Prince George Timber Supply Area
Timber Supply Review

Data Package

April 2015

John Huybers
District Manager
Prince George Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations

David van Dolah
District Manager
Fort St. James Natural Resource District
Vanderhoof Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations

Albert Nussbaum
Director
Forest Analysis and Inventory Branch
Ministry of Forests, Lands and Natural Resource Operations

Ministry of
Forests, Lands and
Natural Resource Operations

Table of Contents

1. INTRODUCTION 1

2. CURRENT FOREST MANAGEMENT CONSIDERATIONS AND ISSUES 2

2.1 BASE CASE MANAGEMENT ASSUMPTIONS 2
2.2 STATEMENT OF FOREST MANAGEMENT CONSIDERATIONS AND ISSUES 2

3. INVENTORIES 5

3.1 BACKGROUND INFORMATION 5
3.2 FOREST COVER INVENTORY 6
3.3 PROVINCIAL SITE PRODUCTIVITY LAYER 7
3.4 BC PROVINCIAL SCALE MOUNTAIN PINE BEETLE MODEL MORTALITY GRIDS 7

4. DIVISION OF THE AREA INTO MANAGEMENT ZONES 8

4.1 MANAGEMENT ZONES AND TRACKING OF MULTIPLE OBJECTIVES 8

5. TIMBER HARVESTING LAND BASE DEFINITION 9

5.1 DETAILS ON LAND BASE CLASSIFICATION 9
5.2 DETAILS ON LAND BASE CLASSIFICATION 10
5.2.1 Land classified as non-forest 10
5.2.2 Lands not administered FLNR for timber supply purposes 10
5.2.3 Inoperable forest stands 11
5.2.4 Problem forest types 16
5.3 WILDLIFE AND FISH HABITAT MANAGEMENT 19
5.3.1 Ungulate winter range 21
5.4 WILDLIFE HABITAT AREAS 23
5.5 FISH SENSITIVE WATERSHEDS 23
5.6 RECREATION AND CULTURAL HERITAGE RESOURCES 24
5.6.1 Cultural heritage resources and First Nations interests 24
5.7 EXISTING ROADS, TRAILS AND LANDINGS 24
5.7.1 Miscellaneous lineal features 25
5.7.2 Future roads, trails and landings 26
5.8 RETENTION 27
5.8.1 Spatial landscape retention 27
5.8.2 Stand-level retention 28
5.8.3 Riparian 29
5.9 CROWN LAND PLANS 29
5.9.1 Land and resource management plans 29

6. CURRENT FOREST MANAGEMENT ASSUMPTIONS 32

6.1 HARVESTING 32
6.1.1 Harvest yields 33
6.1.2 Merchantable timber specifications 34
6.1.3 Minimum harvestable criteria 34
6.1.4 Harvest scheduling 36
6.1.5 Shelf life 37
6.2 DECAY, WASTE, AND BREAKAGE 39
6.3 SILVICULTURE SYSTEMS 39
6.4 UNSALVAGED LOSSES 39
6.5 YOUNG PINE MORTALITY 45
6.6 SILVICULTURE AND REGENERATION ACTIVITIES 46
6.7 INTEGRATED RESOURCE MANAGEMENT 49
6.7.1 Landscape-level retention 49
6.7.2 Disturbance of the non-timber harvesting land base 53
6.8 SCENIC AREAS AND VISUAL QUALITY OBJECTIVES (VQOS) 54
6.9 UNGULATE WINTER RANGES 55

7. SENSITIVITY ANALYSES 60

8. ACRONYMS 61

Table of Contents

Tables

TABLE 1. FOREST MANAGEMENT CONSIDERATIONS 2
TABLE 2. INVENTORY INFORMATION 5
TABLE 3. MANAGEMENT ZONES AND OBJECTIVES TO BE TRACKED 8
TABLE 4. LAND CLASSIFIED AS A NON-FOREST 10
TABLE 5. LANDS NOT INCLUDED IN PGTSA 11
TABLE 6. INOPERABLE AREAS 14
TABLE 7. PROBLEM FOREST TYPES AS DEFINED IN THE PREVIOUS TIMBER SUPPLY REVIEW 16
TABLE 8. AREA AND VOLUME OF BALSAM-LEADING STANDS IN PGTSA 18
TABLE 9. SELECTED REGIONALLY VALUED WILDLIFE SPECIES WITHIN THE TSA 19
TABLE 10. MULE DEER WINTER RANGE ORDER U-7-002 FORT ST. JAMES DISTRICT 21
TABLE 11. CARIBOU UNGULATE WINTER RANGE ORDER U-7-003 (OMINECA NORTHERN CARIBOU FORT ST. JAMES DISTRICT 21
TABLE 12. MOUNTAIN GOAT WINTER RANGE ORDER U-7-019 FORT ST. JAMES DISTRICT 21
TABLE 13. MULE DEER WINTER RANGE ORDER U-7-011 VANDERHOOF DISTRICT 22
TABLE 14. CARIBOU UNGULATE WINTER RANGE ORDER U-7-012 VANDERHOOF DISTRICT 22
TABLE 15. CARIBOU UNGULATE WINTER RANGE ORDER U-7-003 PRINCE GEORGE DISTRICT 22
TABLE 16. MULE DEER WINTER RANGE ORDER U-7-013 PRINCE GEORGE DISTRICT 22
TABLE 17. WILDLIFE HABITAT AREAS 23
TABLE 18. FISH SENSITIVE WATERSHEDS 23
TABLE 19. DISTURBANCE ATTRIBUTED TO BUFFERED ROAD (WEIGHTED MEAN) WITH 5% LANDING ADD ON (2014 DATA) 25
TABLE 20. DISTURBANCE ATTRIBUTED TO LINEAR FEATURES 26
TABLE 21. CLP ZONE AND MODELLING ASSUMPTIONS 29
TABLE 22. LRMP-RELATED THLB NETDOWNS 31
TABLE 23. MERCHANTABLE TIMBER SPECIFICATIONS 34
TABLE 24. MPB CUMULATIVE MORTALITY FOR PGTSA 39
TABLE 25. SUMMARY OF ANNUAL INSECT, WILDFIRE AND WINDTHROW LOSSES ESTIMATED FOR THE PGTSA 45
TABLE 26. MPB ATTACK ESTIMATES FOR YOUNG STANDS WITHIN THE PGTSA BY DISTRICT AND LANDSCAPE UNIT 46
TABLE 27. INVENTORY DATA FOR 10 LARGEST ANALYSIS UNITS IN PG TSA 48
TABLE 28. SUMMARY OF ASPATIAL OLD FOREST RETENTION REQUIREMENTS 51
TABLE 29. NATURAL DISTURBANCE PARAMETERS APPLIED TO NTHLB WITHIN EACH NDU 53
TABLE 30. P2P RATIONS AND VEG HEIGHTS 54
TABLE 31. PREDICTING VQO OBJECTIVES BASED ON PERCENT ALTERATIONS 54
TABLE 32. SUMMARY OF ALL UWR ORDERS 55
TABLE 33. MULE DEER WINTER RANGE ORDER U-7-002 FORT ST. JAMES NATURAL RESOURCE DISTRICT 56
TABLE 34. CARIBOU UNGULATE WINTER RANGE ORDER U-7-003 56
TABLE 35. MULE DEER WINTER RANGE ORDER U-7-011 57
TABLE 36. CARIBOU UNGULATE WINTER RANGE ORDER U-7-012 VANDERHOOF NATURAL RESOURCE DISTRICT 57
TABLE 37. MULE DEER WINTER RANGE ORDER U-7-013 PRINCE GEORGE NATURAL RESOURCE DISTRICT 57
TABLE 38. NORTHERN CARIBOU WINTER RANGE ORDER U-7-015 FORT ST. JAMES NATURAL RESOURCE DISTRICT 58
TABLE 39. MULE DEER WINTER RANGE ORDER U-5-001 PRINCE GEORGE NATURAL RESOURCE DISTRICT 58
TABLE 40. SENSITIVITY ANALYSIS 60

Table of Contents

Figures

FIGURE 1. SPATIAL INDEX DISTRIBUTION IN PG TSA. 12
FIGURE 2. SPATIAL INDEX ZONES. 13
FIGURE 3. INOPERABLE LAND BASE BASED ON CYCLE TIME INDEX. 13
FIGURE 4. DISTRIBUTION OF NET VOLUME PER HECTARE CLASSES FOR BOTH PINE AND NON-PINE LEADING CUTTING PERMITS. 15
FIGURE 5. THE HISTORIC DISTRIBUTION OF BALSAM AS A PROPORTION OF THE TOTAL NON-PINE HARVEST IN THE TSA... 17
FIGURE 6. THE DISTRIBUTION OF BALSAM-LEADING STANDS IN THE CFMLB BY PERCENTAGE BALSAM CLASS. 18
FIGURE 7. FOREST ROAD CROSS SECTION. 25
FIGURE 8. PERMANENT ACCESS STRUCTURE PERCENTAGE DISTRIBUTION. 26
FIGURE 9. STAND-LEVEL RETENTION DISTRIBUTION BASED ON 1997-2012 FREP DATA. 28
FIGURE 10. THE BILLED ANNUAL HARVEST FOR THE ENTIRE PGTSA AND DISTRICTS. 32
FIGURE 11. ANNUAL PINE PERCENTAGE OF VOLUME PERMITTED AND BILLED WITHIN THE PGTSA AS A WHOLE AND WITHIN EACH DISTRICT RESPECTIVELY FROM 2008 TO SUMMER OF 2014. 33
FIGURE 12. THE DISTRIBUTION OF VOLUME PER HECTARE (VPH) IN CUTTING PERMITS BY YEAR IN PINE AND NON-PINE LEADING SPECIES. 35
FIGURE 13. PINE SALVAGE ZONE. 36
FIGURE 14. AREA OF MPB-AFFECTED STANDS BY 'YEARS FROM DEATH' CLASSES. 37
FIGURE 15. OPTIONS CONSIDERED FOR 'SHELF LIFE' (WHERE 1 ON Y AXIS EQUAL TO 100% VOLUME LOSS). 38
FIGURE 16. THE INVENTORY OF PINE AND MPB-KILLED PINE IN PGTSA. 40
FIGURE 17. LOCATION OF VRI PLOTS (2006-2008) AND INVENTORY AUDIT PLOTS IN BALSAM-LEADING STANDS. 41
FIGURE 18. STAND MORTALITY IN BALSAM-LEADING PLOTS. 42
FIGURE 19. DISTRIBUTIONS OF STAND VOLUME, AGE AND MORTALITY AS WELL AS MODEL PREDICTED MORTALITY FOR BALSAM-LEADING SAMPLES. 43
FIGURE 20. PRINCE GEORGE TSA A4 MBEC RECRUITMENT STRATEGY. 52

1. Introduction

This data package summarizes the basic information and assumptions required for the Prince George Timber Supply Area (PGTSA) timber supply analysis.

The completed data package contains those inputs that represent current performance for the TSA. For the purpose of the Timber Supply Review (TSR), "current performance" can be defined by:

- the current forest management regime as reflected in government approved Forest Stewardship Plans (FSP);
- the land available for forest management activities and the timber harvesting land base as defined by historical licensee performance;
- the silviculture treatments and the integrated resource management practices used in the area;
- land-use plans;
- land-use decisions approved by government;
- orders issued through the Government Actions Regulation (GAR) of the *Forest and Range Practices Act (FRPA)*; and
- the order establishing landscape biodiversity objectives for the Prince George Timber Supply Area (PGTSA).

The primary purpose of the TSR 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 generally includes:

1) A short explanation of the data required with a description of data sources and other explanatory comments.
2) Supporting data in the form of lists, tables or figures.
3) A summary of the modelling assumptions proposed to be used.

The information in this data package represents the best available knowledge at the time of publication, but is subject to change. A public review period has been established to allow submission of comments and concerns about the data package to the Ministry of Forests Lands and Natural Resource Operations (FLNR). Submissions and new information made available prior to the analysis may lead to changes in the data listed in this package. Until the timber harvesting land base (THLB) is determined, it is not possible to finalize the values shown in some of the tables in this document. The final timber supply analysis report (the Technical Record) will include a technical appendix that highlights any changes made to this data package.

The data in this package was prepared by a technical working group comprised of government and licensee representatives. Group consensus was achieved on the majority of the issues; however, where there were uncertainties or disagreements, sensitivity analysis will be used to assess the level of risk.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

The assumptions described in this section 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 reference when examining the effects of uncertainties. Section 7, "Sensitivity Analyses" identifies areas of uncertainty in the data and assumptions and outlines intended sensitivity analyses.

2.2 Statement of forest management considerations and issues

The following table lists major forest management issues and considerations. Where possible, the issues will be assessed directly in the timber supply analysis. If the issue does not fall within the definition of current management as described in Section 1, the related timber supply impacts will be assessed in a sensitivity analysis. There may be significant uncertainties in defining some current management issues. In such cases, sensitivity analysis can assist in assessing the potential timber supply implications and assigning degrees of risk to timber supply during the allowable annual cut (AAC) determination.

Table 1. Forest management considerations

Consideration/issue	Description
Mountain Pine Beetle (MPB) salvage harvesting	The PGTSA was significantly impacted by the recent MPB infestation. The infestation peaked between 2005 and 2008 (district-specific) and has since leveled off at approximately 190 million cubic metres of dead pine. AAC uplifts have been in place to allow for salvage since 2002. A partition of 3,500,000 cubic metres was attributed to non-pine volume in the 2011 AAC determination to minimize the impact to live growing stock.
Harvest performance: MPB	According to PGTSA timber harvest monitoring for the three-year reporting period between April 2011 and March 2014, pine represented 63.6% of the total net volume harvested. For the same time period the Prince George Natural Resource District (DPG) achieved 52% pine harvest, potentially signaling a shift away from pine salvage in that district.
Shelf life	There is significant uncertainty regarding the length of time that a mountain pine beetle-killed tree is usable as a sawlog to make lumber (shelf life). The median total cull estimate from pine-leading permits submitted from 2010 to 2014 is 31%. This means that 31% of the volume in a pine stand is estimated to be unsuitable for lumber production. A new shelf life model will be applied to the pine-leading stands to reflect the incremental loss of merchantable volume occurring in the PGTSA.
Harvest performance: balsam-leading stands	Although balsam-leading stands represent 22% of the Crown Forest Management Land Base (CFMLB) area and 19.6% of the total volume, historically they have represented 1.6% of the harvest profile in the PGTSA. The base case will incorporate a partition for this profile.
Utilizing marginally economic stands	As per the August 2012 report titled "Growing Fibre, Growing Value" by the Special (Legislative) Committee on Timber Supply this timber supply review will explore opportunities for utilizing marginally economic stands within the PGTSA. This includes examining the potential harvest of balsam leading stands and low volume conifer stands.
Volume estimates for natural stands	An inventory audit was initiated by Forest Analysis and Inventory Branch (FAIB) in the summer of 2014. The audit samples a random subset of inventory polygons to verify the confidence in the accuracy of the Phase I timber volume estimates and other key vegetation attributes. The audit results will be used to adjust yields for natural stands.

(continued)

Table 1. Forest management considerations (continued)

Consideration/issue	Description
Volume estimates for regenerated managed stands	As requested by the Chief Forester, a young stand monitoring program has been established within the TSA. The sampling data will be used to adjust yields of managed stands.
Mortality in immature pine stands	Mortality in immature pine stands (< 60 years old) was modelled separately from mature pine stands (>60 years old) in the previous TSR. These assumptions will be maintained in this review.
Balsam decline in Fort St. James	Significant mortality in balsam-leading stands in the Fort St. James District will be explicitly accounted for in the base case. Stand volumes will be adjusted to reflect estimated levels of mortality. Regression analysis of previous Provincial Vegetation Resource Inventory (VRI) plots and recently completed forest inventory audit plots will be used to predict balsam mortality based on individual stand attributes, such as stand age and stand volume.
Wildlife management	New ungulate winter range (UWR) orders have been established for the PGTSA.
Fisheries sensitive watersheds	Three new fish sensitive watersheds (FSWs) were established on April 19, 2013 within PGTSA.
Site productivity information	The New Provincial Site Productivity Layer will provide improved productivity information for all commercial tree species.
Economic operability	Economic operability will be assessed through a combination of stand value and past harvesting practice for both pine salvage and green wood harvest. The primary factor considered is average stand volume per hectare. As part of the analysis, future predicted average stand volume is being adjusted to reflect pine shelf life, other tree mortality, natural disturbance and the growth and yield of live trees.
Deciduous utilization	In the last timber supply review, the Chief Forester partitioned 160 000 m^3/year of the AAC to deciduous forest types. Since the AAC decision in 2011, all the deciduous forest licenses within the PGTSA have expired and there has been no significant harvest of deciduous leading stands. It is also recognized that a notable amount of the deciduous leading stands are associated with valuable wildlife habitat. In previous timber supply reviews, in this and other adjacent TSAs, First Nations (FN) have reiterated the importance of deciduous leading stands to wildlife and their traditional interests. As a result of all of the noted considerations, the inclusion of deciduous harvesting in the base case is being examined.
ICH management	In the last TSR, the Chief Forester partitioned 23 000 m^3/year of the AAC to cedar leading stands in the Interior Cedar Hemlock (ICH) biogeoclimatic zone in the Prince George District. This partition will be maintained in this timber supply review. Sensitivity analysis will assess the impact of establishing a new provincial park in the ICH.
First Nations treaty negotiations	Both the Lheidli T'enneh First Nation and Yekooche First Nation have negotiated an agreement in principle, which identifies land that may be held by each First Nation at the time of final treaty or agreement with the governments of Canada and British Columbia. These agreements in principle identify land available in the provincial forest within the TSA. These associated areas have been excluded from the THLB.
First Nations Forest Tenure	It is expected that multiple (up to nine) area based First Nation Woodland Licences (FNWL) will be established from within the PGTSA over the next 3 to 10 years. Once established, these areas are removed from contributing to the TSA and receive their own allowable annual cut (AAC). FNWLs established within the next few months will be removed from the timber harvesting land base (THLB) while others implemented farther in the future will be considered through sensitivity analysis.

(continued)

Table 1. Forest management considerations (concluded)

Consideration/issue	Description
Cultural heritage resources and First Nations interests	Cultural heritage resources and other areas of importance to First Nations are continually being noted and documented throughout the PGTSA. Frequently, though not always, these areas are accounted for through riparian habitat, wildlife areas or other removals from the THLB including buffered trails and archaeological sites. The magnitude of this assumption may change as the extent of cultural heritage and other First Nation areas of importance and their impact on timber harvest activities become better understood.
Wildlife and First Nations interests	Information and analysis gathered during the previous TSR with regards to wildlife abundance will be utilized. This includes First Nations needs for wildlife and impacts of timber harvesting on wildlife. The Ministry of Forests, Lands and Natural Resource Operations (FLNR) will work with First Nations to ensure the best information related to wildlife is available for use in the timber supply review.
Land and resource management plans	Each district within the PGTSA has a Cabinet approved Land and Resource Management Plan (LRMP) (Vanderhoof 1997, Prince George and Fort St. James 1999); however these plans were not approved as higher level plans. These plans were used as a guide to inform the establishment of parks and other legal orders protecting wildlife, fisheries, biodiversity and visual quality and land use (crown land plan).
Crown land plan	A legal order, pursuant to Section 93.4 of the Land Act, was established on November 21, 2006 for two of the zones identified within the Crown Land Plan. The order prohibits logging in Agriculture Development Areas (ADA) and Settlement Reserve Areas (SRA), except for environmental, safety and forest health purposes and will be accounted for in the TSR.
Recreation values	Recreation sites and trails are managed as per current practice resulting in a netdown from the THLB.
Community forests agreements	FLNR has recently offered the communities of Vanderhoof and Fraser Lake the opportunity to apply for Community Forest Agreement's (CFAs). At this time both communities are working toward area selection for these tenures. Depending on the progress, they will either be removed from the THLB or considered through sensitivity analysis. The Fort St. James CFA was expanded in 2013 and the expansion area will be removed from the THLB.
Bioenergy licenses	Bioenergy forest licenses are intended to harvest stands with high mortality and damage that may not otherwise be harvested by other forest licensees. Two 20 year bioenergy forest licenses are committed as a result of a BC Hydro call for power. The combined AAC amount is 570,000 m3 per year. Currently, these bioenergy plants are being constructed and will soon be put into operation. As per the 2011 AAC determination, this timber supply review will consider the need to identify a portion of AAC dedicated to non-sawlog fibre.

3. Inventories

3.1 Background information

The inventories that will be used to define the THLB and model forest management activities are listed in Table 2. The source and vintage of the information are also shown.

