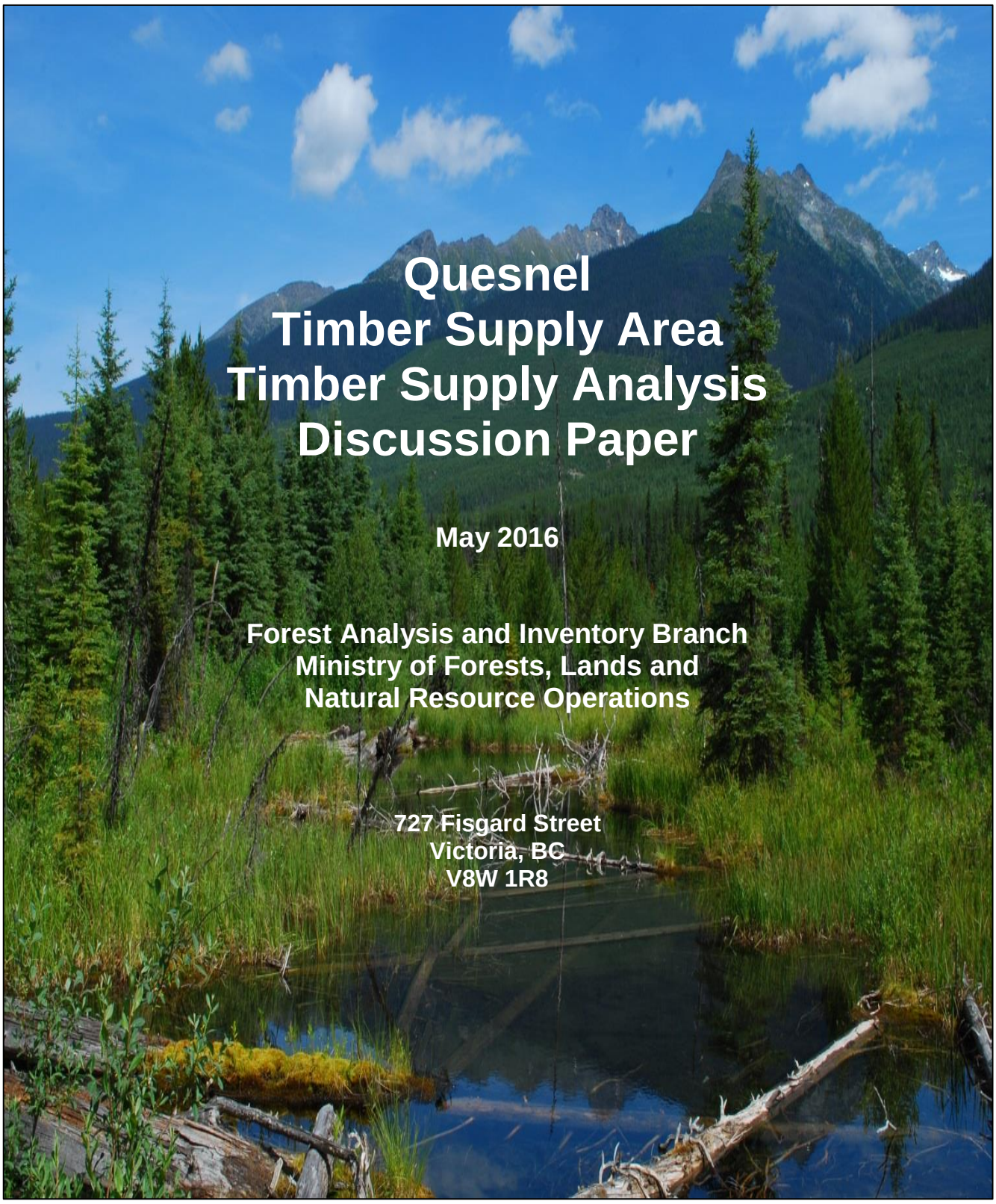

Quesnel Timber Supply Area Timber Supply Analysis Discussion Paper

May 2016

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

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BRITISH COLUMBIA

Ministry of Forests, Lands and Natural Resource Operations

Cover photograph: Quesnel TSA Matthew River Valley
contributed by Brad Powell, Quesnel Natural Resource District

Introduction

The British Columbia Ministry of Forests, Lands and Natural Resource Operations (FLNRO) regularly reviews the timber supply[a] for all timber supply areas[b] (TSA) and tree farm licences[c] (TFL) in the province. This review, the fifth for the Quesnel TSA, examines the impacts of current legal requirements and demonstrated forest management practices on the timber supply, economy, environment and social conditions of the local area and province. Based on this review the chief forester will determine a new allowable annual cut[d] (AAC) for the Quesnel TSA.

According to Section 8 of the *Forest Act* the chief forester must regularly review and set new AACs for all 38 TSAs and 35 TFLs in the Province of British Columbia (BC).

The objectives of the timber supply review are to:

- examine relevant forest management practices, environmental and social factors, and input from First Nations, forest licensees and the public;
- set a new AAC; and
- identify information to be improved for future timber supply reviews.

This discussion paper provides a summary of the results of the timber supply analysis for the timber supply review of the Quesnel TSA. Details about the data and assumptions used in the analysis were provided in a data package (June 2015). Updates to the information used and technical details regarding the analysis are available on request from the FLNRO Forest Analysis and Inventory Branch. The timber supply analysis should be viewed as a "work in progress". Prior to the chief forester's AAC determination for the TSA, further analysis may need to be completed and existing analysis reassessed as a result of input received on this discussion paper.

In May 2012, a Special Committee on Timber Supply was appointed by the Legislative Assembly of British Columbia to make recommendations to address the loss of mid-term timber supply due to mountain pine beetle (MPB) in the central interior of BC. Following its review of technical information and public, stakeholder and First Nations input, the special committee issued a report entitled *Growing Fibre, Growing Value* (August 2012). As described in *Beyond the Beetle: A Mid-term Timber Supply Action Plan* (October 2012), the FLNRO has responded to the special committee's recommendations.

Key ministry responses related to the provincial timber supply review program include:

- Review marginally economic forest types within each TSA and quantify the types and areas of forest that might justifiably be included in a partition[e], while respecting resource objectives for other values, such as wildlife and water.
- Where feasible and appropriate, provide information from the timber supply review to enhance public discussion of resource management objectives.

[a] **Timber supply**
Timber supply is the amount of timber available for harvesting over a specified period of time.

[b] **Timber supply areas (TSAs)**
Timber supply areas are integrated resource management unit established in accordance with Section 7 of the Forest Act.

[c] **Tree farm licences (TFLs)**
Tree farm licences are tenures that grant exclusive rights to harvest timber and manage forests in a specific area; may include private land.

[d] **Allowable annual cut (AAC)**
Allowable annual cut is the maximum volume of timber available for harvesting each year from a specified area of land, usually expressed as cubic metres of wood.

With regard to the ministry's responses to the special committee, marginally-economic stands and operability are noted under 'Sensitivity analyses' outlined later in this discussion paper. It is expected that this discussion paper will stimulate discussion of resource management objectives and practices within the Quesnel TSA and relevant information will be provided to the chief forester for consideration in determining a new AAC.

Timber supply reviews undertaken in support of AAC determinations are based on the current resource management objectives established by government in legislation and by legal orders. For the purposes of the Quesnel TSA timber supply review, forest management objectives are provided by the *Forest and Range Practices Act* (FRPA), the Cariboo-Chilcotin Land-Use Plan (CCLUP) initially declared as a higher level plan by Cabinet in 1996, and subsequent orders for specific objectives such as northern and mountain caribou habitat areas. The information compiled to support this timber supply review can be made available to support land use planning as required. However, land-use planning and land-use decisions are outside the scope of the chief forester's AAC determination. In the event that resource management objectives and practices change, these changes can be reflected in future timber supply reviews.

