Balsam Bark Beetle | 8570.4 | 1650.7 | 46.7 | 0 | 0 | 10 267.8 |

| Disturbance type | Class | Description |
|---|---|---|
| Tree mortality | Trace | < 1% of trees in polygon killed |
| | Light | 1-10% of trees in polygon killed |
| | Moderate | 11-29% of trees in polygon killed |
| | Severe | 30-49% of trees in polygon killed |
| | Very severe | > 50% of trees in polygon killed |

# 6. Current Forest Management Assumptions

Spruce Budworm

- Following aggressive *B.t.k.* spray program in 2007, 2008 and 2009 western spruce budworm populations declined significantly in the TSA. The 2010 aerial overview survey found defoliation on just over 39 000 hectares, down from 100 000 hectares in 2009 and 175 000 hectares in 2008. Egg mass sampling suggests populations will stay low in most areas in the 100 Mile House TSA, with only a few areas around White Lake and Canoe Creek indicating increases.
- A single year of defoliation by spruce budworm generally has little impact on a tree. However, it does cause weakening of the tree, making it more susceptible to attacks by other insects. Defoliation over a few consecutive years causes tree growth loss.
- If defoliation of current and previous-year shoots continues uninterrupted over several years, some trees will die, while others will continue to gradually decline for several years, even after the end of the infestation. This is the case with Douglas-fir, the species most vulnerable to spruce budworm attacks, which dies after four consecutive years of severe defoliation[15].
- Estimated volume loss from spruce budworm is based on the following assumptions: two percent of the average annual moderate and severe area (average between years 2006-2010 = 2954 hectares) would incur mortality, due to severe multiple year infestations. Therefore the mortality volume / ha in Douglas-fir stands is assumed to be = 250$m^3$/year.
- Light defoliation is not included in the spruce budworm non-recoverable loss amount, as this would be classified as endemic.

### 6.2.2 Condition of MPB dead pine

Lodgepole pine trees impacted by MPB start to degrade upon death. The loss of quality affects the value of the timber and the products that may be produced from the fibre. It is generally accepted that the quality of the wood from infested trees moves from dimension lumber quality through to pulp and secondary products, such as biofuels in the years following death.

Shelf life, the length of time since death in which a specific merchantable product can be produced from the fibre inputs, is a major assumption affecting the effectiveness of any salvage program. Shelf life is the length of time dead pine will remain commercially viable for a product. After a period of time greater than the longest shelf life of the secondary products, dead pine is considered a non-recovered loss (NRL).

There is great uncertainty regarding shelf life. It is dependent on several factors, including market access and conditions, and available milling technology. For the analysis, no shelf life for any one particular product will be modelled. Instead, it is assumed that the dead trees will have some commercial use (e.g., sawlogs, chips, or bioenergy) as long as the trees are standing. Dead trees will be assumed to remain standing for at least 15 years after attack. Once the trees fall to the ground it is assumed the stems will quickly rot and will have no commercial use.

The extent and severity of the MPB infestation will be modelled based on the BC Mountain Pine Beetle Model (BCMPB). The BCMPB provides an estimate of the year of death and the proportion of the pine within a stand that was killed. To examine the possible impacts and contribution to the harvest forecast of volume from dead trees, the analysis will display forecasts for grouped periods of *years since death* (YSD): two years or less, three to five years, six to ten years, and 11-plus years. These classes can be used to approximate the amount of volume available within the shelf life period for various products.

[15] Natural Resources Canada; Insects and Diseases of Canada's Forests: Spruce Budworm.

# 6. Current Forest Management Assumptions

**Data source and comments:**

- Presenting the information this way in the analysis report will make it possible to solicit opinions and knowledge regarding shelf life and possible volumes for various commercial products at any time in the future without the requirement to rerun the timber supply model.
- Relatively unknown factors in the shelf life equation are blowdown and stem rot. Anecdotal evidence suggests both are increasing exponentially with years since death. As it is generally accepted that once on the ground dead trees quickly loose all commercial value, windthrow may accelerate the decrease of commercial value for MPB-killed stands.
- Shelf life wood quality assumptions vary even though they are generally related to site conditions and stand attributes. Piece size also appears to be major factor in assigning shelf life , thus further complicating shelf life estimates.