Table 2. Inventory information

Spatial data	Source	Feature name	Vintage/ download
Timber supply areas	BCGW*	WHSE_ADMIN_BOUNDARIES.FADM_TSA	2014
Landscape units	BCGW	WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_SVW	2014
Ownership	BCGW	WHSE_FOREST_VEGETATION.F_OWN	2014
Protected areas: parks and ecological reserves	BCGW	WHSE_TANTALIS.TA_PARK_ECORES_PA_SVW	2014
Community watersheds	BCGW	WHSE_WATER_MANAGEMENT.BC_COMMUNITY_WATERSHEDS	2014
Managed licences	BCGW	WHSE_FOREST_TENURE.FTEN_MANAGED_LIC_POLY_SVW	2014
Indian reserves	BCGW	WHSE_ADMIN_BOUNDARIES.CLAB_INDIAN_RESERVES	2014
Tree farm licence	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_TFL	2014
Private land	BCGW	WHSE_CADASTRE.CBM_CADASTRAL_FABRIC_PUB_SVW	2014
First Nations agreement boundaries	BCGW	WHSE_HUMAN_CULTURAL_ECONOMIC.FNIRS_AGREEMENT _BOUNDARY_SVW	2014
BCTS operating area	BCGW	WHSE_ADMIN_BOUNDARIES.FADM_BCTS_AREA_SP	2014
Biogeoclimatic ecosystem classification	BCGW	WHSE_FOREST_VEGETATION.BEC_BIOGEOCLIMATIC_POLY	2014
Provincial site productivity layer	FAIB*	SITE_PROD_BC	2014
Vegetation resource inventory	BCGW	WHSE_FOREST_VEGETATION.VEG_COMP_POLY_R1	2014
RESULTS reserves	BCGW	WHSE_FOREST_VEGETATION.RSLT_FOREST_COVER_RESERVE_SVW	2014
RESULTS forest cover	BCGW	WHSE_FOREST_VEGETATION.RSLT_FOREST_COVER_INV_SVW	2014
Forest depletions	FAIB	CONSOLIDATED_CUTBLOCKS_2014	2014
Terrain stability mapping	BCGW	REG_LAND_AND_NATURAL_RESOURCE.TERRAIN_STABILITY_ CAR_POLY	2014
Ungulate winter range	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_UNGULATE_WINTER_RANGE_SP	2014
Visual landscape inventory	BCGW	WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_ INVENTORY	2014
Wildlife habitat areas	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_WILDLIFE_HABITAT_AREA_ POLY	2014
Fisheries sensitive watersheds	BCGW	WHSE_WILDLIFE_MANAGEMENT.WCP_FISH_SENSITIVE_WS_POLY	2014
Current fires	BCGW	WHSE_LAND_AND_NATURAL_RESOURCE.PROT_CURRENT_FIRE_POLYS_ SP	2014

*BCGW: BC Geographic Warehouse, LOWG: Landscape Order Working Group, FAIB: Forest Analysis and Inventory Branch.

Table 2. Inventory information (concluded)

Spatial data	Source	Feature name	Vintage/ download
Proposed wildlife habitat areas	BCGW	REG_LAND_AND_NATURAL_RESOURCE.WLD_WHA_PROPOSED_SP	2014
Old growth management areas: legal	BCGW	WHSE_LAND_USE_PLANNING.RMP_OGMA_LEGAL_CURRENT_SVW	2014
Old growth management areas: planned guidance	BCGW	WHSE_LAND_USE_PLANNING.RMP_OGMA_NON_LEGAL_CURRENT_SVW	2014
Mountain Pine Beetle projected mortality	FAIB	BCMPB.V11.FORCUMKILL.PROJECTED	2014
Digital elevation model	BCGW	WHSE_BASEMAPPING.TRIM_CONTOUR_POINTS	2014
Slope	FAIB	IMAGEFILES.BCGOV_DEM_SLOPE_TRIM25M	2014
Wetland management zones (Buffers)	BCGW	REG_LAND_AND_NATURAL_RESOURCE.WETLAND_MGMT_CAR_ POLY	2014
Stream management zones (Buffers)	BCGW	REG_LAND AND NATURAL_RESOURCE.STREAM MANAGEMENT_CAR_POLY	2014
Lake management zones (Buffers)	BCGW	REG_LAND AND NATURAL_RESOURCE.LAKE MANAGEMENT_ZONES_CAR_POLY	2014
Lake classification	BCGW	LAKE_CLASSIFICATION_CAR_POLY	2014
Forest Service road - active or pending	BCGW	WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW	2014
Road permit road - active or pending	BCGW	WHSE_FOREST_TENURE.FTEN_ROAD_SECTION_LINES_SVW	2014
Other roads (non-status)	BCGW	WHSE_BASEMAPPING.DRA_DIGITAL_ROAD_ATLAS_LINE_SP	2014
Land type classification	FAIB	Custom ownership dataset developed for TSR4	2008
Merged BEC units	LOWG	Custom natural disturbance dataset for the PG Landscape Biodiversity Order	2014
Roads trails and landings inventories	FIA	Custom roads inventories by District produced for TSA Licensees	2007-2010

3.2 Forest cover inventory

The Vegetation Resources Inventory (VRI) is the standard for forest cover inventory in the province of British Columbia. FLNR, Forest Analysis and Inventory Branch (FAIB) is the data custodian of this data that has been collected using a set of approved procedures with associated standards. The VRI is designed to answer two questions: "Where is the resource located?" and "How much of given vegetation resource is within an inventory unit?" The VRI is a photo-based, two-phase program. Phase 1 involves photo interpretation, delineating polygons of homogenous land cover types and providing estimates of the vegetation attributes for each polygon. Phase 2 includes several ground sampling activities.

To date, Vegetation Resource Inventory activities for the Prince George Timber Supply Area (PGTSA) have been planned and implemented independently in each of the three Natural Resource Districts (District) that make up the TSA. The PGTSA licensees initiated a VRI program in 2000 to upgrade the District's forest inventories to provincial standards.

The Phase I program was completed in 2003 and the VRI Phase II and Net Volume Adjustment Factor (NVAF) programs were completed between the 2005 and 2009 field seasons. A re-inventory for the Vanderhoof District was initiated in 2013 and is expected to be completed by 2017.

An inventory audit was initiated by FAIB in the summer of 2014. The audit samples a random subset of inventory polygons to verify the confidence in the accuracy of the Phase I volume estimates, as well as some of the other key vegetation attributes. It provides detailed information on tree size and condition. Ground sampling also includes the Young Stand Monitoring (YSM) program. The YSM program provides data to check the growth and yield predictions employed in TSR, silviculture planning, yield modelling, and other key forest management tools and processes. The YSM program targets high-risk areas where young stand growth rates are critical to mid-term timber supply.

The inventory data have been updated for recent harvest depletions and major disturbances. Harvested areas not recorded in the inventory were identified using the consolidated cutblock layer developed by FAIB. The cutblock layer combines VRI, forest tenure, and Reporting Silviculture Updates and Land Status Tracking System (RESULTS) spatial data to identify logged areas by year of harvest completion. The cutblock layer also includes satellite change detection data to identify any recent major disturbance areas not recorded in any of the other data sources.

The PGTSA experienced major fires during the summer of 2014. The extent of the 2014 burned area has not yet been fully mapped. The finalized spatial data will be incorporated into the analysis as it becomes available. The potential for salvage in the burned areas is variable and uncertain. For the Vanderhoof District (DVA) a new inventory project will evaluate the condition of these burned areas and their findings will be incorporated into an update VRI. Burned cutblocks are generally replanted by forest licensees. These will be modelled as managed stands.

3.3 Provincial site productivity layer

The Provincial Site Productivity Layer (PSPL) provides improved site index estimates for second-growth stands of commercial tree species. The estimates are based on ecosystem data from existing Predictive Ecosystem Mapping (PEM) or Terrestrial Ecosystem Mapping (TEM) coupled with site index estimates by Biogeoclimatic Ecosystem Classification Site Series (SIBEC). For stands with PEM or TEM data not available, the data from various growth and yield projects were used to create a biophysical model for site productivity estimates.

3.4 BC Provincial Scale Mountain Pine Beetle Model mortality grids

The BC Provincial Scale Mountain Pine Beetle Model (BCMPB) was developed by FAIB to assess the impacts of mountain pine beetle outbreak and management interactions across the entire province. The model uses forest cover data, the Provincial Aerial Overview Survey of Forest Health and information from a stand-level mountain pine beetle (MPB) population model to estimate the current extent of pine mortality, and to project a possible course of the infestation into the future.

Annual updated versions have been developed to incorporate new infestation data and refine mortality projections. This TSR will utilize resultant data from the BCMPB v11 model. The model generates annual and cumulative mortality grids at a 16 hectares resolution. These grids are incorporated into the timber supply analysis to help define harvest flow projections.
During the previous timber supply review local mortality data augmented the BCMPB model results. Similarly in this analysis, ECAS (E-Commerce Appraisal System) data will be used to confirm mortality projected by the BCMPB model.

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 objectives. For example, a zone may be based on a harvesting system, silviculture system, visual quality objectives or wildlife habitat consideration. An area of forest may be subject to more than one management objective. Each objective can be tracked separately in the timber supply model. Land considered unavailable for timber harvesting can contribute to the achievement of other forest management objectives.

Table 3 outlines the zones or objectives that will be incorporated in the timber supply model. It does not list objectives that will be modelled by excluding areas from the THLB (e.g., riparian areas and wildlife tree areas). Further information on the modelling of these areas can be found in Section 6.7, "Integrated resource management".

Table 3. Management zones and objectives to be tracked

Management zone/objective	Source	Issue
District and supply block	BCGW	Harvest performance and mid-term timber supply
Merged BEC zones	LOWG	Landscape-level biodiversity
Ungulate winter range	BCGW	Habitat
Existing managed stands	RESULTS/FAIB	Mid-term timber supply
Scenic areas	BCGW	Visual quality objectives
MPB-impacted stands	FAIB	Salvage, rehabilitation and mid-term timber supply
Non-pine-leading stands	FAIB	Harvest performance and mid-term timber supply
Balsam mortality in Fort St. James	FAIB	Salvage
Balsam-leading stands	BCGW	Harvest performance and mid-term timber supply
Cedar-leading stands	BCGW	Cedar partition in the ICH
Deciduous-leading stands	BCGW	Potential partition and exclusion

5. Timber Harvesting Land Base Definition

5.1 Details on land base classification

This part of the data package outlines the steps used to identify the Crown forested management land base, gross harvesting land base and timber harvesting land base. The Crown forest management land base (CFMLB) is the portion of the total area with forest cover that contributes to Crown forest management objectives in the context of TSA timber supply, such as landscape-level biodiversity or visual quality objectives.

The CFMLB excludes:

- private land;
- federal reserves;
- long-term leases;
- area-based forest tenures (Tree Farm Licences [TFL], Community Forest Agreements[CFA], Woodlot Licences [WL] and First Nations Woodland Licences [FNWL]; and
- non-forested lands.

The gross harvesting land base (GHLB) is the portion of the CFMLB where timber harvesting is permitted, subject to forest management objectives and constraints. The GHLB excludes:

- miscellaneous provincial crown land not contributing to timber supply;
- federal and provincial parks and protected areas;
- areas with legally established boundaries where timber harvesting is incompatible with management objectives for other resource values.

The timber harvesting land base (THLB) is the portion of the GHLB where timber harvesting is projected to occur over the long term. The THLB excludes:

- areas that are not suitable or uneconomic for timber production; and
- areas without legally established boundaries where timber harvesting is incompatible with management objectives for other resource values.

Land is considered outside the THLB only where harvesting is not expected to occur. Any area in which timber harvesting will occur remains in the THLB, even if the area is subject to other management objectives, such as wildlife habitat and biodiversity. These objectives are modelled in the timber supply analysis as forest cover constraints. The CFMLB and GHLB outside of the THLB also contribute to these other objectives.

The THLB may increase in size over time in the following situations:

- where management activities improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush with commercial tree species);
- through the acquisition of productive forest land (e.g., timber licence reversions);
- timber harvesting occurs consistently in previously excluded stand types.

The THLB may also decrease in size where:

- management activities prevent the reestablishment of a productive forest (e.g., future permanent roads, grassland restoration);
- timber harvesting fails to occur consistently in previously included stand types. These increases and decreases in THLB are generally captured as they occur in time and are modelled in subsequent timber supply review processes.
- Land use objectives are introduced by government that reduce the land base available for harvesting

5.2 Details on land base classification

5.2.1 Land classified as non-forest

The non-forest classification includes areas that are non-vegetated and/or non-productive in the TSA. Stands of trees that have a crown closure less than 10% or a site index less than five metres are also considered to be non-forest (classified as non-productive forest). These areas are excluded from the CFMLB. Land classified as non-forest does not contribute to other management objectives such as old growth for landscape-level biodiversity. Table 4 details the broad classes of non-forest or non-productive forest in the TSA (areas are derived from a netdown summary and some features may fall into more than one type classification. For example, the area for a treed alpine polygon with crown closure less than 10% would only contribute to the non-treed area summary).

Table 4. Land classified as a non-forest

Type	Description	Area
Non-treed	Non-vegetated, non-managed forest with crown closure < 10%, rock, ice, etc.	1,023,708
Non-productive	Site index < 5	797,333
Water	Lakes, wetlands, and rivers	292,239
Alpine	BC land classification, BEC zones: BAFA, IMA	180,995
Total		2,294,276

5.2.2 Lands not administered FLNR for timber supply purposes

Lands not administered by the FLNR for timber supply purposes within the TSA includes private land, municipal land, Indian Reserves, parks, protected areas, tree farm licences, community forest agreement areas, and woodlot licences, and some miscellaneous land tenures.

These areas do not contribute to the THLB. A spatial dataset has been developed that identifies these areas using information from the Tantalis, the Crown Land Registry and Integrated Cadastral Information Society. Table 5 details the land tenure types that are excluded from the PGTSA.

Table 5. Lands not included in PGTSA

Type	Area (hectares)
Private land	386,978
Tree farm licences	314,648
Woodlots	116,653
Community forests	44,464
Research forests	38,290
Indian Reserves	19,112
Federal transfer of admin control	2,387
Crown and private schedule A and B lands	105
Christmas tree permit	76
Total	922,711

5.2.3 Inoperable forest stands

Areas are considered inoperable where there are physical barriers or limitations to harvesting, where appropriate logging methods (e.g., cable) are not available or deemed to be too costly, or where stands are not merchantable due to low volumes or low-value species or have a high harvest cost (primarily due to excessive haul distance). Steep slopes and unstable ground are examples of limited physical operability. Low volumes, low-value species and excessive haul distance are examples of limited economic operability. Changing technology and economic conditions can affect both physical and economic operability.

In this analysis the limits of historical harvest activity will be used as indicators of physical and economic operability. Specifically, five attributes have been assessed to determine the upper and lower bounds for operability:

- slope;
- elevation;
- terrain stability;
- distance; and
- low-volume stands.

Slope and elevation

An analysis of cutblocks from past 50 years was used to determine the historic distribution of harvesting in slope, elevation and distance classes. Slope and elevation class thresholds were derived using the 25-metre resolution digital elevation model of the PGTSA. The slope and elevation class thresholds reflect harvest equipment capability and environmental suitability. Safety guidelines for machine operability have also been incorporated into threshholds' determination.

The analysis indicates that the historic upper threshold for harvesting (for 99.9% of all area harvested in the past 50 years) is 62% slope. For the purposes of defining operability, this value has been used as an upper bound. The elevation analysis indicates that the historic upper threshold for harvesting has been 1492 metres. For the purposes of defining operability this value has been used as an upper bound. To approximate operational practice small areas (< 2.0 hectares) are aggregated with surrounding larger areas from which the operability criteria are adopted.

Terrain stability

Terrain stability was identified utilizing two data sources:

- Biophysical and terrain stability mapping completed for portions of the Fort St. James and Prince George Districts. The mapping was completed as part of a TSA-wide and integrated Vegetation Resources Inventory (VRI)/terrain mapping projects between 2001 and 2004. It has provided the foundation inventory for implementing a TSA-wide Predictive Ecosystem Mapping (PEM).
- Environmentally Sensitive Areas (ESA) mapping completed for TSR2.

Where terrain stability mapping exists, terrain stability class V (unstable) was excluded from the operable land base. Where terrain stability mapping does not exist, ESA inventory class "S1" (highly sensitive soils) was excluded.

Distance

A production weighted cycle time surface for the TSA was created to assess performance thresholds with respect to haul distance. The surface is a spatial index of cycle times for each sawmill to a systematic grid of 700 points spread across the TSA. Each cycle time is weighted by the sawmill's annual production capacity to create a spatial index for the TSA.

The index is applied to historic harvest practice to produce a distribution of cycle time indices for both the upper bound of pine salvage and the upper bound of historic harvest in all timber types. These limits will be used to differentiate cycle time zones for harvest preference and to delineate operability limits.

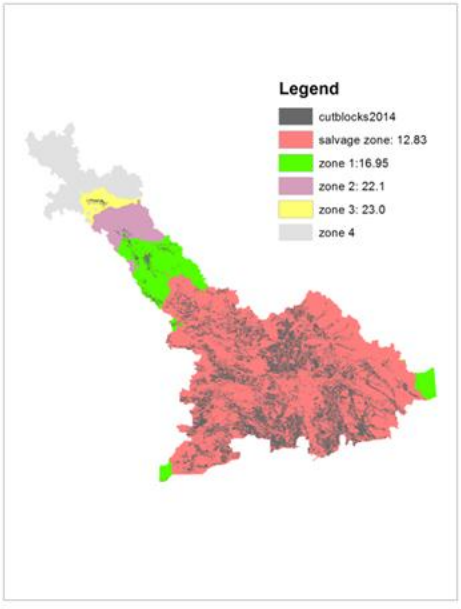

Figure 1. Spatial index distribution in PG TSA.

The cycle time index analysis indicates that the historic upper threshold for timber harvesting has been 22.1 hours. For the reference, Figure 2 illustrates the impact of cycle time index on the size of timber harvest area in PGTSA.

In this analysis the 99.9 percentile of historic practice is adjusted to 23.0 hours to account for westward movement of timber to Houston mill from the west side of Takla Lake (Figure 3).

Figure 2 depicts the distribution of historic cutblocks by cycle time index.

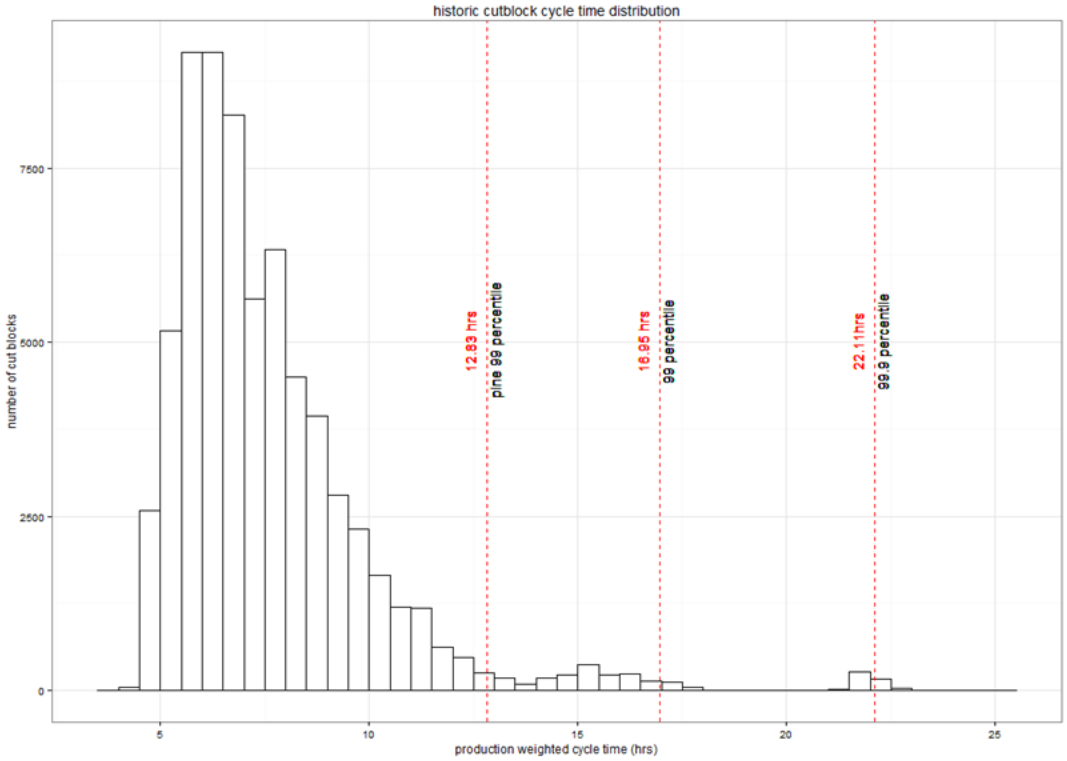

Figure 2. Spatial index zones.

Figure 3. Inoperable land base based on cycle time index.

Table 6 details the relative reductions in land base that result from applying each of the operability thresholds. The total net impact is a reduction of 614 577 hectares in the size of crown forest.

