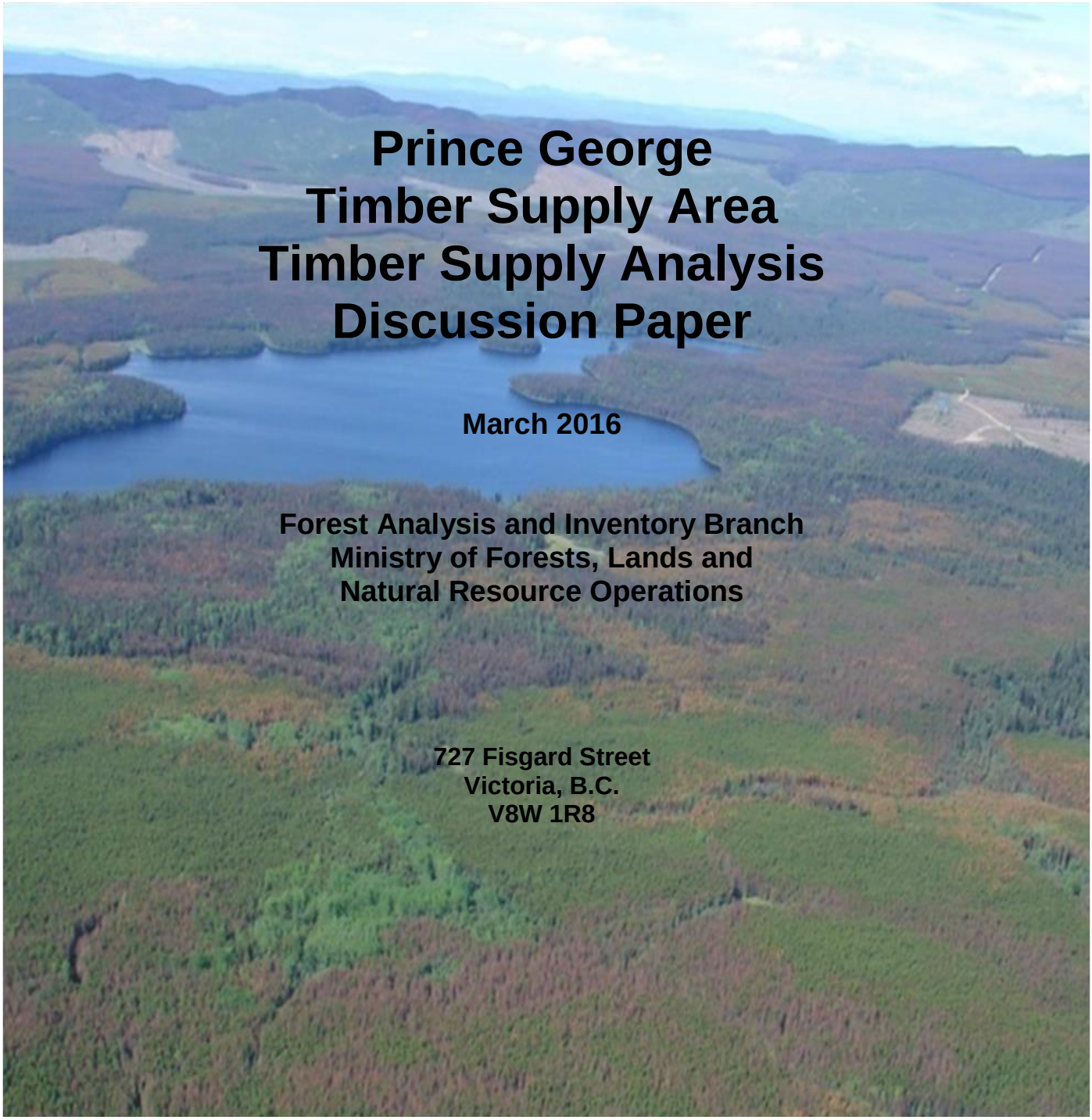

Prince George Timber Supply Area Timber Supply Analysis Discussion Paper

March 2016

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

727 Fisgard Street
Victoria, B.C.
V8W 1R8

BRITISH COLUMBIA

Ministry of Forests, Lands and Natural Resource Operations

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] (TSA) and tree farm licences[c] (TFL) in the province. This review for the Prince George TSA examines the impacts of current 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[d] (AAC) for the Prince George TSA.

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

The objectives of the timber supply review (TSR) 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 Prince George TSA. Details about the information used in the analysis are provided in a February 2015 data package. Additional technical detail is available upon request from the Ministry of Forests, Lands and Natural Resource Operations, Forest Analysis and Inventory Branch. Contact information is provided at the end of this document.

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 will 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 loss of mid-term timber supply due to mountain pine beetle 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 FLNR has responded to the special committee's recommendations.

[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.

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

1. Review marginally economic forest types within each TSA and quantify the types and areas of forest that might be justifiably 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.
2. Where feasible and appropriate, provide information from the timber supply review to enhance public discussion of resource management objectives and practices.

With regard to the ministry's responses to the special committee, marginally-economic stands and operability are noted under 'Additional 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 Prince George TSA. All relevant information will be provided to the chief forester for consideration in determining a new AAC.

Current allowable annual cut

On January 11, 2011, the chief forester set the AAC for the Prince George TSA at 12.5 million cubic metres, of which no more than 3.5 million cubic metres is to consist of non-pine species volume, 160 000 from deciduous-leading stands and 23 000 from cedar-leading stands in the Prince George Natural Resource District. In his rationale, the chief forester noted that the partitioned harvest was intended to maximize the conservation of non-pine species stands for harvest in the mid-term, while allowing for the salvage of beetle-infested stands. To this end, he indicated that of the 3.5 million cubic metre partition attributable to non-pine species volume, about 90 percent would come from incidental non-pine volume resulting from the salvage of mountain pine beetle-infested, pine-leading stands, while a maximum 875 000 cubic metres could come from spruce-leading stands. In addition, the chief forester requested that district and licensee staff continue to monitor the extent of beetle infestation and salvage and to report the results to the chief forester on an annual basis. He also indicated that in the event that there were significant changes in beetle infestation or management, it might be necessary to re-determine the AAC earlier than the 10-year maximum required under the *Forest Act*.