### 6.2.3 Operational adjustment factors

The objective of this section is to describe what operational adjustment factors (OAF) are, why they are needed, and how to determine OAF for planning purposes. OAF are required because they relate to the type of yields the Tree and Stand Simulator (TASS[16]) model generates for use in TIPSY.

The yield tables generated by TASS for use in TIPSY reflect the growth relationships observed in research plots established by FLNR and industry. Research plots were generally located in fully stocked, even-aged stands of uniform site, and in forests with little or no pest activity. The influence of stand density on yield is reflected in the yield tables, but full stocking is assumed. As a result, TIPSY yields reflect the **potential** yield of a specific site, species and management regime given full stocking. OAF is applied to these potential yields to adjust them to reflect an operational environment.

Two types of OAF are available in TIPSY to account for elements that reduce potential yields. The two OAF values are referred to as OAF 1 and OAF 2. OAF 1 affects the magnitude of the yield curve and is constant across all ages, whereas the impact of OAF 2 accelerates with age. Changing both OAF values affects the magnitude and shape of the yield curve.

OAF 1 represents uneven stocking or gaps and was historically handled by a 15% reduction, or a factor of 0.85. OAF 2 represents the impact of decay, waste and breakage in second-growth stands and has generally been handled by a five percent reduction or a reduction factor of 0.95. Insect and disease problems are not part of OAF 2.

With the exception of mountain pine beetle impacted young pine stands (Section 6.3); the analysis will use standard OAF factors unless stated otherwise.

### 6.2.4 MPB mortality in young pine stands

After several years of epidemic MPB infestation, it has been observed that stands as young as 20 year old have been attacked. This has been confirmed through both aerial and ground surveys. Table 20 shows the results of the 2007 and 2008 young pine stand MPB overview assessments for the 100 Mile House District.

[16] The Tree and Stand Simulator (TASS**)** is a three-dimensional growth simulator that generates growth and yield information for even-aged stands of pure coniferous species of commercial importance in coastal and interior forests of British Columbia. TASS generates the volume growth curves for use by TIPSY in managed stands.

# 6. Current Forest Management Assumptions

Immature stands composed of more than 70% pine between the ages of 20 and 60 will be modelled with an additional OAF 1 reduction of 20% (total OAF 1 value of 0.65) to account for the reduced site occupancy in young MPB impacted stands. Pine-leading stands aged 20 years and younger will be modelled on the normal managed stand yield curves.

*Table 20. The number of stands with and without MPB attack and the average percent attack (red and grey) within attacked stands by age*

| Young pine | Percent stands with MPB attack | | | Average % attack in MPB stands | | |
|---|---|---|---|---|---|---|
| **Age** | **2007** | **2008** | **Avg** | **2007** | **2008** | **Avg** |
| 20-25 | 92.0 | 88.4 | 90.2 | 27.5 | 32.2 | 29.8 |
| 26-30 | 97.1 | 100 | 98.5 | 50.7 | 45.3 | 48.0 |
| 31-40 | 98.7 | 100 | 99.3 | 53.8 | 50.8 | 52.3 |
| 41-50 | 100 | 100 | 100 | 43.8 | 53.1 | 48.4 |
| 51-55 | 100 | 100 | 100 | 47.1 | 48.0 | 47.5 |
| **Avg** | **97.56** | **97.68** | **97.6** | **44.58** | **45.88** | **45.2** |

**Data source and comments:**

- The results are based on the 2008 Forest Health Aerial Overview Assessments and permanent sample plot information.
- Discussion with district staff and tenure holders confirm that all pure pine stands (> 70%) aged 20 years or older within the TSA have been attacked to some level.
- Impacts to harvest volumes in mixed-pine (<= 70%) stands is anticipated to be less due to the dispersed nature of the pine stocking that resulted in reduced beetle activity and produced a more scattered mortality pattern. No MPB mortality specific growth or volume reductions will be made to mixed-pine stands in the analysis.

