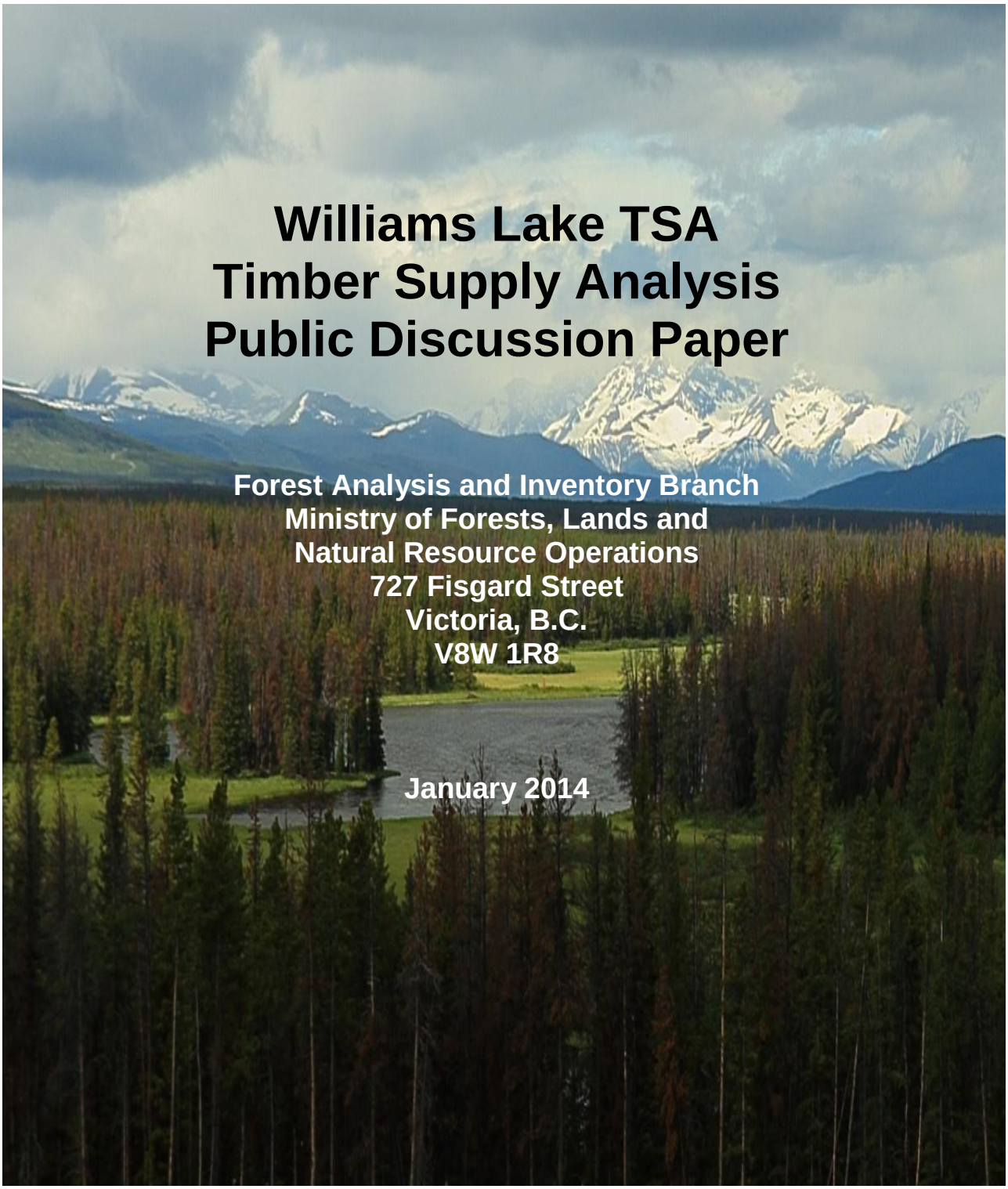

Williams Lake TSA Timber Supply Analysis Public Discussion Paper

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 courtesy of Dan Hicks
Ministry of Forests, Lands and Natural Resource Operations
Cariboo-Chilcotin Natural Resource District
Circle A Lake and Coast Mountains

Introduction

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

According to Section 8 of the *Forest Act* the chief forester must regularly review and set new AACs for all 38 TSAs and 34 TFLs in the Province of British Columbia (BC).

The objectives of the timber supply review are to:

- examine relevant forest management practices, economic, 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 public discussion paper provides a summary of the results of the timber supply analysis for the timber supply review of the Williams Lake TSA. Details about the initial information used in the analysis were provided in an April 2013 data package. Updates to the information used and the technical details of the final analysis will be available April 2014 on request from the Forest Analysis and Inventory Branch of FLNR. 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 inputs received during this review process.

In May 2012, a Special Committee on Timber Supply was appointed by the Legislative Assembly of British Columbia to make recommendations to address the reduction 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), FLNR has responded to the special committee's recommendations. Key ministry responses related to the provincial timber supply review program include:

[a]**Timber supply**
The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.

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

[c]**Tree farm licences (TFLs)**
Provides rights to harvest timber and outlines responsibilities for forest management in a particular area.

[d]**Allowable annual cut (AAC)**
The maximum amount of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood.

- Review marginally economic forest types within each timber supply area (TSA) and quantify the types and areas of forest that might justifiably be included in a partition[e] within the timber harvesting land base[f] (THLB), 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.

With regard to the ministry's responses to the special committee, the potential contribution of marginally economic stand types to fibre supply will be discussed under sensitivity analysis exploring minimum stand merchantability. It is expected that this public discussion paper will enhance discussion of resource management objectives and practices within the Williams Lake 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 current resource management objectives and practices. For the purposes of the Williams Lake TSA timber supply review, one source of resource management objectives is provided by the Cariboo-Chilcotin Land Use Plan (CCLUP), which is described in more detail in the "Land use planning" section of this paper. The information compiled to support this timber supply review can be made available to support land use planning activities, as required. 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 Williams Lake TSA

On April 18, 2007, following an urgent timber supply review due to the MPB infestation, the chief forester set the AAC for the Williams Lake TSA at 5 770 000 cubic metres. In his rationale, the chief forester stated that his determination was predicated on the entire AAC being harvested from stands with at least 70 percent pine that are located west of the Fraser River.

In April 2013, 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 Williams Lake TSA. Before setting a new AAC, the chief forester considers all relevant information, including the results of the timber supply analysis and input from government agencies, the public and First Nations on both timber and non-timber values. Following this review, the chief forester's determination will be outlined in a rationale statement that will be publicly available. The actual AAC determined by the chief forester during this timber supply review may differ from the harvest projections presented in this public discussion paper, including the base case, as the chief forester must consider a wide range of information, some of which cannot be quantified. Ultimately, the chief forester's AAC determination is an independent, professional judgement based on the legal requirements set out in Section 8(8) of the *Forest Act*.

Once the chief forester has determined the 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.

[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.*

[f]**Timber harvesting land base (THLB)**
The portion of the Crown forest land base (CFLB) that is managed for timber supply by the Ministry of Forests, Lands, and Natural Resource Operations where timber harvesting is both legally allowed and economically feasible, while meeting objectives for all relevant forest values, existing timber quality, market values and applicable technology.

Description of the Williams Lake TSA

The Williams Lake TSA is located in the central 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. The TSA is bounded by the Quesnel TSA to the north, and 100 Mile House and Lillooet TSAs to the south. The climate, terrain and forests of the 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.

The TSA covers about 4.93 million hectares, of which approximately 66 percent—3 238 188 hectares—is Crown forest land base[g] (CFLB). About 1 408 272 hectares of the TSA are in reserves for old growth, wildlife habitat, wildlife tree patches or riparian areas, in areas of environmental sensitivity or low productivity, non-merchantable forest types, or for other reasons are unavailable for timber harvesting. About 56 percent of the CFLB, or 37 percent of the total TSA area, comprise the current timber harvesting land base of 1 829 922 hectares.

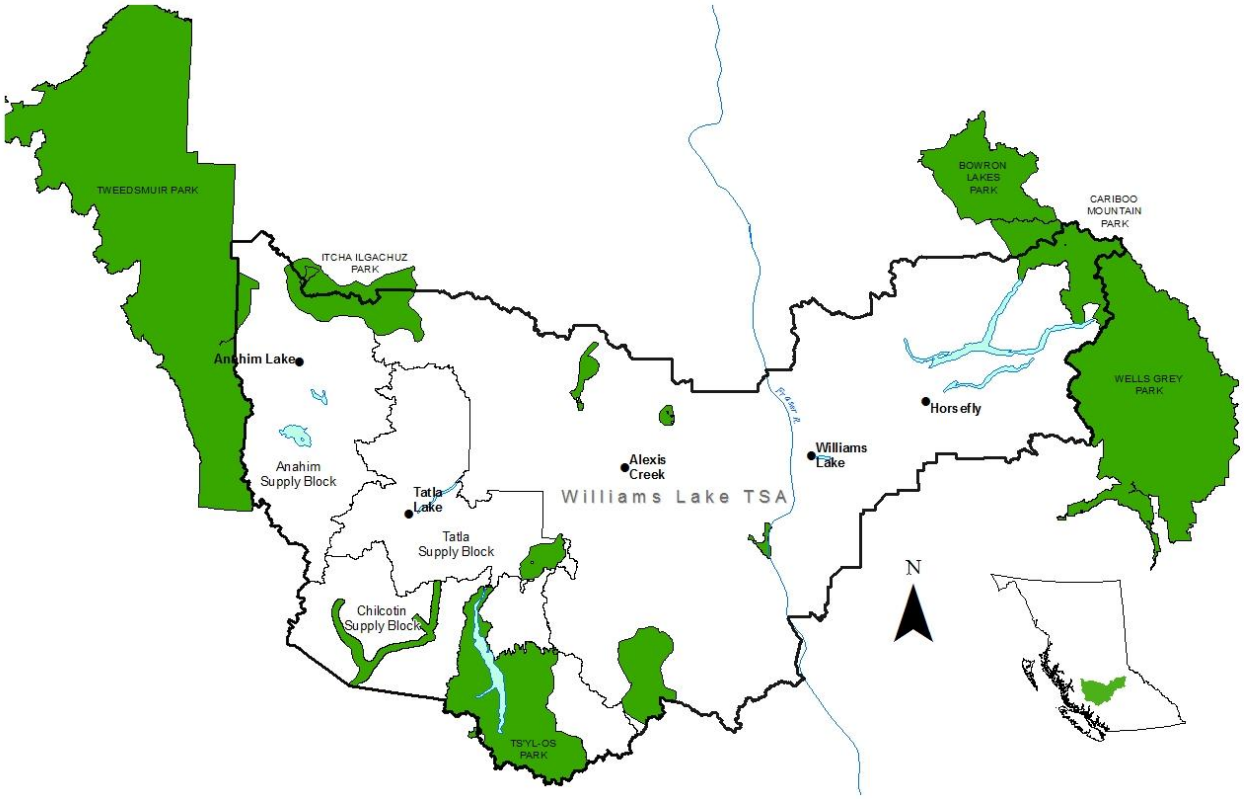


Figure 1. Williams Lake TSA.