Timber supply review in the Quesnel TSA

The current AAC for the Quesnel TSA, effective January 11, 2011, is 4 000 000 cubic metres. This AAC includes a partition which limits the harvest of non-pine species to 650 000 cubic metres. The intent of the non-pine partition was to encourage the salvage of dead pine while conserving non-pine volume to mitigate the projected decrease in mid-term timber supply.

In June 2015, a data package documenting the data and forest management assumptions to be used in this timber supply analysis was released for public review and to assist with First Nations consultation. This discussion paper is being released in order to provide an overview of the timber supply review and to highlight the key findings of the timber supply analysis for the Quesnel TSA. Before setting a new AAC, the chief forester will review all relevant information, including the results of the timber supply analysis and input from government agencies, the public, licensees and First Nations. Following this review, the chief forester's determination will be outlined in a rationale statement that will be publicly available. The actual AAC that is determined by the chief forester during this timber supply review may differ from the harvest projections, including the base case, presented in this discussion paper as the chief forester must consider a wide range of information, some of which is not quantifiable. Ultimately, the chief forester's AAC determination is an independent, professional judgment based on the legal requirements set out in Section 8(8) of the *Forest Act.*

Once the chief forester has determined a new AAC, the Minister of Forests, Lands and Natural Resource Operations will apportion the AAC to the various licence types and programs as per Section 10 of the *Forest Act*. Based on the minister's apportionment, the regional executive director will establish a disposition plan that identifies how the available timber volume is assigned to the existing forest licences and, where possible, to new opportunities.

Description of the Quesnel TSA

The Quesnel TSA is located in the northern part of the Cariboo Region, lying in the Fraser Basin and the Interior Plateau between the Coast Mountains on the west and the Cariboo Mountains on the east. To the west of Quesnel and of the Fraser plateau, the TSA includes the Itcha-Ilgachuz mountain ranges and the intervening gently rolling terrain encompassing the Blackwater and Nazko river systems. To the east lie the Quesnel Highlands, Barkerville, and the Cariboo River.

[e] **Partition**
Under Section 8(5) of the Forest Act *the chief forester in determining an AAC can specify a portion of the AAC that is attributable to certain types of timber, terrain or areas of the TSA.*

The climate, terrain and forests of the Quesnel TSA are varied. West of the Fraser River, a relatively dry climate supports forests predominated by lodgepole pine. East of the Fraser River, the forests receive more rainfall and contain more spruce and subalpine fir. Overall, the TSA is covered by stands of lodgepole pine (85 percent by area), spruce (10 percent), and Douglas-fir (3 percent) with hemlock and subalpine fir, and deciduous species forming minor components. The Biogeoclimatic Ecosystem Classification (BEC) zones present in the TSA (in descending order by total area in the TSA) are sub-boreal pine-spruce; sub-boreal spruce; montane spruce; Engelmann spruce-subalpine fir; interior Douglas-fir; interior cedar-hemlock; and two alpine tundra zones.

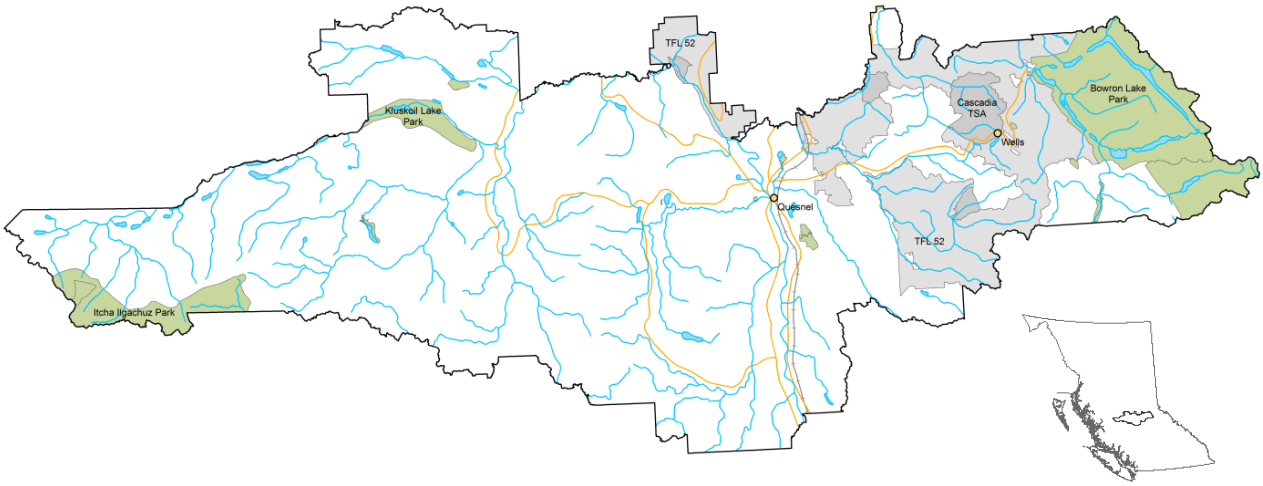


Figure 1. Map of the Quesnel TSA.

The TSA is administered by the FLNRO Quesnel Natural Resource District office in Quesnel. The Quesnel Natural Resource District includes, in addition to the Quesnel TSA, 65 woodlot licence areas, TFL 52 and the Wells Community Forest Agreement. The information provided in this discussion paper pertains to the TSA only, unless otherwise specified.

Environmental values

The distinct ecological features of the eight BEC zones in the Quesnel TSA contribute to high biodiversity values. The western portion of the TSA is characterized by higher elevation lodgepole pine and Interior spruce stands. Areas exposed to frequent wildfires usually regenerate to even-aged densely stocked stands of lodgepole pine. Where dominant old forests exist, white spruce, Engelmann spruce and subalpine fir are the main species. Minor components of Douglas-fir, black spruce, trembling aspen and black cottonwood can also be found.

The diverse forests host a range of wildlife species, of which some are considered to be endangered or threatened. Examples in the Quesnel TSA include woodland caribou, the American white pelican and northern goshawk. Species considered to be potentially threatened by human activities or natural events include bull trout, sandhill crane, grizzly bear, and fisher. The Blackwater River has a unique subspecies of rainbow trout.

Protection and management of environmental values are addressed under provincial and federal legislation. The FRPA is the primary provincial legislation regulating forestry practices. Under FRPA, the Forest Planning and Practices Regulation identifies objectives set by government for environmental values including fish, wildlife, biodiversity, soils and water that are to be addressed within forest stewardship plans. Orders may be established under the Government Actions Regulation or the Land Use Objectives Regulation for specific land uses such as ungulate winter ranges, wildlife habitat areas, critical habitat for fish, and old growth management areas (OGMA). Approximately 13 percent of the Quesnel TSA is provincially designated for the protection of its natural environment.

Natural resources

Numerous natural resources are associated with the forest land base. Forest products, recreation and tourism, ranching, and wildlife highlight the wide range of resources and values found in the Quesnel TSA. West of the Fraser River, the dry climate yields predominately lodgepole pine forests. East of the Fraser River, where rain and snow occur in higher amounts, the forests include spruce and subalpine fir.

Crown range provides forage for both livestock and wildlife. In the Quesnel area grazing occurs under the forest canopy as well as in early seral stage openings where forage is temporarily available a few years following harvesting or fire.