Since the current AAC was determined, licensees have focused on the harvest of pine-leading stands and salvage of dead pine. Based on harvest history and estimates of how long dead pine remains suitable for harvest after death, about 70 million cubic metres of salvageable dead pine remain on the THLB. However, this dead-pine volume is increasingly dispersed throughout stands that include significant volumes of live timber and non-merchantable fibre. Concurrently, harvest in spruce-leading stands has increased in various parts of the Prince George TSA while spruce beetle mortality has begun to expand markedly within the Prince George Natural Resource District. Based on the information reported, the chief forester concluded that there is a need to re-examine the Prince George timber supply and to determine a new AAC.

In April 2015, a data package documenting the information requirements and assumptions for the timber supply analysis was released for public review and to assist with First Nations' consultation. This discussion paper is being released to provide an overview of the timber supply review process and to highlight the results of the timber supply analysis, including harvest projections for the Prince George TSA.

[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 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.

Before determining a new AAC, the chief forester will review all relevant information, including the results of the timber supply analysis, socio-economic information, 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 determined by the chief forester during this timber supply review may differ from the harvest projections presented in this analysis, as the chief forester must consider a wide range of information including the social, economic and environmental implications associated with a given harvest level. Ultimately, the chief forester makes a professional judgment 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. 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 Prince George TSA

The Prince George TSA is located in the north-central portion of the province, to the east of the Coast Mountains and to the west of the Boreal Plains, covering approximately 7.97 million hectares. It consists of several physiographic systems including the Fraser Basin and Plateau, characterized by broad areas of low relief, with expanses of flat or gently rolling country. The basin and plateau are bounded by mountains to the west and north including portions of the southern Skeena and Omineca mountains, while those to the east include the Hart Ranges and associated foothills and the Rocky Mountains.

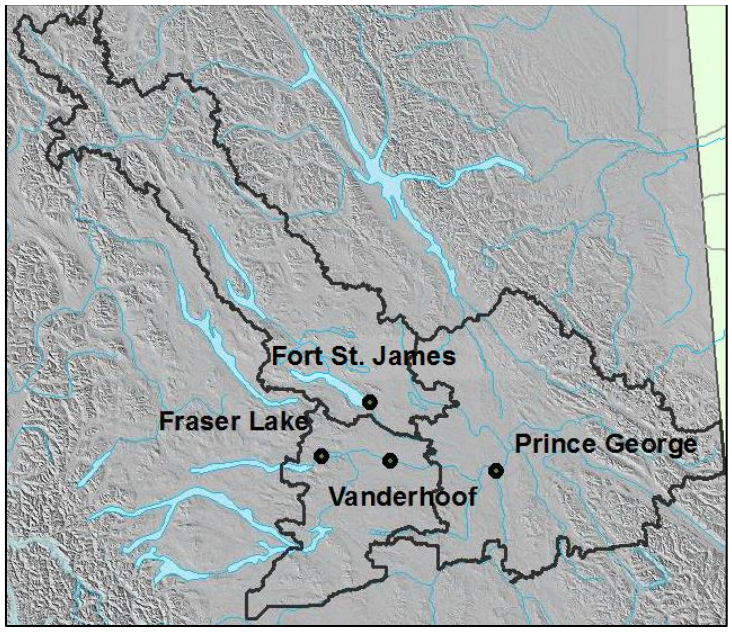

Figure 1. Map of the Prince George TSA.

The area has a sub-continental climate, typified by cold winters, warm summers, and precipitation that is equal in summer and winter.

Vegetation in the Prince George TSA reflects increased coolness and moisture with an increase in latitude when compared to more southern timber supply areas. The dominant vegetation is dense coniferous forest dominated by lodgepole pine, white spruce, and sub-alpine fir, from valley bottom to timberline, with increased shrub and tree cover on the scattered wetlands. Deciduous forests are more common here than in southern TSAs.

Forestry is the most extensive industrial activity but there is also substantial mining and mineral development. Agriculture is restricted to the area of finer textured soils in the Fraser Basin; it is limited to grazing and some forage and few cereal crops.

The TSA includes the City of Prince George (71,363 residents in 2015) and the communities of Vanderhoof (4,492 residents in 2015), Fort St. James (1,776 residents in 2015), and Fraser Lake (1,149 residents in 2015), as well as several smaller unincorporated communities. The Prince George timber supply area is part of the Omineca Natural Resource Region and is administered by the Prince George Natural Resource District and the Stuart Nechako Natural Resource District (previously known as the Fort St. James Natural Resource District and Vanderhoof Natural Resource District).

First Nations

First Nations within the Prince George TSA are Carrier and Sekani. The traditional territories of the Carrier and Sekani comprise approximately 7.6 million hectares in the Interior Plateau Region, which is bound to the east by the Rocky Mountains, to the north by the Omineca Mountains, and to the west by the Coast Mountains. The traditional territories of the Carrier surround the Nechako, Stuart, and Fraser River watersheds, while those of the Sekani coincide with the Finlay, Parsnip and Peace Rivers. The traditional territories of their Southern Carrier neighbours surround the basins of the Dean, Blackwater, and Quesnel Rivers. First Nations communities within the Prince George TSA include: Nak'azdli, Takla Lake, Tl'azt'en, Nadleh Whut'en, Stellat'en, Saik'uz, Lheidli T'enneh, Yekooche and McLeod Lake. Each First Nation has its own distinct traditional territory, usually corresponding to a watershed or lake system. Other First Nations whose communities are outside of the Prince George TSA but whose territories extend into the Prince George TSA include: the Cheslatta, Lhoosk'uz Dene, Ulkatcho, Skin Tyee, West Moberly, Halfway River, Gitxsan, Lake Babine, Tsay Key Dene, Red Bluff, Nazko, Tahltan, Blueberry River, Saulteau, Simpcw, Nee Tahi Buhn, Tsetsaut Skii Km La Ha , and Tsilhqot'in National Government.

FLNR has been consulting with First Nations about this timber supply review and the potential impacts to First Nations interests. In April 2015 the Province of British Columbia and seven Carrier Sekani First Nations signed a Collaboration Agreement. The agreement provides a framework for the Province and the seven signatory First Nations to increase and deepen collaboration on a range of issues and decisions, including TSR.