[g]**Crown forest land base (CFLB)**
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 (e.g., brush areas). The CFLB does include federal protected areas because of their contribution to biodiversity.

The TSA is administered by the FLNR Cariboo-Chilcotin Natural Resource District office in Williams Lake. There are 53 woodlot licences and three community forest agreements within the boundaries of the TSA. The AAC for these tenures are determined through a separate process and they do not contribute to the AAC for the TSA. The information provided in this discussion paper pertains to the remainder of the TSA only, unless otherwise specified.

The major population centre in the TSA is the city of Williams Lake with a population of 10,938 in 2012 (BC Stats). The smaller communities of Horsefly, Likely, Miocene, Alexis Creek, Anahim Lake, Tatla Lake, Riske Creek, Big Creek, Nimpo Lake, 150 Mile House, Big Lake, and Mcleese Lake contribute to the TSA's total population of approximately 25,000.

First Nations

The following First Nations (including tribal councils and associations) have communities or reserve holdings in the timber supply area: Tsilhqot'in National Government , Xats'ull (Soda Creek), Stswecem'c/Xgat'tem (Dog Creek/Canoe Creek), Esketemc First Nation (Alkali Lake), T'exelc (Williams Lake), Tl'esqox (Toosey), Tl'etinqox (Anaham), Yunesit'in (Stone), Xeni Gwet'in (Nemiah Valley), Tsi Del Del (Alexis Creek), 'Esdilagh (Alexandria), Ulkatcho, Tsq'escen (Canim Lake).

In addition, First Nations with interests but located outside of the timber supply area include: 'Esdilagh (Alexandria), Bridger River Indian Band, Canim Lake Band, Da'naxda'xw/Awaetlala First Nation, High Bar First Nation, Homalco First Nation, Lhoosk'uz Dene (Kluskus First Nation), Lheidli T'enneh, Lil'wat Nation, Nanwakolas, Nazko First Nation, Northern Shuswap Tribal Council, Nuxalk Nation, Lhtako Dene (Red Bluff), Simpcw First Nation, Skin Tyee Nation, St'at'imc Chiefs Council (Lillooet), T'it'q'et First Nation, Ts'kw'aylaxw First Nation (Pavilion).

First Nations have identified the importance of wildlife in the Williams Lake TSA and the need to consider the impacts of harvest levels on First Nation rights with respect to wildlife. To assist with this understanding, the ministry conducted a preliminary habitat supply assessment and projections for moose, grizzly bear, and pine marten. Initial results of this analysis are included in Appendix A. More detailed results will be made available for discussions with First Nations communities and other interested parties during the next few weeks.

Regional economy

The city of Williams Lake is located in the heart of the Cariboo-Chilcotin Region and is the principal centre in the region for transportation, trading, financial, educational, healthcare, travel, and administrative services. Many residents from the outlying communities commute daily for employment or to use the services available in Williams Lake.

The economies of the communities in the TSA are largely resource-based, and the majority of them are dependent on the local forest industry. Ranching, mining and tourism are also integral to communities in the TSA. The forest industry is the main economic driver in the region. According to the report *British Columbia Local Area Dependencies: 2006*, the forest sector accounts for 27 percent of the basic income in the Williams Lake area. Other sectors providing employment in the Williams Lake area include; the public sector (22 percent), construction (7 percent), mining (5 percent), tourism (4 percent), agriculture (2 percent).

The forest sector supports numerous other jobs in the area through companies and employees purchasing goods and services.

The Williams Lake area has a large processing sector with three major lumber mills, one veneer/plywood plant, one smaller lumber mill, two log home manufacturers, a remanufacturing plant and a pellet mill. There are other small processing plants in some outlying areas, but their operations are intermittent. In 2012, sawmills and other solid wood mills processed approximately 3.4 million cubic metres of logs per year, which includes volume harvested from within and outside of the Williams Lake TSA.

There is a large wood waste-fuelled electric generating plant. Each year it consumes over 600,000 tons of wood waste from local sawmills to generate about 66 megawatts of electricity for sale primarily to BC Hydro.

Since the last TSR, one sawmill in Williams Lake was closed indefinitely, primarily due to poor market conditions.

There are also two large mines in the region, Gibraltar and Mount Polley, which contribute to the local economy.

Land use planning

The Cariboo-Chilcotin Land Use Plan (CCLUP) was designated as a higher level plan in 1995. The CCLUP addresses the long-term balance of environment and economy in the region and guides application of forest legislation and other resource management activities within the plan area.

The CCLUP establishes access to timber for the local forest industry, and certainty for the mining, ranching and tourism industries while also establishing conservation and recreation objectives for many natural values in the Cariboo Region. The CCLUP seeks to provide economic and social stability and increased opportunities for growth and investment throughout the region.

A key part of implementing the CCLUP was the completion of Sustainable Resource Management Plans (SRMPs). Seven SRMP planning areas covering the entire Cariboo Region have been completed. SRMPs address CCLUP strategies and targets on an area-specific basis and provide detailed objectives and strategies for the management of natural resources and the maintenance of environmental values.

A Land Use Order declared by the provincial government in June 2010 under Section 93.4 of the *Land Act* sets legal direction for forestry activities with respect to key resource values from the SRMPs. The order contains objectives and maps for a number of important values including biodiversity, old growth, critical habitat for fish, community areas of special concern, lakes, riparian, mature birch retention, grasslands, scenic areas, trails and high value habitat for moose and grizzly bears. Additional orders establishing wildlife habitat areas for northern caribou were declared in 2004 and for mountain caribou in 2009. Ungulate winter ranges for mule deer were also established under the *Government Actions Regulation* (GAR) in 2006 and 2007. Smaller wildlife habitat areas for other species have also been established but the impact to forest land area is very small.

The natural resources

Numerous natural resources are associated with the forests of the Williams Lake TSA, including forest products (timber and non-timber), forage, minerals, recreation and tourism amenities, as well as a variety of fishery and wildlife habitats.

The Williams Lake TSA includes three general landscape types. The Chilcotin Plateau, west of the Fraser River, is characterized by a drier climate with extensive lodgepole pine forests and some Douglas-fir, and is bounded on the west by the Coast Mountains. The central portion of the TSA, both east and west of the Fraser River, has mixed species forests, primary leading in Douglas-fir and lodgepole pine, interspersed with open range lands. To the east of the Fraser River, the rolling plateau gently increases in elevation to meet the Cariboo Mountains and Quesnel Highlands where forest of spruce, pine, western redcedar, western hemlock and subalpine fir predominate.

The diverse landscapes of the Williams Lake TSA provide a variety of wildlife habitats, including grasslands, wetlands, forested slopes, and alpine areas. Large mammals in the TSA include mule deer, moose, mountain goat, caribou, California bighorn sheep, cougar, lynx, black bear, grizzly bear, coyote and wolf. Many smaller furbearing species such as snowshoe hare, pine marten, fisher, and squirrel are also common. The TSA has numerous rivers, lakes and streams that support many species of fish such as sockeye and chinook salmon, steelhead, sturgeon, rainbow trout, kokanee and bull trout.

Environmental values

Current forest management follows the legislative requirements of the *Forest and Range Practices Act* (FRPA) and associated regulations as well as the direction given by the CCLUP which are designed to maintain a range of biodiversity and wildlife values. All forested lands, whether they contribute to timber supply or not, help to maintain critical habitats for many species. In the Williams Lake TSA, about 44 percent of the CFLB is not considered suitable or available for timber harvesting and will provide for additional environmental values.

The *Forest and Range Practices Act* designates wildlife habitat areas with specific management practices for species at risk. Currently, a number of species identified as 'at risk' may be found in the Williams Lake TSA, among them the American white pelican, sandhill crane, grizzly bear, mountain caribou and northern goshawk.

Protecting water quality and quantity is an important management objective of the TSA. Significant demands are placed on water resources for domestic and agricultural purposes, as well as maintenance of fisheries values and aquatic ecosystems.

This timber supply analysis reflects the current land use and management practices designed to maintain biodiversity, wildlife habitat, visual quality, water quality, recreation areas, riparian areas, and protection of unstable terrain.

Forest management

Timber harvesting land base

As part of the process used to define the timber harvesting land base (THLB) in the timber supply analysis, a series of deductions are made from the TSA land base. The land base on which timber harvesting is expected to occur is 37 percent of the total land area of the Williams Lake TSA. The remaining 63 percent of the TSA is not suitable or available for timber harvesting, because of ecological, economic or social considerations.

The total area within the boundaries of the Williams Lake TSA is 4 934 367 hectares. After accounting for lands that are not Crown-owned or are under area-based forest tenures, non-productive land (e.g., rocks, swamps), and existing roads, the CFLB that remains is 3 238 194 hectares. Approximately 27 percent of the CFLB is excluded from harvesting because it occurs in parks, recreational areas, community areas of special concern, old growth management areas (OGMA), fish and wildlife habitat, or riparian (see Table 1). Another 16 percent of the area is excluded from harvesting because it is uneconomic or on terrain unsuitable for timber harvesting. This land continues to provide for other values. The current timber harvesting land base is 1 829 922 hectares.