## 6.4 Site productivity

Site index (SI) is a relative measure of forest site quality based on the height (in metres) of the dominant trees at a specific age (50 years). Site index information helps estimate future returns and land productivity for timber and wildlife.

Changes to site index have important implications for estimating the potential yield of regenerated stands since site index is a required input for the TIPSY model that is used for managed stands in timber supply analysis.

# 6. Current Forest Management Assumptions

### 6.4.1 Second generation site index estimates

Improved site productivity information may be obtained for young and future managed stands based on the BEC information provided by the PEM. The FLNR project, Site Index Estimates by BEC Site Series (SIBEC), relates site index to biogeoclimatic site series for the primary tree species in different areas of BC. A major advantage of the SIBEC approach is that it provides consistent site index estimates across the province. The SIBEC project was initiated in the mid-1990's and the first approximation SIBEC estimates provided site index values in three metre classes; a relatively low precision for the estimates.

As sampling standards were revised and more data were collected, second approximation SIBEC estimates were developed by FLNR to provide improved accuracy and precision. This included the review of previously collected data and data found to be inadequate were removed from the database.

A report by Mah and Nigh[17] indicated the SIBEC site index estimates would be appropriate for supporting AAC determination and other timber management decisions.

Second generation SIBEC tables were released by FLNR in 2011 and will be used in conjunction with PEM (see Section 3.3) to estimate site productivity for the TIPSY growth model.

Increases[18] in site index that accrue from the implementation of SIBEC can:

- Potentially increase the area of timber harvesting land base by reducing the amount of low productivity area;
- Redistribute area from lower site classes into higher site classes;
- Lower the age to green-up (i.e., reduce the time before adjacent areas may be harvested);
- Reduce the time it takes for stands to reach minimum merchantable volume (i.e., reduce the minimum harvest age).

## 6.5 Silviculture

### 6.5.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYT) produced using TIPSY based on observed current practices. The inputs required to produce MSYT shown in Table 21 were summarized from RESULTS free-growing survey data for 22 860 hectares recorded since 1999. Regular spacing is assumed (i.e., the "planted" option in TIPSY) for all MSYT so the initial density was based on *total well-spaced trees* where available, otherwise *well-spaced* was used. Since MSYT are based on the stand condition at free growing, the actual method of stand establishment is no longer considered except for estimating genetic gains (see Section 6.5.1.1).

[17] SIBEC Site Index Estimates in Support of Forest Management in BC, Shirley Mah and Gordon Nigh, Ministry of Forests Science Program, 2003.

[18] Increasing the precision of the site index estimate may also produce lower productivity estimates with a reverse effect from those stated.