Environmental values

Current forest management must be consistent with the requirements of the *Forest and Range Practices Act* (FRPA) and associated regulations, which are designed to maintain a range of biodiversity and wildlife values. All forest lands, whether they contribute to timber supply or not, help to maintain critical habitats for many species. The timber supply analysis includes forest resource values or cover requirements for biodiversity, visual quality, wildlife habitat, community watersheds, recreation features, riparian management and protection of environmentally sensitive areas.

These requirements are applied to the Crown Forest Management Land Base (CFMLB). In the Prince George TSA, about 40 percent of the CFMLB is neither suitable nor available for timber harvesting given the various forest resource values or cover requirements.

[g]**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 (e.g., brush areas). The Crown Forest does include federally protected areas because of their contribution to biodiversity.

The diverse forests and landscapes of the Prince George TSA are home to a wide variety of wildlife species. Although best known for its moose population, the TSA also supports mule deer and, to a lesser extent, whitetail deer, grizzly and black bear, mountain goat, wolves, coyotes and small herds of caribou. Significant populations of small mammals also exist, with pine marten, beaver and lynx being the most common. Fifty-seven percent of the bird species known to occur in British Columbia and 45 percent of all species known to breed in the province are found in the TSA. The rivers and lakes of the TSA support many fish species, including four species of salmon, steelhead, rainbow trout, Kokanee, lake trout, Dolly Varden, bull trout, cutthroat trout, and whitefish. Numerous lakes in the TSA also provide a range of fishing opportunities.

The Prince George TSA has a wide range of forest resources, including timber and non-timber forest products, forage, minerals, recreation and tourism amenities, and fish and wildlife habitats. In addition, the cattle ranching industry depends heavily for summer forage on Crown rangeland. Good access to a diversity of landscapes, including lakes and rivers, provides a variety of recreation opportunities for both residents and tourists. Summer activities include: camping, hiking, fishing, boating, canoeing, wildlife viewing and back-country recreation. Hunting for mule deer, mountain goat, moose, black bear and grizzly bear is popular in the spring and fall. Recreational activity in winter is high, including snowmobiling, ice fishing, and cross-country and back-country skiing.

Land use planning in the Prince George TSA

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

Timber supply reviews undertaken in support of AAC determinations are based on the land use objectives established by government and current forest management. In the Prince George TSA these include:

- The Order Establishing Biodiversity Objectives for the Prince George TSA;
- The Orders Establishing Agriculture Development and Settlement Reserve Areas;
- The Order Establishing OGMAs for the Interior Cedar Hemlock Zone;
- The Order Establishing OGMAs (Ancient Forest Trail Area);
- The Orders Establishing the Slim, Dome and Humbug Landscape Unit Objectives;
- The Orders Establishing Scenic Areas in Prince George and Fort St. James;
- The Orders Establishing Ungulate Winter Ranges, Wildlife Habitat Areas and Fisheries Sensitive Watersheds throughout the TSA.

As in previous timber supply reviews the information compiled during this review can be made available to support a variety of other processes, including land use planning. In the event that new legal objectives are established following completion of the base case and prior to the chief forester's AAC determination, sensitivity analyses will be used to assess the impact, if any, on the base case.

Any changes in legal objectives that occur following the determination can be addressed in subsequent timber supply reviews or earlier if the chief forester thinks that that the changes could significantly affect timber supply.

Regional economy

Based on the 2006 report *Economic Dependency Tables for Forest Districts*, the forest sector accounts for 29 percent of the total basic employment for the three districts – the largest sector. The percentage of basic employment by sector for each district is as follows:

- Fort St. James District: forestry (49 percent), public sector (36 percent), mining and mineral production (1 percent), agriculture and food (3 percent); tourism (6 percent); construction (2 percent) and other (3 percent);
- Prince George District: forestry (26 percent), public sector (38 percent), mining and mineral production (3 percent), agriculture and food (2 percent); tourism (9 percent); technology (2 percent); construction (10 percent) and other (10 percent); and
- Vanderhoof District: forestry (45 percent), public sector (27 percent), mining and mineral production (6 percent), agriculture and food (7 percent); tourism (8 percent); construction (4 percent) and other (2 percent).

Table 1 summarizes the results of an input/output analysis that assesses the economic impact of the forest Industry in the Omineca Region. The British Columbia Input-Output Model (BCIOM) was used to generate the estimates.

Table 1. Economic impact of the forest industry in the Omineca Region between 2011 and 2015

Yearly average based on 2011-2015: Forest sector impacts for Omineca Region by District					Direct Output				
All $ values in millions		Harvest volume (m^3)	Stumpage value		Output (gross revenue)	GDP	Household income	Employment	Gov Tax revenue
	2015 Total	13,873,085	$120		$2,233	$702	$530	6,346	$128
	Fort St. James	4,022,379	$38		$647	$204	$154	1,840	$37
	Mackenzie	2,652,068	$16		$427	$134	$101	1,213	$25
	Prince George	4,630,691	$46		$745	$234	$177	2,118	$43
	Vanderhoof	2,567,947	$19		$413	$130	$98	1,175	$24
Indirect and Induced					Total				
	Output	GDP	Household income	Employment	Gov Tax Revenue	Output	GDP	Household income	Employment	Gov Tax revenue
2015 Total	$935	$438	$280	4,334	$93	$3,169	$1,140	$810	10,680	$221
Fort St. James	$271	$127	$81	1,257	$27	$919	$331	$235	3,097	$64
Mackenzie	$179	$84	$53	829	$18	$606	$218	$155	2,042	$42
Prince George	$312	$146	$93	1,447	$31	$1,058	$381	$270	3,565	$74
Vanderhoof	$173	$81	$52	802	$17	$586	$211	$150	1,977	$41

The forest sector includes forestry and logging, support activities for forestry and logging, wood product manufacturing, and paper manufacturing. These industries are based on the North American Industry Classification System (NAICS). Direct impacts are directly attributable to these industries, indirect impacts are impacts from their suppliers, and induced impacts are from employees spending their wages. Stumpage value is not included in government tax revenue columns. These were calculated using results from the 2011 version of the B.C. Input-Output Model and FLNR Harvest Billing System (HBS) data. Mackenzie District is highlighted in grey because it is part of the Omineca Region but not part of the Prince George TSA.