Table 1. Derivation of the timber harvesting land base

Land classification	Gross area (ha)	Area net of overlaps with prior items		
		Area (ha)	Percent (%) of total	Percent (%) of CFLB
Total TSA area	**4,934,367**			
Non-Crown land	456,277	456,277	9.25%	
Non-productive land	1,316,627	1,205,296	24.43%	
Existing roads	34,600	34,600	0.70%	
Sub-total		**1,696,173**		
Crown Forest Land Base	**3,238,194**		**65.63%**	**100%**
Trail buffers	44,719	23,428		0.72%
Parks	595,464	262,832		8.12%
Non-commercial brush	1,132	357		0.01%
Old growth management area	295,713	239,608		7.40%
Wildlife habitat area	1,597	650		0.02%
Caribou no-harvest area	167,541	153,748		4.75%
Community area of special concern	436,083	65,612		2.03%
Critical fish habitat	50,782	14,622		0.45%
Riparian area	208,190	82,545		2.55%
Unstable terrain	84,016	28,659		0.89%
Steep slopes	442,461	20,314		0.63%
Low productivity sites	2,061,062	393,405		12.15%
Deciduous types	162,861	76,042		2.35%
Wildlife tree patches	143,489	46,450		1.43%
Sub-total		**1,408,272**		
Timber harvesting land base	**1,829,922**		**37.08%**	**56.51%**
Future roads		30,558		
Long-term THLB	**1,799,364**			**55.57%**

Figure 2 shows the composition of the CFLB and THLB by leading species. Note that deciduous-leading stands are not included in the THLB, and that lodgepole pine-leading stands comprise 57 percent of the CFLB and 64 percent of the THLB. Areas that were recently harvested or burned were classified as “no species” because the inventory file was not yet updated to reflect what was planted in those areas.

Figure 3 shows the age class distribution for forests in the CFLB separated by THLB and non-THLB. The large amount of young forest in the THLB reflects the recent increased harvesting to salvage MPB-killed pine.

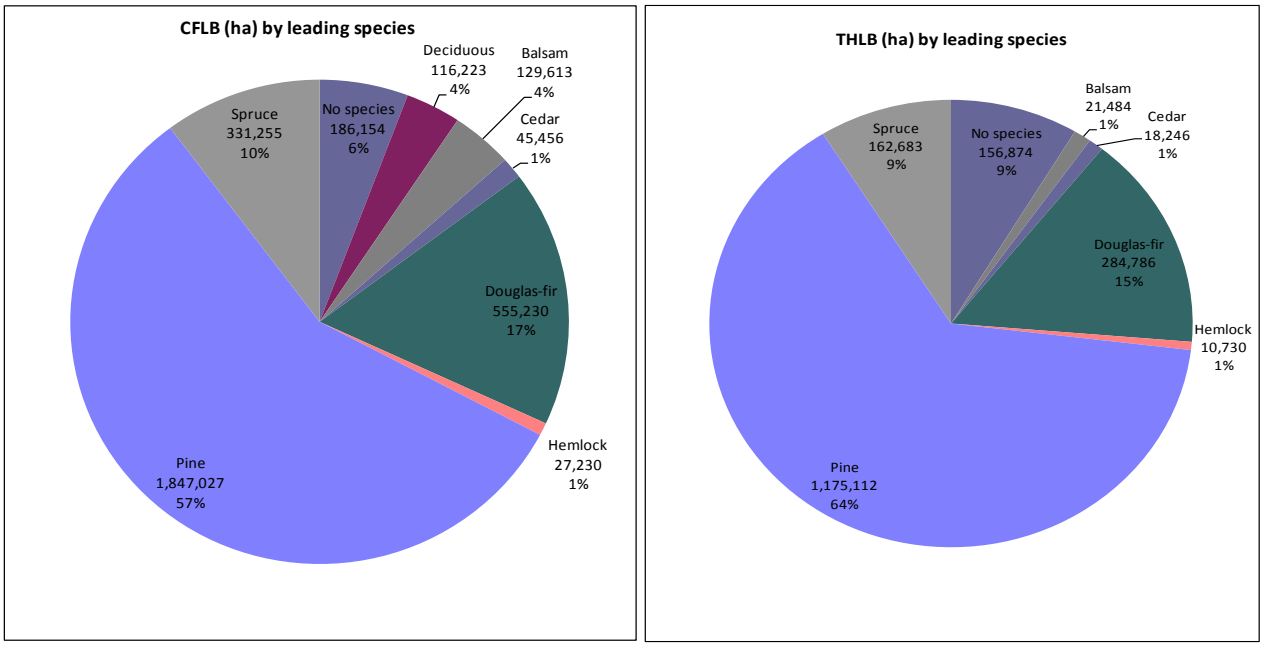


Figure 2. Proportion of leading species for the Crown forest land base and timber harvesting land base of the Williams Lake TSA.

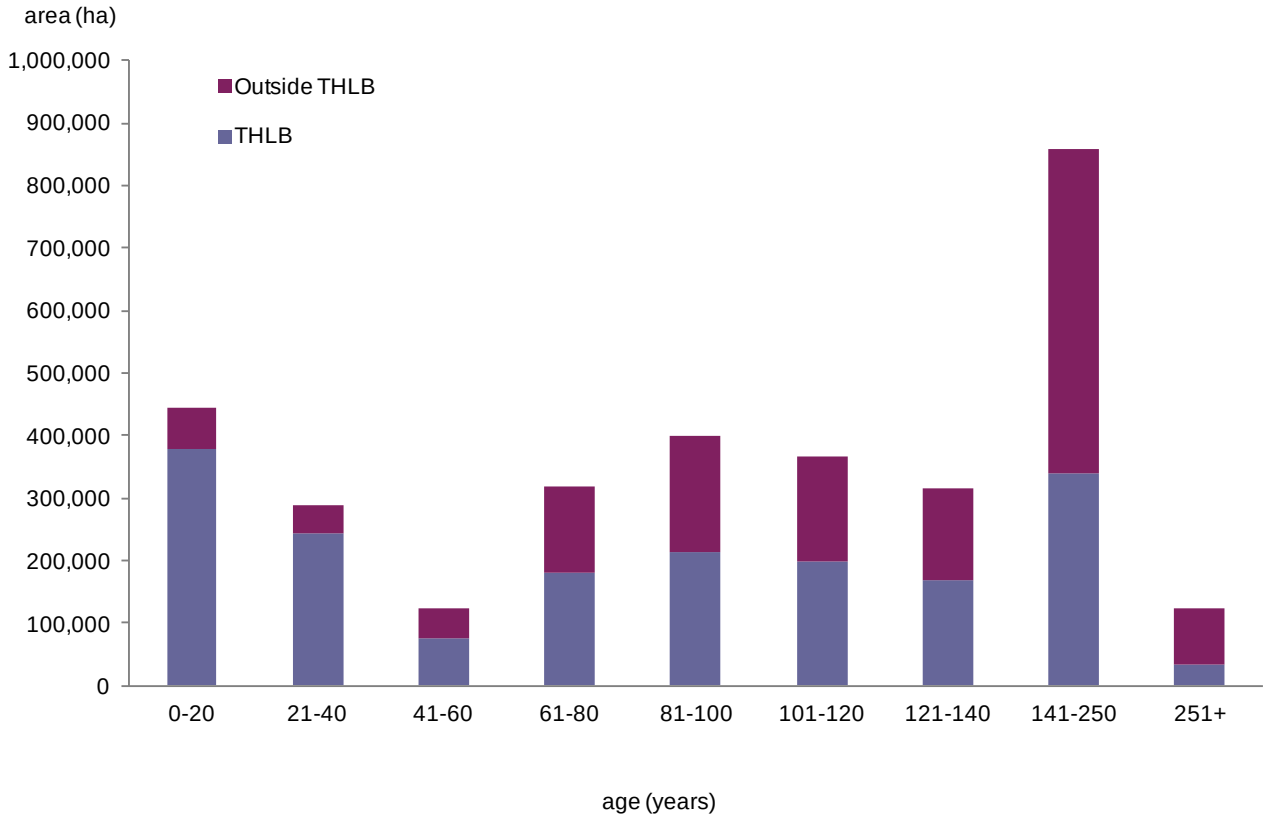


Figure 3. Age class distribution of stands in the Crown forest land base in the Williams Lake TSA.

Land base and forest management changes since 2001

The last AAC determination for the Williams Lake TSA on April 18, 2007 was an urgent decision in response to the MPB epidemic sweeping the central Interior. The analysis conducted for that decision used an updated version of the September 2001 timber supply analysis. Since then, several changes have occurred to the land base and forest management data and practices. These changes are reflected in this timber supply analysis. The major changes are:

- the most recent estimates of pine mortality using the BC Mountain Pine Beetle (BCMPB) model version 9 shows that the infestation is largely over and total mortality has stabilized at about 60 percent;
- establishment of spatial old growth management areas and other land use designations;
- improved site productivity estimates based on ecosystem mapping;
- new natural stand yield projections using Variable Density Yield Projection (VDYP) model version 7 without adjustments;
- estimates of minimum stand merchantability were revised from 65 m^3/ha for all stands to 80 m^3/ha and age 60 years for pine-leading stands, and 120 m^3/ha and age 80 years for non-pine leading stands.

Mountain Pine Beetle epidemic

Mountain pine beetle 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 this most recent outbreak, a major beetle infestation swept across the Chilcotin plateau during the early 1980s until it was curtailed by extremely cold early winter weather in 1984 and 1985. The total area in the province infested in the current epidemic is about 14.5 million hectares. Between 1998 and the summer of 2011 it is estimated that mountain pine beetle killed approximately 710 million cubic metres of pine or about 53 percent of the commercially available pine volume in B.C.

The magnitude of the current outbreak has been attributed to two factors. First, due to the success of fire suppression over the past century, there was an accumulation of mature lodgepole pine stands on the land base. The second factor is climate. Historically, beetle populations have been limited by cold winters; however, the absence of extreme cold temperatures in the Interior has allowed large populations of beetles to survive the winters under the bark of pine trees.

It appears that the infestation peaked in the Williams Lake TSA in the summer of 2005. By 2012, approximately 60 percent, or 86 million cubic metres of mature pine volume in the timber harvesting land base in the Williams Lake TSA had been killed by the mountain pine beetle epidemic. There has been very little new attack since 2009. The impacts of the mountain pine beetle epidemic were modelled in all the forecasts presented in this paper.

Shelf life

A major assumption impacting any salvage program is the estimated shelf life of the dead lodgepole pine, or the length of time dead trees are expected to remain commercially viable. After that time, the dead pine is considered a non-recoverable loss and the volume of the dead trees is excluded from the projected harvest. The actual length of time that dead pine can be salvaged determines when harvest will have to shift to live stands.