# 6. Current Forest Management Assumptions

*Table 21. Regeneration assumptions by analysis unit*

| Analysis unit | Label | Site index (m) | Regen delay (years) | Species composition | Density initial (sph) |
|---|---|---|---|---|---|
| 11 | Decid poor | 14 | 2 | At 50% Pli 37% Fdi 7% Sx 5% | 1,244 |
| 12 | Decid medium | 14 | 2 | At 50% Pli 37% Fdi 7% Sx 5% | 1,244 |
| 13 | Decid good | 18 | 2 | At 60% Pli 22% Sx 10% Fdi 7% Bl 2% | 1,097 |
| 14 | Decid very good | 22 | 2 | At 52% Pli 26% Sx 13% Fdi 6% Bl 2% | 1,216 |
| 21 | Douglas-fir poor | 16 | 1 | Pli 63% Fdi 24% At 9% Sx 4% Bl 1% | 1,029 |
| 22 | Douglas-fir medium | 16 | 1 | Pli 63% Fdi 24% At 9% Sx 4% Bl 1% | 1,029 |
| 23 | Douglas-fir good | 15 | 3 | Pli 57% Fdi 25% At 14% Sx 2% Bl 1% | 1,066 |
| 24 | Douglas-fir very good | 20 | 1 | Pli 27% Fdi 25% Sx 24% At 15% Bl 9% | 982 |
| 31 | Balsam poor | 17 | 2 | Bl 56% Pli 26% Sx 11% Fdi 3% At 4% | 1,065 |
| 32 | Balsam medium | 17 | 2 | Bl 56% Pli 26% Sx 11% Fdi 3% At 4% | 1,065 |
| 33 | Balsam good | 15 | 3 | Pli 55% Fdi 29% At 13% Sx 2% Bl 1% | 1,040 |
| 34 | Balsam very good | 21 | 2 | Pli 45% At 26% Fdi 10% Sx 9% Bl 9% | 1,159 |
| 41 | Pine poor | 16 | 2 | Pli 75% Fdi 8% At 8% Sx 6% Bl 2% | 1,076 |
| 42 | Pine medium | 16 | 2 | Pli 75% Fdi 8% At 8% Sx 6% Bl 2% | 1,076 |
| 43 | Pine good | 16 | 2 | Pli 75% At 9% Fdi 9% Sx 6% Bl 2% | 1,072 |
| 44 | Pine very good | 20 | 2 | Pli 55% At 16% Sx 13% Fdi 10% Bl 5% | 1,064 |
| 51 | Spruce poor | 15 | 1 | Sx 52% Pli 37% Bl 8% At 2% | 1,314 |
| 52 | Spruce medium | 16 | 1 | Pli 71% Sx 20% At 4% Bl 3% Fdi 1% | 1,668 |
| 53 | Spruce good | 18 | 2 | Pli 58% Sx 20% At 14% Bl 5% Fdi 3% | 1,101 |
| 54 | Spruce very good | 19 | 1 | Pli 40% Sx 29% At 13% Fdi 10% Bl 7% | 1,067 |

# 6. Current Forest Management Assumptions

**Data source and comments:**

- Very few records were available for the poor productivity analysis units as recent harvest performance has been very limited in these areas. Where less than 50 hectares of records were available, the silviculture assumptions from the corresponding medium productivity analysis unit were used.
- Standard OAF values of OAF1 - 15% and OAF2 - 5% except in MPB impacted young pine stands (Section 6.3).
- No thinning or fertilization is assumed.

#### 6.5.1.1 Genetic gain

When reforesting Crown land, legislation requires the use of the best genetic quality seed available – also known as select seed. Planting trees grown from select seed increases the volume available for harvesting in the future. Using select seed can also affect timber supply indirectly by influencing factors that constrain timber (e.g., harvest flow requirements, green-up and minimum harvest age).

The extra volume available in the future may allow a short-term increase in timber supply decades before the planted trees are ready for harvesting. This is known as the *allowable cut effect* and is a result of harvest flow modelling where the objective is to avoid large fluctuations in harvest levels over a harvest cycle. The potential increase in future volumes may allow early harvesting of some stands, and this may help to mitigate the anticipated mid-term deficit.[19]

Current practice in utilizing genetically improved growing stock was summarized from RESULTS regeneration survey data for the same 22 860 hectares discussed above. The genetic gain by species was weighted by the proportion of the area regenerated with the improved stock out of the total area surveyed. Therefore, areas established with planting stock with no genetic gain or areas left to natural regeneration will reduce the overall genetic gains modelled.

[19] FGC Extension Note 01: Incorporating Genetic Gain in Timber Supply Analysis, Forest Genetics Council of BC, March, 2011.