Table 6. Inoperable areas

Land base	Area (hectares)	Slope reduction (hectares)	Slope %	Elevation reduction (hectares)	Elevation %
Gross area	7,965,549	390,831	5%	1,025,397	13%
Crown forest	5,065,053	92,304	2%	168,184	3%

Distance reduction (hectares)	Distance %	Terrain stability reduction (hectares)	Terrain %	Total reduction (hectares)	%
792,286	10%	360,430	5%	1,756,376	22%
275,599	5%	216,533	4%	614,577	12%

Low stand volumes

Stands are considered not merchantable if their characteristics (low volumes, low value or have a high cost of harvest [primarily excessive haul distance]) deviate significantly from the characteristics that have defined historic harvest preference and practice. In order to define the lower bounds of merchantability, statistical analysis of FLNR appraisal data collected from cutting permits issued over the last 30 years was used to determine the minimum volumes per hectare (MVH) a stand must achieve in order to be considered merchantable.

All values greater than the first percentile of the sampled harvest distribution are considered representative of historic practice and preference. Since some existing stands have yield projections that never achieve the threshold and would never be eligible for harvest in the timber supply forecast, they are excluded from the THLB. The Electronic Commerce Appraisals System (ECAS) volume per hectare values represent net values once endemic and catastrophic losses are removed (See Section 6.1.5, “Shelf life”, for further discussion).

Since the volume per hectare values from the inventory have not been adjusted for catastrophic loss from mountain pine beetle, care must be taken applying thresholds derived from ECAS to avoid including stands that would otherwise be excluded if gross ECAS values were applied.

Figure 4 depicts a sample distribution of net volumes per hectare classes divided into pine and non-pine-leading cutting permits. The first percentile for pine-leading stands is 153 m^3/hectare while the first percentile for non-pine-leading stands is 186 m^3/hectare. Sub-sampling for the salvage period 2006-2014 indicates a downward trend in pine-leading stands MVH with a first percentile of 133 m^3/hectare while the first percentile for non-pine-leading stands rises to 193 m^3/hectare.

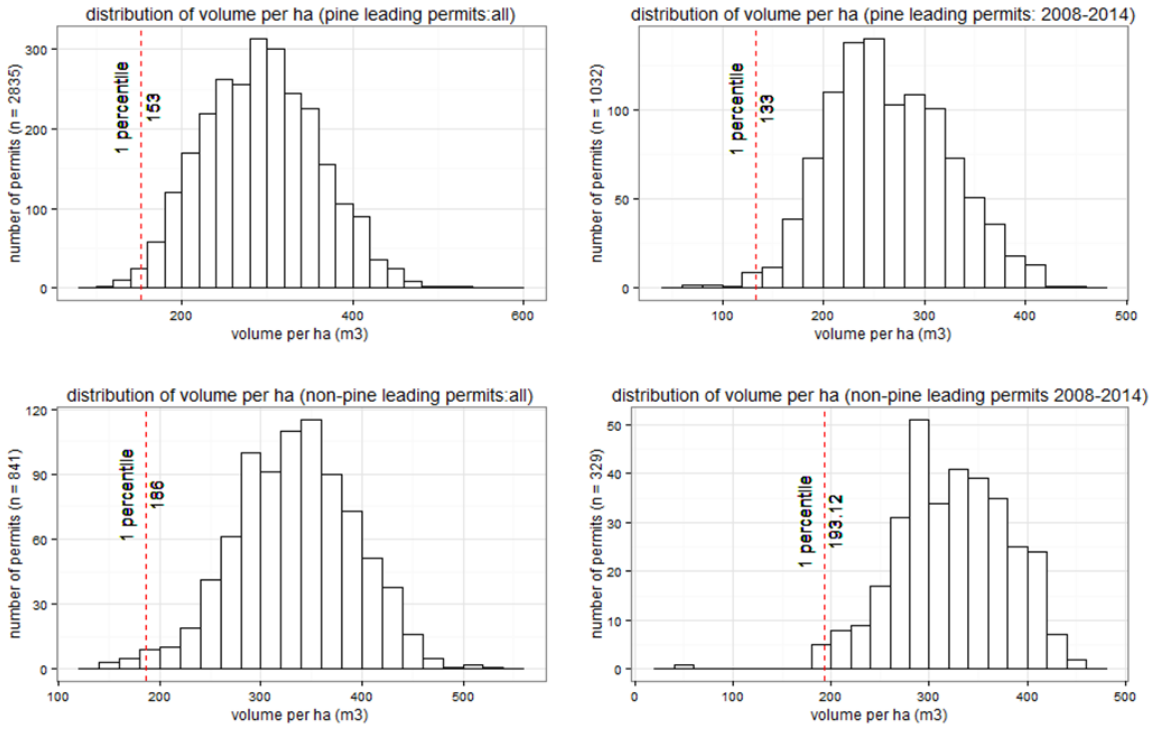

Figure 4. Distribution of net volume per hectare classes for both pine and non-pine leading cutting permits.

The data represents the last 30-year period (left) and the pine salvage period (right).

In the previous timber supply review the MVH was set at 182 m^3/hectare for the roaded portion of the TSA and 248 m^3/hectare for the rail portion of the TSA (Supply Block A and the northern portion of Supply Block B in the Fort St. James District). Since the inventory (unadjusted for catastrophic loss) better reflects the non-pine condition in the TSA the MVH of 182 m^3/hectare will be maintained for this review. The more stringent threshold for the rail portion of the TSA will be relaxed to 182 m^3/hectare to reflect the evolving access development (road construction) allowing westward movement of timber from those areas into the Houston area for milling.

To simulate the salvage of mountain pine beetle losses in pine-leading stands both a MVH of 140 m^3/hectare will define the lower bound of timber availability for harvest and a shelf life loss adjustment factor will be applied to the inventory volumes (for more discussion see Section 6.1, "Current management assumptions: harvesting"). The MVH of 140 m^3/hectare is the minimum economic operability threshold established in TSR2 and adequately reflects current salvage practice.

5.2.4 Problem forest types

Problem forest types (PFT) are stands that are physically operable and/or exceed the nonproductive site index threshold but are not currently utilized or have marginal merchantability and are considered uneconomic. PFTs are excluded from the THLB.

Table 7 details the stand types that were removed from the land base during TSR4 analysis. Since no harvesting was observed in these types in the time between TSRs these types will also be removed from the THLB.

Table 7. Problem forest types as defined in the previous timber supply review

Leading species*	THLB reduction (%)
Hemlock	100
Deciduous	100% in Vanderhoof District only
Black Spruce	100
Non-commercial deciduous	100

* Leading species refer to the dominant (generally highest volume) species in the VRI polygon.

Balsam (Abies spp.) forest types

An analysis was undertaken to assess harvest performance in the balsam (Abies spp.) leading profile in the PGTSA. Although balsam-leading stands represent 22% of the CFMLB area and 19.6% of the total timber volume in the PGTSA, historically they have accounted for only 1.6% of the total PGTSA harvest volume. Figure 5 depicts the distribution of non-pine-leading permits harvested in the TSA over the past 30 years. It shows that 99.5% of all non-pine cutting permits have less than 79% of balsam content.

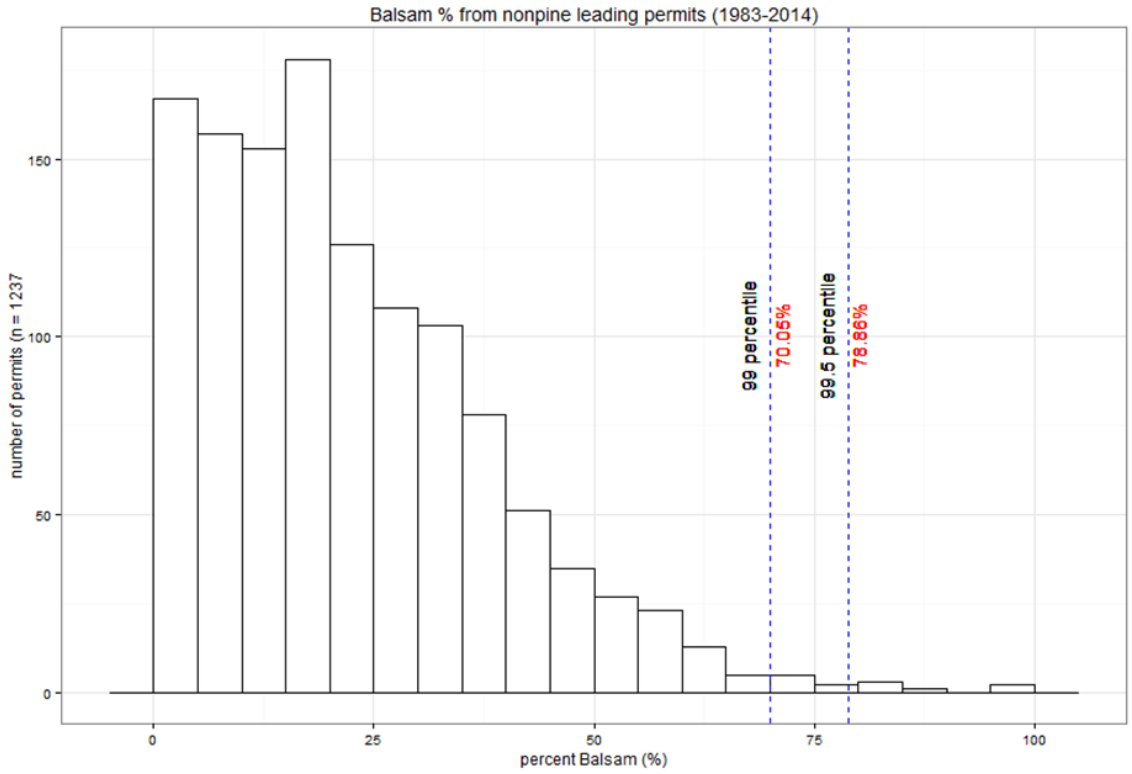

Figure 5. The historic distribution of balsam as a proportion of the total non-pine harvest in the TSA.

The following figures represent the distribution of balsam-leading stands in the CFMLB by percentage balsam class. The percentage balsam class is defined by percentage of balsam in the inventory label for VRI polygons. Vanderhoof District (DVA) has been excluded due to the negligible area of balsam-leading stands.

There is significant volume and area of balsam-leading stands that contain more than 80% balsam in the PGTSA. The distribution of the classes differs between districts. The majority of balsam volume is located in northern half of the Fort St. James District (DJA) and occurs in near homogenous stands with greater than 80% balsam by volume. In the Prince George District (DPG) balsam volume occurs predominately in mix stands with 50% to 70% percentage balsam composition.

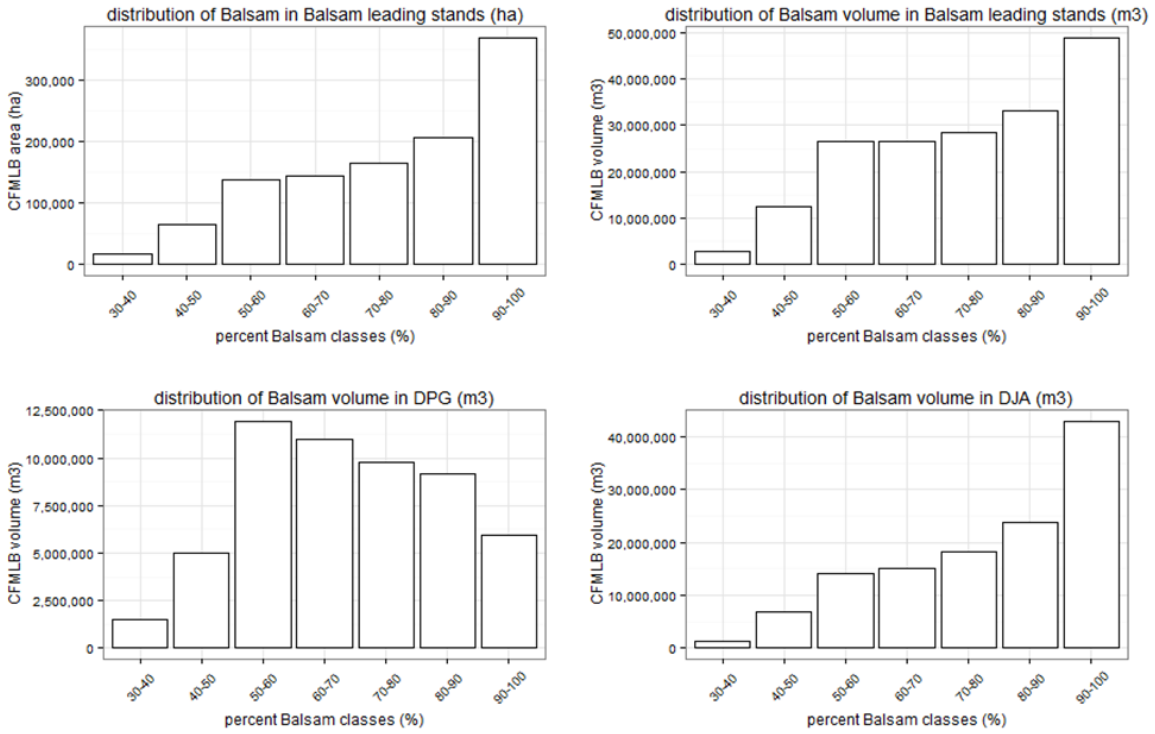

Figure 6. The distribution of balsam-leading stands in the CFMLB by percentage balsam class.

Table 8. Area and volume of balsam-leading stands in PGTSA

Stands with 80% Balsam or greater			**90% Balsam or greater**	
Land base	**Area**	**Volume**	**Area**	**Volume**
CFMLB	707,508	104,558,953	533,496	75,261,218
Inoperable removed	344,671	53,349,913	229,987	33,635,957
District				
DPG	108,190	12,209,568	62,223	6,061,224
DVA	3,312	383,659	896	99,207
DJA	233,170	40,756,685	166,868	27,475,526

Considering the low level of balsam utilization and high level of balsam representation on the land base, for the purposes of this review stands greater than 80% balsam will be treated as a problem forest type. Rather than exclude these stands from the THLB, their contribution to the harvest forecast will be partitioned to assess their impacts on the mid-term timber supply.

5.3 Wildlife and fish habitat management

Biological diversity (or biodiversity) is the diversity of plants, animals and other living organisms in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.

Terrestrial and aquatic habitats are managed within the THLB to protect and preserve biodiversity and wildlife habitat using the following regulatory tools: ungulate winter ranges, stand-level retention, riparian and coarse woody debris retention, the PGTSA biodiversity order, wildlife habitat areas, and fisheries sensitive watershed orders. Designations for managing scenic areas also contribute to habitat supply.

Table 9 details selected regionally valued wildlife species and their specific management framework.

Table 9. Selected regionally valued wildlife species within the TSA

Type	Species	District	Management approach	IWMS[3] species	Sensitive species (CDC)[4] listing	Species at risk (COSEWIC)[5] listing
Ungulate	Woodland Caribou (Northern Ecotype)	All	UWR order,	✓	Blue	E/SC
	Woodland Caribou (Mountain Ecotype)	DPG	UWR order, WHA order	✓	Red	E
	Mule Deer	All	UWR order,			
	White-Tailed Deer	All				
	Elk	All				
	Moose	All				
	Mountain Goat	All	UWR order,	✓		
	Bighorn Sheep	DPG	UWR order,	✓	Blue	
Omnivores	Grizzly Bear	All	FPPR[2]WHA order		Blue	SC
Omnivores	Black Bear	All				
Furbearers[1]	Muskrat	All				
	Beaver	All				
	Mink	All				
	Marten	All				
	Fisher	All		✓	Blue	
	Weasel	All				
	Wolverine	All		✓		SC
	Otter	All				
	Bobcat	None				
	Lynx	All				
	Fox	All				
	Coyote	All				
	Wolf	All				

(continued)

Table 9. Selected regionally valued wildlife species within the TSA (concluded)

Type	Species	District	Management approach	IWMS[3] species	Sensitive species (CDC)[4] listing	Species at risk (COSEWIC)[5] listing
Other mammals	Snowshoe Hare	All				
	Columbian Ground Squirrel	All				
Other mammals	Marmot	All				
Upland Birds	Grouse species	All				
Waterfowl	Ducks, Geese, Swans	All				
Raptor	Goshawk	All		✓		
Other bird	Raven	All				
	American White Pelican	All	WHA order	✓	Red	NAR
	Sandhill Crane	All		✓	Blue	NAR
Fish	Chinook Salmon	All	Watershed health, riparian			
	Sockeye Salmon	All	Watershed health, riparian			
	Kokanee	All	Watershed health, riparian			
	Rainbow Trout	All	Watershed health, riparian, FSW order,			
	Steelhead	All	Watershed health, riparian			
	Lake Trout	All	Watershed health, riparian			
	Bull Trout	All	Watershed health, riparian, WHA order, FSW	✓	Blue	SC
	Dolly Varden	All	Watershed health, riparian		Blue	
	Sturgeon	All	Watershed health, riparian		Red	E
	Arctic Grayling	DJA, DPG	Watershed health, riparian		Red	
	Whitefish	All	Watershed health, riparian			

(1) Management Guidelines for Furbearers in B.C.
(2) FPPR objectives for:
- Wildlife;
- Water, fish, and wildlife biodiversity in riparian areas;
- Wildlife and biodiversity – landscape-level;
- Wildlife and biodiversity – stand-level;
- Protection of fish and fish habitat;
- Steam riparian;
- Wetland riparian;
- Lake riparian.

(3) Identified Wildlife Management Strategy (IWMS) is an initiative of the Ministry of Environment in partnership with the Ministry of Forests Lands and Natural Resource Operations and carried out in consultation with other resource ministries, stakeholders and the public. Statutory authority is provided for the Ministry of Forests Lands and Natural Resource Operations to carry out this strategy under provisions of the *Forest and Range Practices Act* and previously under the *Forest Practices Code Act*.

(4) Conservation Data Centre (CDC) was established in 1991 as a joint project of the Ministry of Forests Lands and Natural Resource Operations, the Nature Trust of B.C., the Nature Conservancy of Canada and the Nature Conservancy (US).
   a. Red List – List of ecological communities, and indigenous species and subspecies that are extirpated, endangered or threatened in British Columbia. Red-listed species and sub-species may be legally designated as, or may be considered candidates for legal designation, as 'extirpated, endangered or threatened' under the *Wildlife Act*.
   b. Blue List – List of ecological communities, and indigenous species and subspecies of 'special concern' (formerly 'vulnerable') in British Columbia.

(5) COSEWIC (Committee on the Status of Endangered Wildlife in Canada) is a committee of experts that assesses and designates wildlife species are in some danger of disappearing from Canada. COSEWIC was established in 1977 to provide Canadians with a single, scientifically-sound classification of wildlife species at risk of extinction. COSEWIC began its assessments in 1978 and has met each year since then to assess species. COSEWIC uses a process based on science, Aboriginal Traditional Knowledge and community knowledge to assess the risk of extinction for species. Species that have been designated by COSEWIC may then qualify for legal protection and recovery under the Federal *Species at Risk Act* (SARA).
   a. T = Threatened, likely to become endangered if limiting factors are not reversed.
   b. SC = Special Concern, a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
   c. E = Endangered, facing imminent extirpation or extinction.
   d. NAR = Not at Risk, a wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.

5.3.1 Ungulate winter range

Ungulate winter range (UWR) management has been ongoing for over 20 years in some portions of the PGTSA. Formal legal establishment of UWRs and associated objectives began under the *Forest Practices Code Act* and continue under the *Forest and Range Practices Act* (FRPA).

UWRs contain both forest cover constraints to THLB and netdowns to the THLB. The complete netdowns are identified in the following seven tables. Forest cover constraints are detailed in Section 6.12 where applicable.