There are no definitive studies about sawlog shelf life of MPB-killed pine stands in British Columbia. The infestation in the Chilcotin of the 1980s occurred mainly in the dry ecosystems west of the Fraser River and harvesting continued for about 15 years after the infestation collapsed. Many of those stands harvested still had a significant component of live pine which made them economically viable for harvest despite the component of dead stems.

In the data package, it was planned to use a shelf life of 20 years, i.e., beetle-killed trees would remain standing for 20 years after death and be useable for some purpose but not necessarily sawlogs. Since the majority of trees harvested in the TSA are used to produce lumber rather than other forest products, it was later decided that a sawlog shelf life estimate of 10 years would more accurately reflect actual practices. Sawlog shelf life is defined as the length of time a tree is capable of producing sawlogs after attack by the mountain pine beetle.

Since sawlog shelf life depends on mill technology, market prices and environmental conditions, it was decided to conduct a sensitivity analysis using a shelf life of 20 years. The results of this sensitivity analysis are discussed later in this document.

In this analysis, it was further assumed that if after 20 years beetle-killed stands are unharvested they will revert to stands aged 25 years and continue growing as natural stands. This estimate is based on an assumption that pine stands regenerate naturally after beetle infestation but will not benefit from practices applied to managed stands.

Ministry and licensees response to the beetle infestation

There has been a sustained effort by government and forest licensees within the Williams Lake TSA to salvage mountain pine beetle infested stands. Between 2010 and 2013, 76 percent of the harvest volume was lodgepole pine, of which 78 percent was dead due to mountain pine beetle.

This has been accomplished through the following beetle management strategy:

- annual monitoring of MPB populations;
- targeted harvesting of stands with active beetle infestation to facilitate population control;
- harvesting of affected stands before their economic value is degraded;
- encouraging increased stand level retention to compensate for large opening sizes;
- increasing the AAC to allow for increased harvesting capacity to support beetle population management and salvage damaged timber; and
- issuing new non-replaceable forest licences restricted to the harvesting of lodgepole pine-leading stands with significant levels of beetle damaged timber.

History of the allowable annual cut

The Williams Lake TSA was established in 1981 with an allowable annual cut of 2 500 000 cubic metres. During the following years the AAC was adjusted and partitioned as shown in Table 2 to reflect changes in the TSA such as the beetle outbreak of the early 1980s and the identification of stand types to support Pulpwood Agreement (PA) 16.

Historically the three western supply blocks (WSB) (Anahim, Tatla, and Chilcotin) have been given special consideration in timber supply reviews because of the lower stand volumes and distance from milling facilities. The three western supply blocks were not included in the AAC determination until 1989, as until then those areas were considered uneconomic to be harvested. As will be shown later in Appendix B (maps of projected harvest areas and volumes), short-term harvest of mountain pine beetle salvage stands needs to be focused in areas west of the Fraser River to maximize the salvage of mountain pine beetle stands. This will allow harvest of non-pine stands east of the Fraser River after mountain pine beetle salvage is completed.

Table 2. History of the AAC for the Williams Lake TSA

Year	AAC (m^3/year)	Main TSA	Three WSB	Deciduous	PA 16	MPB killed or damaged wood
1981	2,500,000	2,500,000				
1985	3,750,000	2,500,000				1,250.000
1989	4,092,510	2,500,000	600,000			992,510
1992	3,975,000	2,500,000	600,000	25,000		875,000
1996	3,807,000	2,500,000	350,000		107,000	850,000
2003	3,768,400	2,361,400	450,000		107,000	850,000
2007	5,770,000					5,770,000

Effective April 18, 2007, in order to support a forest management strategy in response to the MPB epidemic, the AAC for the Williams Lake TSA was set at 5 770 000 cubic metres. This represented a 2 001 600 cubic metre (53 percent) increase from the previous AAC. The determination was predicated on harvesting the entire AAC from stands with at least 70 percent pine located west of the Fraser River.

Data from the Ministry's Harvest Billing System show that the average volume harvested during the past 10 years (2003-2012) from the Williams Lake TSA was 3.31 million cubic metres per year.

Timber supply forecasts

The purpose of the current timber supply review is to provide the chief forester with information to consider in determining a new AAC for the Williams Lake TSA. One of the key issues in this determination, and potentially subsequent ones, is to identify the best way to manage the flow of timber from the suitable remaining mature forest until currently immature stands are suitable for harvesting.

In a timber supply analysis, one harvest forecast is presented as an outcome of the best available data and current management practices. This forecast is referred to as the 'base case'. The base case is not an AAC recommendation, but rather one of many sources of information the chief forester will consider when setting the AAC. The AAC determined by the chief forester may be greater or less than the initial harvest level presented in the base case.

Due to the existence of uncertainties in the input data and management assumptions, additional forecasts are usually conducted to examine how sensitive the base case forecast is to changes in the input assumptions. These forecasts are called sensitivity analyses. Both the base case and sensitivity analyses were prepared using a computer model that projects the future availability of timber for harvesting based on the growth of the forest and level of harvesting, while staying within the legal objectives established by the provincial government under higher level plans (see Land use planning).

The base case forecast

In the base case, the initial harvest level was set at 3.4 million cubic metres per year, which is the current harvest level in the TSA. Since there is still much beetle-killed pine volume remaining in the TSA, the short-term harvest focuses on dead, pine-leading stands. After all salvageable pine-leading stands are harvested, i.e., before the 10-year sawlog shelf life expires, harvest shifts to existing live stands. After 10 years, the harvest level drops from 3.4 million m^3/year to 1 420 500 m^3/year and stays at that level for 50 years.

Managed stands will become the main source of timber supply after 60 years and the analysis shows the harvest level increases to the long-term harvest level of 2 994 000 m^3/year (see Figure 4) at that time. Appendix B shows the area and volume harvested by landscape unit in the base case.

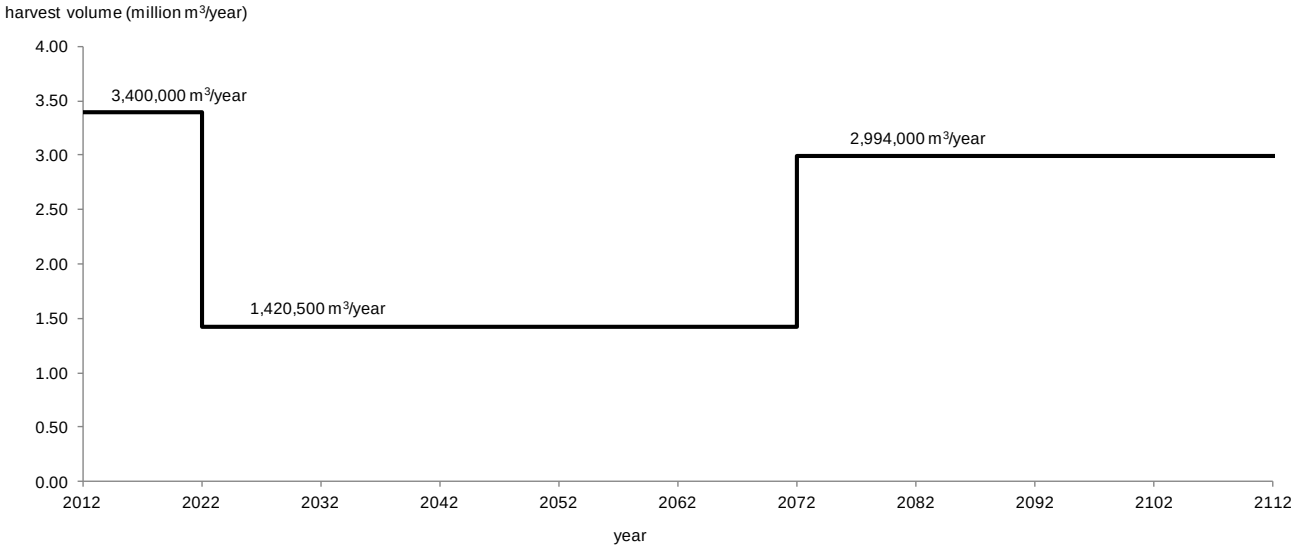


Figure 4. Base case harvest forecast - Williams Lake TSA 2013.

The following table shows details of the volume harvested for the first 20 years or 4 periods (1 period = 5 years) by species group, live *versus* dead, and years since death.

Table 3. Harvest volume by species group and years since death for the first 20 years – base case

	Harvest volume (m^3/year)			
Volume category	**Period 1**	**Period 2**	**Period 3**	**Period 4**
Non-pine	189,878	1,022,170	1,344,415	1,355,146
Live pine	1,763,101	1,706,564	75,132	63,176
Dead within 2 years	11,901	2,750	0	287
Dead within 2 to 4 years	53,111	2,750	780	309
Dead within 4 to 6 years	166,678	22,264	70	9
Dead within 6 to 8 years	435,733	150,918	68	108
Dead within 8 to 10 years	779,578	492,564	11	1,442
Total	3,399,980	3,399,980	1,420,475	1,420,475

As shown in Table 3, during the first five-year period, pine accounts for 94 percent of the total harvest volume. During the second period, harvest shifts to non-pine-leading stands but pine volume still accounts for 70 percent of the total harvest. Table 3 also shows that of the total pine volume harvested, approximately 55 percent is live volume in period one and 72 percent is live volume in period two. After the first 10 years, the harvest is composed of non-pine stands because the pine is either harvested or past the assumed shelf life.

During the first 10 years harvest primarily occurs west of the Fraser River, where pine stands are dominant (Figure 5). After 10 years, the mid-term begins, and harvesting from the east of the river contributes significantly to the total harvest. When second-growth stands become harvestable after 60 years, harvest activity shifts back to the west of the TSA.