Significant changes since the previous TSR

The timber supply analysis presented in this discussion paper differs from the analysis used for the previous (2011) AAC determination. Some of the significant changes include:

- Harvest performance - Since the previous analysis there has been an ongoing decline in the pine percentage within cutting permits issued in the TSA. The proportion of pine permitted has dropped significantly in the Prince George District driving down the TSA average. Concurrently, there has been a significant shift from the Prince George District and Vanderhoof District into the Fort St. James District. The current analysis assumes significantly higher levels of non-pine harvest during salvage phase of the projection.
- Adjusted inventories - In the summers of 2014 and 2015 approximately 250 audit plots were established in the Prince George TSA to validate inventory attributes. The results of the audit were used to adjust the attributes used to determine natural and managed stand yields.
- Treatment of balsam - Although balsam-leading stands represent 22 percent of the CFMLB and 20 percent of the total volume, historically they have represented 1.6 percent of the harvest profile in the Prince George TSA. This analysis explores the contribution of balsam to the base case.
- Shelf life definition - There is uncertainty regarding the length of time that a mountain pine beetle-killed tree is usable as a sawlog to make lumber (shelf life). In the previous analysis it was assumed that 100 percent of the impacted pine volume would be suitable for some product for 15 years post-attack, after which time it would be useless. This analysis assumes merchantable sawlog volume decreases following an exponential loss curve. Figure 2 contrast the shelf life assumptions of pine merchantability for this analysis with that of the previous analysis.

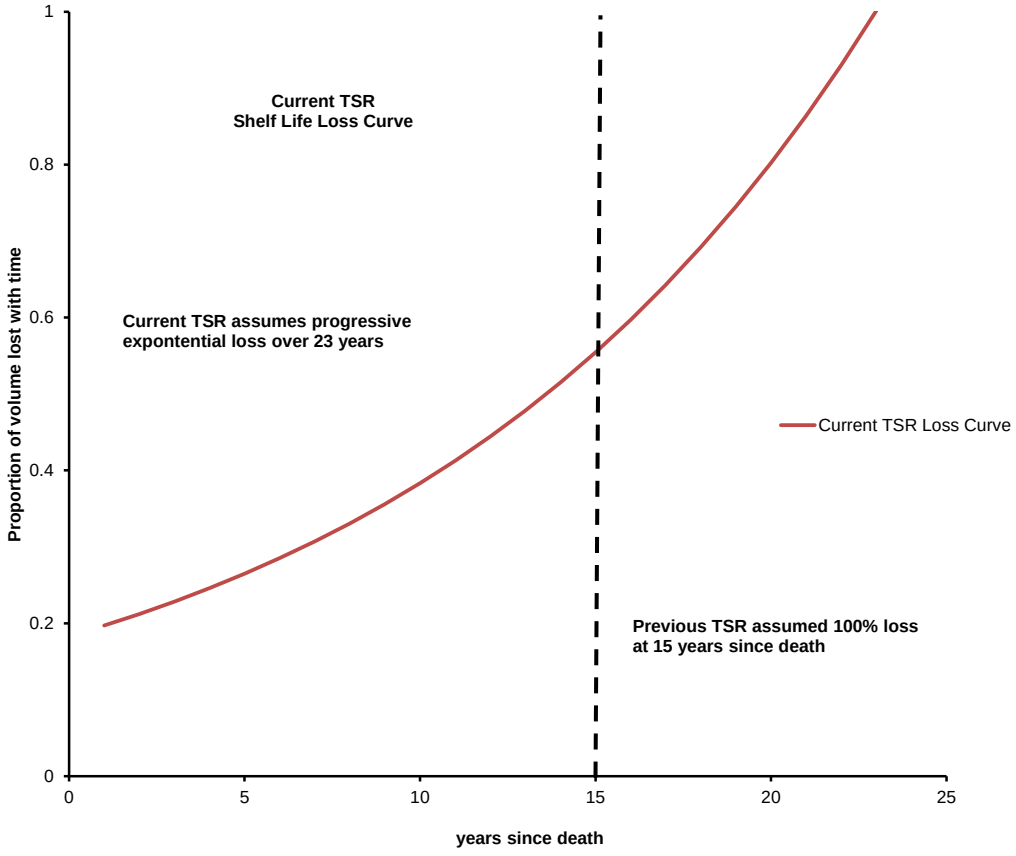

Figure 2. Current shelf life loss curve.

- Flow policy - Harvest projections for the Prince George TSA are consistent with the Forest Analysis and Inventory Branch (FAIB) catastrophic flow policy (see Appendix 1).
- Treatment of future managed stands - Stand age was not used as a merchantability criterion in the previous analysis. To better reflect current practice and historic piece size preference a minimum harvest age of 75 years was implemented in this analysis.

Spruce Beetle

- Due to favourable weather conditions and available host trees, the level of spruce beetle (IBS) infestation has the potential to reach epidemic proportions in some areas of the TSA. Aerial overview assessment flights completed over the past two years surveyed approximately 156 000 hectares impacted by IBS in the Prince George TSA. Analysis is currently underway to assess the potential impacts of a potential IBS epidemic and expanding salvage operations on the mid-term timber supply and other resource values in the TSA. Figure 3 details the current known distribution of the spruce beetle (IBS) infestation.