Parks, recreation sites and trails, and roaded and non-roaded areas provide opportunities for numerous outdoor activities. There are two large provincial parks (Bowron Lake Park and Itcha Ilgachuz Park), several smaller parks, as well as 43 recreation sites with 28 actively managed and 35 recreation trails in the area. There is a range of recreational activities such as hiking, canoeing, camping, guided horse tours, fishing, hunting, snowmobiling, dog-sledding, and downhill and cross-country skiing.

First Nations

The Lhoosk'uz Dene First Nation (Kluskus Band), the Lhtako-Dene First Nation (Red Bluff Band), the ?Esdilagh First Nation (Alexandria Band), and the Ndazkhot'en First Nation (Nazko Band) located within the TSA, as well as eight other First Nations communities located outside the TSA, have all asserted traditional territories or interests within the TSA.

First Nations are actively involved in the forest industry. First Nations companies hold nine non-replaceable forest licences of varying terms and annual harvest levels.

Regional economy

The major population centre in the TSA is the city of Quesnel with a population of 10,007 in 2011. The adjacent communities of Red Bluff, Barlow Creek, Dragon Lake and Bouchie Lake, contribute to the TSA's total population of 22,096 (BC Stats). Other communities within the TSA include Wells and Barkerville in the east, and Nazko and Kluskus villages in the west. The economies of the communities in the TSA are largely resource-based, and the majority is dependent on the local forest industry. Ranching, mining and tourism are also integral to communities in the TSA.

Table 1. Major primary timber processing facilities Quesnel TSA (FLNRO Competitive and Innovation Branch 2015)

Existing Demand					
Mill number	**Mill type**	**Company**	**Estimated annual capacity**	**Required log input in m^3**	**Capacity assumptions**
113	Chip mill	West Fraser Mills Ltd.	278,000 BDU	667,200	240 days per year, two 8-hour shifts per day
473	Log home mill	Reko Log Homes Ltd.		N/A	
252	Lumber mill	C & C Wood Products Ltd.	41,280,000 board feet	147,466	240 days per year, two 8-hour shifts per day
98	Lumber mill	Tolko Industries Ltd.	199,000,000 board feet	715,751	240 days per year, two 8-hour shifts per day
113	Lumber mill	West Fraser Mills Ltd.	371,000,000 board feet	1,334,391	240 days per year, two 8-hour shifts per day
931	Pellet mill	Pinnacle Renewable Energy Group	84,000 tonnes	N/A uses sawmill residuals	345 days per year, three 8-hour shifts per day
497	Pulp and Paper mill	Cariboo Pulp & Paper Co. Ltd.	323,000 tonnes	N/A uses sawmill residuals	345 operating days per year, 24 hours per day
553	Pulp and Paper mill	Quesnel River Pulp Company	377,000 tonnes	N/A uses sawmill residuals	345 operating days per year, 24 hours per day
112	Plywood mill	West Fraser Mills Ltd.	209,000,000 square feet 3/8" thick	413,191	240 days per year, three 8-hour shifts per day
112	Veneer mill	West Fraser Mills Ltd.	165,000,000 square feet 3/8" thick	326,204	240 days per year, two 8-hour shifts per day
113	Panel mill	West Fraser Mills Ltd.	190,440,000 square feet 3/8" thick	N/A uses sawmill residuals	345 days per year, three 8-hour shifts per day
			Total	3,604,203	

Note:

Canadian Forest Products Lumber Mill Number 110 was closed in 2014.

Numbers are based on: Major Primary Timber Processing Facilities in British Columbia 2013.

Conversion factors:

1 BDU = 2.4 m^3 log input

LRF = 0.278 mfbm/m^3

Solid wood conversion factor = 1.61 m^3/mfbm

Raw log conversion factor = 2.234 m^3 raw/m^3 sawn (nominal)

1 cubic meter (plywood) = 1130 square feet 3/8” thick

The Quesnel Natural Resource District has a large processing sector with three lumber mills, two pulp mills, a veneer/plywood plant, panel board plant, log home manufacturer and pellet mill. The district has seen a contraction in the number of timber processing facilities over the past 10 years. West Fraser's Northstar Mill and Canfor's mill have permanently closed. Currently, Tolko's Questwood Sawmill is running at half capacity with only one shift.

Land use planning

The Quesnel TSA lies within the area covered by the CCLUP. Forest development in the TSA is required to be consistent with legally established goals and objectives of this higher level plan. The timber supply analysis assumes that forest management and timber harvesting will be consistent with the CCLUP.

Forest management

Timber harvesting land base

As part of the process used to define the modelled timber harvesting land base (THLB) in the timber supply analysis, a series of deductions are made from the TSA land base. Table 2 shows categories of land that are considered not to contribute to the THLB. The table presents the area of the categories within the gross TSA boundary and the area for each factor that is uniquely (i.e., no overlaps with other factors) considered excluded from timber harvesting.

The total area within the TSA boundary covers 2 077 293 hectares, of which 66 percent—1 375 613 hectares—is Crown forest management land base (CFMLB). About 354 914 hectares of the CFMLB area in the TSA are in reserves for old growth, riparian areas, in areas of environmental sensitivity or low productivity, support non-merchantable forest types, or for other reasons are unavailable for timber harvesting. About 74 percent of the CFMLB, or 49 percent of the total TSA area, is included in the current THLB of 1 020 699 hectares.

Table 2. Quesnel TSA land base classification

Land classification	Total area	Percent of total area	Unique area excluded
TSA boundary	**2,077,293**		
Not administered by FLNRO	482,994	23.3	482,994
TFL 52 and Cascadia TSA	294,438	14.2	31,647
Private land	99,232	4.8	12,121
Crown managed	1,550,531	74.6	
Unclassified	2,730	0.1	2,730
Water	26,789	1.3	26,789
Non-vegetated	34,320	1.7	34,320
Vegetated non-forest	129,914	6.3	95,725
Roads and landings	15,799	0.8	15,354
Crown forest management land base	**1,375,613**	**66.2**	
Small area-based tenures	39,159	1.9	38,162
Parks	46,101	2.2	46,100
Old growth management areas	84,323	4.1	83,881
Wildlife habitat areas	70,881	3.4	70,353
Critical habitat for fish	6,971	0.3	5,927
Class A lakes	3,656	0.2	3,269
Recreation and historic trails	4,794	0.2	3,242
Mature birch	345	0.0	341
Riparian reserves and management areas	81,552	3.9	66,727
Inoperable	13,152	0.6	8,071
Low site	62,883	3.0	28,840
Timber harvesting land base	**1,020,699**	**49.1**	

[f]**Crown forest management land base (CFMLB)**
The forested area of the TSA that the provincial government manages for a variety of natural resource values. This excludes non-forested areas (e.g., water, rock and ice), non-productive forest (e.g., alpine areas, areas with very low productivity), and non-commercial forest. Under the direction of the CCLUP, parks and small area-based tenures contribute to the accounting for biodiversity targets and are therefore included in the CFMLB.

[g]**Timber harvesting land base (THLB)**
The THLB is an estimate of the land where timber harvesting is considered both acceptable and economically feasible, given the objectives for all relevant forest values, existing timber quality, market values and applicable technology. The THLB is derived from the data, forest management practices and assumptions described in the data package. It is a theoretical, strategic-level estimate used for timber supply analysis and could include areas that may never be harvested or may exclude areas that will be harvested.

Figure 2 shows the current age class distribution for forests in the CFMLB separated by THLB and non-THLB. The large amount of young forest in the THLB reflects the recent increase in harvesting to salvage MPB-killed pine and the large amount of non-THLB in the older forest classes reflects the non-timber management objectives.