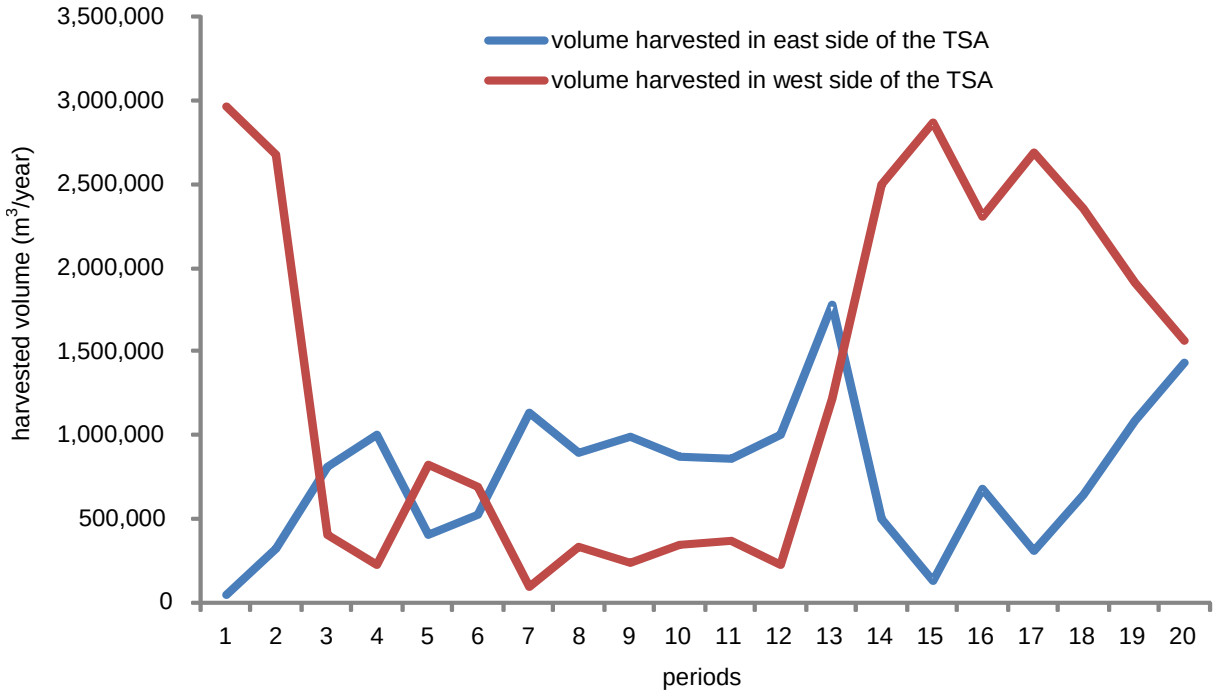


Figure 5. Harvest volume from east and west sides of the Fraser River - base case.

Since mid-term timber supply depends on the availability of live trees, alternative harvest forecasts were conducted to test whether the mid-term timber supply could benefit from harvesting less live trees in the short term. Figure 6 and Table 4 show that by harvesting less live volume in the second period (approximately 1.6 million m^3/year compared to 2.7 million m^3/year of live volume in the base case) it is possible to increase the mid-term timber supply by 84 500 m^3/year, or six percent, to 1 505 000 m^3/year. Compared to the base case, the reduction in harvest in the short term is 6 million m^3, whereas the total increase in the mid-term (2022 – 2072) is about 4.2 million m^3. However, if licencees are able to harvest dead pine for longer than 10 years after death, it will be possible to increase harvest levels in the second period beyond the level of 2.2 million m^3/year shown in this alternative harvest forecast. In determining AACs, the chief forester has the ability to set partitions limiting the amount of green timber harvested.

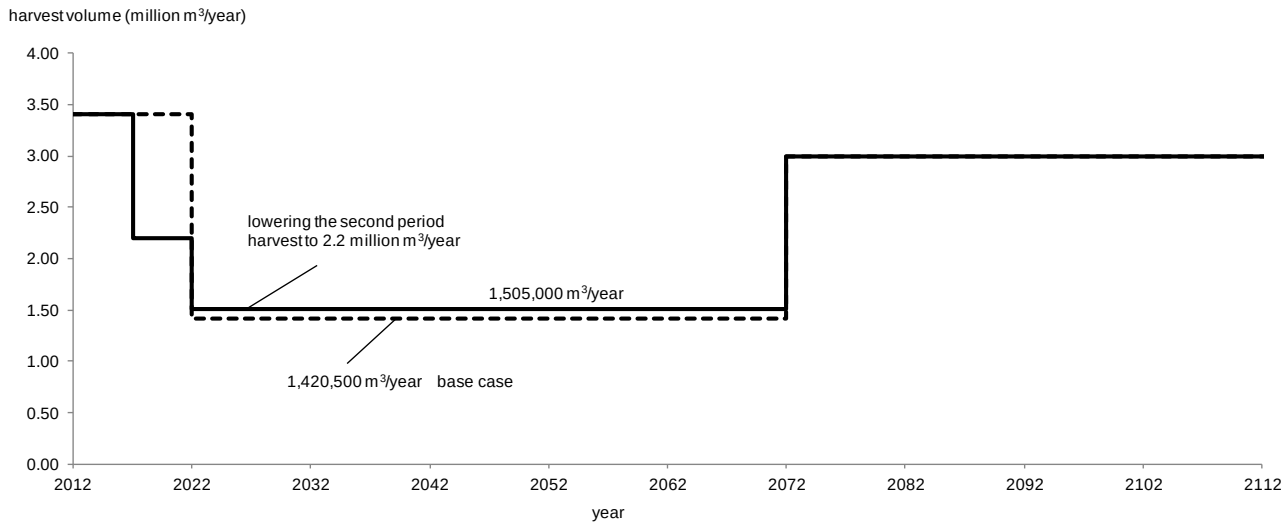


Figure 6. An alternative harvest flow - Williams Lake TSA.

Table 4. Harvest volume by species group and years since death for the first 20 years - an alternative harvest flow

	Harvest volume (m^3/year)			
Volume category	**Period 1**	**Period 2**	**Period 3**	**Period 4**
Non-pine	190,429	358,481	1,405,048	1,433,689
Live pine	1,763,035	1,254,724	96,276	69,844
Dead within 2 years	11,956	506	420	186
Dead within 2 to 4 years	53,172	621	1,514	244
Dead within 4 to 6 years	166,763	17,356	503	0
Dead within 6 to 8 years	435,411	133,365	611	74
Dead within 8 to 10 years	779,215	434,894	626	960
Dead within 10 to 12 years	0	0	0	0
Dead within 12 to 20 years	0	0	0	0
Total	3,399,980	2,199,947	1,504,998	1,504,998

Sensitivity analysis #1 – minimum harvestable volume for pine stands 65 m^3/ha for 60 years

One of the main sources of uncertainties in this analysis is the criterion for minimum merchantability of pine-leading stands. Pine-leading stands in the Chilcotin plateau are typically of low volume, but the easy terrain helps to lower harvest cost. Previous TSRs used 65 m^3/ha as the minimum harvestable volume (MHV). Harvest data records for the period 1997 to 2009 showed that 80 m^3/ha better represents minimum merchantability for these stands. Hence 80 m^3/ha was used as the minimum merchantability in the base case. A sensitivity analysis using 65 m^3/ha as the minimum harvestable volume for pine-leading stands for the first 60 years was conducted and the results are shown in Figure 7.

As a result of lowering the minimum harvestable volume to 65 m^3/ha for pine leading for the first 60 years, the analysis showed an increase in mid-term timber supply of 480 600 m^3/year (34 percent) to 1 901 100 m^3/year. The main reason for this increase in timber supply is that the lowered minimum harvestable criterion allowed those beetle-killed stands which would have fallen below the merchantability cut off to remain eligible for harvesting and contribute to timber supply.

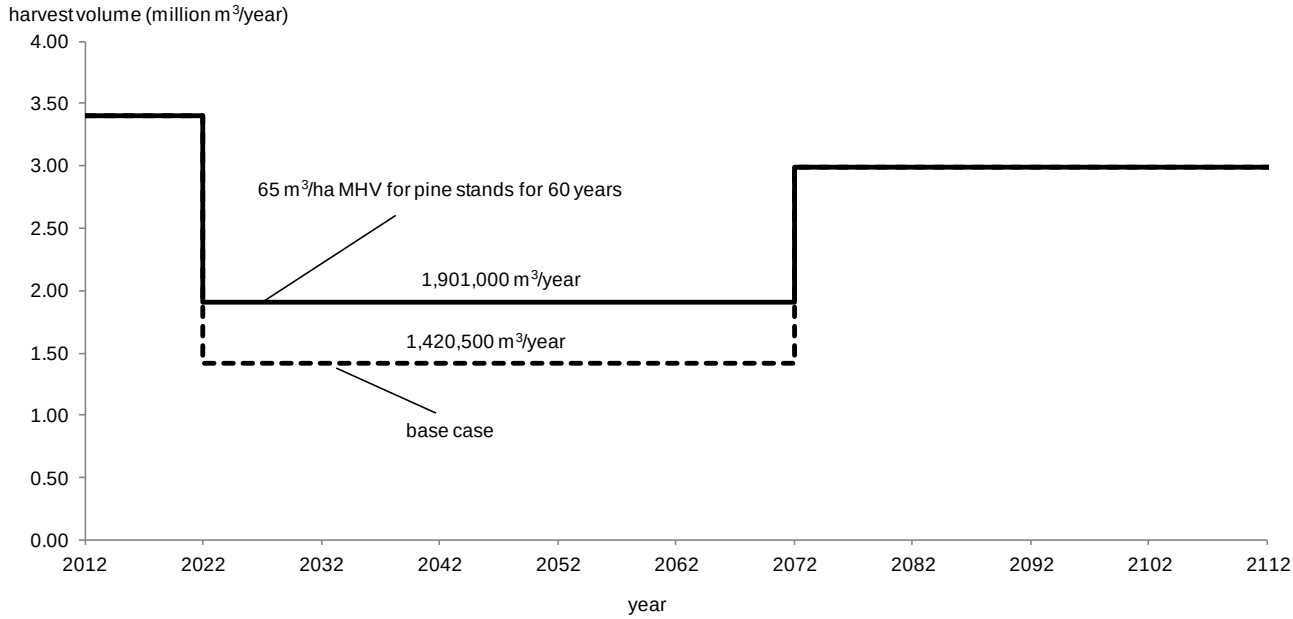


Figure 7. Minimum harvestable volume for pine-leading stands reduced to 65 m^3/ha - Williams Lake TSA.

Sensitivity analysis #2 – 20-year shelf life for MPB-killed trees

There is considerable uncertainty and debate about the actual sawlog shelf life for beetle-killed trees. The base case assumed a shelf life of 10 years, but there are many examples of MPB-killed trees being harvested for a longer period after death.