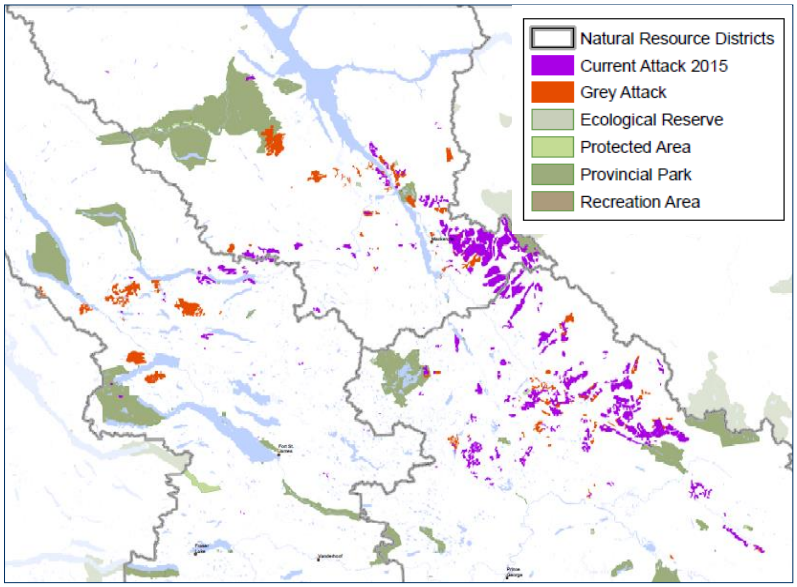

Figure 3. Spruce beetle infestation in the Prince George TSA, 2015.

For further information see: http://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/forest-pests/bark-beetles/spruce-beetle/omineca-spruce-beetle

Forest management

Area available for timber harvesting

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 (see Table 3). The total area of the TSA is approximately 7.96 million hectares. After accounting for lands that are under area-based tenures, not Crown land or forested, the Crown forest management land base (CFMLB) is approximately 5.1 million hectares.

After further reductions for areas not suitable or available for timber harvesting because of ecological, economic, or social considerations, the THLB is approximately 3.1 million hectares. This is 0.8 percent smaller than in the 2009 timber supply analysis with the difference largely attributable to the area reductions in the Crown land base and the CFMLB resulting from the expansion of community forests and the creation of new woodlots and ungulate winter ranges, and the treatment of research forests as area-based tenures. Area reductions are partially offset by the reintroduction of the "Area of Agreement" areas, and the broadening of the definition of merchantability. About 61 percent of the total TSA area and 40 percent of the Crown forest is not available for timber harvesting. Areas excluded from harvest include land base designated for protection of wildlife, riparian reserves, old growth values and archaeological sites, potentially or unstable terrain, inoperable conditions, and uneconomic stands or areas otherwise unsuitable for timber harvesting.

As well, there are several areas within the THLB that have seen limited or no harvesting historically. The timber analysis will include an assessment of the harvesting activity in these areas and will report the projected contribution of them to the TSA timber supply. Sensitivity analysis will also explore the implications of excluding some of these areas from the THLB.

Current forest management must be consistent with the requirements of the FRPA and associated regulations that 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 habitat for many species. Therefore, the timber supply analysis includes constraints or forest cover requirements for biodiversity, visual quality, wildlife habitat, community watersheds, recreation features, riparian management and protection of environmentally sensitive areas. These requirements are applied to the CFMLB in the timber supply analysis.

The timber harvesting land base is not a legal entity, rather it is a modelling construct. The THLB is a strategic-level estimate used for the purposes of timber supply analysis and consequently inclusion or exclusion of any particular area has no bearing on how an area will actually be managed. At an operational level, there will always be areas that are excluded from the THLB that can be harvested and areas within the THLB that may not be harvested.

The various land base classes including the timber harvesting land base assumed in the analysis are listed in Table 3 (overleaf).

Table 3. Prince George TSA land base netdown

Land Class	Gross Area	Net Area	Category Total
Gross Timber Supply Area			7,965,496
Private Land	386,978		
Tree Farm Licences	314,648		
Woodlots	116,653		
Community Forests	44,464		
Research Forests	38,290		
First Nation's Reserves	19,112		
Federal Transfer of Admin	2,387		
Crown and Private Schedule A and B Lands	105		
Christmas Tree Permit	76		
Area based tenures, Private land, Federal lands	922,711	915,139	
Crown Land Base			7,050,357
alpine	397,573		
non-productive	678,512		
non-treed	658,316		
water	459,941		
Non-forest	2,194,341	1,883,006	
Roads, Rail, Transmission and pipeline corridors lines	93,423	70,562	
Crown Forest Management Land Base			5,096,789
Parks, Reserves, Protected Areas and Conservancies	538,030	334,565	
Management Land Base			4,762,224
Inoperable area	1,659,331	500,054	
Problem Forest Types	105,992	52,702	
Ungulate Winter Range (w. 100% exclusion)	894,876	165,983	
Recreation (w. 100% exclusion)	29,462	18,620	
Old Growth Management Areas	27,475	12,474	
Agricultural Development and Settlement Reserve Areas	64,946	52,357	
Gross Timber Harvesting Land Base			3,960,035
Not Economic (based on past performance)	1,886,376	561,139	
WTPs and Riparian Retention	328,594	328,594	
Current Timber Harvesting Land Base			3,070,301

Figures 4 illustrates the spatial distribution of the THLB and CFMLB within the TSA. The TSA is sub-divided into its associated supply blocks (nine supply blocks running alphabetically from Supply Block A in the northwest to Supply Block H in the south-eastern portion of the Prince George District). The area in light green is classified as THLB, the area in blue is classified as CFMLB (the CFMLB also includes the area classified as THLB). Areas in white are either non-forest or are outside the boundaries of the TSA.