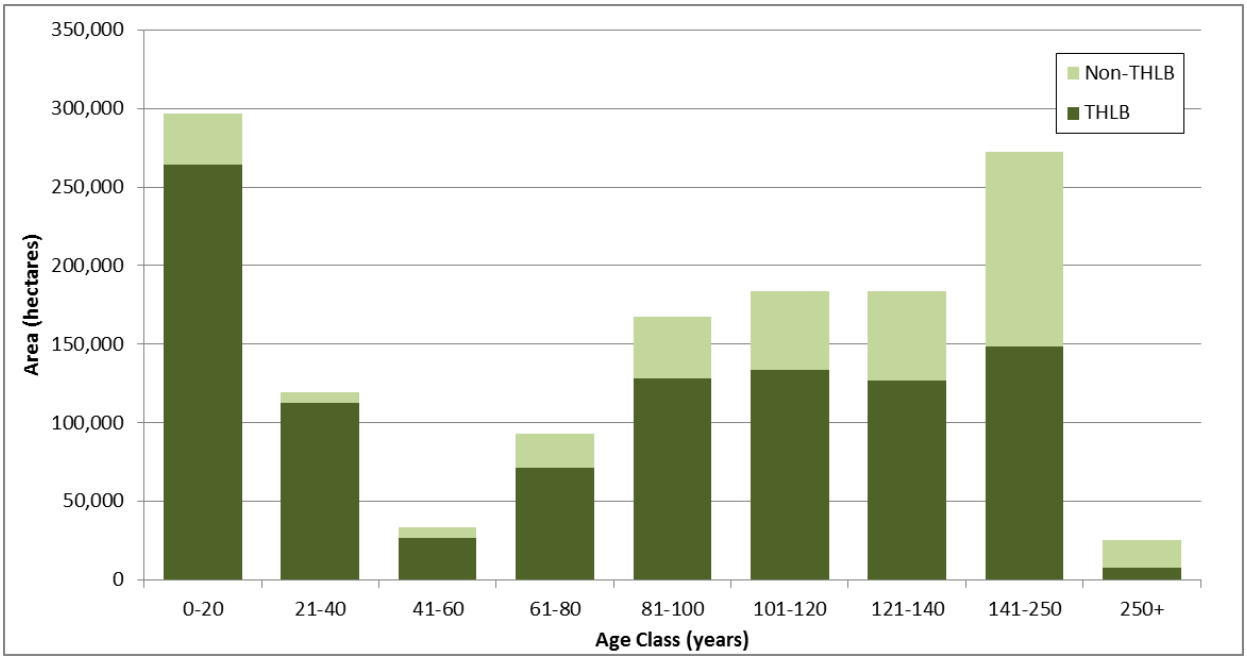


Figure 2. Age class distribution for the Crown forest management land base in the Quesnel TSA.

Figure 3 summarizes the area and current volume by leading species on the THLB and illustrates the loss of pine volume due to the MPB epidemic. The THLB area with no species represents the recently harvest area that is typed as non-forest in the inventory.

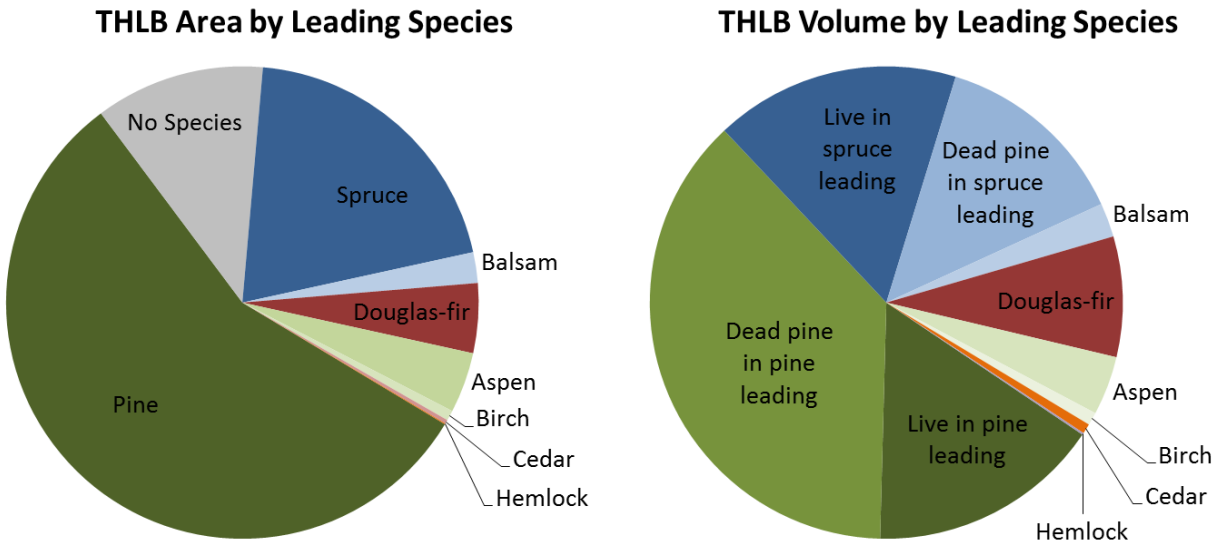


Figure 3. Leading species composition of the timber harvesting land base – Quesnel TSA.

Land base and forest management changes since 2011

The last AAC determination for the Quesnel TSA on January 11, 2011 was necessitated as part of an ongoing assessment of the MPB epidemic in the central interior. Since then, several changes have occurred to the land base, forest management data and practices, including:

- the end of the MPB epidemic;
- a new vegetation resource inventory (VRI) in the eastern TSA completed in 2011;
- a new landscape vegetation inventory (LVI) in the central TSA completed in 2013;
- a new provincial site productivity map (PSPL) based on predictive ecosystem mapping; and
- reconciled OGMA boundaries in 2015;

Mountain pine beetle

Mountain pine beetle (MPB) is native to BC and usually occurs at endemic levels. Epidemic outbreaks have occurred periodically throughout the Interior of BC and have played a vital role in the natural disturbance of pine forests, contributing to biodiversity and variation across the landscape.

Prior to the current epidemic, the largest outbreak in recorded history occurred between 1930 and 1936 on the Chilcotin Plateau. At its peak, this infestation affected 650 000 hectares; whereas, the area infested in the current epidemic is about 14.5 million hectares. In the early 1980's a severe MPB epidemic swept across the Chilcotin Plateau to the south of the TSA. The epidemic was subdued by extremely cold early winter weather in 1984 and 1985. Between 1998 and the summer of 2008 it is estimated that MPB killed approximately 620 million cubic metres of pine or about 46 percent of the commercially available pine volume in BC.

The magnitude of the recent outbreak has been attributed to two factors. First, due to the success of fire suppression over the past century, the area of mature lodgepole pine – the beetle's preferred host – has increased six-fold since 1910. The second factor is climate change. Historically, beetle populations have been limited by cold winters; however, the absence of sufficiently-cold temperatures in the interior has allowed large populations of beetles to survive the winters under the bark of the pine trees.

The infestation peaked in the Quesnel TSA in the summer of 2005. By 2009, approximately 68 percent of the forest inventory available for harvesting in the Quesnel TSA had been killed by the MPB epidemic. Very little new beetle attack has been observed since then and none is projected to occur over the next 10 years.

No assumptions are made about the potential end use of the dead pine (i.e., whether or not the fibre is of sufficient quality for use as sawlog, pulp or for bioenergy). All scenarios presented in this analysis assume that beetle-killed trees will remain standing for 15 years to demonstrate the volume available for all potential products. After 15 years, the dead trees are assumed to fall over and are no longer viable for harvest.