Figure 8 shows that by assuming a shelf life of 20 years it is possible to increase the mid-term harvest level by 531 800 m^3/year, or 41 percent to 1 952 300 m^3/year. Assuming a longer shelf life allows stands to meet the minimum merchantability criterion for a longer period and contribute to the harvest. The current infestation started in 1999, which means that almost all dead trees are still within a 20-year shelf life and may remain salvageable for another seven years.

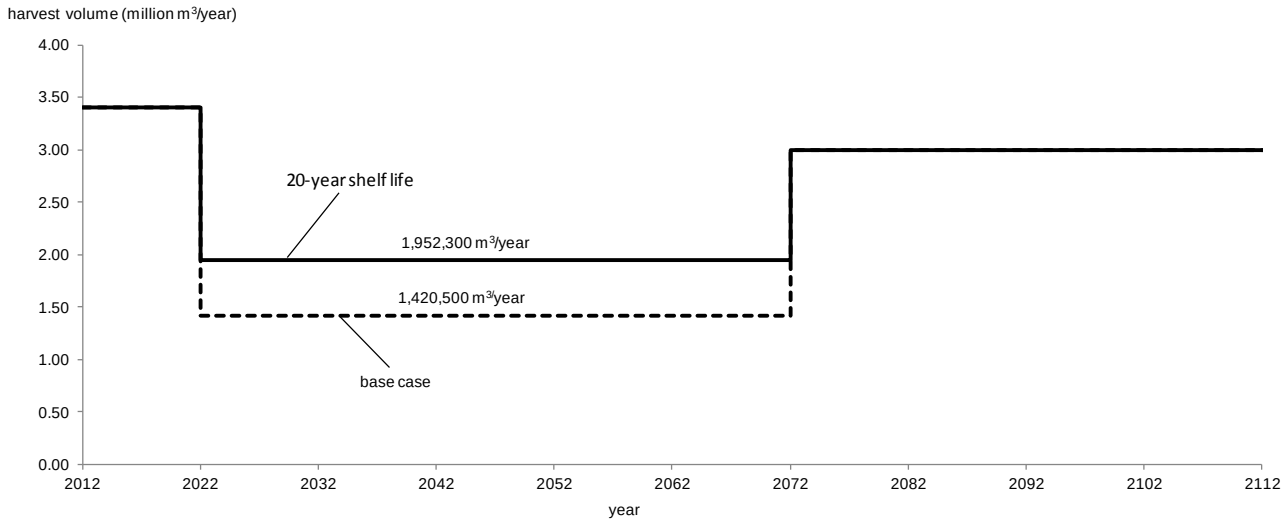


Figure 8. Shelf life for MPB-killed trees increased to 20 years - Williams Lake TSA.

Sensitivity analysis #3 – 20-year shelf life and 65 m^3/ha minimum harvestable volume for pine stands for 60 years

This sensitivity analysis is the combination of the above two sensitivity analyses. As shown in Figure 9, combining these two factors can increase the mid-term harvest level by 773 400 m^3/year, or 54 percent to 2 193 900 m^3/year. The increase in mid-term timber supply is significant, but less than the addition of the two separate increases due to the fact that some of the same stands are represented in both sensitivity analyses.

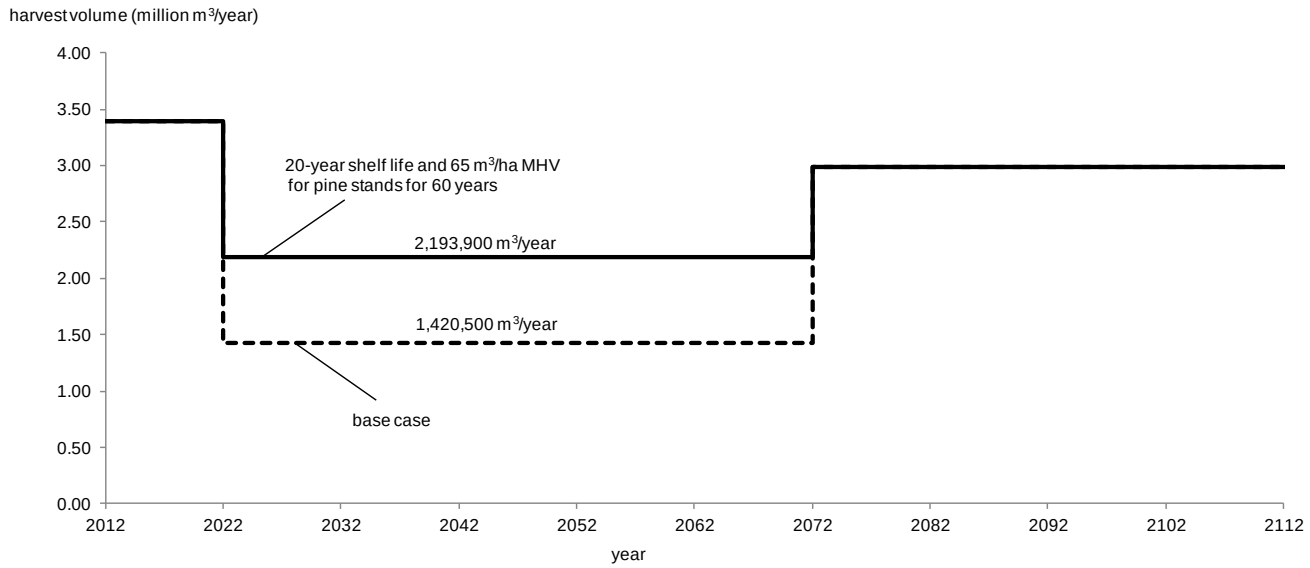


Figure 9. Minimum harvestable volume 65 m^3/ha and 20-year shelf life - Williams Lake TSA.

Sensitivity analysis #4 – three-metre green-up height

In the base case the green-up height for scenic areas ranged from five to seven metres. In this sensitivity analysis, the green-up height is reduced to three metres to test whether green-up height is a major constraining factor on mid-term timber supply. As shown in Figure 10, lowering green-up height to three metres can increase the mid-term harvest level by 70 500 m^3/year, or five percent to 1 491 000 m^3/year.

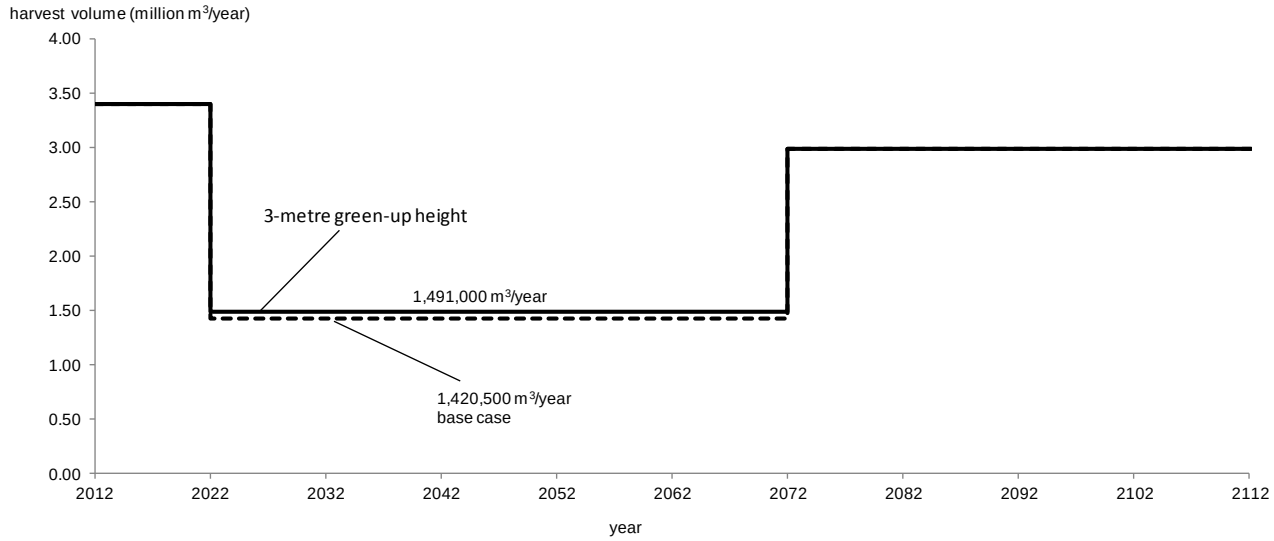


Figure 10. Green-up height reduced to three metres for scenic areas - Williams Lake TSA.

Table 5 shows a summary of the results of some of the other sensitivity analyses conducted for the Williams Lake TSA. Please note that the impacts on long-term timber supply were not tested.

Table 5. Select sensitivity analyses

Issue tested	Short-term (0-10 years) harvest (m^3/year)	Mid-term (11-60 years) harvest (m^3/year)	Long-term (>60 years) harvest (m^3/year)
Base case	3,400,000	1,420,500	2,994,000
Uncertainty regarding the growth rate of dry-belt Douglas-fir stands. The base case assumed 1 m^3/ha/year but permanent sample plot data suggests growth rate may be 2 m^3/ha/year.	No change	5.5% increase	No change
No harvest in engagement zone D as defined in the Tsilhqot'in Strategic Engagement Agreement.	No change	9.1% decrease	No change
Uncertainty regarding harvest ages. The base case applied both an age (60 years for pine, 80 years for non-pine), and a volume (80 m^3/ha for pine and 120 m^3/ha for non-pine) requirement. In this sensitivity analysis only the volume requirement was applied.	No change	13.8% increase	No change

Conclusions

The base case suggests that a harvest of 3.4 million per year can be maintained for 10 years if licensees focus on lodgepole pine stands on the west side of the TSA. The haul distances from the west side of the TSA to the processing facilities in the city of Williams Lake are a major component of delivered wood cost. The base case also indicates that of the pine volume harvested for the next 10 years, approximately 62 percent is live volume. When all mountain pine beetle-attacked stands have either been salvaged or are beyond the 10-year shelf life, the mid-term harvest level that is sustainable is 1 420 500 cubic metres per year. The mid-term harvest level lasts for 50 years until managed stands become the main source of timber supply. The decline from the short-term pine salvage phase to the mid-term shown in the base case is dramatic, but there might be approaches that would facilitate smoother transition to the mid-term harvest level. This analysis did not explore these approaches since the chosen approach will likely be a decision in the future based on updated information and practices. The sensitivity analysis that explored a lower minimum harvestable volume for pine stands for 60 years shows that if licensees can harvest lower volume pine stands mid-term timber supply can be increased significantly.