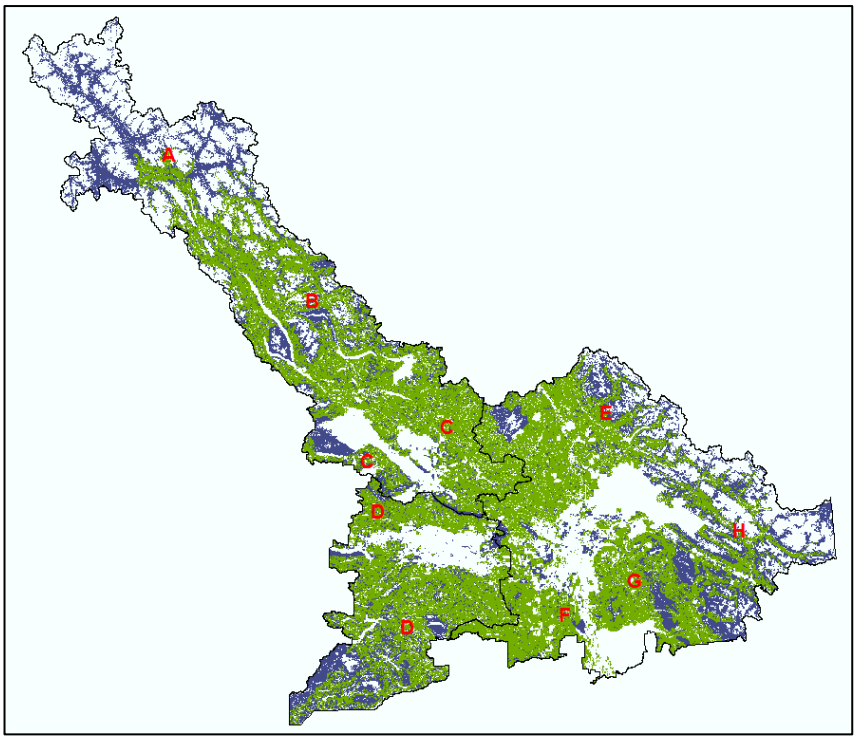

Figure 4. Timber harvesting land base (green) and Crown forest management land base (green+blue) in the Prince George TSA nine supply blocks.

Forest structure and composition

Figure 5 illustrates the distribution of forest ages (categorized in 10-year increments) between the THLB and the remaining CFMLB (the difference denoted as NTHLB). The current age class distribution and the assumptions governing minimum harvest age have a significant impact on the harvest flow.

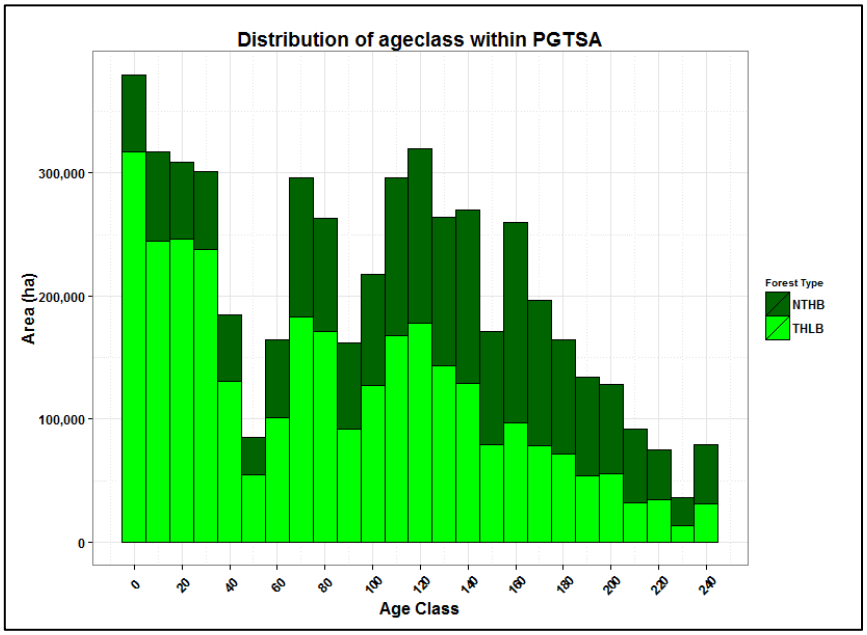

Figure 5. Current distribution of THLB and non-THLB area among forest age classes in the Prince George TSA.

Figures 6 and 7 show the spatial distribution of stands by age class. Figure 6 represents the spatial distribution in 2002 at the onset of the mountain pine beetle epidemic and prior to large-scale salvage operations in the TSA. Stands older than 30 years are shown in green, stands between the ages of 10 to 29 years are shown in orange and stands younger than 10 years, including cutblocks yet to be planted, are shown in gold.