There has been a sustained effort by government and forest licensees within the Quesnel TSA to salvage MPB-infested stands. Between 2010 and 2015, 84.1 percent of the harvest volume was lodgepole pine and 85.2 percent of that pine was dead.

History of the allowable annual cut

The allowable annual cut (AAC) for the Quesnel TSA was first established in 1981, at 2.3 million cubic metres. In response to the early 1980's severe MPB epidemic that swept across the Chilcotin Plateau to the south, the AAC for the Quesnel TSA was increased by 50 percent to 3 450 000 cubic metres. The beetle infestation was subdued in 1984 and 1985 by extremely cold early winter weather, and, although the infestation in the Quesnel TSA never reached the high levels experienced in the Chilcotin area, the AAC increase (through a licence that expired in 1990) allowed a consortium of local licensees to harvest trees under attack and to salvage forest stands killed by beetles.

In 1989, the AAC for the TSA was further increased by 50 000 cubic metres to accommodate a partition for harvesting attributable to deciduous species. In 1990, when the area of TFL 52 was removed from the TSA, the AAC for the remaining area of the TSA was determined at 2 450 000 cubic metres. This included 400 000 cubic metres attributable to harvesting in problem forest types (PFT). In 1992 this partition was reduced to 300 000 cubic metres, for a total AAC of 2 350 000 cubic metres. In 1996, the AAC was determined at 2 340 000 cubic metres, of which 1 965 000 cubic metres were attributable to conventional sawlogs, 300 000 cubic metres were attributable to PFTs, and 40 000 cubic metres were attributable to deciduous species.

In 2001 during the initial outbreak of the current MPB epidemic, the AAC for the Quesnel TSA was set at 3 248 000 cubic metres to facilitate the salvage of timber and attempt to diminish the extent of future damage. Of this total AAC, 300 000 cubic metres were attributable to PFTs as defined by the Quesnel Forest District Manager, and 20 000 cubic metres were attributable to deciduous species.

Effective October 1, 2004, the AAC for the Quesnel TSA was further raised to 5 280 000 cubic metres, an increase of about 63 percent from the previous AAC. The purpose of this increase was to provide the district with sufficient AAC to salvage timber killed by the current and projected MPB epidemic. Of the AAC, 20 000 cubic metres were attributable to deciduous-leading species and 450 000 cubic metres were attributable to PFTs as defined by the Quesnel Forest District Manager.

On January 11, 2011, a new AAC for the Quesnel TSA was set at 4 000 000 cubic metres, a decrease of about 24 percent from the previous AAC. Of this total AAC, 650 000 cubic metres were attributable to non-pine volume. This AAC initiated what was expected to be a transitional decline in the AAC until the MPB-killed trees have been harvested. The PFT and deciduous partitions were removed as these areas showed reasonable current harvest performance. This AAC is in effect today.

Table 3 shows the harvest performance in the Quesnel TSA since the 2011 AAC determination. The non-pine harvest partition of no more than 650 000 cubic metres per year was never exceeded each year until 2015. The average non-pine harvest over the five years was 585 721 cubic metres per year.

Table 3. Harvest performance since the last AAC determination

Year	Total harvest volume (m^3/year)*	Non-pine partition harvest volume (m^3/year)*
2011	3,601,604	594,112
2012	4,223,751	619,732
2013	3,950,827	550,880
2014	2,687,348	468,742
2015	2,921,438	695,140

*Source: HBS Mark Monthly Scaling History.

Timber supply forecast

For most AAC determinations, a timber supply analysis is carried out using three categories of information: land base inventory, timber growth and yield, and management practices. Using this information and a computer model, a series of timber supply forecasts are produced to reflect different starting harvest levels, rates of decrease or increase, and potential trade-offs between short- and long-term harvest levels.

From a range of possible forecasts, one is chosen which attempts to avoid both excessive changes from decade to decade and significant timber shortages in the future, while ensuring the long-term productivity of forest lands. This is known as the 'base case' forecast and forms the basis for comparison when assessing the effects of uncertainty of the information modelled on timber supply. The base case is designed to reflect current management practices.

Because it represents only one in a number of possible forecasts, and because it incorporates information and modelling assumptions about which there may be some uncertainty, the base case is not an AAC recommendation. Rather, it is one possible timber supply forecast, whose validity - as with all the other forecasts provided - depends on the validity of the data and assumptions incorporated into the computer model used to generate it.

Due to the existence of uncertainty in the timber supply analysis, additional forecasts are usually prepared to test the effect of changing some of the assumptions or data used in the base case. These harvest forecasts are referred to as 'sensitivity analyses'. Both the base case and sensitivity analyses are prepared using a computer model that projects the future availability of timber for harvesting based on the growth of the forest and the level of harvesting, while staying within the legal land use objectives established by the provincial government.

The base case forecast

In this analysis the base case was constructed as three even-flows: one for the short term, one for the mid term and one for the long term. The three harvest levels were established with the objective of maximizing the mid term. The transition between the short- and mid-term occurs at the end of the salvage period. The transition to the long term occurs when 75 percent of the harvest comes from stands established after the onset of the MPB epidemic. The long-term harvest level was capped at a level that ensured the growing stock at the end of the forecast equated to a rotation's worth of harvest. Scenarios showing other possible transitions between the short- and mid-term are provided as alternate harvest flows.

The previous AAC determination reduced the harvest level to 4 000 000 cubic metres to bring it into alignment with the maximum rate of harvest achieved since the implementation of the temporary uplift for salvage harvesting. The AAC was fully utilized for the three years following the determination but harvest levels have started to decline in the past two years. The base case initial harvest level was set at 4 000 000 cubic metres per year to reflect the historic harvest performance and explore the potential for continued salvage harvesting.

In the base case (Figure 4), the initial harvest level was maintained for the first five years of the forecast. By 2020, the majority of the remaining MPB-killed pine trees are assumed to have fallen over after reaching 15 years since the peak of the MPB outbreak in 2005. The temporary uplift for salvage is no longer required at this time and the forecast harvest was reduced to the mid-term level of 1.617 million cubic metres per year. Stands that were established since the start of the MPB outbreak are forecast to become available for harvest 50 years from now. These stands are forecast to provide almost the entire harvest by 70 years from now and were able to support an increase to the stable long-term harvest level of 2.139 million cubic metres per year.