The analysis also revealed that the shelf life of the beetle-killed trees have significant impacts on timber supply. In the base case, the shelf life is assumed to be 10 years, but this can vary with mill technology, environmental conditions and product prices. If the actual shelf life is longer, not only will more volume be recovered from the MPB-attacked stands, but also more stands will be harvested and converted to managed stands. On the other hand, a shorter shelf life will have negative impacts on timber supply.

The provincial chief forester's AAC determination is a judgement based on his professional experience and his consideration of a wide range of information as required under Section 8 of the *Forest Act*. An AAC is neither the result of a calculation nor limited to the results of timber supply analysis; therefore, the new AAC may not be the same as any of the initial harvest levels depicted in any of the scenarios included in this document.

Your input is needed

Public input is an important part of establishing the new AAC. Feedback is welcomed on any aspect of this discussion paper or any other issues related to the timber supply review for the Williams Lakes timber supply area. Ministry staff would be pleased to answer questions to help you prepare your response.

Your comments will be accepted until March 17, 2014.

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 contact and/or mail your comments to:

Mailing Address:

Cariboo-Chilcotin Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations
200-640 Borland Street
Williams Lake, BC
V2G 4T1

Or contact:

Kerri Howse, RPF, Stewardship Officer
Telephone: (250) 398-4357 Fax: (250) 398-4790

Email Kerri.Howse@gov.bc.ca

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

For more information, visit our website at http://www.for.gov.bc.ca/hts

Appendix A: Summary of habitat supply analysis

The Chief Forester's AAC determination reflects the level of timber supply available under current forest management and established land use objectives for other resource values (e.g., ungulate winter range). This determination does not make any decisions related to proposed land use or management practices that might affect the levels of other resources such as wildlife populations. However, to help stakeholders and the chief forester better understand the implications of the base case harvest forecasts on wildlife, particularly for use in First Nation's consultation, the habitat supply implications of the base case scenario were investigated for three wildlife species – pine marten, moose and grizzly bear. The harvest forecast of the base case scenario was used as an input to habitat supply models and compared against a no-harvest scenario (Figure A1).

The habitat supply analysis is provided to help the conversation with the chief forester about the implications of harvesting on wildlife. The existing models are simplifications that do not incorporate some important features that impact wildlife populations. Nevertheless, the models do provide general temporal information important to understanding changes in habitat supply associated with harvesting. It is important to note that the modelling approach used is *aspatial* in that the model sums up all areas of available habitat whether they are functional or not. The following factors would likely decrease the estimate of usable (functional) wildlife habitat as compared with the model results. No quantitative estimates of these differences are available.

- The size and distribution of available forest patches will significantly affect actual wildlife use.
- The density and utilization of roads by motor vehicle traffic can affect the effectiveness (use) of suitable wildlife habitat.
- Natural disturbances including fire and other damaging insects and diseases will reduce the effectiveness of some of the modelled habitat.

The habitat supply analysis used existing Wildlife Habitat Ratings models developed for investigating the implications of the mountain pine beetle infestation within the central interior of British Columbia. The Wildlife Habitat Rating models were based upon ecosystem information and resource rating values determined by species experts. Model details are described in Tripp and Button (Eds) 2013.

The analysis show the expected trends for habitat supply. Marten habitat supply is linked largely to contiguous tracts of mature and old forest. The difference between the base case and no harvest scenarios reflects the difference in mature forest availability. Moose habitat supply is less affected by the presence of mature forest but moose still require suitable forest cover adjacent to feeding areas. In wetter parts of the region, feeding areas can be temporarily enhanced through forest harvesting. Grizzly bear assessment is largely linked to early seral habitat. Although habitat is important to grizzly bear, human activity and availability of "roadless" areas are considered to be key factors in ensuring population maintenance.

A more detailed summary of the habitat supply analysis is available for discussions with First Nations. The detailed summary separates the analysis further into east and west of the Fraser River, shows projections by suitability class, considers natural disturbance, and looks at several life requisite stages for grizzly bear. This detailed summary also provides a more detailed description of the limitations of the models and some of the implications of those limitations.

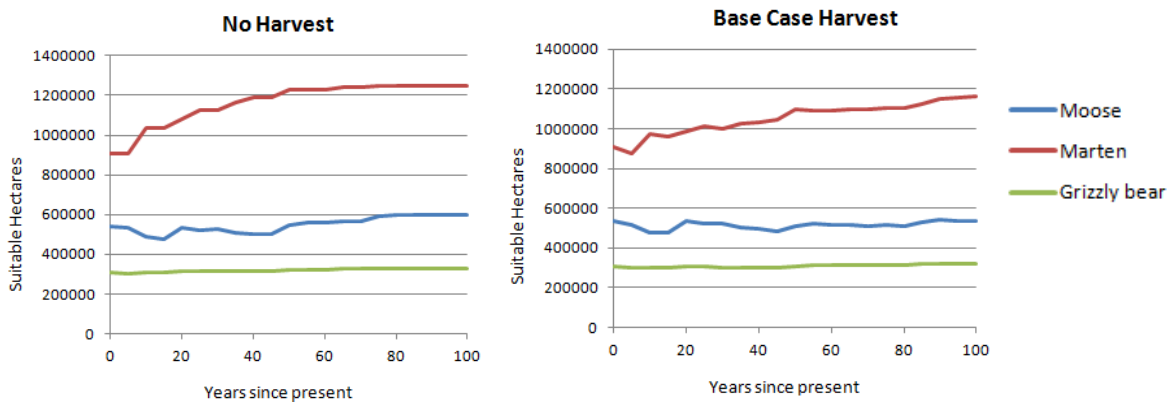


Figure A1. Suitable habitat supply projections for the Williams Lake TSA based on the base case scenario and a no-harvest with natural disturbance[a] scenario.

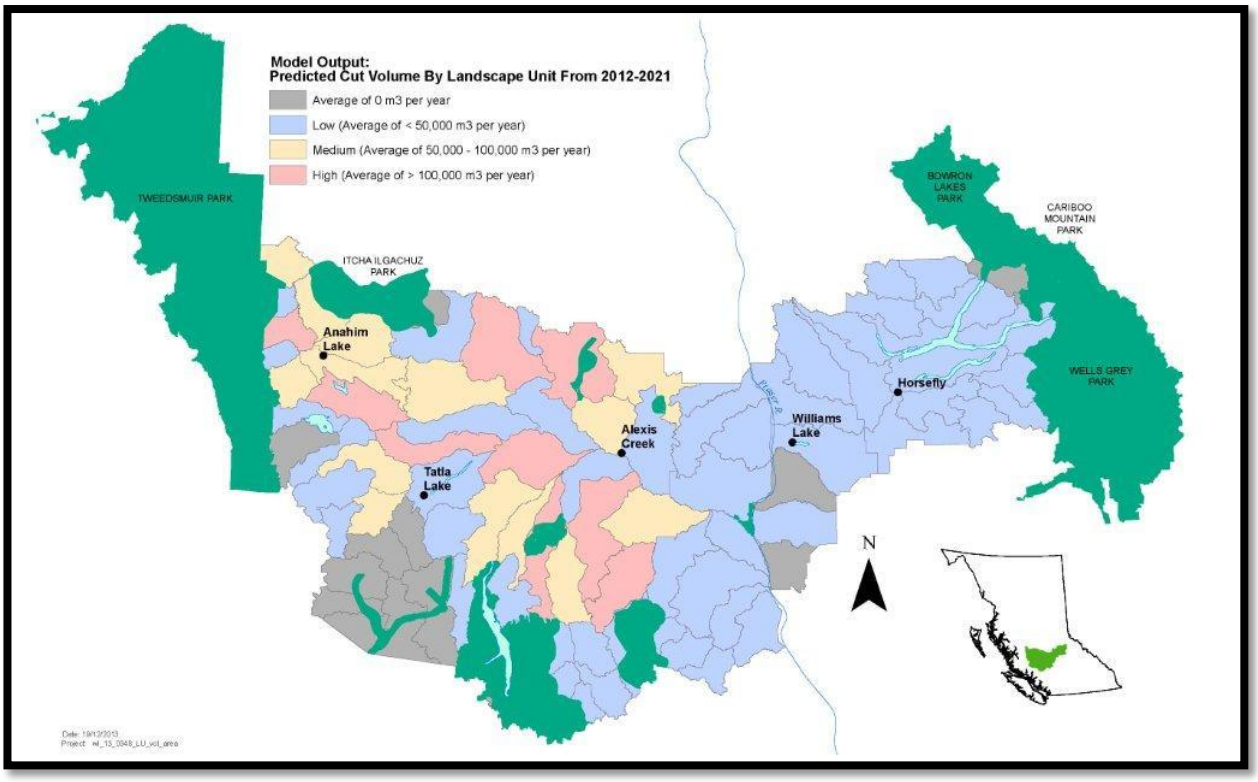
The projection is the weighted[b] sum of suitable habitat within the TSA for the identified species. Moose and marten are based upon winter food, security, and thermal suitability. Grizzly bear is based on early spring food suitabilty.