Table 10. Mule deer winter range order U-7-002 Fort St. James District

Mule deer habitat type	Habitat units	Must do management	Constraint
No harvest	19	No commercial forest harvesting	100% netdown

Table 11. Caribou ungulate winter range order U-7-003 (Omineca Northern Caribou Fort St. James District

Caribou habitat type	Habitat units	Required management	Constraint
High	T-003, T-006, T-014, T-016	Caribou 'high' habitat No harvesting or road building	No harvest 100% netdown

Table 12. Mountain goat winter range order U-7-019 Fort St. James District

Mountain goat habitat	Habitat units	Required management	Constraint
	All	No harvesting or road building	No harvest 100% netdown

Table 13. Mule deer winter range order U-7-011 Vanderhoof District

Mule deer habitat type	Habitat units	Required management	Constraint
No harvest	VD-03, VD-07	No commercial forest harvesting	100% netdown

Table 14. Caribou ungulate winter range order U-7-012 Vanderhoof District

Northern caribou habitat type	Habitat units	Required management	Constraint
No harvest	HE-1-001, HE-3-001, HE-4-001	No forest harvesting, no new mainline road construction	100% netdown

Table 15. Caribou ungulate winter range order U-7-003 Prince George District

Caribou habitat type	Habitat units	Required management	Constraint
High	P-002, P-003, P-006, P-007, P-008, P-010, P-011, P-012, P-014, , P-019, P-020, P-021, P-022, P-023, P-024, P-025, P-030, P-031, P-032, P-033, P-034, P-035, P-036, P-037, P-038, P-040, P-041, P-043, P-045, P-048, P-049, P-053, P-054, P-055, P-056, P-057, P-058, P-060, P-064, P-065, P-066, P-067, P-068, P-069, P-072, P-074, P-075,	Caribou 'high' habitat No harvesting or road building	100% netdown

Table 16. Mule deer winter range order U-7-013 Prince George District

Mule deer habitat type	Habitat units	Required management	Constraint
No harvest	PGD-005,006	No commercial harvesting	100% netdown

5.4 Wildlife habitat areas

Wildlife habitat areas (WHA) are designated areas that are necessary to meet the habitat requirements of an identified wildlife species. WHAs designate critical habitat in which activities are managed to limit impact on identified wildlife element. The purpose of WHAs is to conserve those habitats considered most limiting for an identified wildlife species.

Table 17. Wildlife habitat areas

WHA number	District	Species	Date of order	Area (hectares)	Constraint	Exclusion
7-003	Prince George	Mountain Caribou	December 13, 2005	175	No harvesting	100%

5.5 Fish sensitive watersheds

Fish sensitive watersheds (FSW) are designated areas that are necessary to meet the habitat requirements of an identified fish species. To qualify as an FSW candidate, watersheds must meet two criteria: they must have significant fisheries values and watershed sensitivity. Watersheds which meet the FSW test, and that have been designated by way of an order as an FSW by the Minister, require *Forest Act* agreement holders to establish results and strategies in their Forest Stewardship Plans consistent with the objective(s) set by the Minister. An FSW order established by the Minister sets out management direction to conserve important watershed level attributes protecting fisheries values. These attributes include:

- natural stream bed dynamics;
- stream channel integrity;
- quality, quantity and timing of water flow; and
- natural, watershed level, hydrological conditions and integrity.

There are three approved FSWs in PGTSA as shown in Table 18. Also there are 12 proposed FSWs in Fort St. James District (DJA). These include the Gluskie, Forfar, Kynoch, Bivouac, Van Decar, Sidney, Paula, Sandpoint, Narrows, Frypan, Lovell and Ankwill watersheds. In the Prince George District (DPG) the list of proposed FWS includes Walker Creek, Missinka River, Hominka River, Table River and Anzac River. If any of proposed FSWs are approved prior to AAC determination the impact on the timber supply will be considered.

Table 18. Fish sensitive watersheds

FSW number	District	Name	Date of order	Area (hectares)
7-001	Prince George	Seeback Creek	April 19, 2013	41,483
7-002	Prince George	Framstead Creek	April 19, 2013	45,696
7-005	Prince George	Chehischic Creek	April 19, 2013	19,349

5.6 Recreation and cultural heritage resources

All legally designated recreation sites/reserves will be excluded from the THLB. It is acknowledged that minor amounts of MPB-infested lodgepole pine have been removed from a few sites for public safety and forest health reasons, however considering the long-term management objective the total area of 4315 hectares of recreation sites and 2002 kilometres of recreation trails have been excluded from the THLB.

5.6.1 Cultural heritage resources and First Nations interests

A cultural heritage resource is an object, site, or location of a traditional societal practice that is of historical, cultural or archaeological significance to the province, a community, or an aboriginal people.

Cultural heritage resources include archaeological sites, structural features, heritage landscape features and traditional use sites. Features associated with past and current human use, including aboriginal use are found throughout the PGTSA.

First Nations have expressed the importance of managing for cultural heritage resources that they have relied on for generations. Traditional diets, based on numerous plant foods and animals have sustained First Nations. In addition, plants, fungi and animals have provided a wide range of important material resources for fuel, tools, medicine, and transportation. First Nations' belief systems, art, songs and ceremonies are also reliant on the biodiversity of the landscape.

The *Heritage Conservation Act* provides for the protection and conservation of certain types of cultural heritage resources by prohibiting any disturbance, alteration or destruction. In situations where heritage resources are not automatically protected under the *Heritage Conservation Act* the appropriate protection or management measures are developed in consultation with First Nations.

Past and current aboriginal culture is closely associated with the elaborate network of ancient to contemporary trails in the area. The existing inventory of known aboriginal trails was expanded during the development of the TSR data package from information provided by First Nations about the trail locations.

A wide range of methods is applied in managing the values associated with heritage trail corridors. A small percentage of trails are managed through permanent timber reserves, while the majority are managed through mitigating operational designs, silviculture systems, and operational timing. For the trails that currently have management buffers applied to either side of the trail beds, netdowns will be applied within the buffers.

Cultural heritage sites are sometimes located within established recreational areas throughout the PGTSA. Recreational sites/reserves will be excluded from the THLB.

Cultural heritage resources are also accounted for within other sections of this data package, including existing resource management zones, protected areas, wildlife and fish habitat areas, riparian, scenic areas, as well as visual preservation zones.

5.7 Existing roads, trails and landings

Estimates are made to reflect the area excluded from the CFMLB to account for existing and future roads, trails, and landings. A road dataset developed for the Roads, Trails, and Landing Inventories for Fort. St. James (2010), Prince George (2010) and Vanderhoof (2007) was adopted and updated to the summer of 2014. Figure 7 depicts how average road widths are defined in the road inventories and for this timber supply review.

Roads were grouped based on road class and weighted average road width, kilometres of length and area occupied as defined in Figure 8 and Table 19.

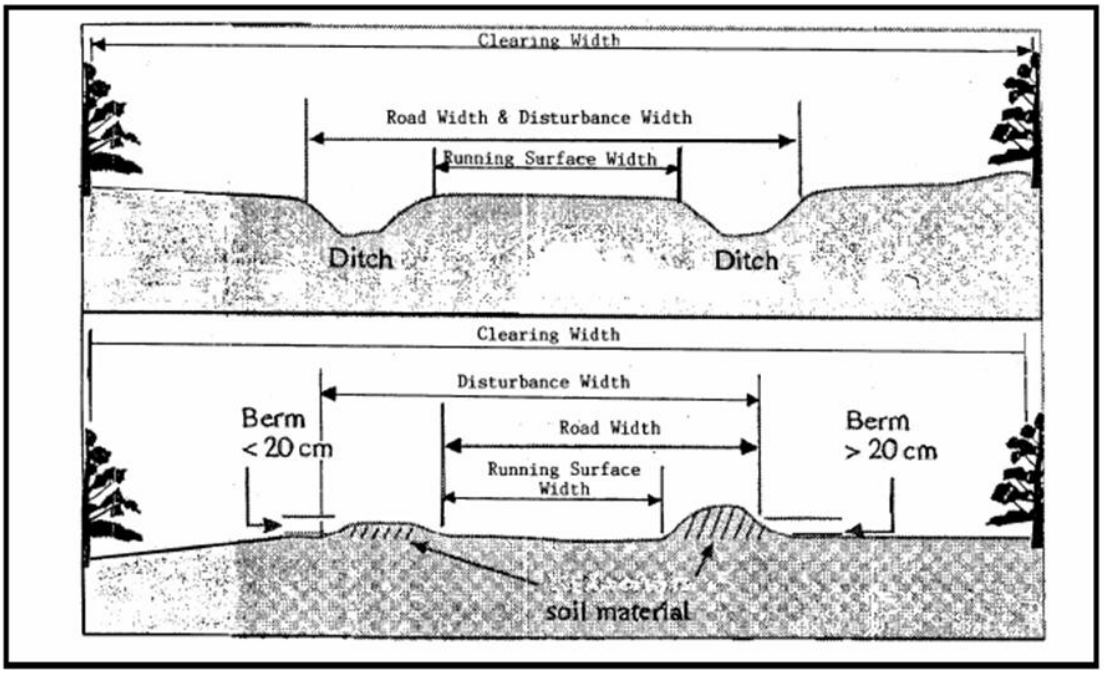

Figure 7. Forest road cross section.

Table 19. Disturbance attributed to buffered road (weighted mean) with 5% landing add on (2014 data)

Road category	Weighted average width	Length (kilometres)	Hectares
Main	28	5,247	16,747
Operational	13	25,507	36,481
Spur	6	37,492	23,902
Total		68,246	77,131

5.7.1 Miscellaneous lineal features

Estimates are also made for areas excluded from the CFMLB to account for other existing lineal feature right of ways including transmission lines, rails, pipelines, water and sewer lines, telecommunication sites, etc. A lineal features dataset was developed from Tantalis, TRIM and BC HYDRO corporate databases. Table 21 identifies the gross area associated with each lineal feature class.

Table 20. Disturbance attributed to linear features

Type	Area
Pipeline	7,452
Powerline	7,432
Right-of-way	7,408
Rail	5,209
Total	27,501

5.7.2 Future roads, trails and landings

To determine the reduction to the CFMLB for future roads trails and landings the BCTS RESOURCES database was queried for the amount of permanent access structures (PAS) attributed to each timber sale (TSL). One thousand and three TSLs were sampled for the period from 2004 to 2014 and a weighted average percentage of PAS was derived. The median of 2.7% will be applied for future netdowns attributed to road construction (Figure 8). Consequently, as areas are harvested in the timber supply model 2.7% of area will not be available for harvest in subsequent rotations.

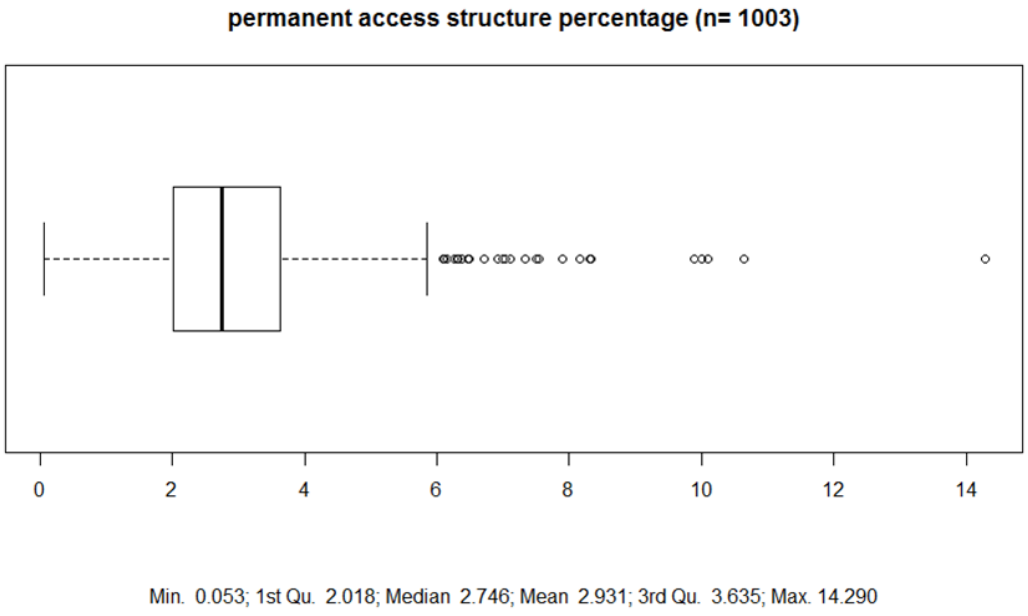

Figure 8. Permanent access structure percentage distribution.

5.8 Retention

5.8.1 Spatial landscape retention

The *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area (*referred as the *Order* in the text) was brought into force on October 20, 2004. The *Order* establishes non-spatial objectives for old forest retention, old interior forest retention and young forest patch size retention and it is based on the natural range of variability reported by Delong in *Land units and benchmarks for developing natural disturbance-based forest management guidance for northeastern British Columbia*. B.C. Min. For. Range, For. Sci. Prog., Victoria, B.C. Tech. Rep. 059 (DeLong, S.C. 2010). http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr059.htm

Further to this *Order*, specific areas have been designated as spatial old-growth reserves in three landscape units in the Interior Cedar Hemlock (ICH) biogeoclimatic zone. These areas are reserved from harvesting and contribute to the overall aspatial old forest retention requirements. The following orders establish old-growth reserves in three landscape units:

- Order to Establish Dome and Slim Landscape Units and Objectives (October 31, 2002) — 6035 hectares of THLB (TSR2);
- Order to Establish Humbug Landscape Unit and Objectives (August 1, 2003) — 3100 hectares of THLB (TSR2).

The *Order*, developed by B.C. government staff and forest licensees attempts to balance environmental, economic and social costs and benefits. Three clauses allow for flexibility in managing old forest objectives:

D.3. Epidemic or Catastrophic Events: A representative portion of stands that have been affected by an epidemic or catastrophic event may contribute to meeting the Old Forest Retention and the Old Interior Forest objectives.

D.4. A Portion of Younger Age Classes: Where it can be demonstrated that equal or better conservation benefits would result, up to 20% of the Old Forest Retention and Old Interior Forest objectives may comprise younger age classes.

D.5. Alternatives to the *Order*: Where either the Old Forest Retention or the Old Interior Forest objectives cannot be achieved, with consideration of the timely and economic harvesting of timber rights, then a recruitment strategy must be submitted and complied with.

Current condition

Prince George TSA has 27 600 hectares in approved and Guidance spatial Old Growth Management Areas (OGMAs). The Guidance OGMAs were designated in 2008 in the ICH biogeoclimatic zone in order to protect ancient cedar stands. These Guidance OGMAs are recognized in licensees FSPs and approved and Guidance OGMAs help to meet the non-spatial *Order*. For the purposes of TSR5 these areas have been removed from the THLB.

The non-spatial *Order* applies to the whole timber supply area. Licensees must report on the amount of old forest in each unit and meet rules around thresholds. A technical working group of government and forest licensees, which has been working on issues related to old growth since 2002, is exploring ways to improve the *Order*, or the way the *Order* is implemented, to improve mid-term timber supply while maintaining landscape-level biodiversity. For TSR5 the old growth retention targets are modelled as a forest cover constraint (see Section 6.7.1, "Landscape-level, retention", for further detail).

5.8.2 Stand-level retention

Stand-level retention refers to unharvested areas associated with individual cutblocks. An analysis of retention practices derived from the Forest and Range Evaluation Program (FREP) Stand-Level Biodiversity data from 2006 to 2014 has been utilized to estimate total stand-level retention for the PGTSA. The FREP data has been validated against BC Timber Sales retention data and the RESULTS database to ensure its ability to represent the larger population. While the RESULTS retention dataset is significantly larger, inconsistencies in the way the data is reported make it less reliable as a primary data source for this analysis.

The retention estimate includes areas occupied by riparian retention, wildlife tree patch retention, as well as retention for the protection of forest values including archaeological features, site specific habitat features, and blue-listed species. Figure 9 depicts the distribution of stand-level retention from sampled cutblocks harvested between 1997 and 2012 in the PGTSA.

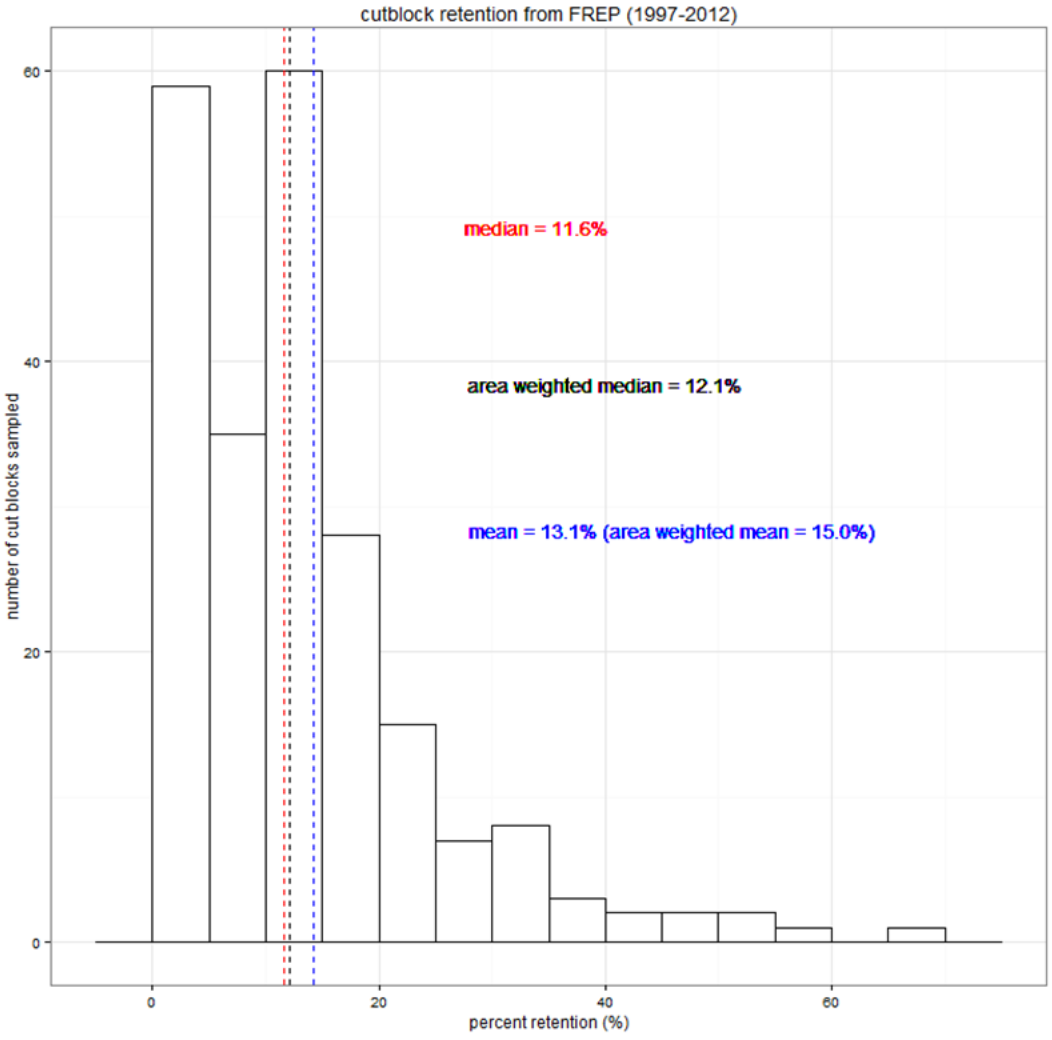

Figure 9. Stand-level retention distribution based on 1997-2012 FREP data.

Analysis of the sample indicates a right-skewed distribution with numerous samples with high retention levels pulling the mean to the right. In addition, a disproportionate number of small openings (less than 10 hectares in size) have either large or no retention. To account for this bias in the data an area-weighted estimate of retention levels was calculated.

The area weighted median retention value of 12.1% will be utilized in the timber supply model to represent stand-level retention for the entire PGTSA. Once the THLB definition process is complete the retention estimate will be adjusted to reflect retention levels specifically within the THLB.

5.8.3 Riparian

To avoid double-counting, riparian reserve areas have not specifically been identified for exclusion from the THLB because these areas are captured within the total retention estimate for each district.

5.9 Crown land plans

Crown land plans are a unique type of plan in the northern interior of BC that cover rural settlement and agricultural areas around the major communities. There are four Crown land plans within the PGTSA: Prince George, Robson Valley (portion), Vanderhoof, and Fort St. James.

The plans have historically been implemented as a policy and have guided land use in these areas for many years. The mountain pine beetle epidemic, however, created some uncertainty around intended land use and a legal order, pursuant to Section 93.4 of the *Land Act*, was established for two of the zones on November 21, 2006. This order prohibits logging in Agriculture Development Areas (ADA) and Settlement Reserve Areas (SRA), except for environmental/safety and forest health purposes (Table 21).

Table 21. CLP zone and modelling assumptions

Designation in CLP	Source	Assumption for this TSR base case
ADA Agriculture Development Area	CLP files / Tantalis	100% netdown
SRA Settlement Reserve Area	CLP files / Tantalis	100% netdown
Community Pasture Areas	CLP files	One pass*

*One pass refers to a single-harvest entry then the area is no longer available for subsequent harvest.

5.9.1 Land and resource management plans

The Vanderhoof, Fort St. James, and Prince George Land and Resource Management Plan (LRMP) processes began in 1992 and 1993. The planning processes provided an opportunity for the public, interest groups, and government to make recommendations for integrated resource management that reflects a local vision for how the public land base should be managed. All three plans were agreed to by consensus, and were approved by Cabinet as policy plans in 1997 (Vanderhoof) and 1999 (Prince George and Fort St. James).