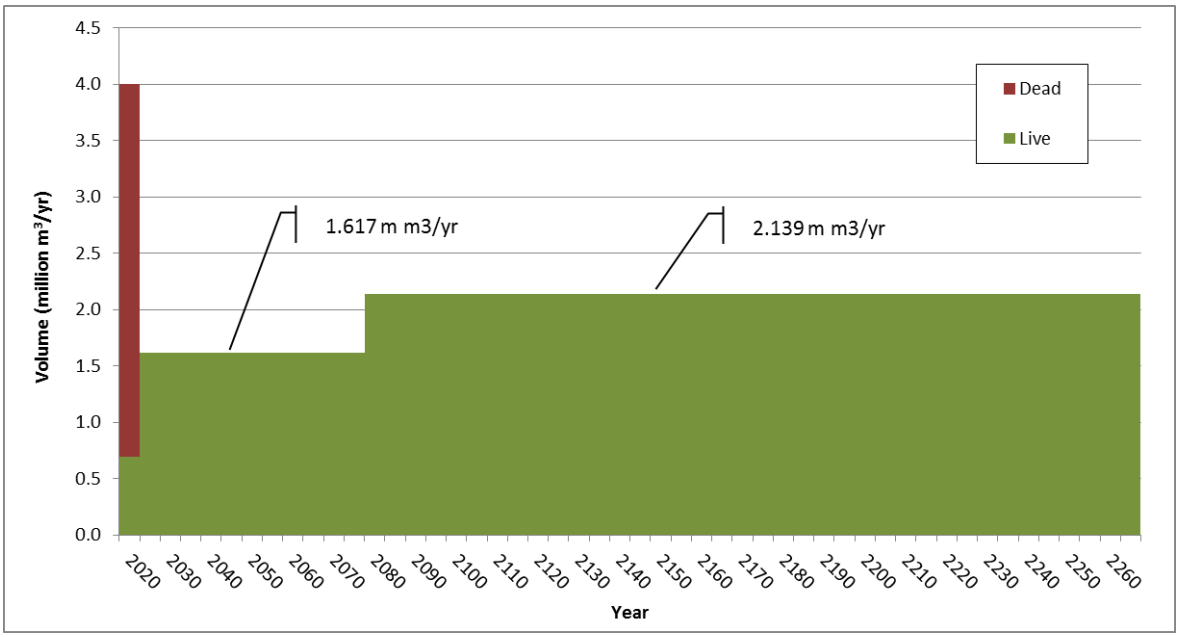


Figure 4. Base case – Quesnel TSA, 2015.

During the first five years of the forecast, approximately 700 000 cubic metres of the harvest is composed of live trees. Harvesting was limited to stands that are composed of more than 50 percent dead volume while the temporary uplift was in place. The live harvest volume represents the incidental harvest of live trees from stands that are mostly composed of dead volume. Over the first five years of the forecast the stands harvested averaged 83 percent dead. The constraint on the location of harvest was removed once the dead trees were assumed to no longer be viable for salvage and the forecast harvest was reduced to the mid-term level.

The base case is one of many alternative harvest flows possible. Figure 5 presents three alternatives that demonstrate how changing the initial harvest level or changing the assumptions regarding potential salvage can affect the forecast harvest levels in the following decades.

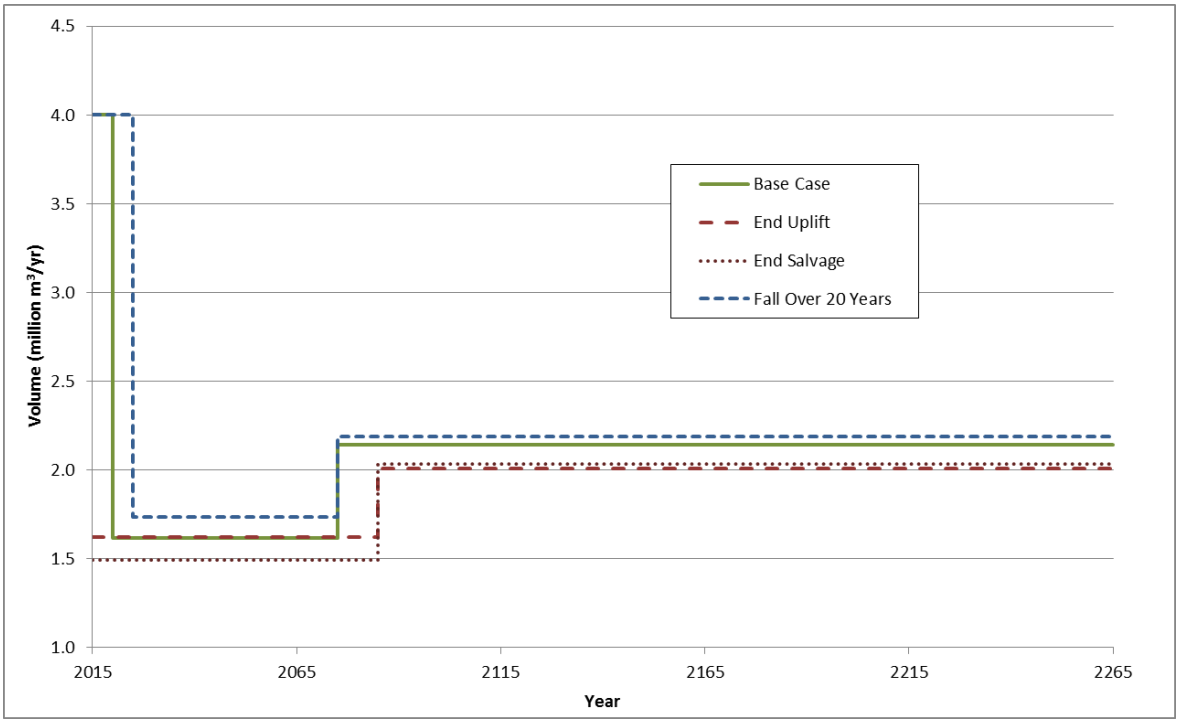


Figure 5. Alternative harvest forecasts – Quesnel TSA 2015.

An alternative harvest flow explored the implications of immediately removing the temporary uplift for salvage harvesting. The initial harvest level was set at the highest possible mid-term harvest level. There was a negligible difference between the mid-term harvest level of this forecast and the base case level. However, the first consequence of discontinuing accelerated salvage harvesting was a delay in the transition to the long-term harvest. There was insufficient volume to support an increased long-term harvest level until 80 years from now, as opposed to 70 years in the base case, without the contribution from managed stands established during the accelerated harvest in the first five years of the forecast. Some stands with a majority of dead volume are never able to meet the minimum harvest criteria once the dead trees fall over. Immediately reducing the harvest level in the alternative forecast resulted in a larger accumulation of stands that are never viable for harvest. The managed stand growing stock was reduced without the contribution of these stands and the long-term harvest level was reduced by 134 000 cubic metres per year (- 6.3 percent) compared to the base case level.

The first alternative harvest forecast removed the temporary uplift but assumed that salvage would continue to be a priority during the first five years of the forecast. A second alternative forecast explored the implications of ending both the uplift and the salvage harvest priority. The dead trees were immediately assumed to be no longer viable for harvest and the priority placed on stands with more than 50 percent dead volume was removed. With the salvage volume no longer available, stands that were reserved to support the mid-term harvest in the base case were harvested in the first five years. This resulted in a decrease in the mid-term harvest level of 127 000 cubic metres per year (- 7.9 percent) compared to the base case level. The two alternative forecasts both demonstrate the consequences to the long-term growing stock of immediately ending the uplift but the reduction to the long-term harvest level is slightly smaller in this forecast. The long-term harvest level is 104 000 cubic metres per year (- 4.9 percent) lower than the base case level.

In contrast to the previous forecast the final alternative harvest forecast explores the consequences of extending the temporary uplift. In this forecast it was assumed that dead trees would be viable for harvest for 20 years following the year of tree death as opposed to 15 years in the base case. This change allowed the initial harvest level of 4 000 000 cubic metres per year to be maintained for 10 years. The priority that limited harvest to stands with greater than 50 percent dead volume was maintained during the first 10 years. The additional harvest of dead volume allowed live stands to be reserved for harvest later during the mid term. This resulted in a mid-term harvest level 118 000 cubic metres per year (7.3 percent) higher than the base case. The additional harvested stands also increased the managed stand growing stock resulting in a long-term harvest level 51 000 cubic metres per year (2.4 percent) higher than the base case.