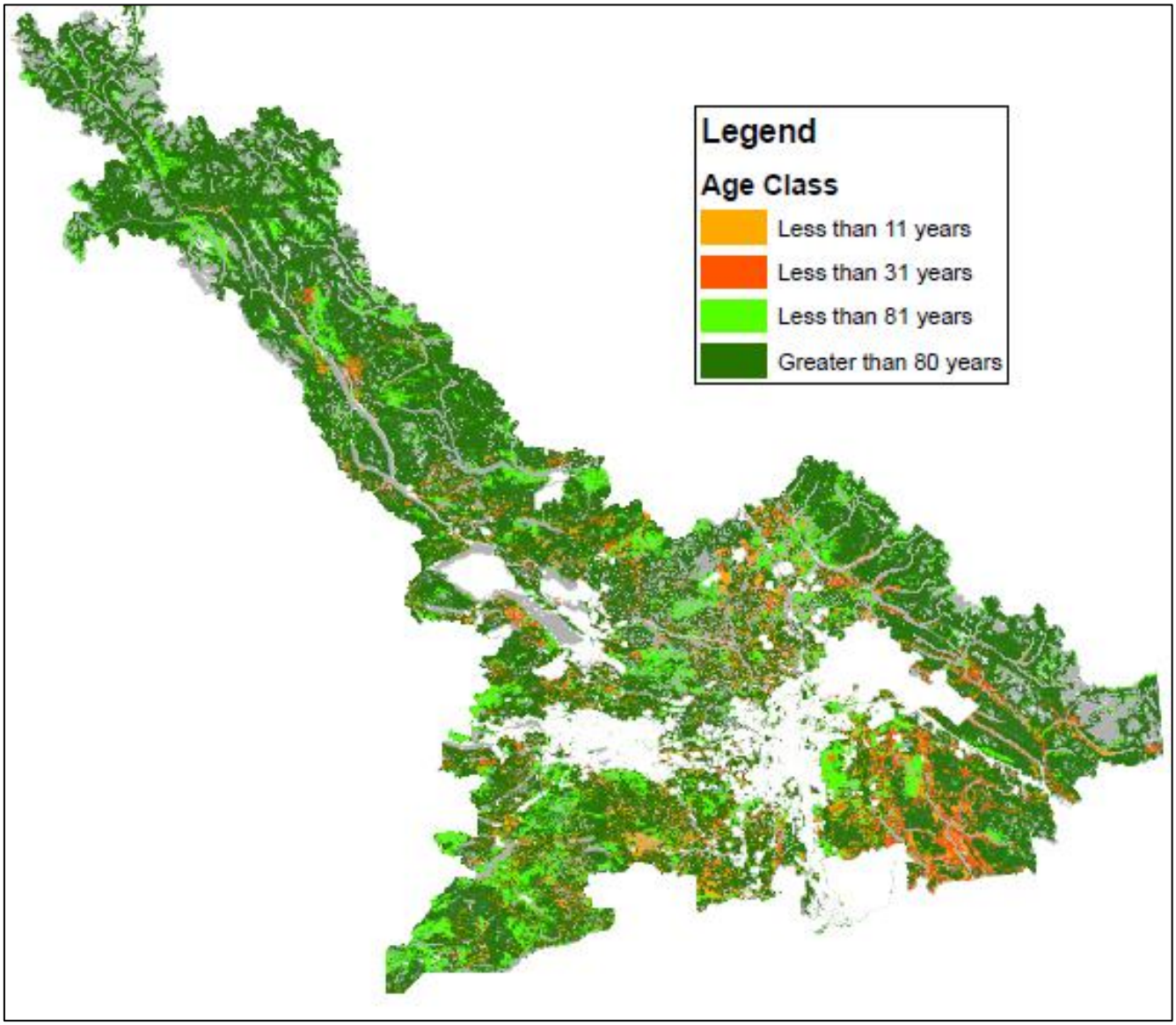

Figure 6. Age class distribution in the Prince George TSA in 2002.

Figure 7 depicts the spatial distribution of forest stands by age class in 2015. This representation shows the effect of salvage harvesting as well as all major fires since 2002 (outlined in red).

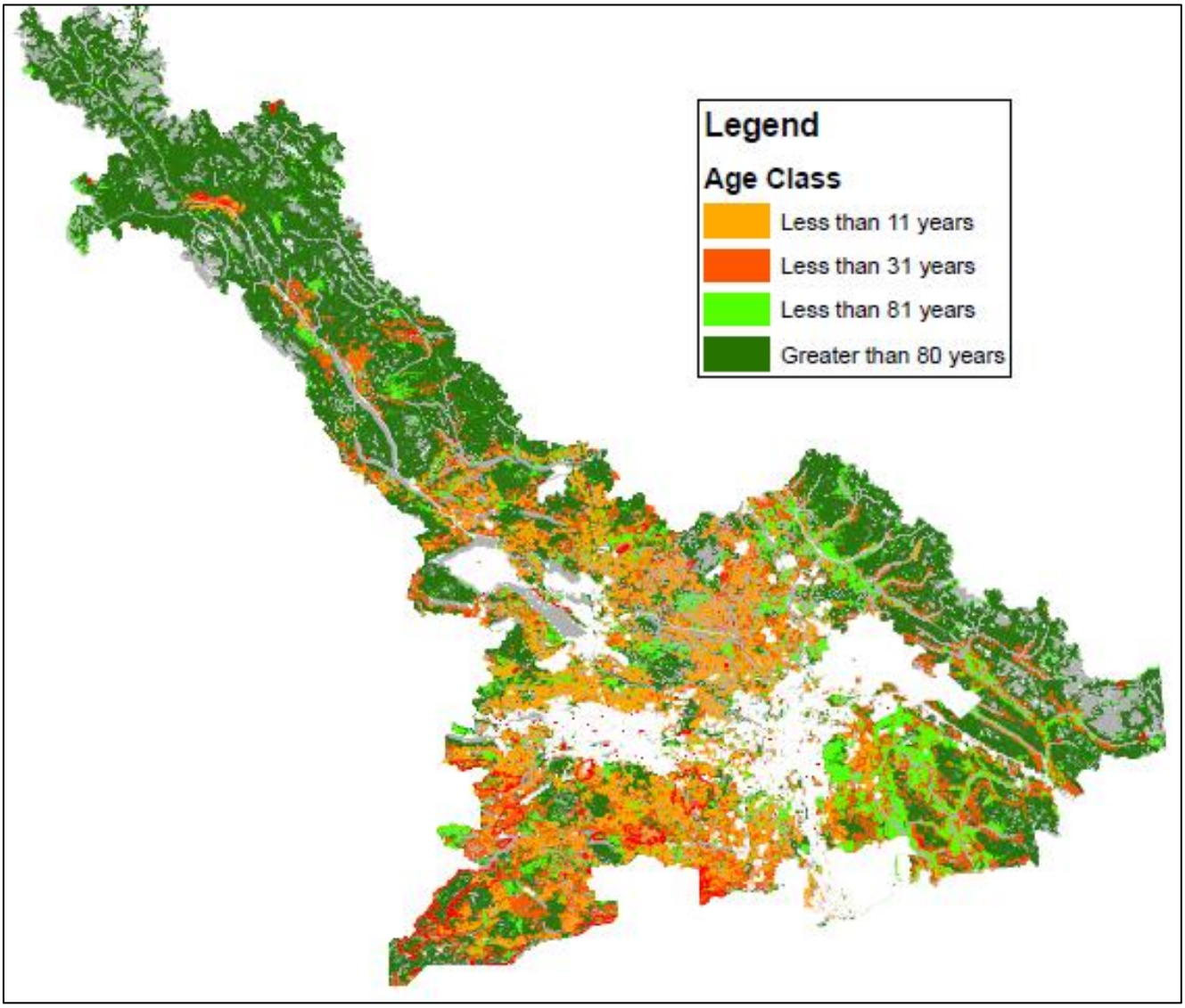

Figure 7. Age class distribution in the Prince George TSA in 2015.

Figure 8 illustrates the distribution of timber volume of stands within the CFMLB and the THLB grouped by dominant tree species: spruce, pine, balsam, Douglas-fir, and deciduous. The THLB is further stratified into those areas considered merchantable (stands that meet the merchantability thresholds of 182 cubic metres [gross] volume per hectare and 140 cubic metres [net of MPB losses] volume per hectare and greater than 75 years of age) and areas that are currently available to harvest) (stands that meet the merchantability criteria and are not currently required to meet other resource objectives). Each chart details the total volume by leading species and the percentage the dominant tree species class represents.