# 6. Current Forest Management Assumptions

*Table 22. Genetic worth of non-pine seedlings requested by genetic class*

| Analysis unit | Label | Genetic weight (%) | | |
|---|---|---|---|---|
| | | Fdi | Sx | Pli |
| 11 | Decid poor | | 2.0 | 0.2 |
| 12 | Decid medium | | 2.0 | 0.2 |
| 13 | Decid good | | 1.1 | 0.6 |
| 14 | Decid very good | | 1.8 | 1.4 |
| 21 | Douglas-fir poor | | 0.5 | 0.1 |
| 22 | Douglas-fir medium | | 0.5 | 0.1 |
| 23 | Douglas-fir good | 0.1 | 0.3 | 0.1 |
| 24 | Douglas-fir very good | 0.9 | 1.6 | 0.1 |
| 31 | Balsam poor | | 0.8 | |
| 32 | Balsam medium | | 0.8 | |
| 33 | Balsam good | 0.1 | 0.3 | |
| 34 | Balsam very good | 4.1 | 2.1 | 0.5 |
| 41 | Pine poor | 0.1 | 0.6 | 0.1 |
| 42 | Pine medium | 0.1 | 0.6 | 0.1 |
| 43 | Pine good | 0.2 | 0.6 | 0.1 |
| 44 | Pine very good | 0.7 | 1.8 | 0.5 |
| 51 | Spruce poor | | 0.2 | |
| 52 | Spruce medium | | 1.0 | 0.1 |
| 53 | Spruce good | 0.3 | 1.7 | 0.2 |
| 54 | Spruce very good | 0.2 | 2.8 | 0.4 |

**Data source and comments:**

- For this analysis it is assumed that the planted genetic stock will survive to be part of the well-spaced stems measured at the free-growing survey.

# 6. Current Forest Management Assumptions

### 6.5.2 Immature plantation history

The purpose of this section is to identify areas of existing immature forest where stocking density (stems per hectare) was controlled and therefore should be assigned to a TIPSY managed stand yield table. Managed means that a new stand was established naturally or artificially and that stand densities, both minimums and maximums, are within desired limits.

Stands greater than 50 years old will be grown using natural stand yield tables. All existing age class 2 and 3 pine stands will be grown with the Mountain Pine Beetle impacts as described in Section 6.3, "MPB in young pine stands".

Variable retention harvest systems, as modelled for Douglas-fir leading stands, will be grown using managed stand yield tables. Group selection systems as modelled for UWR will also be modelled on managed stand yield tables. Single tree UWR selection systems, where the retained overstory canopy is likely to reduce understory growth through shading, will be modelled using the variable retention adjustment factor in TIPSY.

### 6.5.3 Not satisfactorily restocked (NSR) areas

Lands classified in the VRI as *not satisfactorily restocked* (NSR) are included in the current timber harvesting and base. The purpose of this section is to identify the total area of NSR currently existing in the timber harvesting land base, and the estimated rate at which the NSR area will be restocked.

The backlog NSR (pre-1987) is based on RESULTS Milestone Declaration Reports, stocking status reports and a district silviculture file review. A Forests for Tomorrow (FFT) survey project is currently underway to inventory the backlog, and the results expected are that 50% of the backlog will be declared free growing this year based on inventory updates. The long-term expectation is that all backlog area will be treated and declared by 2015.

*Table 23. Not satisfactorily restocked (NSR) areas*

| Description | Total area (ha) | Hectares of NSR (age range years from now) | | | |
|---|---|---|---|---|---|
| | | Restocked | 1 - 10 | 11 - 20 | >20 |
| Backlog NSR | 1,132 | 100% | 566 | 0 | 0 |
| Current NSR | 50,596 | 100% | 50,596 | See comments | See comments |
| **Total** | 52,328 | 100% | 51,162 | | |

**Data source and comments:**

- The current NSR is based on the RESULTS *Milestone Declaration Report* and is a reflection of current harvesting.
- Current NSR is expected to regenerate as per Table 21 of Section 6.5.1, "Regeneration Activities in Managed Stands".
- Current NSR is expected to decline in two decades and beyond as the MPB salvage opportunities decrease and the rate of harvest decreases.

# 6. Current Forest Management Assumptions

## 6.6 Integrated resource management

### 6.6.1 Objectives that limit area disturbed

Area disturbance constraints will be modelled for the integrated resources management zone and the visually sensitive areas. The IRM zone is assumed to be the area outside of any other management constraint and will be represented generally in the THLB area. The maximum disturbance area for the IRM zones is based on a three-pass TSA harvest regime and serves as a general surrogate for adjacency and green-up.