Between 2004 and 2006, the Integrated Land Management Bureau initiated risk assessment projects, under the mandate of the Provincial Mountain Pine Beetle Action Plan and Task Force, for the three LRMPs. The purpose was to determine the level of impact or risk, if any, to all values identified in the LRMPs due to the mountain pine beetle epidemic and subsequent management activities. Risk assessments have been completed for all three LRMPs and it is not expected that the outcomes of those assessments will have any impact to the timber supply, thus they will not be modelled.

Modelling assumptions for all three LRMPs

Resource management zones

For the base case, resource management zones (RMZ) not listed in Table 25 will be 100% included in the THLB subject to all other constraints.

Protected area resource management zones

During the development of the LRMPs, areas were identified as Protected Area RMZs for proposed protection from industrial development, including timber harvesting. Since the approval of the three LRMPs by government, all identified Protected Area RMZs have been legally protected and are thus excluded from the THLB. This is the same modelling assumption that was applied in the past timber supply processes.

Modelling assumptions for the Vanderhoof LRMP

Resource management zones

For Vanderhoof Special RMZs and Multi-value Emphasis RMZs identified for special management, TSR2 modelling assumptions for cutblock adjacency and green-up will not be applied. Rather, the base case for this TSR will reflect retention management requirements of old forest, interior old forest, and young forest patch size distribution through the implementation and modelling of the *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area (October 12, 2004)*. This precludes the need to model for adjacency and green-up constraints in any time period.

Euchiniko Sidehills proposed sensitive site

The 800-hectare Euchiniko Sidehills area was proposed as a sensitive area in the Vanderhoof LRMP. The Sidehills are a unique 14 kilometre park-like stretch of land along the Euchiniko River, characterized by steep, south-facing grassland scattered with pine, spruce and aspen. In combination with groves of mature coniferous cover along the river bottom, the Euchiniko Sidehills provide excellent wildlife shelter and habitat. Because the open grasslands of the Sidehills are by nature sparsely timbered, harvesting has not been a current practice within the area. Thus, the Euchiniko Sidehills will be excluded from the THLB in the base case.

Modelling assumptions for the Prince George LRMP

Herrick Creek resource management zones

The Herrick Local Resource Use Plan (LRUP) was initiated in 1991 as a result of direction from the Provincial Old Growth Forest Strategy, and approved in November 1994. In March of 1999, the Prince George LRMP incorporated management objectives from those plans and designated a significant portion of the Herrick Landscape unit as the Herrick Creek Old Growth Reserves (RMZ # 39).

The management objectives for these reserves are to maintain the integrity of viable old-growth forest ecosystems in their natural state, as well as to maintain wildlife habitat and recreation values. Even though there is no legal establishment of these areas to date, current practice is that these old-growth areas are reserved from harvesting and so will be modelled as 100% netdown in the base case.

Modelling assumptions for the Fort St. James LRMP

Lower Sustut visual preservation zone

The Fort St James LRMP endorsed a visually sensitive preservation zone around the Sustut and Bear rivers, a zone that was originally proposed in the draft Sustut Local Resource Use Plan (1994). This area is addressed in the visual landscape inventory for the TSA.

Table 22. LRMP-related THLB netdowns

Objective	TSR management strategy/ modelling assumptions	Resource management zones		
		Vanderhoof LRMP[1]	**Fort St. James LRMP**	**Prince George LRMP[2]**
Land and Resource Management Plans (LRMP) – Parks and Protected Areas	100% netdown - exclusion from timber harvesting land base	Stuart River; Sutherland River; Francois South; Nechako Canyon; Finger-Tatuk; Entiako	Stuart River; Mt. Pope; Fleming[3]; Mudzenchoot; Blanchet; Nation; Omineca; Upper Sustut-Thumb[4]; Damdochax; Small (Goal 2) Protected Areas[5]	Crooked River Provincial Park Addition; Carp Lake Provincial Park Addition; Stuart River; Eskers Provincial Park Addition; Fort George Canyon; Dahl Lake Provincial Park Additions; Bobtail Mountain; Fraser River; Three Sisters Lake; Purden Lake Provincial Park Addition; Giscome Portage Trail; Arctic/Pacific Lakes; Fang Mountain[6]; Close to the Edge; Monkman Provincial Park Addition; Kakwa Recreation Area; Kakwa South Addition; Grand Canyon of the Fraser[7]; Sugarbowl/Grizzly Creek[8]; Bowron Provincial Park Addition – Wolverine River; Ptarmigan Creek; Erg Mountain; Slim Creek; Whiskers Point Provincial Park Addition
Herrick Creek Old Growth Reserves	100% netdown	N/A	N/A	Prince George LRMP Herrick Creek Old Growth Reserve (RMZ #39)
Euchiniko Sidehills Sensitive Area	100% netdown	800 hectare area within Vanderhoof LRMP Kluskus Resource Management Zone (RMZ #14)	N/A	N/A

1. Vanderhoof RMZ # 2, 3, 7, 11, 13, 20.
2. Prince George RMZ # 7,8,12, 13, 16, 18, 19, 23, 26, 29, 32,34, 36, 37, 38, 42, 43, 44, 45, 48, 49, 50, 51, 54.
3. Established January 25, 2001 as Rubyrock Provincial Park.
4. Established in 2001 as Sustut Provincial Park and Protected Area.
5. A grouping of 13 small Protected Areas incorporated into Stuart Lake Marine Provincial Park, Trembleur Lake Provincial Park, Takla Lake Marine Provincial Park, and Nation Lakes Provincial Park.
6. Established June 29, 2000 as Evanoff Provincial Park.
7. Incorporated into Sugarbowl-Grizzly Den Provincial Park and Protected Area.
8. Established June 29, 2000 as Sugarbowl-Grizzly Den Provincial Park and Protected Area.

6. Current Forest Management Assumptions

6.1 Harvesting

Over the past decade harvesting in the Prince George TSA has been directed at pine-leading stands to expedite the salvage of MPB damaged timber. The mean annual harvest since the onset of the epidemic has been approximately 8.7 M m^3/year. Over the period from 2002 through to 2013 on average 61% of the AAC was harvested annually, of which on average 69% was pine volume. Figure 11 depicts the actual and 'smoothed' harvest history by District, and by the TSA as a whole, over the past decade (Source: Harvest Billing System [HBS]).

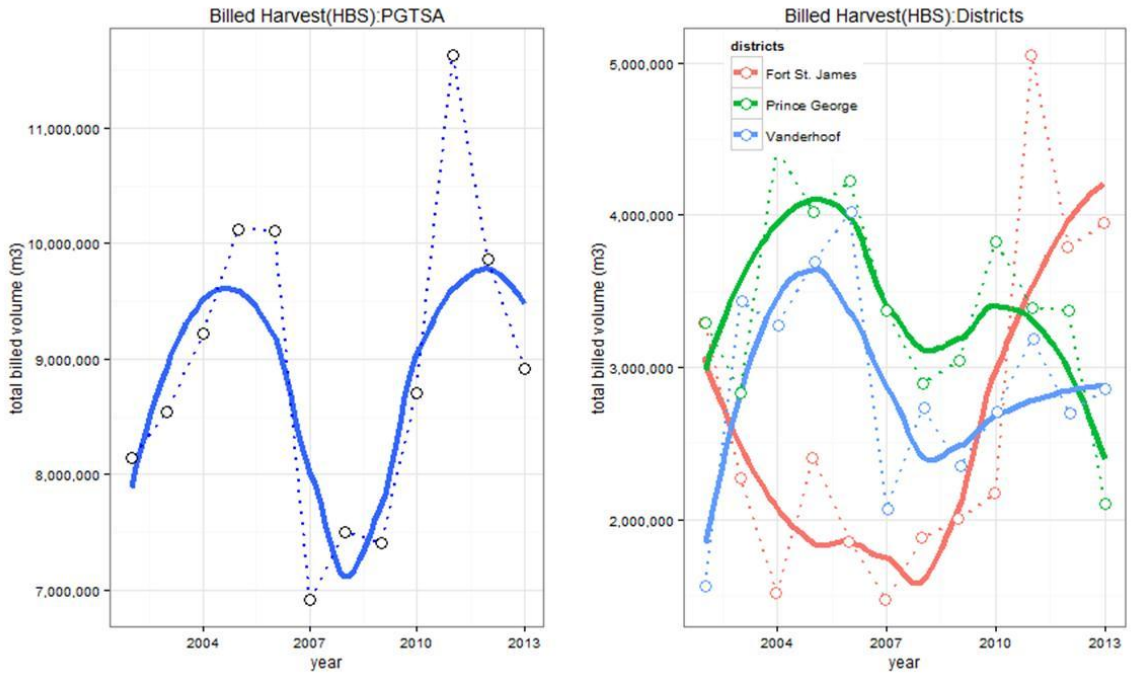

Figure 10. The billed annual harvest for the entire PGTSA and districts.

When viewed as a whole the PGTSA exhibits a gradual downward trend in pine percentage harvested over the past seven years. When viewed at the district level declines in permitted and harvested pine percentages are far more significant than on the whole TSA level, especially in the Prince George District. Although the harvested pine percentage in Vanderhoof has increased in recent years (Figure 11), and its' impact on PGTSA downward trend in pine harvesting is diminished by the drop in total volume permitted and billed in Vanderhoof.

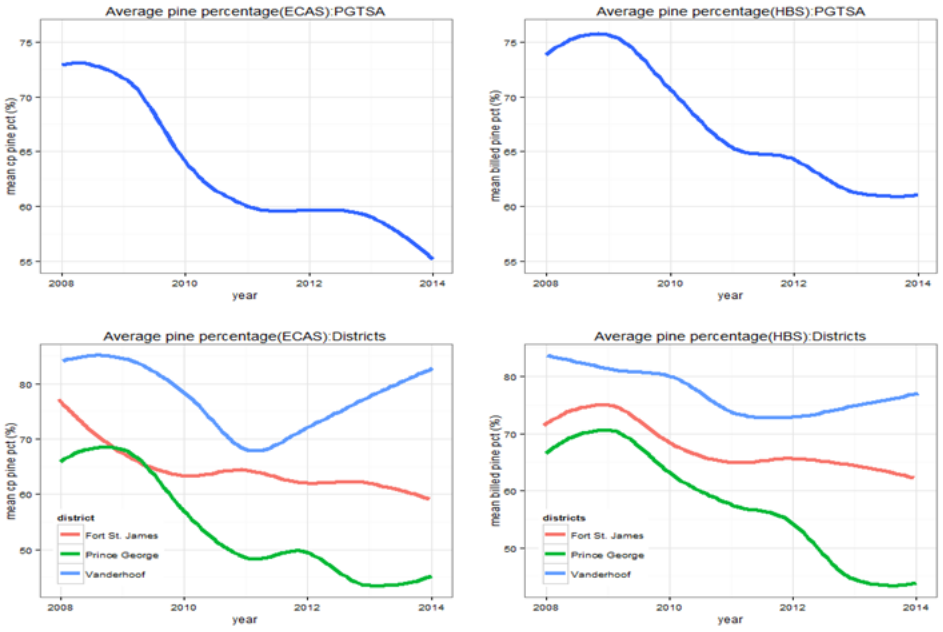

Figure 11. Annual pine percentage of volume permitted and billed within the PGTSA as a whole and within each district respectively from 2008 to summer of 2014.

Modelling harvest in this timber supply review will reflect ongoing practice by focusing the short-term harvest on pine-leading stands identified for salvage (see Section 6.1.4, "Harvesting scheduling", for further discussion).

6.1.1 Harvest yields

The Vegetation Resource Inventory (VRI) provides an estimate of stand attributes and volume within mature stands. The change in inventory volume over time is estimated using the Variable Density Yield Prediction (VDYP) model version 7. VDYP generates a yield table forecasting the growth of each stand that is used in the annual update of the VRI. These yield tables will be used to estimate the harvest volumes in the analysis.

A *Volume Audit Sampling and Young Stand Monitoring* project was initiated in the TSA in 2014. The Volume Audit (VA) samples a random subset of polygons from the inventory to verify the confidence in the accuracy of the volumes estimates, as well as some of the other key vegetation attributes. It provides detailed information on tree size and stand condition. Ground sampling also includes the Young Stand Monitoring (YSM). YSM involves the establishment of long-term monitoring plots to observe the performance and development of young stands, targeting 15-50 year old stands that are likely to contribute to the management unit's future timber supply. Once statistical analysis of the VA and YSM sampling results are completed, yield projections from unmanaged and managed stands will be adjusted to reflect the sampled stand conditions.

Regulated reforestation of harvested stands dates back to 1987 with the advent of the Silviculture Regulation, which set minimum silviculture standards and the requirement for pre-harvest stand establishment planning across the province. For the purposes of modelling regeneration, all stands established in 1987 to present are considered to reflect current reforestation and silviculture practices and will be modelled with harvest yields estimated using Table Interpolation Program for Stand Yields (TIPSY) model version 4.3 (July 3, 2014 release). The TIPSY model inputs used to generate managed stand yield are discussed in Section 6.6.

6.1.2 Merchantable timber specifications

The merchantable timber specifications define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species and are used in the analysis to calculate merchantable volume. The merchantable timber specifications are described in Table 23.

Table 23. Merchantable timber specifications

	Utilization		
Leading species	**Minimum dbh (cm)**	**Maximum stump height (cm)**	**Minimum top dib (cm)**
Pine	12.5	30	10.0
Cedar older than 141 years	17.5	30	15
Other species	17.5	30	10.0

6.1.3 Minimum harvestable criteria

For the purposes of modelling timber supply the minimum volume per hectare (MVH) and minimum harvestable age (MHA) represent the lower bounds of what is considered economic to harvest. While harvesting may occur in stands at the minimum threshold 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), most stands in the model are harvested with volumes well in excess of the minimum thresholds because of stand preference assumptions or management objectives for other resource values (e.g., requirements for the retention of older forest).

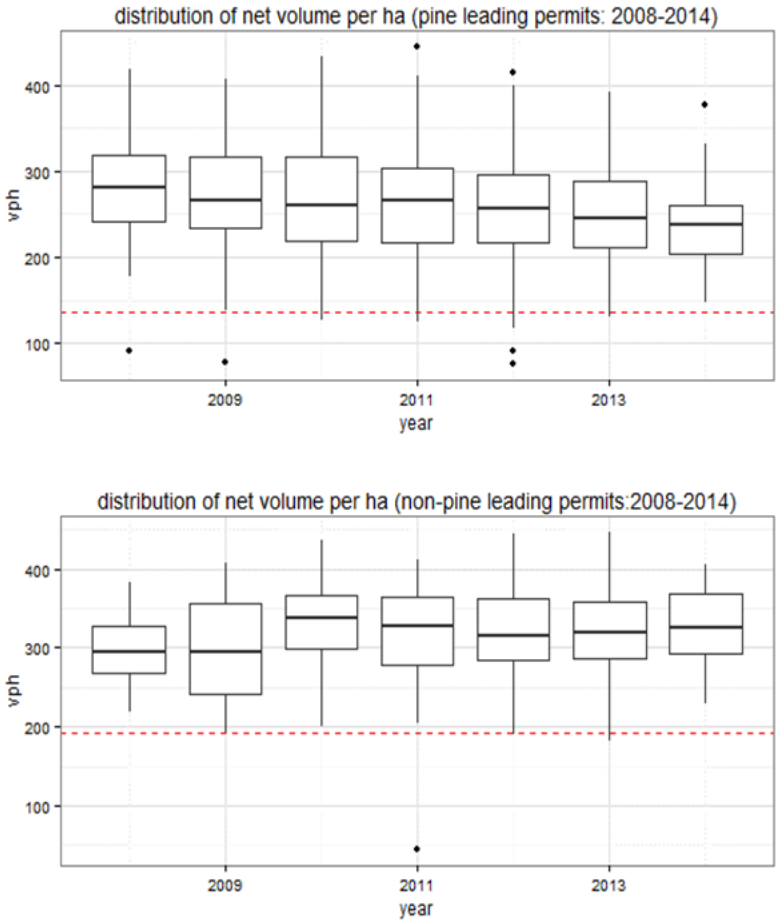

Figure 12. The distribution of volume per hectare (VPH) in cutting permits by year in pine and non-pine leading species.

As discussed in Section 5.2.3 data collected from a sample of cutting permits issued over the last 30 years was analyzed to provide information on the historic harvest profile in the TSA. Figure 12 shows the distribution of net volume per hectare (VPH) in cutting permits issued since TSR4 by year (the red-dashed line indicates the one percentile threshold).

The data show that the median net VPH in the pine-leading cutting permits has been decreasing since the peak of the MPB outbreak, from approximately 280 m^3/hectare in 2008 to 240 m^3/hectare in 2013.

The decrease can, in part, be attributed to the harvest sequence that initially prioritized highest volume-quality/least cost stands for salvage and in the latter years of salvage harvesting progressed to lower volume-quality/least cost stands.

The decrease in median pine net VPH also reflects the loss of volume attributed to dead trees and decay beyond merchantability (shelf life). The loss of volume is considered defect or cull volume that is not included in the appraisal and not accounted for in the AAC. If market conditions and demand permits this volume may still harvested and sold as chips or fibre.

Stands currently being salvaged are generally in the latter stages of decay as the non-merchantable volume and 'fibre-dominated' stands are becoming more prevalent. To account for this value/volume decay, shelf life loss factors have been applied to MPB-impacted stands and the short-term net MVH threshold has been adjusted to 140 m^3/ha to reflect current practice (see Section 6.1.5, "Shelf life", for further discussion). For non-MPB-impacted stands the net MVH assumed in this analysis will be the same as that calculated to derive the timber harvesting land base—182 m^3/hectare.

For existing and future managed stands a minimum age (MHA) threshold, along with the MVH will define a stand's availability for harvest. The MHA will be equal 95% of the analysis unit's culmination age: the age in the growth cycle of a tree or stand at which the mean annual increment (MAI) for height, diameter, basal area, or volume is at a maximum.

6.1.4 Harvest scheduling

Priorities and limits will be placed on the simulated harvest in the model within certain stand types, management zones, or regions of the PGTSA to reflect salvage operations and other forest management objectives. Setting harvest level targets on individual management zones will also serve to inform the determination of an AAC that may be partitioned by these stand types, management zones or regions.

The short-term harvest preference will be designed to mimic (as close as possible) harvest practice since the previous timber supply review. The focus will be the continuation of the salvage harvest of pine-leading stands with MPB mortality. The initial TSA harvest level will be set at the average realized harvest level over the past five years and the district-specific harvest targets will be set to reflect the movement of harvest within the PGTSA since the last TSR.

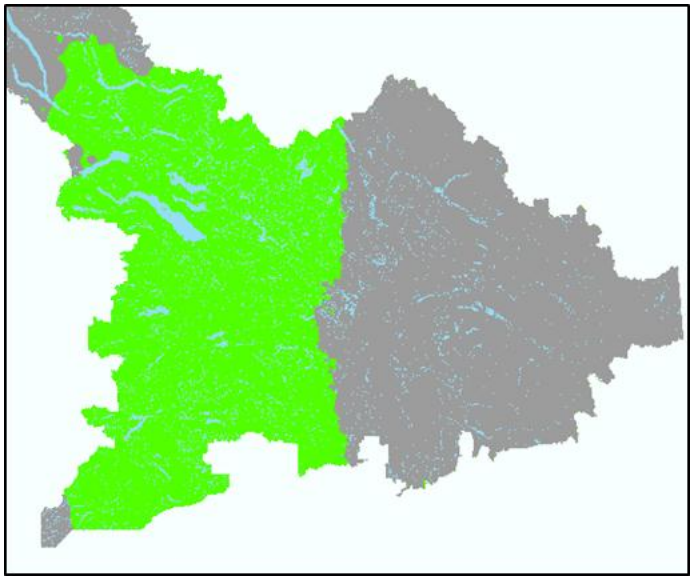

Figure 13. Pine salvage zone.

The harvest forecast will be broken into two phases: the short-term salvage phase and the post-salvage phase. During the salvage phase a pine-leading stand preference (soft partition) will be maintained predominately in the Fort St. James and Vanderhoof Districts until that profile is depleted, at which point, the model will be released from its pine-leading preference.

Salvage will be focused primarily in a salvage zone (see Section 5.2.3, "Inoperable forest stands/distance", for details [Figure 13]). The harvest queue for both the salvage phase and remainder of the forecast will be driven by a stand preference function based on maximum VPH, production weighted average cycle time index, and distance to the nearest existing road.

6.1.5 Shelf life

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 value of the products derived from MPB-impacted stands decreases as recovery shifts from dimension lumber to pulp and secondary products, such as fibre for bioenergy, in the years following death.

Shelf life refers to the length of time since death in which a specific merchantable product can be produced from a dead tree. It is dependent on several factors, including stand condition, market, access, and available milling technology. In this analysis shelf life is defined as the time a stand (or portion of a stand) remains economically viable for sawlog harvesting.