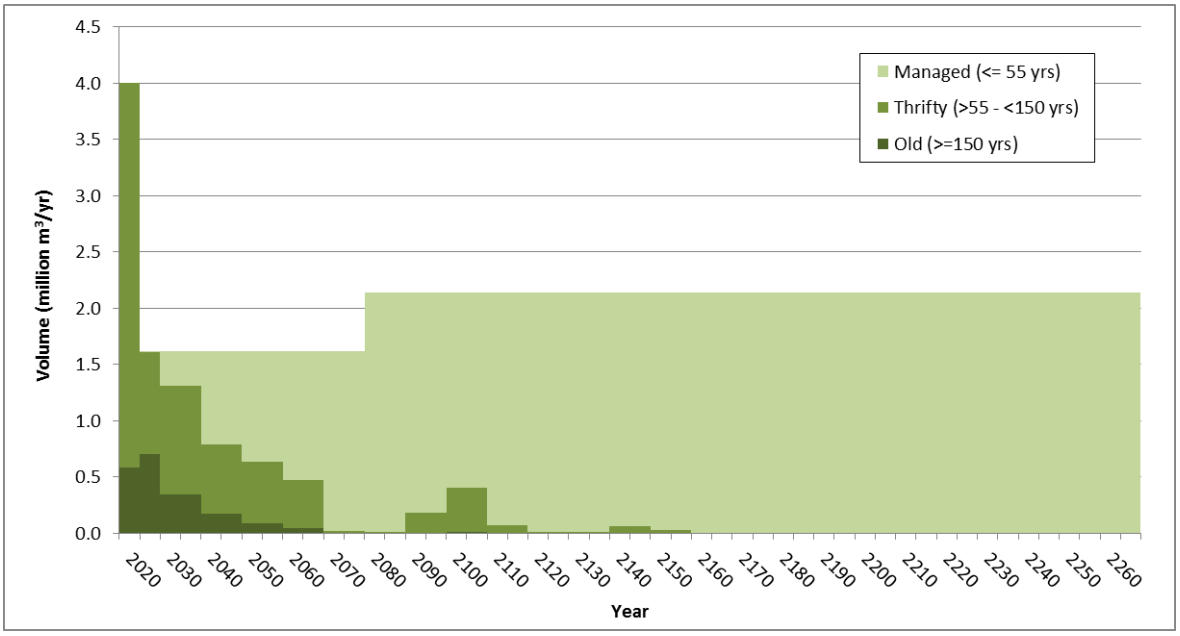
In the base case, the highest volume stands available for harvesting are prioritized for harvesting. While there is recognition that substitution of stands with different characteristics is often operationally feasible without affecting the harvest flow, it is important to reflect on the timing of the contribution of different stand types to the harvest flow in the base case *versus* current operational expectations. Figure 6 presents the characteristics of the stands harvested in the base case and the trends observed are discussed below.

Managed *versus* Existing Stands: In the base case, managed (i.e., stands harvested after 1959) stands are expected to start contributing to the harvest flow after one decade. By 2065, almost the entire harvest is forecast to be provided by managed stands.

Harvest Age: Salvage is completed after five years and the harvesting moves to older high volume stands in the regions of the TSA not impacted by MPB. As harvesting transitions from existing natural stands to managed stands the average harvest age is expected to become younger. Stands that are 50 years old or younger are forecast to contribute approximately 57 percent of the harvest at the completion of the transition to managed stand harvest in 2065. Stands that are 60 years or younger are expected to contribute to 94 percent of the harvest in the following decade. The average harvest age stabilizes at approximately 65 years over the long term.

Stand Volume: A significant decrease in stand volume is expected in five years across the MPB-impacted portion of the TSA when the majority of the dead trees fall over after 15 years since death. The average harvest volume does not follow the abrupt decrease in stand volume but rather transitions down gradually over many decades. The harvesting moves to older higher volume stands that were reserved over the previous 15 years of focused salvage harvesting.

Harvest Area: The abrupt decrease in the annual area harvested after five years results from the end of the temporary uplift for salvage harvesting as well as the transition of harvest to older high volume stands. The area harvested each year to sustain the mid-term harvest level is expected to increase as harvesting progresses into lower volume stands. This trend ends when the first high volume managed stands become available for harvest. A final abrupt increase in annual harvest area occurs when the harvest is forecast to increase to the long-term level. The area disturbed accounts for the area retained through group selection or single tree selection silviculture systems in mule deer winter range or caribou management areas.



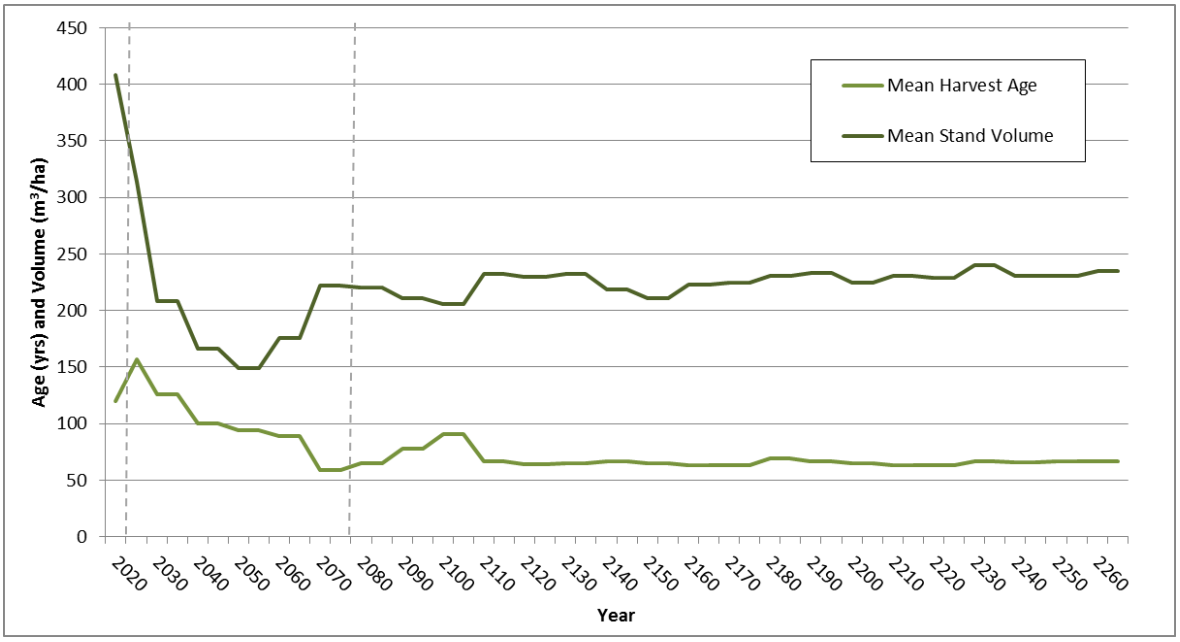


Figure 6. Harvested stand characteristics of the base case — Quesnel TSA, 2015.