Scenic areas and visual quality objectives have been established under the CCLUP. The visual quality class (VQC) percent denudation range for each VQO is from Table 3 of *Procedures for Factoring Visual Resources into Timber Supply Analysis*. For the analysis, the percent disturbance mid-point for each VQO will be modelled.

Productive forested area that does not contribute to the timber harvesting land base is not used to meet IRM objectives but is used to contribute to the visual quality objective requirements.

*Table 24. Forest cover requirements*

| Zone or group | Maximum allowable disturbance (% area) | Green-up height (m) | Consideration of forested area outside the THLB (%) | Source of prescription |
|---|---|---|---|---|
| THLB | 33 | 3 | 0 | See comments |
| VQO: P | 0-1 (0.5) | 3 | 100 | CCLUP |
| VQO: R | 1.1-5 (2.5) | 3 | 100 | CCLUP |
| VQO: PR | 5.1-15 (7.5) | 3 | 100 | CCLUP |
| VQO: M | 15.1-25 (20) | 3 | 100 | CCLUP |

**Data source and comments:**

- P = Preservation, R = Retention, PR=Partial Retention, and M= Modification.
- The actual visually effective green-up height (VEG) will vary by site and visual viewpoint. Three metres is an estimated average for modelling purposes.

# 6. Current Forest Management Assumptions

### 6.6.2 Seral stage distribution

The Biodiversity Conservation Strategy was completed in July of 1996 and sets out landscape units and biodiversity emphasis options (BEO)for seral stage distribution.

Seral stage distribution requirements will be applied in the analysis for each landscape unit and BEC zone in keeping with the CCLUP Biodiversity Conservation Strategy and updates. Non-THLB forested area and defined retention patches will contribute towards *mature plus old* biodiversity objectives. The timber supply model does not age the non-THLB area so that the current age distribution remains constant over the forecast. This prevents the non-THLB from eventually accumulating in the oldest age class. It is assumed that the natural disturbances that resulted in the current age distribution would maintain a similar distribution over time.

*Table 25. Mature seral stage definitions and mature plus old targets*[20]

| NDT | BEC | Mature min age (years) | Seral stage distribution | | |
|---|---|---|---|---|---|
| | | | Low | Intermediate | High |
| 1 | ESSF | > 120 | 19 | 36 | 54 |
| 1 | ICH | > 100 | 17 | 21 | 32 |
| 2 | ESSF | > 120 | 14 | 28 | 42 |
| 2 | ICH | > 100 | 15 | 31 | 46 |
| 2 | SBS | > 100 | 15 | 31 | 46 |
| 3 | ESSF | > 120 | 14 | 23 | 34 |
| 3 | MS | > 100 | 14 | 26 | 39 |
| 3 | SBPS | > 100 | 8 | 17 | 25 |
| 3 | SBS | > 100 | 11 | 23 | 34 |
| 3 | ICH | > 100 | 14 | 23 | 34 |
| 4 | IDF-Fdi | > 100 | 22 | 43 | 33 |
| 4 | IDF-Pli | > 100 | 11 | 23 | 34 |

Data source and comments:

- A onetime drawdown (i.e., seral-stage levels temporarily below desired CCLUP targets) to allow salvage of the epidemic levels of MPB mortality in pine and mixed-pine stands was approved by the Regional Biodiversity Conservation Committee. The *Strategy for Management of Mature Seral Forest and Salvage of Mountain Pine Beetle Killed Timber* is provided in the Biodiversity Conservation Strategy Update Note #8.
- The strategy recognizes that in some landscape units, MPB mortally may result in *mature plus old* seral stage deficits and sets out harvest criteria as well as *mature plus old* recruitment strategies for these scenarios. These strategies are assumed to be managed at the operational level with no influence on timber supply.