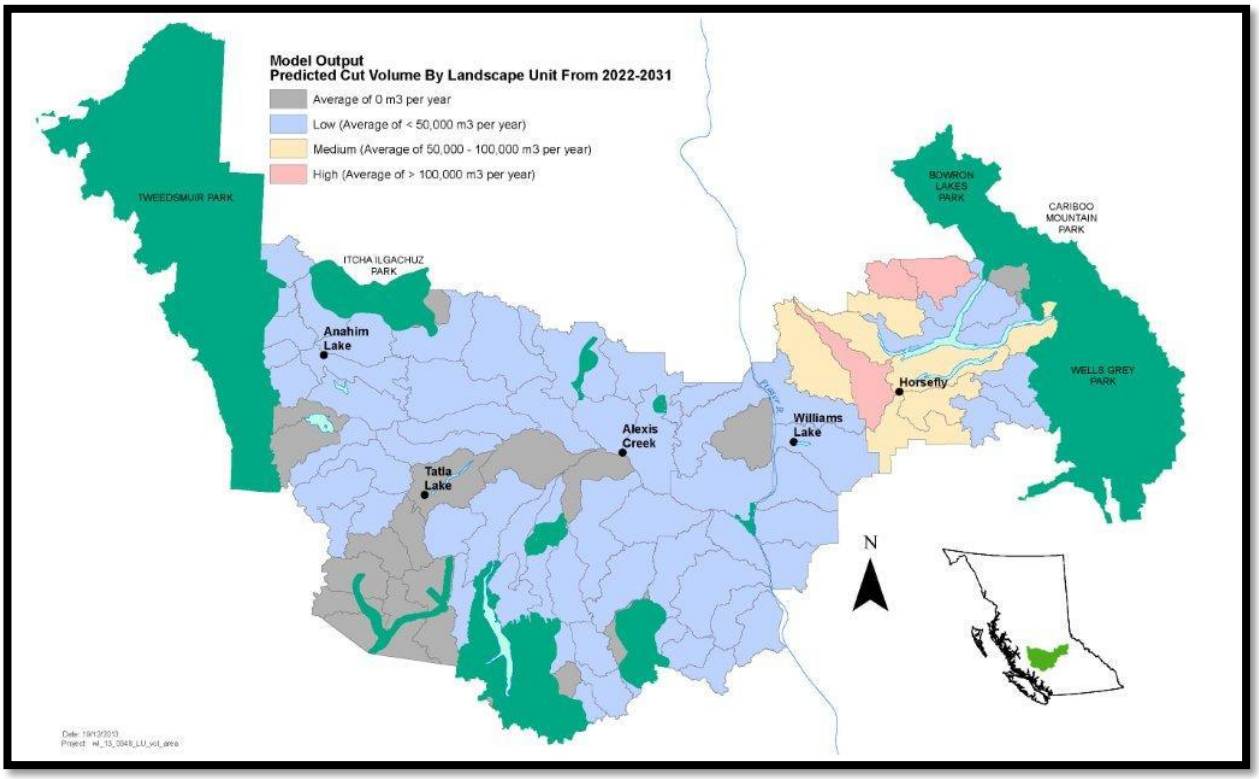
In addition to the above analysis that explores the impact of harvesting over time, staff of the Cariboo Region of FLNR have developed habitat supply models for cumulative impact assessment. These models have been, or are being prepared for moose, mule deer, grizzly bear, and pine marten and for indicators of biodiversity and hydrology. Due to the structure of these models, most of which incorporate a measure related to roads, only the current conditions have been modelled for the Williams Lake TSA. These models are best for understanding risk to habitat at a landscape unit or watershed level in the Williams Lake TSA.

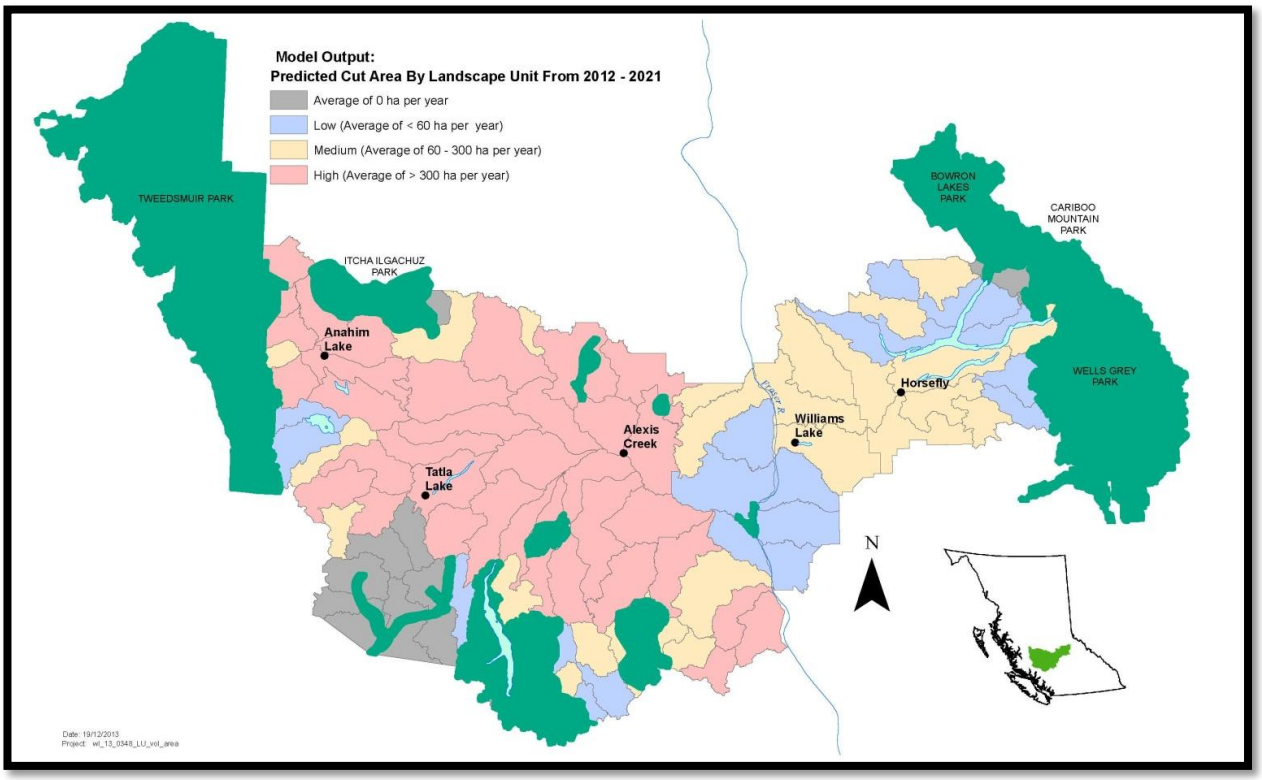
[a] Natural disturbance was modelled by resetting a polygons age to zero if the age exceeded a random age derived based on a negative exponential distribution and a mean return interval.

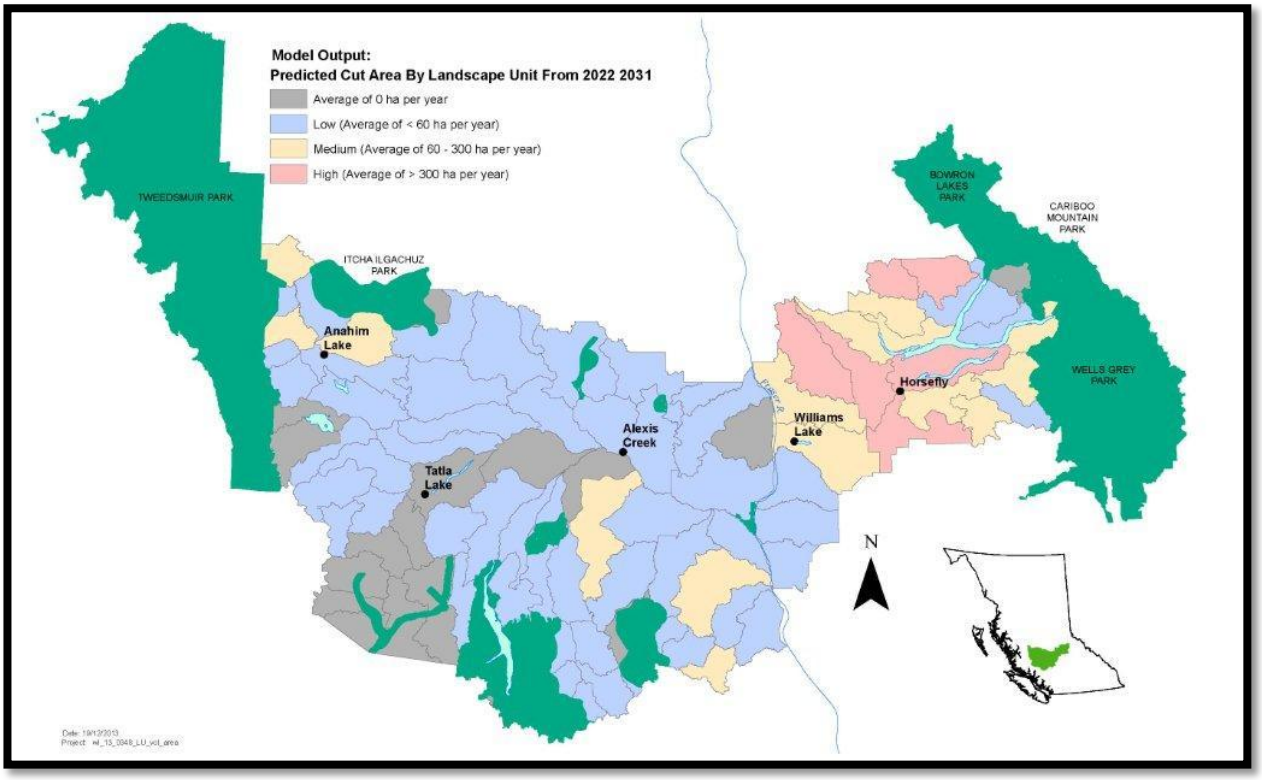
[b] These graphs are derived from habitat suitability class summaries of area of high, moderately high, and moderate classes. The weighted sum is based on respective weights of 0.875, 0.625, and 0.375 to reflect the classes 76-100%, 51-76%, and 26-50%.

Appendix B: Harvest volume and area by landscape unit for 20 years






Model Output:
Predicted Cut Area By Landscape Unit From 2012 - 2021
Average of 0 ha per year
Low (Average of < 60 ha per year)
Medium (Average of 60 - 300 ha per year)
High (Average of > 300 ha per year)
TWEEDSMUIR PARK
ITCHA ILGACHUZ PARK
BOWRON LAKES PARK
CARIBOO MOUNTAIN PARK
WELLS GREY PARK
Anahim Lake
Alexis Creek
Tatla Lake
Williams Lake
Horsefly
N
Date: 19/12/2013
Project: wl_13_0348_LU_vol_area


Model Output:
Predicted Cut Area By Landscape Unit From 2022 2031
Average of 0 ha per year
Low (Average of < 60 ha per year)
Medium (Average of 60 - 300 ha per year)
High (Average of > 300 ha per year)
TWEEDSMUIR PARK
ITCHA ILGACHUZ PARK
BOWRON LAKES PARK
CARIBOO MOUNTAIN PARK
WELLS GREY PARK
Anahim Lake
Alexis Creek
Tatla Lake
Williams Lake
Horsefly
N
Date: 19/12/2013
Project: wl_13_0348_LU_vol_area