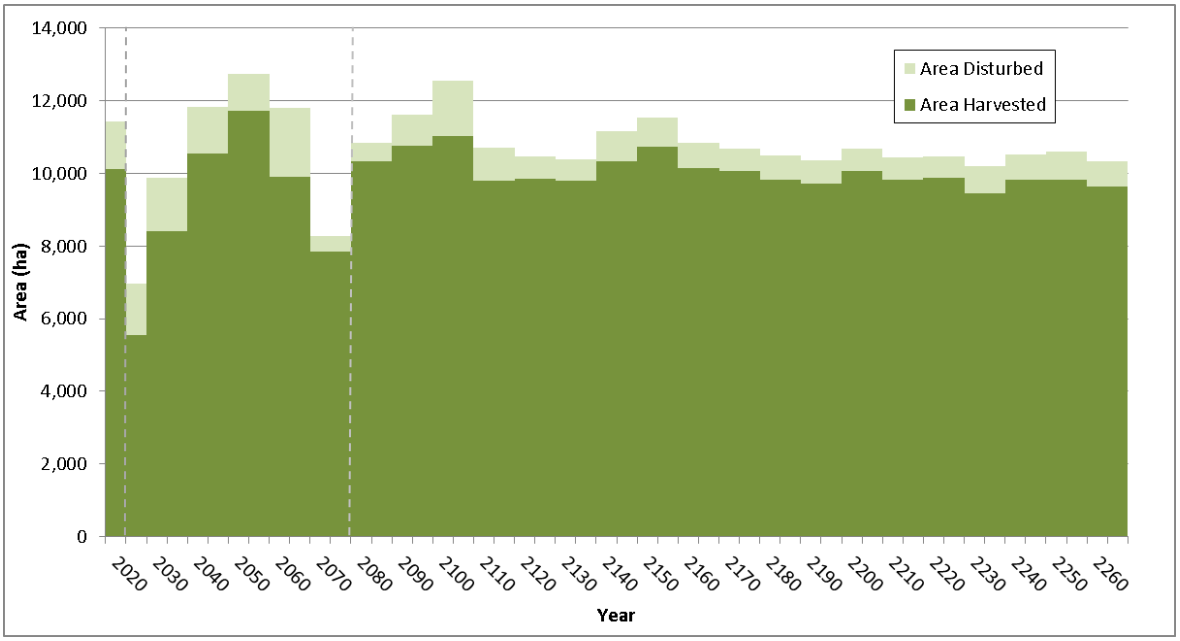


Figure 6. Harvested stand characteristics of the base case — Quesnel TSA, 2015 (concluded).

Sensitivity analyses

The base case uses a specific set of data and assumptions that are intended to reflect forest composition and growth, legally-established land use objectives and current forest management practices. However, while the base case is designed to reflect current management in the Quesnel TSA, there is uncertainty about some management information and the modelling framework. Therefore, sensitivity analyses are used to provide further understanding by examining the effect on timber supply of uncertainty in data and assumptions. The results of the sensitivity analyses completed are summarized in Table 4 below.

Table 4. Adjusted harvest flow sensitivity analyses where mid-term = years 5-70, long-term = years 80-250

Issue tested	Sensitivity levels	Percent impact	
		Mid term	Long term
Timber harvesting land base	Include marginal and inoperable stands (gross THLB)	+ 7.3	+ 3.6
Natural stand yields	+ 10%	+ 10.1	+ 2.6
	- 10%	- 10.3	- 6.3
Existing managed stand yields	+ 10%	+ 3.9	0
	- 10%	- 3.5	- 0.4
Future managed stand yields	+ 10%	+ 0.8	+ 6.6
	- 10%	- 1.1	- 11.6
Minimum harvestable age	+ 5 years	- 5.4	+ 2.4
	- 5 years	+ 5.8	- 5.6
Minimum harvestable volume	80 m^3/ha	+ 0.5	+ 0.5
	90 m^3/ha	+ 0.2	+ 0.5
	100 m^3/ha	+ 0.2	+ 0.3
	120 m^3/ha	- 2.9	- 3.7
	150 m^3/ha	- 19.3	- 11.6
Short rotation pine harvest	35 - 40 years harvest age	- 1.1	- 1.4
Green-up height	+ 1 m	- 0.4	+ 0.2
	- 1 m	+ 0.5	+ 0.5
Visual quality objectives	Increase retention class	- 2.0	- 2.1
	Decrease retention class	+ 1.7	+ 0.7
Visual absorption capacity	Increase absorption class	+ 1.4	+ 1.0
	Decrease absorption class	- 1.1	- 0.9
Utilization	All species at 12.5 cm DBH	+ 3.0	0
Deciduous	Exclude deciduous leading	- 7.9	- 7.4
Dead pine fall over age	+ 5 years	+ 7.3	+ 2.4
	- 5 years	- 7.9	- 4.9
Abandon MPB salvage	Use uplift to harvest in live stands	- 37.5	- 1.8
	Immediately reduce cut to mid-term level	+ 0.2	- 6.3
Site index adjustment project (2009)	Use SIA and VRI site index	- 12.2	- 23.3
	Use SIA and PSPL site index	- 0.4	- 5.1
Kluskus harvest performance	Limit haul distance to 120 km	- 5.7	- 6.3
Terrain stability mapping	Exclude unstable and potentially unstable	- 1.7	- 0.9
Genetic gain	Apply no genetic gain	- 0.4	- 6.5
Natural regeneration	Increase pine natural regeneration	- 13.4	- 15.8

The *Data Package* committed to perform three additional sensitivity analyses that could not be completed at the time this *Discussion Paper* was published. The young stand monitoring project was expected to provide adjustments to be applied to both site index and species composition. These adjustment factors are still under development at this time. The OGMA reconciliation was listed as a sensitivity analysis at the time the *Data Package* was published but the revised OGMA boundaries have since been made legal through a ministerial order amending the land-use order (October 26, 2015).

Wildlife habitat supply analysis

The timber supply review process will include a habitat availability analysis for moose, grizzly bear, marten, lynx, and northern goshawk. The completed timber supply analysis provides a forecast of the inventory attributes over time which can now be used in the habitat supply analysis. The results of the habitat analysis will be presented along with the timber supply analysis results for consideration by the chief forester at the AAC determination meeting.

Similarly, the forecast of inventory attributes may also be utilized for cumulative effects analysis. If completed in time, the results of a cumulative effects analysis will also be considered by the chief forester at the AAC determination meeting.

Conclusion

The base case started with an initial harvest level of 4.0 million cubic metres per year which reflects the temporary uplift currently in place. However, an alternative harvest forecast shows the initial harvest level can be set at any transitional step between 4.0 million and the forecast mid term of 1.617 million cubic metres per year with no effect on timber supply until the transition to the long term. The alternative harvest forecast is based on the assumption that salvage of MPB-killed trees will remain a priority over the next five years.

The other alternative harvest forecasts demonstrated the reliance of future harvest levels on continued salvaging of dead pine. The total harvest of live volume was limited to approximately 700 000 cubic metres per year over the first five years in the base case. If this assumption is not met, and harvest of live volume increases, the mid-term and long-term timber supply will both be reduced. Conversely, if salvage harvesting can be extended beyond the next five years, it may be possible to increase both the mid-term and long-term timber supply.

Although the above timber supply analysis is a significant source of information provided to the chief forester for consideration, the chief forester's AAC is not a calculation solely based on this strategic level analysis. The AAC determination of the chief forester is an independent judgment based on professional experience and consideration of the broad range of social, economic and environmental factors required under Section 8 of the *Forest Act* in addition to the timber supply analysis.

Your input is needed

Public input is a vital part of establishing the allowable annual cut. Feedback is welcomed on any aspect of this discussion paper, the data package or any other issue related to the timber supply review and the allowable annual cut determination for the Quesnel TSA.

Ministry staff would be pleased to answer questions to help you prepare your response. Please send your comments to the resource district manager at the address below.

Your comments will be accepted until July 15, 2016.

You may identify yourself on the response if you wish. If you do, you are reminded that responses will be subject to the *Freedom of Information and Protection of Privacy Act* and may be made public. If the responses are made public, personal identifiers will be removed before the responses are released.

For more information or to send your comments, contact:

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Ministry of Forests, Lands and Natural Resource Operations
322 Johnston Avenue,
Quesnel, BC V2J 3M5
Telephone: 250-992-4400 Fax: 250-992-4403

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Further information regarding the technical details of the timber supply analysis is available on request by contacting Forests.ForestAnalysisBranchOffice@gov.bc.ca

Visit the Forest Analysis and Inventory Branch web site at http://www.for.gov.bc.ca/hts