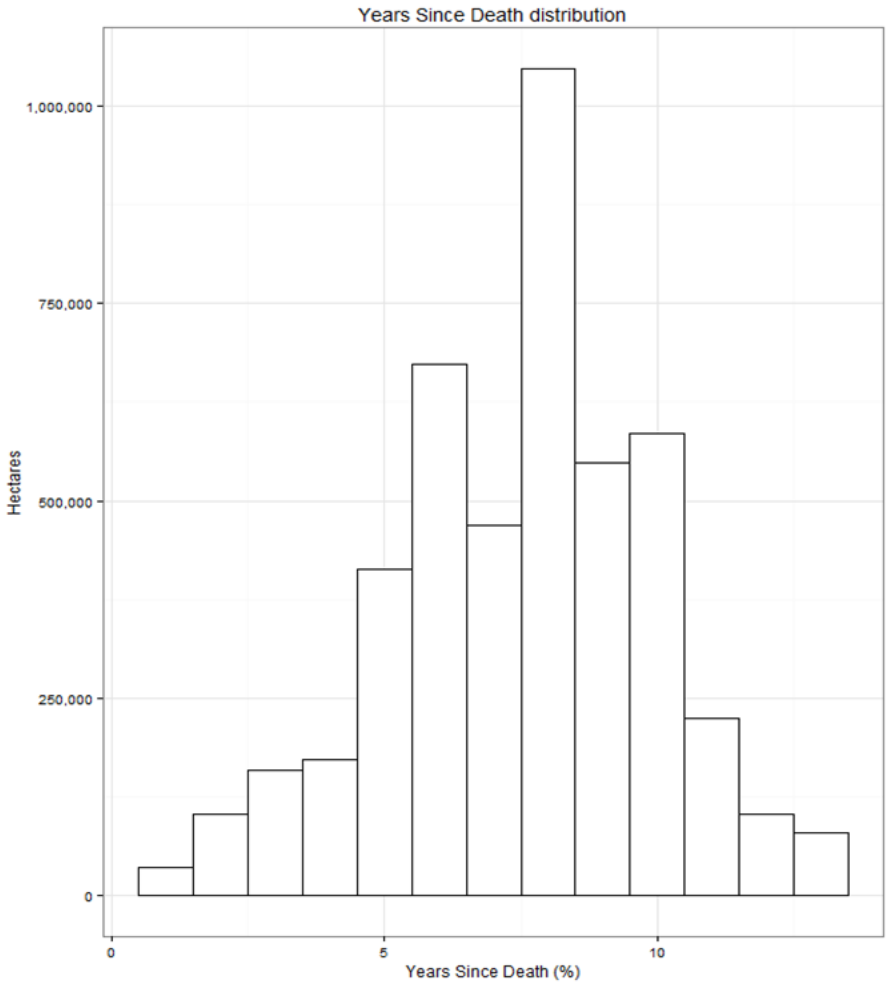

Figure 14. Area of MPB-affected stands by 'years from death' classes.

Figure 14 depicts the distribution of years since death (YSD) of mountain pine beetle-impacted stands in the PGTSA. The weighted average YSD in MPB-impacted stands in the PGTSA is 7.53 years. In the previous TSR, it was assumed that 100% of the impacted pine volume was available for harvest for 15 years post attack, after which time it no longer contributed to the total stand volume.

For this review merchantable pine volume within an attacked stand decreases over time. Each year during the infestation a portion of an MPB-impacted stand is killed. That portion of stand volume is tracked through its 'shelf life', decrementing volume (merchantable volume lost due to cracking and decay) over time based on a shelf life loss curve.

The shelf life definition proposed for the base case is based on an exponential loss curve shown in Figure 15. This curve will be slightly modified in the model by assuming 100% merchantability for one year after death, then the merchantability declines immediately to 80% and continues the decline to 40% at year 15. The current data suggest that 10 to15% of an impacted stand's pine volume remains undamaged post infestation.

Given the high degree of uncertainty associated with shelf life loss, sensitivity analysis will explore the timber supply impacts of a range of shelf life assumptions including those used in the last TSR, as well as the PGTSA licensees operational experience (Figure 15).

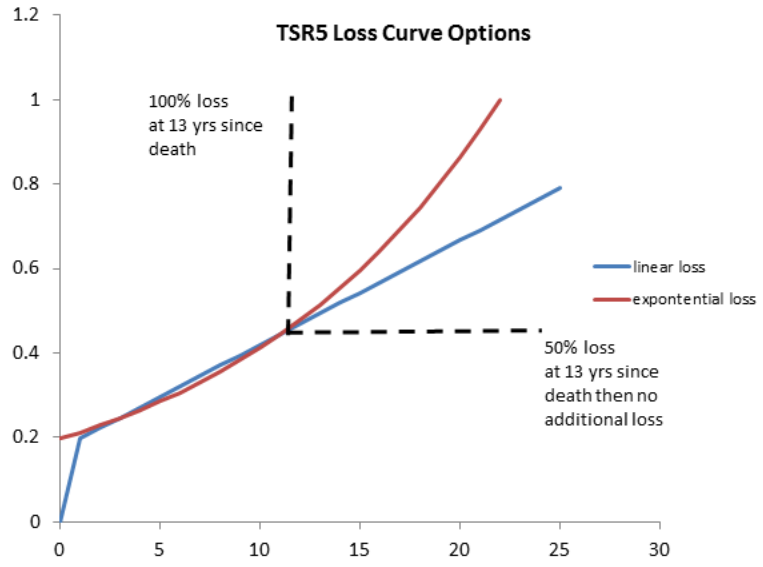

Figure 15. Options considered for 'shelf life' (where 1 on y axis equal to 100% volume loss).

6.2 Decay, waste, and breakage

The VDYP model is used to project volumes for natural stands and incorporates estimates of the volumes of wood lost to decay, waste, and breakage. Decay losses are built into the volume estimates, while standard waste and breakage factors are applied to the analysis in the development of VDYP yield curves. These estimates of losses have been developed for different areas of the province based on field samples. For regenerated stands, an operational adjustment factor (OAF2) is applied to account for anticipated decay, waste, and breakage, and the value applied for OAF2 in the Prince George analyses increases from zero through to five percent by the time forest stands reach 100 years of age.

6.3 Silviculture systems

Clearcut with reserves is the predominant silvicultural system in use in the PGTSA.

6.4 Unsalvaged losses

Mountain pine beetle modelling

The extent and severity of the MPB infestation was forecast in previous analyses using the BC Mountain Pine Beetle Model (BCMPB). The BCMPB was used with the VRI to forecast the proportion of live and dead volume within MPB impacted stands over time. The BCMPB v.11 model will be used to calculate existing and future mortality of pine in stands greater than 60 years of age. Unsalvaged losses due to mountain pine beetle are dependent on the potential shelf life of the pine to produce various forest products and the amount of merchantable volume attributed to the affected land base.

Table 24 summarizes the BCMPB v11 projected cumulative mortality for each district within the PGTSA assuming there is no salvage of dead pine.

Table 24. MPB cumulative mortality for PGTSA

District	2013 annual attack (m^3)	2013 cumulative attack (m^3)	2014 projected attack (m^3)	2014 projected cumulative attack (m^3)	2024 projected attack (m^3)	2024 projected cumulative attack (m^3)
Vanderhoof	11,264	71,282,464	5,616	71,288,080	2,640	71,304,256
Prince George	48	49,275,168	1,200	49,276,368	3,632	49,320,416
Fort St. James	312,032	73,145,488	212,944	73,358,432	47,072	74,357,024

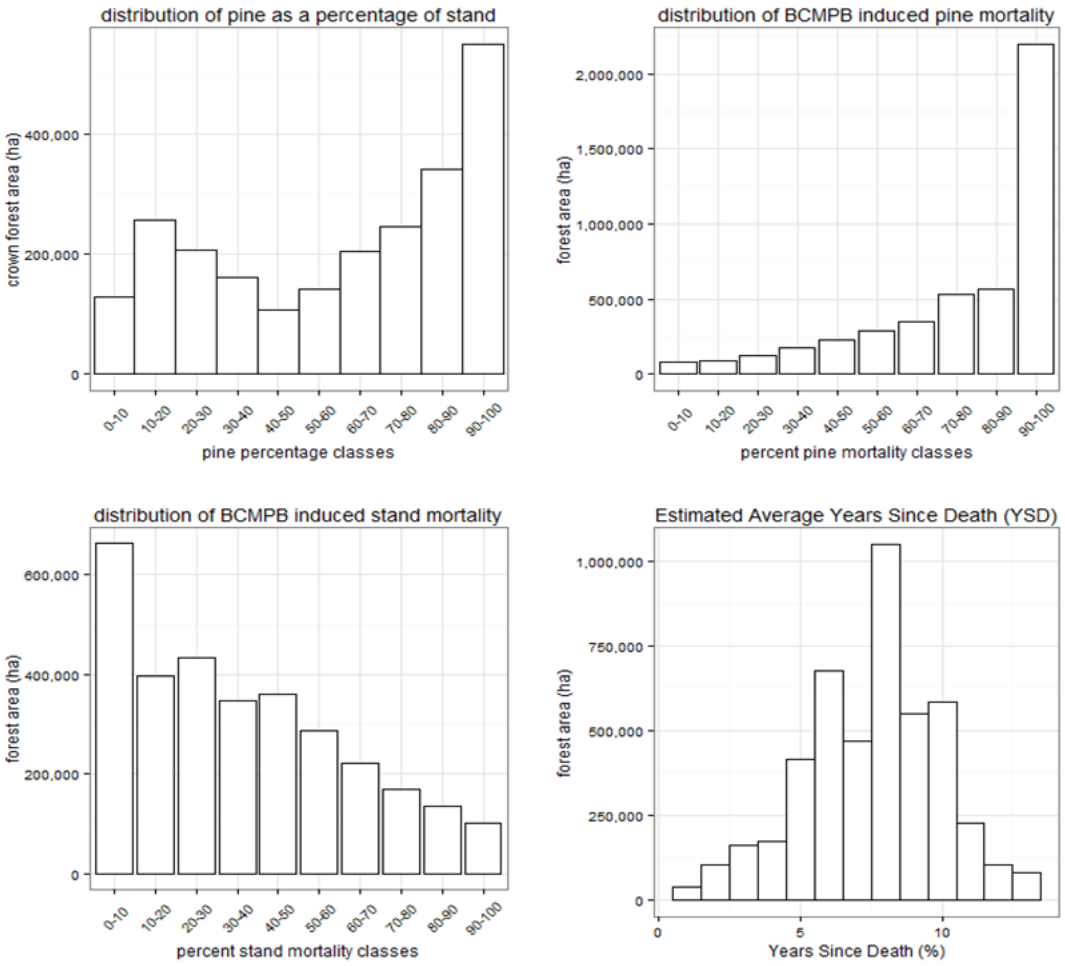

Figure 16. The inventory of pine and MPB-killed pine in PGTSA.

On average pine makes up approximately 28% of the species composition by volume of all stands in the crown forest (including stands with no pine). The more detailed distribution of pine as a percentage of stands in PGTSA is shown in Figure 16 (the top left graph).

Figure 16 also depicts the impacts of mountain pine beetle within the PGTSA projected for 2014. BCMPB analysis indicates that the median level of pine mortality in the TSA is 92%, equating to a median level of stand mortality of 46% (top right and bottom left graph Figure 16).

The median years since death (YSD) in the TSA is 7.5 years (bottom right graph, Figure 16), reflective of the culmination of epidemic related loss in the Vanderhoof and Prince George Districts in 2004 and 2006 respectively. The implications of YSD are discussed further in Section 6.1.5, "Shelf life".

Sub-alpine fir (balsam) decline within the Fort St. James District

Sub-alpine fir (*Abies lasiocarpa*) decline has been a serious forest health concern in the Fort St. James District since the early 1990s. Ongoing outbreaks of western balsam bark beetle (*Dryocoetes confuses)* and two-cycle spruce budworm (*Choristoneura biennis*) over the past decade, coupled with various heart rot diseases common to over-mature sub-alpine fir-leading stands, have contributed to extensive stand mortality and significant loss of merchantable volume.

Figure 17. Location of VRI plots (2006-2008) and inventory audit plots in balsam-leading stands.

In the last TSR mortality in balsam-leading was modelled by applying a weighted mean reduction to stand volume as a spatial operational adjustment factor. Values were derived from mortality mapping conducted in Fort St. James in 2007.

Further analysis was conducted for this TSR using 121 VRI established between 2006 and 2008 and inventory audit plots (Figure 17) established in 2014 within balsam-leading stands in the district.

Thirty-four percent of the plots recorded no stand mortality. The remaining plots measured a median level of 36% mortality. In the last TSR the mortality estimates ranged between 24 to 38%.

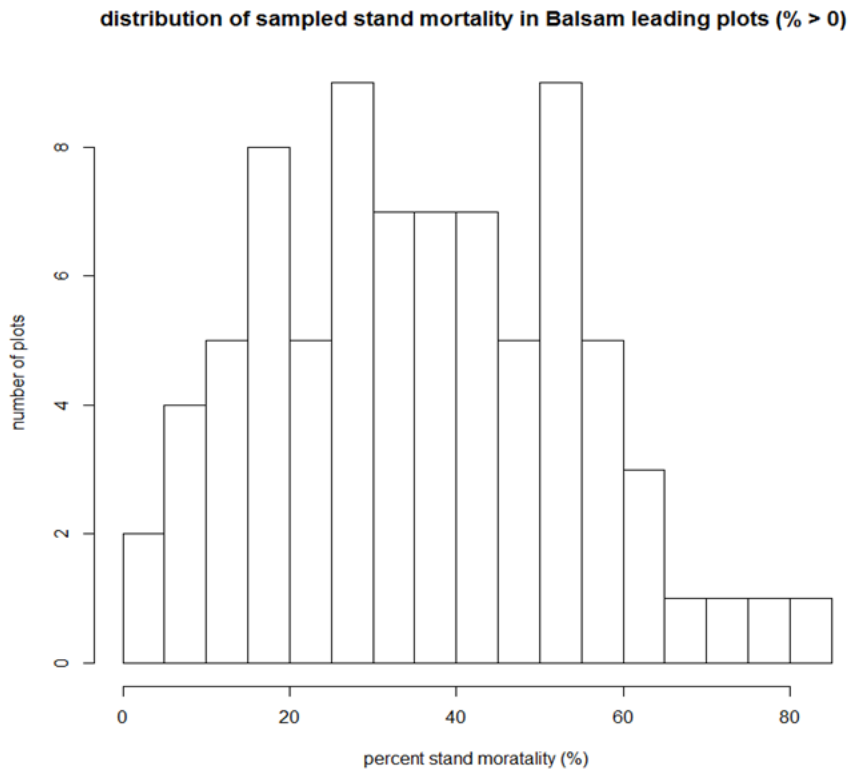

Figure 18. Stand mortality in balsam-leading plots.

Figure 18 depicts the distribution of stand mortality on sample plots where mortality was recorded. The samples revealed a significant relationship between the percentages of total recorded stand mortality and total stand volume and stand age. Based on that relationship a mortality regression model was developed based on the inventory age and volume attributes.

In this TSR the application of the mortality regression model:

*final volume = initial volume * (1 –(- 4.55E-02 + (3.21E-04* initial volume)+(1.02E-03* age)))*

will be used capture balsam mortality and adjust stand volumes in the inventory in balsam-leading stands in supply blocks B and A (northern two-thirds of the Fort St. James District).

Figure 19 shows the distributions of sample distributions of stand mortality, volume, and age along with the model predicted mortality (when the model is applied to the same sample).

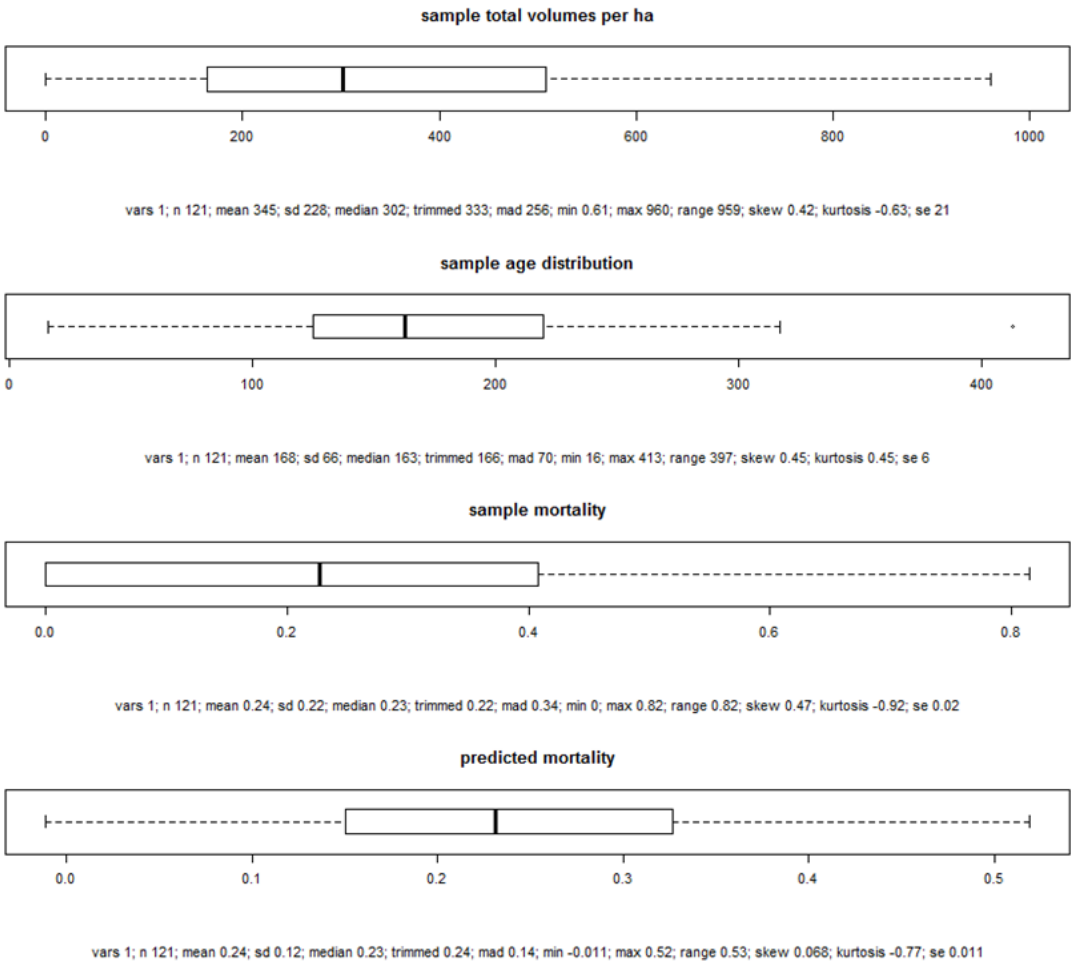

Figure 19. Distributions of stand volume, age and mortality as well as model predicted mortality for balsam-leading samples.

Regression tree functions and volume audit adjustment are being considered as alternative methods for adjusting volumes of balsam-leading stands. The final approach and methodology for applying balsam mortality losses to the inventory will be fully documented in the timber supply review's technical report.

Other insects, fire and wind losses

Periodic natural disturbances caused by extreme weather, fire, or epidemic forest health factors can result in large volume losses if the impacted stands are not salvaged. These events are accounted for by averaging the recorded periodic volume losses over the recorded time frame to approximate an average annual volume loss. This volume is deducted from the growing stock each year in the timber supply model forecast.

For this review the estimate of periodic unsalvaged losses is addressed separately for the short-term salvage period focused on dead pine volume recovery and the post salvage period. For the pine salvage period the unrecovered losses estimates are based on the assumption that salvage activities during this period focus primarily on MPB-induced mortality with only incidental salvage of non-MPB related losses.

For the pine salvage period timber volume losses due to wild fires or insects affecting spruce and Douglas-fir stands have been annualized using the provincial methodology developed by FAIB for the period of 1999 to 2013. The timber volume affected by a windthrow is estimated using the record of 2004-2013 provincial forest health overview survey and the BCGW inventory data. Only insects impacting mature forests were summarized. These include Douglas-fir bark beetle (IBD) and spruce beetle (IBS).

The 2014 forest health aerial overview surveys captured a significant increase in spruce beetle activity, especially in the northeastern portion of the Prince George District. However, the 2014 spruce beetle losses are not included in calculation of annual insect losses in Table 25. It is expected that the major licensees will address the 2014 spruce beetle infestation by planned salvage harvesting.

The annual losses estimates were derived following data sources:

1. The annual provincial overview survey is the source of data for each forest health factor including spatial location and severity of damage.
2. The THLB utilized in TSR4.
3. The BCGW spatial layers provided data including TSA boundary, timber volume per hectare, species for each VRI polygon, and location of cutblocks.

The following process was used to estimate windthrow loss:

1. Windthrow related polygons from the overview survey were used to calculate net merchantable volume per hectare (trees with DBH>12.5 cm) for each windthrow polygon.
2. The annual sum of net merchantable volume of the windthrow was calculated for years from 2004 to 2013.
3. The annual sum of net merchantable volume of the salvaged windthrow was estimated for years 2004-2013.
4. In Table 25 the unrecovered volume during the salvage period for the windthrow is a difference between 10 years average of gross volume and the 10 years average of salvaged volume.