[20] 100 Mile House SRMP, August 10, 2005 pages 23-29 and Biodiversity Conservation Strategy for CCLUP, July, 1996 page 40.

# 6. Current Forest Management Assumptions

### 6.6.3 Reductions to reflect volume retention in cutblocks

Retention of volume within cutblocks may occur for a variety of forest management considerations. For example, these may include wildlife tree patches, riparian management zones or partial cutting systems.

**Riparian management zones**

The appropriate method to account for the timber supply implications of riparian management practices within riparian management zones (RMZ) depends upon the management practices applied in these zones and the availability of stream mapping.

Current practice within the TSA is to incorporate RMZ within wildlife tree retention areas (WTRA) as described in the following section. This is in keeping with enhanced retention strategy objectives. FREP riparian monitoring assessments done for the years 2007-2009 found that the majority of RMZ are within WTRA and that retention levels within the reserves generally averages over 90%. Because of the overlap, a separate deduction for RMZ is considered unnecessary.

**Wildlife trees and wlldlife tree retention areas**

The *Biodiversity Guidebook* describes two methods for providing the maintenance of stand structure over time. One method is (dispersed) wildlife trees while the other is wildlife tree patches (current characterization is wildlife tree retention area or WTRA).

Current practice within the TSA is to leave dispersed retention as well as defined WTRA for a full rotation (no re-entry planned). Seven percent is the legislated legal minimum area that must be reserved at the landscape level. WTRA will be modelled as a seven percent reduction of the forest land base. An additional 13% will be added to existing pine-leading analysis units to account for enhanced retention requirements during salvage operations. A second pass re-entry is not anticipated before the next rotation. Therefore, the enhanced (13%) retention area will be made available for harvest again after one rotation (60 years as discussed in Section 6.1.3).

*Table 26. Reductions to reflect volume retention in cutblocks*

| Management unit | Analysis unit | Reason for residual volume | Persistence | % recommended in applicable guidebook or legislation | Area estimate on the timber harvesting land base |
|---|---|---|---|---|---|
| Pli Leading | All | Biodiversity | Full rotation | 7 | 7% |
| Pli Salvage | All | Biodiversity | Full rotation | +13[21] | 20% |
| All Other | All | Biodiversity | Full rotation | 7 | 7% |

**Data source and comments:**

- A wildlife tree GIS analysis completed by district staff in 2009 in support of the district's enhanced retention strategy found approximately 40% of retained area is constrained by ecological or environmental values, e.g., streams, wetlands, sensitive soils.
- This is supported by FREP stand-level biodiversity sampling which also found that approximately 65% of retention patches are > 2 ha in size.

[21] Actual values vary depending on stand and site condition, 13% is an approximation for the analysis. The additional 13% is the enhanced component of the retention requirements; this is in addition to the legislated seven percent.

# 7. Sensitivity Analyses to be Performed

Sensitivity analysis can provide a measure of the timber supply impact if uncertainty in management assumptions and/or data integrity exists. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. Sensitivity analysis may indicate that a small reduction in these attributes may alleviate or exacerbate anticipated harvest level reductions in the future. By developing and testing a number of sensitivity analyses, it is possible to determine which variables most affect results. Table 27 presents the standard sensitivity analyses that are generally performed in all analyses. Additional sensitivities may be included after the base case has been completed and new uncertainties are identified.

*Table 27. Sensitivity issues*

| Issue to be tested | Sensitivity levels |
|---|---|
| Minimum harvestable age | + / - 5 yrs |
| Existing stand yields | + / - 10% |
| Regenerated stand yields | + / - 10% |
| Land base changes | + / - 10% |
| Visual quality objectives | Lower disturbance limits |
| PEM/SIBEC | Use VRI site index |
| Regeneration | One year regeneration delay, all blocks planted |
| Green-up height | + / - 1 m |
| Operability | Include all class 2 |
| Deciduous | Exclude deciduous leading |
| Dead pine fall-over age | + / - 5 yrs |
| Abandon MPB salvage | Harvest in live stands only |
| Green-up height | + / - 1 m |