The non-recoverable loss estimate methodology will be fully documented in the timber supply review's technical report.

For the period following the MPB salvage harvesting the unrecovered losses estimates are derived from the pre-epidemic salvage estimates utilized in TSR2.

Table 25. Summary of annual insect, wildfire and windthrow losses estimated for the PGTSA

	Insects (m^3)	Fire(m^3)	Wind(m^3)	Total
Gross volume during salvage period*	312,293	63,314	66,664	382,271
Unrecovered volume during salvage period*	257,040	60,630	51,637	369,307
Unrecovered volume post-pine salvage period**	278,500	111,000	3,670	397,800

*Based on 1999-2013 data.

** Based on estimates from TSR2.

6.5 Young pine mortality

This section summarizes recent FLNR efforts to assess mountain pine beetle (MPB) mortality in young stands in the PGTSA.

When calculating mortality due to MPB the BCMPBv11 model only considers stands greater than 60 years old. The MPB induced mortality in younger stands observed since year 2005, is not addressed by BCMPB v.11 model.

During culmination of MPB infestation some young spaced pine stands seemed to be the first hit, probably because they had larger stem diameters. Research projects, including those by Southern Interior Forest Region (SIR) entomologist Lorraine MacLauchlan and University of Northern BC (UNBC's) Chris Hawkins, began investigating attack in young stands. They found that stems less than 10 cm diameter at breast height (DBH) were not attacked, and observed mortality in stems down to 12 cm DBH and brood development in stems as low as 17 cm DBH.

To address the MPB impact on stands younger than 60 years the approach used in TSR4 was applied as follows:

1. Pine-leading stands > 15 years old and < 60 year old (Crown Forest Land Base – Parks not included) were identified with the VRI:

Fort St. James Natural Resource District	58 534 hectares
Vanderhoof Natural Resource District	109 354 hectares
Prince George Natural Resource District	113 331 hectares
Total PGTSA	281 219 hectares

2. The inventory data was summarized by landscape units.

   Landscape units affected by MPB infestation were sampled (sampling occurred in 2008). No new MPB infestations in the young pine stands have been reported post 2008.

3. The mortality estimates were derived and applied to all pine-leading stands within each identified age class within each surveyed landscape unit.

Table 26 summarizes the landscape unit estimates of MPB related losses in young stands.

Table 26. MPB attack estimates for young stands within the PGTSA by district and landscape unit

DJA	Age Class	Total Area (ha)	Area Surveyed (ha)	Total % Attack	DPG	Age Class	Total Area (ha)	Area Surveyed (ha)	Total % Attack	DVA	Age Class	Total Area (ha)	Area Surveyed (ha)	Total % Attack
Pinchi	1	1842	391	5	Bill's	2	1098	729	67	Blackwater	3	3771	82	0
Pinchi	2	3160	5401	14	Bowron	2	2463	759	38	Chilako	2	8524	234	18
Pinchi	3	803	581	2	Captain	2	437	391	70	Chilako	3	2901	272	17
Salmon	1	3528	201	8	Crooked	2	751	289	37	Cluculz	2	8380	365	53
Salmon	2	5268	6816	14	Crooked	3	330	95	75	Cluculz	3	585	29	29
Salmon	3	2674	397	27	Gleason	2	334	62	65	Endako	2	2708	6	0
Stuart	1	75	121	42	Gregg	1	2278	169	0	Endako	3	284	7	53
Stuart	2	785	275	4	Gregg	2	4632	2510	58	Entiako	3	1988	270	9.6
Tezzeron	2	4193	1679	1	Grizzly	2	1731	566	33	Halett	2	3853	38	60
Tezzeron	3	1707	114	24	Haggen	2	596	304	17	Halett	3	2575	308	35
Whitefish	1	476	58	0.5	Mollie	2	3317	1523	27	Kluskus	2	3128	133	0
Whitefish	2	3916	5300	6	Mud	2	6672	3485	37	Lucas	2	915	70	44
Whitefish	3	504	29	0.3	Mud	3	2836	937	60	Lucas	3	154	22	54.5
					Nechako	2	4278	2442	58	Nechako	2	2480	96	53
					Nechako	3	452	125	60	Nithi	2	3792	7	0
					Prince	2	1734	120	40	Nithi	3	1583	244	4.2
					Punchaw	2	3411	1400	35	Stuart	2	5051	133	59
					Punchaw	3	2249	494	5	Sutherland	2	1441	31	0
					Purden	2	2612	1238	52	Tachick	2	4212	23	89
					Purden	3	5559	1200	8	Tachick	3	1155	15	0
					Slender	2	4648	2474	54	Tatelkuz	3	4083	454	15.6
					Slender	3	1148	350	90					
					Stony	2	747	111	28					
					Willow	2	1942	553	58					
					Willow	3	5379	2020	60					

6.6 Silviculture and regeneration activities

The RESULTS database has been used to develop the silviculture assumptions for managed stand analysis units (AU) for this TSR (see Section 4.1, "Management zones and tracking of multiple objectives", for more detail).

To identify the managed stands the RESULTS data was limited to forest cover records that were:

- immature;
- not "UNEVEN" aged;
- the species 1 attribute for the regenerating stand was populated;
- the age and height attributes were populated for the regenerating stand;
- the total stems per ha (TS) and the uncapped well-spaced stems per ha (WSS) was populated (however, if the uncapped number was missing the capped value was used if populated).

The AUs are modelled using data from two sources:

- Regeneration survey for stands established after 2002;
- Free-growing surveys for stands established between 1986 and 2002.

The RESULTS data was stratified into two groups: data originating from regeneration surveys and data originating from free-growing surveys. The survey was assumed to be a 'regeneration survey' if the difference between the reference year (of the survey) and the declared date for the regeneration declaration was one year or less.

Similarly, the survey was assumed to be a 'free-growing survey' if the difference between the reference year (of the survey) and the declared date for the free-growing declaration was one year or less.

Regeneration survey data was further limited to those openings with a disturbance (harvest) end date back to and including 2003. Free-growing survey data was further limited to those openings with a disturbance (harvest) end date back to and including 1987. Some analysis units have little (less than 100 hectares) or no history of logging. In that case, species composition, regeneration delay, and establishment density are derived from similar analysis units.

For each survey type (regeneration *versus* free growing) the data has been summarized by management unit, BEC zone and current leading species. The leading species is based on the area weighted species composition derived from the opening inventory label recorded in RESULTS.

The timber supply analysis requires also the assessment of regeneration delay, genetic worth values and site indices for each AU.

Regeneration delay is calculated as follows:

- if a planting year was known the regeneration delay is the difference between the harvest end year and the planting year.
- if a planting year was NOT known it is defined as:
  (reference year – harvest end year) - the sample tree age.

Genetic Worth (GW) values for openings regenerated by planting come from the Tree Improvement Branch SPAR database. GW values are provided for each species and have been pro-rated based on the values recorded in the RESULTS planting table as follows:

GWs are calculated as per the following example:

- An opening is planted with two seedlots of White Spruce.
- The order was for 15000 seedlings of seedlot "1" with a genetic gain of 10% and 10000 seedlings of seedlot "2" with no genetic gain.
- The assumed genetic gain for the planted spruce in the opening is assumed to be ((15000*10)+(10000*0))/(15000+10000) = 6%.
- The prorated genetic gain has not been further adjusted for subsequent natural ingress.
- When summarized to the MU, BEC, SPC level GW is weighted by polygon area.

Site index is a species composition weighted average value derived from the Provincial Site Productivity Layer (PSPL). This layer was developed in 2011 and early 2012 as a collaborative effort between the Ministry of Environment and the Ministry of Forests, Lands and Natural Resource Operations.

For stands where "Terrestrial Ecosystem Mapping" (TEM) or "Predictive Ecosystem Mapping" (PEM) exists the site indices are based on SIBEC (http://www.for.gov.bc.ca/hre/sibec/). Otherwise, the source of the site indices is FLNR's Provincial Site Productivity Layer.

AUs with stands established after year 2002

Where stands were established post-2002 and the regeneration survey summaries form the primary data, source stocking is based on the area weighted uncapped well-spaced stems per hectare, GW and the planted option in TIPSY is applied. Use of this methodology was advised by FLNRs TASS/TIPSY growth and yield research group. The well-spaced number implies a regular spatial configuration. Therefore the appropriate regeneration method to assume is 'planted' regardless of actual stand origin.

AUs with stands established between 1986 and 2002

For stands established post-1986 and prior to 2003 the free-growing survey summaries form the primary data source. When modelling, stocking is based on the weighted average total stems per hectare and the natural option employed in TIPSY. Due to the substantial natural ingress occurring in these stand types GW is not applied.

AUs yield curves

Historically, in the absence of any better information, an OAF1 of 15% and an OAF2 of 5% has been applied to the managed stand yield curves. The rationale behind OAFs is to reduce the theoretical projected yields from those found in research plots to actual yields experience in managed stands. Table 27 shows the TIPSY input summary for the 10 largest analysis units in the TSA representing 89% of the CFMLB. Included in the summary is the analysis unit culmination age, volume per ha at culmination, and volume per tree at culmination.

Table 27. Inventory data for 10 largest analysis units in PG TSA

analysis unit	area (ha)	pct (%)	label	curve type	regen delay	total stems	uncapped wss	spc1	pct1 (%)	spc2	pct_2 (%)	spc3	pct3 (%)	spc4	pct4 (%)	spc1_gw	spc2_gw	site index	regen method	cmai (yrs)	vph (m3/ ha)	vpt (m3)
34	1,423,031	24	SBS_P	fut_mgd_std	2	1700	1200	PL	67	SW	33					1.5	17.6	17.7	P	80	295	0.345
35	1,205,696	20	SBS_S	fut_mgd_std	2	1600	1300	SW	55	PL	38	FDI	7			17.5	1.2	18.3	P	80	367	0.406
8	835,939	14	ESSF_B	fut_mgd_std	1	1500	1200	SE	73	PL	21	BL	6			11.6	2.4	16.4	P	100	364	0.432
31	408,337	7	SBS_CD	fut_mgd_std	2	2200	1400	SW	55	PL	21	FDI	16	BL	8	21.0	2.3	18.2	P	80	338	0.367
64	406,093	7	SBS_P	ex_mgd_std_RG	2	1700	1200	PL	64	SW	28	FDI	5	BL	3	1.5	17.6	17.7	P	80	286	0.336
29	332,555	6	SBS_B	fut_mgd_std	2	2500	1200	SW	57	PL	25	BL	10	FDI	8	15.3	0.6	18.1	P	80	328	0.386
14	276,427	5	ESSF_S	fut_mgd_std	1	1500	1200	SE	82	PL	13	BL	5			17.6	0.8	17.3	P	90	372	0.44
13	170,590	3	ESSF_P	fut_mgd_std	2	2900	1300	PL	62	BL	21	SE	17			1.1	13.3	16.9	P	90	303	0.333
91	167,478	3	SBS_P	ex_mgd_std_FG	2	5700	1400	PL	69	SW	13	BL	11	FDI	7	0.0	0.0	17.8	N	90	304	0.274
65	99,824	2	SBS_S	ex_mgd_std_RG	2	1600	1300	SW	55	PL	38	FDI	5	BL	2	17.5	1.2	18.1	P	80	338	0.378

In 2014, a Young Stand Monitoring (YSM) project was initiated for the PGTSA. The objective of the YSM program is to check the accuracy of the growth and yield predictions of key timber attributes of young stands.

It is hoped this project data can be used to adjust managed stand attributes (OAFs, Site Indices) and yields to better reflect the conditions on the ground. The results of the YSM project and its application will be detailed in a technical report.

Also, between 2009 and 2014 an extensive network of Stand Development Monitoring (SDM) plots under the Forest and Range Evaluation Program (FREP) have been established throughout the PGTSA on stands aged 15 to 47 years. The intent of SDM sampling is to evaluate stand growth mid rotation and to quantify forest health impacts. In this program the 126 polygons were randomly sampled from the RESULTS population of regenerated stands. The expectation is that analysis of the SDM data will complement the YSM information and allow evaluation of attributes as stand densities, site index, total basal area and forest health affected basal area for AUs.

6.7 Integrated resource management

Specific objectives and modelling assumptions are as follow:

6.7.1 Landscape-level retention

The following analysis assumptions are drawn from the:

- Order Establishing Landscape Biodiversity objectives for the Prince George Timber Supply Area, October 20, 2004 (PGTSA order), found at:

http://www.for.gov.bc.ca/tasb/slrp/srmp/north/prince_george_tsa/pg_tsa_biodiversity_order.pdf

- Order to establish the Humbug Landscape Unit and Objectives, April 2003 and Order to Establish the Dome and Slim Landscape Units and Objectives, October 31, 2002. found at: http://www.for.gov.bc.ca/tasb/slrp/srmp/north/prince_george/legalobj_Oct31_02.pdf

Base case

Old forest retention

The PGTSA landscape biodiversity order specifies objectives for old forest retention, old interior forest retention, and young forest patch size distribution objectives to be applied at the merged biogeoclimatic unit (mBEC) level. mBECs are a combination of natural disturbance sub-units and biogeoclimatic subzones as defined by Craig Delong.[1] In the PGTSA old forest is generally considered to be stands older than 140 years of age for the more mountainous areas and 120 years old for the lower elevation areas where disturbance tends to be more frequent (such as in the Vanderhoof District).

Stand age is as indicated in forest inventory attributes found in the vegetation resource inventory file. The PGTSA order allows for old MPB-killed stands to contribute to old forest objectives in the form of "natural forest areas". Current direction is that these natural forest areas will contribute to old forest objectives until they regenerate into mature second-growth natural forests and are harvested (possibly 100 years from initial death).

As the meeting of mBECs old growth objectives relies on significant contributions of natural forest areas, the order provides direction for maintaining the required minimum old forest area. The implementation policy specifies a minimum amount of CFMLB that must be retained as old non-pine leading stands. Table 28 lists the mBEC units and their corresponding minimum requirements for aspatial old growth. Old forest in parks and protected areas will contribute to old forest retention targets. Although the Order does not specify the minimum percentage of the CFMLB to be retained as old non-pine leading forest for all mBEC units, Section D.3 (*Epidemic or Catastrophic Events*) of the Order does state that "licensees and BC Timber Sales must ensure that a representative portion of stands that have not been affected by the epidemic (e.g., non-pine forest) are used to meet the Old Forest Retention objectives". The middle section of Table 28 shows those mBECs where the "minimum % of the CFMLB retained as old non-pine" was not specified in the original order.

[1] DeLong, S.C. 2002. Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management. Unpublished Report. Ministry of Forests, Prince George, B.C.

Another project aimed at identifying landscape unit biodiversity areas may eventually replace the non-spatially identified old-growth areas from the order. This project is in its infancy and it is unlikely that deliverables will be available in time for this analysis.

Spatial old-growth objectives for the Slim, Dome and Humbug landscape units

Specific areas have been designated as old-growth reserves in three landscape units in the Interior Cedar Hemlock (ICH) biogeoclimatic zones.

These areas are reserved from harvesting and contribute to the overall aspatial old forest retention requirements documented in Table 28.

Table 28. Summary of aspatial old forest retention requirements

Source of old growth	Minimum % of the CFLB retained as old forest or "natural forest area"	Minimum % of the CFLB retained as old non-pine leading forest	Minimum age of old forest	Merged biogeoclimatic subzone (mBEC) unit label (as per Prince George TSA biodiversity order)		
				Vanderhoof Natural Resource District	Prince George Natural Resource District	Fort St. James Natural Resource District
mBEC units where there are specific requirements for old forest retention from non-pine leading forests outlined in Tables 8 to 10 of the implementation policy in the Prince George TSA old growth order	12	1	120		A8	
	12	2	120	D4, D7	A11	
	12	3	120	D6	A9	
	12	4	120		A12	E4
	12	6	120		A13	E5
	17	3	120	D2		
	17	5	120	D3, D5		
	17	10	120			E3
	17	13	120			E2
	17	14	120		A7, A10	
	29	12	140		A5	
	29	16	140	D1		
	29	28	140		A6	
	41	33	140			E1
mBEC units where the retention from non-pine leading forests is unspecified in the order but where pine makes up a significant portion of the old forest[2].	12	9	120		A3	
	16	9	120			E12
	16	10	120			E14, E16
	16	12	120			E17
	16	13	120			E15
	26	23	140		A4	
	30	27	140		A24	
mBEC units where no significant quantity of old pine leading forests exists. In these units utilization of any or all of the old dead (MPB-killed) pine does not constitute a risk to the intent of the old-growth order and its implementation.	23		140			E13
	26		140		A2, A16	E8
	33		140		A1	
	37		140			E6, E7
	41		140			E10, E11
	46		140		A25	
	48		140		A19, A21	
	50		140		A14, A17	
	53		140		A22, A23	
	58		140			E9
	80		140		A18, A20	
	84		140		A15	

[2] Data for non-pine-leading old forest is from the same 2004 forest inventory file used to derive the tables in the original 2004 PGTSA Old Growth Order.

Pursuant to the Order there is flexibility to allow younger forest areas to be set aside to allow recruitment of old forest. In December of 2014 the Omineca Regional Executive Director approved a recruitment strategy for mBEC A4 in the Prince George District. This recruitment strategy was submitted by the Licensee Landscape Objectives Working Group (LLOWG) and established 'landscape biodiversity areas'. For the purposes of the requirement under the order these spatially located areas partially satisfy the old forest requirement. For A4 the Order requires that 26% (59 208 hectares) of the CFMLB (227 732 hectares) to be old. The approved recruitment strategy satisfies 72% of the requirement leaving 28% of the 26% (16 578 hectares) to be obtained from aspatial old forest areas. Recruitment areas are shown in red and labeled *licensee proposed biodiversity areas* on the map below (Figure 20).

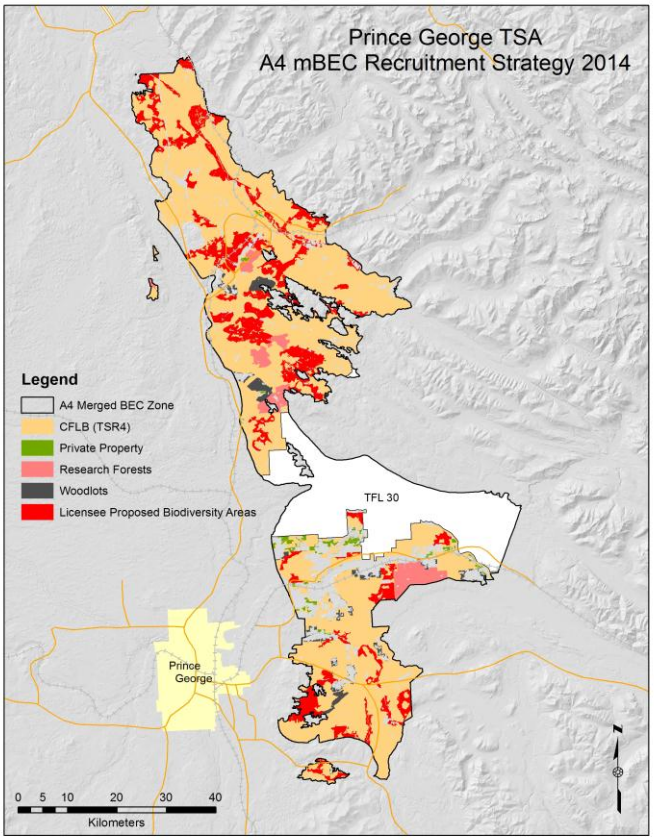

Figure 20. Prince George TSA A4 mBEC recruitment strategy.

Old interior forest retention

The PGTSA order also specifies the minimum percentage of the old forest that must be old interior forest. This is forest that is buffered from young forest or disturbance (logging or roads). Timber supply modelling techniques currently employed do not allow for direct modelling of this objective. Instead, at certain time intervals the output of the model will be examined and interior old forest will be quantified and reported. Old dead pine forests (natural forest areas) are assumed to contribute as old interior forest where adequately buffered from disturbance. Time intervals proposed are initial (time 0), 5, 10, 20, 30 and 40 years from the year 2015.

Young forest patch size distribution objectives

The PGTSA Order (Part C) requires that there is a "demonstrated trend toward the young forest patch size distribution by natural disturbance sub-unit". For the purposes of the base case this objective will be handled in a similar manner to the old interior forest retention objective. Area in each patch size category (> 1000 hectares, 101 to 1000 hectares, 51 to 100 hectares, and less than 50 hectares) will be reported at regular time intervals. Dead pine-leading forests (natural forest areas) are not assumed to contribute to an early seral patch. Suggested time intervals are: initial (time 0), 10, 20, 50 years from now and 100 years from the year 2015.

6.7.2 Disturbance of the non-timber harvesting land base

As described in this data package, management objectives for forest values such as biodiversity and wildlife will be modelled in the timber supply analysis. Often these objectives are to retain a specified amount of area in old forest condition. Objectives to address these values apply to the entire CFMLB (both THLB and non-timber harvesting land base [NTHLB]). The NTHLB includes forested areas of uneconomic timber, parks, caribou high habitat, ungulate winter range, and other Crown-managed areas. As a result, NTHLB areas must also be factored into this analysis.

Various modelling assumptions have been used in the past to simulate the role of natural disturbance in altering NTHLB forest conditions. In this analysis a disturbance function will be applied in the base case to prevent NTHLB from continually aging and providing a disproportionate and often improbable amount of old forest cover conditions to satisfy landscape biodiversity requirements. The natural disturbance function utilizes the thresholds set out by Delong in *Land Units and Benchmarks for Developing Natural Disturbance based Forest Management Guidance for North-eastern British Columbia* (Table 29*)*. Stands exceeding the old forest thresholds utilized in the Prince George Landscape Biodiversity Order will be selected for disturbance. The selection will be probabilistically based on the stand replacement disturbance cycle of the BEC variant and associated Natural Disturbance Unit (NDU).

Table 29. Natural disturbance parameters applied to NTHLB within each NDU

Natural Disturbance Unit	Stand Replacement Disturnace Cycle	Old Threshold	Time since disturbance distribution
	(return interval)	(yrs)	% of forest area
Boreal Foothills–Mountain	150	140	33-49
Boreal Foothills–Valley	120	140	23-40
Boreal Plains–Alluvial	200	140	41-61
Boreal Plains–Upland	100	140	17-33
Cariboo Mountain Foothills	400	140	65-74
McGregor Plateau	220	120	43-61
Moist Interior–Mountain	200	140	41-61
Moist Interior–Plateau	100	120	17-33
Moist Trench–Mountain	300	140	58-69
Moist Trench–Valley	150	140	33-49
Northern Boreal Mountains	180	140	37-60
Omineca–Mountain	300	140	58-69
Omineca–Valley	120	120	23-40
Wet Mountain	900	140	84-89
Wet Trench–Mountain	800	140	80-88
Wet Trench–Valley	600	140	76-84

6.8 Scenic areas and visual quality objectives (VQOs)

Procedures to model the scenic areas and VQOs are as follows. Plan to Perspective (P2P) ratios and Visually Effective Green-up (VEG) heights will be determined for 5% slope class increments for each individual scenic area polygon. The P2P ratios will then be applied in the analysis to adjust the percent allowable alteration by visual quality objective. VEG tree heights will be modelled for each scenic area polygon individually as it was done in the last TSR.

The following documents detail the modelling processes:

- *Procedures for Factoring Visual Resources into Timber Supply Analyses* (March 17, 1998) https://www.for.gov.bc.ca/hfp/values/visual/Publications/timber_supply/TSR10.pdf
- Procedures for Carrying out Visually Effective Green-up (VEG) Tree Height Assessment in Scenic Areas, Northern Interior Forest Region (November, 2007);
- *Bulletin-Modelling Visuals in TSR III* (December 12, 2003). https://www.for.gov.bc.ca/hts/fia/bulletin_p2p_final.pdf

Table 30 indicates the P2P ratios and VEG heights by slope class that will be applied in the analysis.

Table 30. P2P rations and VEG heights

Modified visual unit slope classes for plan-to-perspective ratios (P2P) and visually effective green-up (VEG) tree height input into TSRs[1]															
Slope %	0-5	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	70.1+
P2P ratios[2]	4.68	4.23	3.77	3.41	3.04	2.75	2.45	2.22	1.98	1.79	1.6	1.45	1.29	1.17	1.04
VEG tree height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0	8.5	8.5	8.5

[1] Adapted from Procedures for Factoring Visual Resources into Timber Supply Analysis manual (1998) and Modelling Visuals in TSR III Bulletin (2003) in Preparation for TSR4 (by Luc Roberge, Visual Resources Specialist, MFLNR-December 2007).

[2] A recent study shows a first approximation of the predicted P2P ratios for absolute slope classes in 10% increments. Although P2P ratios and slope classes did not show a linear relationship, the median value was used in this table to determine the ratios for slope classes in 5% increments.

Table 31 identifies the percent allowable alteration in perspective view by visual quality objective (VQO).

Table 31. Predicting VQO objectives based on percent alterations

VQO	Permissible % alteration in perspective view	Proposed % alteration in perspective view for this TSR (mid-point of range)
Preservation	0	0
Retention	0 - 1.5	0.8
Partial retention	1.6 - 7.0	4.3
Modification	7.1 - 18.0	12.6
Maximum modification	18.1 - 30.0	24.1

Note: These percentages apply to the visible treed portion of the landscape in perspective view. Rock, snow and ice patches are excluded from the calculation.

To determine available denudation in plan view for an individual visual unit, the perspective percent alteration number must be converted by a P2P ratio for the average slope class of that unit. For example, assume a partial retention (PR) visual unit is managed in the field at the mid-range of the permissible percent alteration in perspective view, 4.3%, and has an average slope of 20% resulting in a P2P ratio of 3.41. The corresponding percent denudation value in plan view would be: 4.3% x 3.41=14.7%. Therefore, if this PR visual unit is 5000 hectares (THLB) in size and has no prior harvesting, or any past harvesting has reached VEG, 735 hectares is available for harvesting (5000 hectares x 14.7%) and this is the number that would be used for modelling.

6.9 Ungulate winter ranges

Tables 32 to 39 identify constraints to the THLB associated with mule deer and caribou ungulate winter ranges. UWR objectives resulting in 100% netdown to the THLB are found in Section 5.3.1.

Table 32. Summary of all UWR orders

UWR ID	UWR name	# of UWR units within plan	Total UWR area (hectares)	Natural resource district(s)	Gross area – no harvest	Gross area – modified harvest
U-5-001	PG Mule Deer (Blackwater River – Unit dqu_14)	1	5,185	Prince George	0	5,185
U-7-002	Fort St. James Mule Deer	19	3,657.2	Fort St. James	176	3,481
U-7-003	Omineca Mt. Caribou (PGTSA portion only – includes SARCO incremental habitat proposal)	102	655,793	Prince George, Fort St. James	565,679	90,114
U-7-011	Vanderhoof Mule Deer	7	2,327	Vanderhoof	514	1,813
U-7-012	Vanderhoof Caribou	11	48,696	Vanderhoof	22,629	26,067
U-7-013	Prince George Mule Deer	66	10,062	Prince George	323	9,739
U-7-015	Fort St. James PLWR Northern Caribou	19	52,606	Fort St. James	0	52,606
U-7-016	Additional – Vanderhoof Mule Deer			Vanderhoof		
U-7-022	Additional Prince George Mule Deer			Prince George		
U-7-023	See U-5-001 – Blackwater CCLUP Mule Deer			Prince George		

Table 33. Mule deer winter range order U-7-002 Fort St. James Natural Resource District

Mule deer habitat type	Habitat units	Habitat strategy	Constraint
Modified harvest	1-5,11,12,14	Minimum of 40% of winter range area in age class 8 (> 140 years) or greater at all times with a crown closure of > 56% (Douglas-fir, Spruce) Minimum of 50% species composition of Douglas-fir, with Douglas-fir leading. Keep timber harvesting openings irregular in shape and smaller than 1 ha in size and less than 250-m wide.	≥ 40% ≥ 140 years Regen ≥ 50% Fd
Modified harvest	6-8,13	Minimum of 50% species composition of Douglas-fir with Douglas-fir leading. Keep timber harvesting openings irregular in shape and smaller than 1 ha in size and less than 250-m wide.	Regen ≥ 50% Fd
Modified harvest	9,10,15-18	Minimum of 50% of stand in age class 8 (> 140 years) or greater at all times with a crown closure of > 66% (Douglas-fir, Spruce). Minimum of 50% species composition of Douglas-fir with Douglas-fir leading. Keep timber harvesting openings irregular in shape and smaller than 1 ha in size and less than 250-m wide.	≥ 50% ≥ 140 years Regen ≥50% Fd

Table 34. Caribou ungulate winter range order U-7-003

Caribou habitat type	Habitat units	Total area (hectares)	Habitat strategy	Constraint
Medium	T-001, T-002, T-004, T-007, T-008, T-011, T-013, T-015, T-017, T-018, T-019	21 406	Caribou medium habitat Harvest < 30% volume removal on a cutblock area every 80 years, opening sizes do not exceed 1.0 ha, with a mean opening size of < 0.5 ha	Modified harvest ≥ 30% ≥ 160 years old ≤ 30% < 80 years old
Corridor	P-001, P-004, P-005, P-009, P-013, P-017, P-015,P-018, P-026, P-028, P-029, P-039, P-042, P-044, P-046, P-047, P-050, P-051, P-052, P-059, P-061, P-062, P-063, P-070, P-073, T-005, T-009, T-010, T-012	68 708	Caribou travel corridors Harvesting will result in a minimum of 20% of the forest within each unit as 100+ years of age in corridor with no more than 20% of the productive forest area of the unit being less than 3 metres green-up condition	Modified harvest ≥ 20% of the forest ≥ 100years ≤ 20% ≤ 3 metres

Table 35. Mule deer winter range order U-7-011

Mule deer habitat type	Habitat units	Must do management	Constraint
Modified harvest	VD-01,02,05,06	Minimum of 50% of stand in age class 8 (> 140 years) or greater at all times with a crown closure of >66% (Douglas-fir, Spruce) Maintain 30 to 40% deciduous shrub component Minimum of 50% species composition of Douglas-fir, with Douglas-fir leading. Keep timber harvesting openings irregular in shape and smaller than 1 ha in size and less than 250 m-wide.	≥ 50% ≥ 140 years Regen ≥ 50% Fd
Modified harvest	VD-04	Minimum of 40% of winter range area in age class 8 (> 140 years) or greater at all times with a crown closure of > 56% (Douglas-fir, spruce) Maintain 30 to 40% deciduous shrub component Minimum of 50% species composition of Douglas-fir, with Douglas-fir leading. Keep timber harvesting openings irregular in shape and smaller than 1 ha in size and less than 250 m-wide.	≥ 40% ≥ 140 years Regen ≥ 50% Fd

Table 36. Caribou ungulate winter range order U-7-012 Vanderhoof Natural Resource District

Caribou habitat type	Habitat units	Habitat strategy	Constraint
Modified harvest	LE-1-001 – LE-1-009 LE-2-001 LE-2-011 – LE-2-015 LE-2- 017, 018 LE-4-001	Manage the defined Non-terrestrial Lichen Habitat and Terrestrial Lichen Habitat through a two-pass, 140 year rotation. Within each pass, harvest 50% +/- 20% of the total area. Primary forest activities initiated at the start of a rotation are to be completed within 20 years, areas not harvested during that 20-year period will be locked into the 140 year rotation.	≤ 50% < 70 years old

Table 37. Mule deer winter range order U-7-013 Prince George Natural Resource District

Mule deer habitat type	Habitat units	Habitat strategy	Constraint
Modified harvest	PGD-001,002,012, 014 PGD-019-022, 035,054,066	Minimum of 50% of stand in age class 8 (> 140 years) or greater Maintain 30 to 40% deciduous shrub component Minimum of 50% species composition of Douglas-fir	≥ 50% ≥ 140 years Regen ≥ 50% Fd
Modified harvest	PGD-004,008, 010,011,013,015, 023,026-029, 031,038,040-052, 055,063-065	Minimum of 40% of winter range area in age class 8 (> 140 years) or greater Maintain 30 to 40% deciduous shrub component Minimum of 50% species composition of Douglas-fir	≥ 40% ≥ 140 years Regen ≥ 50% Fd

Table 38. Northern Caribou winter range order U-7-015 Fort St. James Natural Resource District

Caribou habitat type	Habitat units	Habitat strategy	Constraint
Modified harvest	9a-001, 9b-001, 9c-001, 10-001, 9a-002, 9a-007, 9b-002, 9c-002, 9c-003, 10-002, 10-004	Manage the defined Non-terrestrial Lichen habitat and Terrestrial Lichen habitat through a two-pass, 140 year rotation Within each pass, harvest 50% +/- 20% of the total area	≤ 50%< 70 years old

Table 39. Mule deer winter range order U-5-001 Prince George Natural Resource District

Mule deer habitat type	Habitat units	Habitat strategy	Constraint
Modified harvest	DQU-14	Primary forest activities will result in the protection of existing Douglas-fir regeneration and retention of Douglas-fir in juvenile spacing treatments First pass selection is to be applied when the stand basal area is $\geq$ 45 m^2 in the Interior Cedar Hemlock or $\geq$ 40 m^2 in other biogeoclimatic zones Forest activities planned for each cutblock area must result in a condition where the 0 – 40 year category Table 1 Stand structure habitat Class / Max % cutblock area in age class 0-40 years Low 33 Moderate 25 High 20 Primary forest activities in stands of trees, where the group selection silviculture system is to be employed, will result in the harvest proportions and cutting cycles for each stand structure habitat class Table 2 Stand habitat class / Area harvest per pass / Min cut cycle / Effective rotation / # of different aged patches after full rotation Low 33 40 120 3 Mod 35 40 160 4 High 20 40 200 5 9 (a) Primary forest activities on sites ecologically capable of growing Douglas-fir must achieve at least on additional 20% in post-harvest Douglas-fir composition as compared to the pre-harvest Douglas-fir composition Despite 9 (a), no further increase in post-harvest Douglas-fir composition is required beyond 60% for sites in the following biogeoclimatic zones: ICH, SBSwk, SBSmc, SBSmw Despite 9 (a), no further increase in post-harvest Douglas-fir composition is required beyond 80% for sites in all biogeoclimatic zones Primary forest activities will result in a range of opening sizes and an average opening size consistent with the specifications for the types of forest sites Table 3 Snowpack zone / Warm aspect / Opening size / Frost prone Transition 0.1-0.4(0.3) 0.1-0.7(0.4) 0.1-0.3(0.2) Deep 0.1-0.4(0.3) 0.1-1.0(0.6) 0.1-0.4(0.3)	≤ 20% < years old ≥ retention over 200 year rotation Regen ≥ 50% Fd

(continued)

Table 39. Mule deer winter range order U-5-001 Prince George Natural Resource District (concluded)

Mule Deer habitat type	Habitat units	Habitat strategy	Constraint
		Primary forest activities must not result in the construction of roads or landings within: • Topographic buffers identified along major topographic features or 100 m of minor ridges or minor topographic breaks identified in the field; • Primary forest activities must not result in the construction of roads within old growth management areas; • Primary forest activities for the purpose of Douglas-fir bark beetle sanitation to remove currently infested stems will result in: • Volume of non-target, non-infested stems greater than 27.5 cm DBH being less than 10% of the total volume of infested stems removed; • No harvesting of green uninfected Douglas-fir trees that are > 37.5 cm DBH; • No salvage of dead trees within old growth management area or wildlife tree patches; • In stands with > 40% lodgepole pine where greater than 50% of the pine component is dead or at high risk of mountain pine beetle mortality, primary forest activities will result in: • No harvest or damage to Douglas-fir trees that exceeds: - 15% for stems 22.5 to 37.5 cm DBH and 5% for stems > 37.5 cm DBH; • No cutting of Douglas-fir stems > 22.5 cm DBH to access lodgepole pine located in patches less than 0.1 ha; • Protection of established Douglas-fir regeneration where regeneration is of good form and likely to produce a timber resource of good value; • Use wildlife tree patches to maintain and recruit snags; • Timber harvesting practices that employ thinning-from below for stems from 12.5 to 37.5 cm DBH will result in: • Harvest or damage to Douglas-fir stems > 37.5 cm DBH that does not exceed 10% of the pre-harvest basal area of the Douglas-fir trees > 37.5 cm DBH; • Retention of a minimum residual basal area of 75% of the pre-harvest conifer basal area (counting stems > 12.5 cm DBH); • Harvesting priority on species other than Douglas-fir in mixed-species stand.	

7. Sensitivity Analyses

Sensitivity analyses are additional timber supply forecast that are carried out to explore the implications to the timber supply from uncertainty in management assumptions or data quality. The analyses typically change one variable while holding all others constant to see if there is disproportionate change in the timber supply. The magnitude of the increase or decrease in a particular variable should reflect the degree of uncertainty surrounding the assumption. Sensitivity analysis may help identify variables that have the potential to alleviate or exacerbate points of constrained timber supply in the forecast. By conducting a number of sensitivity analyses it is possible to determine which variables have the most influence on the base case harvest levels.

Table 40 details the specific sensitivity analyses that will be performed in TSR5. Additional sensitivity analyses may be included after the base case has been completed if new uncertainties are identified.

Table 40. Sensitivity analysis

Issues to be tested	Sensitivity levels
Shelf life	- 100% loss in 2015 - losses frozen at 2015 levels - substitute linear loss curve
Minimum harvestable volume	- reduce MVH threshold over time to 140 m^3 everywhere
Salvage impacts	- test model with various partition options - assume end of salvage in 2015
THLB	- remove proposed area based tenures from the TSA - use alternate cycle time thresholds to define THLB - assess the impact of Ancient Forest park on ICH partition - assess aggregate impact of all proposed area based withdrawals - assess the impact of removing all deciduous leading stands
Yield	- substitute type 4 yield curves - assess applying 12.5 cm utilization standard to all species
Balsam	- remove balsam partition - apply alternative loss model
Stand-level retention	- decrease stand-level retention to FRPA minimums over time
MPB	- assess the impact of removing secondary stand structure
Fire	- assume total loss in wildfires in Vanderhoof since 2008
Wildlife	- assess proposed FSW impacts - assess proposed WHA impacts - assess proposed UWR impacts

8. Acronyms

ADA – Agriculture Development Area

BCMPB – British Columbia Mountain Pine Beetle Model

BCTS – British Columbia Timber Sales

CCLUP – Caribou – Chilcotin Land Use Plan

CFLB – Crown Forest Land Base

DBH – Diameter at Breast Height

DJA – Fort St. James Natural Resource District

DPG – Prince George Natural Resource District

DVA – Vanderhoof Natural Resource District

ECAS – E-Commerce Appraisal System

ESA – Environmentally Sensitive Area

FIA – Forest Investment Account

FLNR – Ministry of Forests Lands and Natural Resource Operations

FRPA – Forest and Range Practices Act

FPC – Forest Practices Code

FTEN – Forest Tenures Title

GAR – Government Actions Regulation

IBB – Balsam Bark Beetle

IBD – Douglas-fir Bark Beetle

IBM – Mountain Pine Beetle

IBS – Spruce Beetle

IFMA – Integrated Forest Management Area

IFPS – Important Fish Productive Stream

ILMB – Integrated Land Management Bureau

ILRR – Integrated Land Resource Registry

INRA – Industrial Reserve Area

LRDW – Land and Resource Data Warehouse

LRF – Lumber Recovery Factor

LRMP – Land and Resource Management Plan

LRUP – Land and Resource Use Plan

MAL – Ministry of Agriculture and Lands

MBEC – Merged Biogeoclimatic Ecosystem Classification Unit

MEM – Ministry of Energy and Mines

MFR – Ministry of Forests and Range

MOU – Memorandum of Understanding

MOE – Ministry of Environment

MPB – Mountain Pine Beetle

MPS – Market Pricing System

MTSA – Ministry of Tourism, Sports and Arts

NAT – Natural Regeneration

NEA – Natural Environment Area

NIR – Northern Interior Region

NPL – Non-plantable Ground

OAF – Operating Adjustment Factor

NRL – Non-recoverable losses

OGC – Oil and Gas Commission

OGMA – Old Growth Management Area

PA – Pulpwood Agreement

P2P – Plan to Perspective

PEM – Predictive Ecosystem Modelling

PFT – Problem Forest Type

PL – Plantable Ground

RCMA – Recreational Conservation Management Area

RESULTS – Reporting Silviculture Updates and Landstatus Tracking System

RIC – Resource Inventory Committee

RMZ – Resource Management Zone

RVQC – Recommended Visual Quality Class

SAR – Species-at-risk

SGR – Sand and Gravel Reserves

SIBEC – Site Index Biogeoclimatic Ecosystem Classification

SIR – Southern Interior Region

SRA – Settlement Reserve Areas

TFL – Tree Farm Licence

THLB – Timber Harvesting Land Base

TIPSY – Table Interpolation Program for Stand Yields

TRIM – Topographic Resource Inventory Mapping
TSR – TSR
UREP – Reserves for Use, Recreation, Enjoyment of the Public
VDYP – Variable Density Yield Predictor
VQO – Visual Quality Objective
WHE – Wildlife Habitat Emphasis

WTP – Wildlife Tree Patch

TSA – Timber Supply Area
UNBC – University of Northern BC
UWR – Ungulate Winter Range

VEG – Visually Effective Green-up
VRI – Vegetation Resource Inventory
WHMA – Wildlife Habitat Management Area