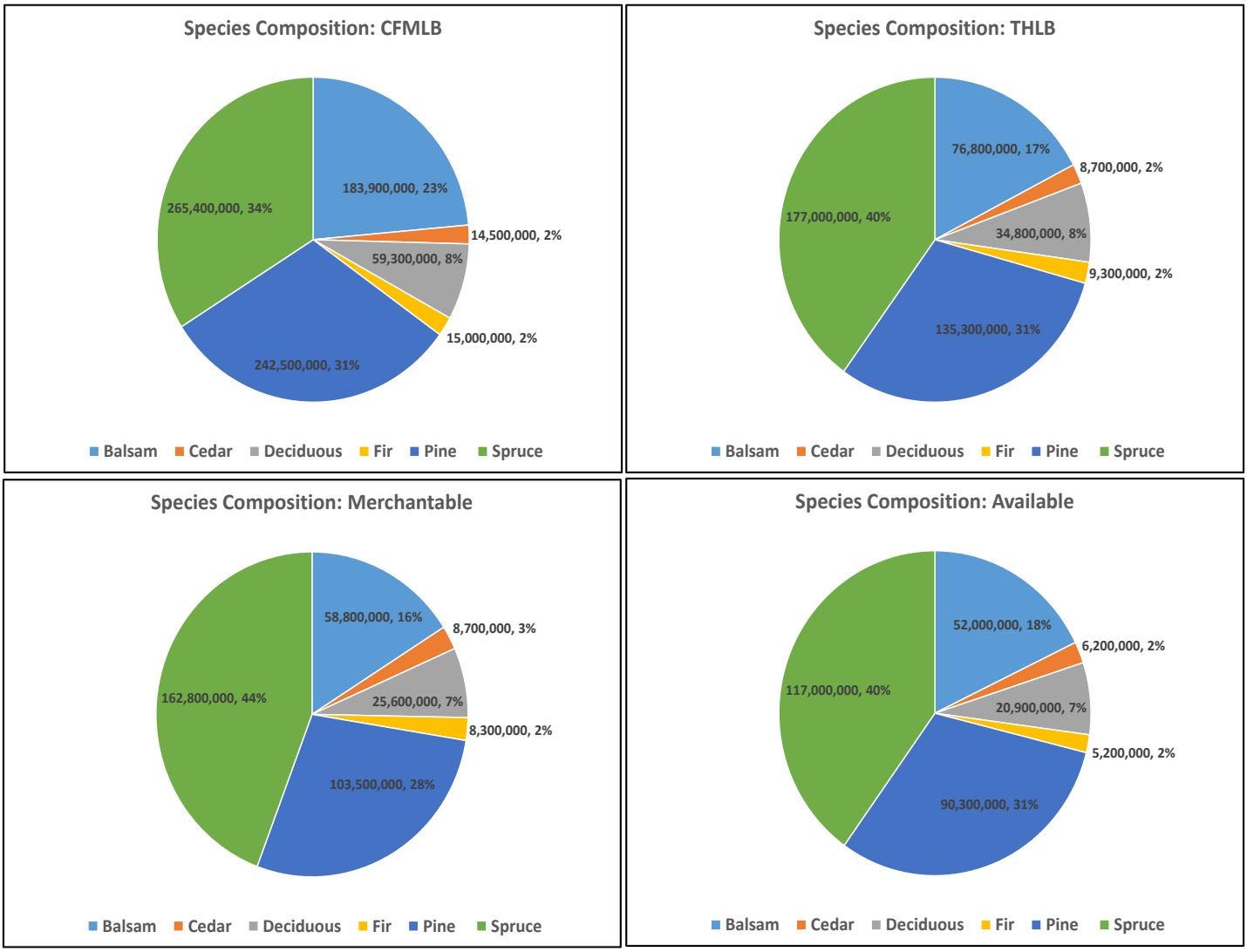

Figure 8. Species volume distribution in the Prince George TSA.

Timber supply analysis

In order to determine an AAC, the chief forester reviews many sources of information including a timber supply analysis that models the development of the forest through time and its response to harvesting while respecting government's many timber and non-timber objectives. This section highlights some of the important findings from the timber supply analysis.

The base case

For a timber supply review, a number of projections are prepared that are an outcome of the best available data and assumptions intended to reflect current management practices. However, more than one forecast can be prepared using the same data, information and timber supply model depending on the harvest flow objectives applied in the analysis. From these projections, the chief forester selects one to use as a reference for the purposes of assessing the uncertainty associated with the information and assumptions used in the analysis. This forecast is referred to as the "base case". The remaining projections that were not selected as the base case are still considered in the AAC determination and are referred to as "alternative harvest projections".

The base case and alternative harvest projections are not AAC recommendations, but rather one of many sources of information the chief forester will consider when setting the AAC. Furthermore, based on the input received from the public and First Nations or new information that becomes available following the review and consultation period for this discussion paper, the base case may be revised prior to use by the chief forester. The AAC determined by the chief forester may be different than the initial harvest level presented in the base case or the alternative harvest projections or any of the projections presented in this paper.

In the base case for the Prince George TSA, the initial harvest level was set at the 10.1 million cubic metres per year starting in 2014, which reflects the five-year average harvest for the TSA. In addition:

- Regenerating stands were prohibited from harvest until at least age 75 years (area-weighted culmination age), regardless of volume or piece size, allowing them to approach their potential maximum yield. This requirement prevents a regenerating stand from being harvested as a low-volume stand "today" if it can be harvested a high-volume stand "tomorrow".
- In addition to the age requirement, stands with salvageable volume are required to achieve a minimum net volume (volume post shelf life netdown) of 140 cubic metres per hectare to be eligible for harvesting.
- Stands with the combination of highest volume per hectare (volumes exceeding 182 cubic metres per hectare) and highest salvageable volume, and proximity to the milling complex were given priority for harvesting.
- The sawlog shelf life of dead pine was assumed to decline exponentially over time.
- During the salvage phase, the harvest is allocated among pine-leading stands (81 percent of the harvest request), deciduous-leading stands (4 percent of the harvest request) and all other stand types (15 percent of the harvest request). The allocations reflect the distribution of harvest between stand types since the previous analysis. The deciduous allocation is projected as a maximum non-declining even-flow for the entire planning horizon.

Figure 9 depicts the current base case projection.

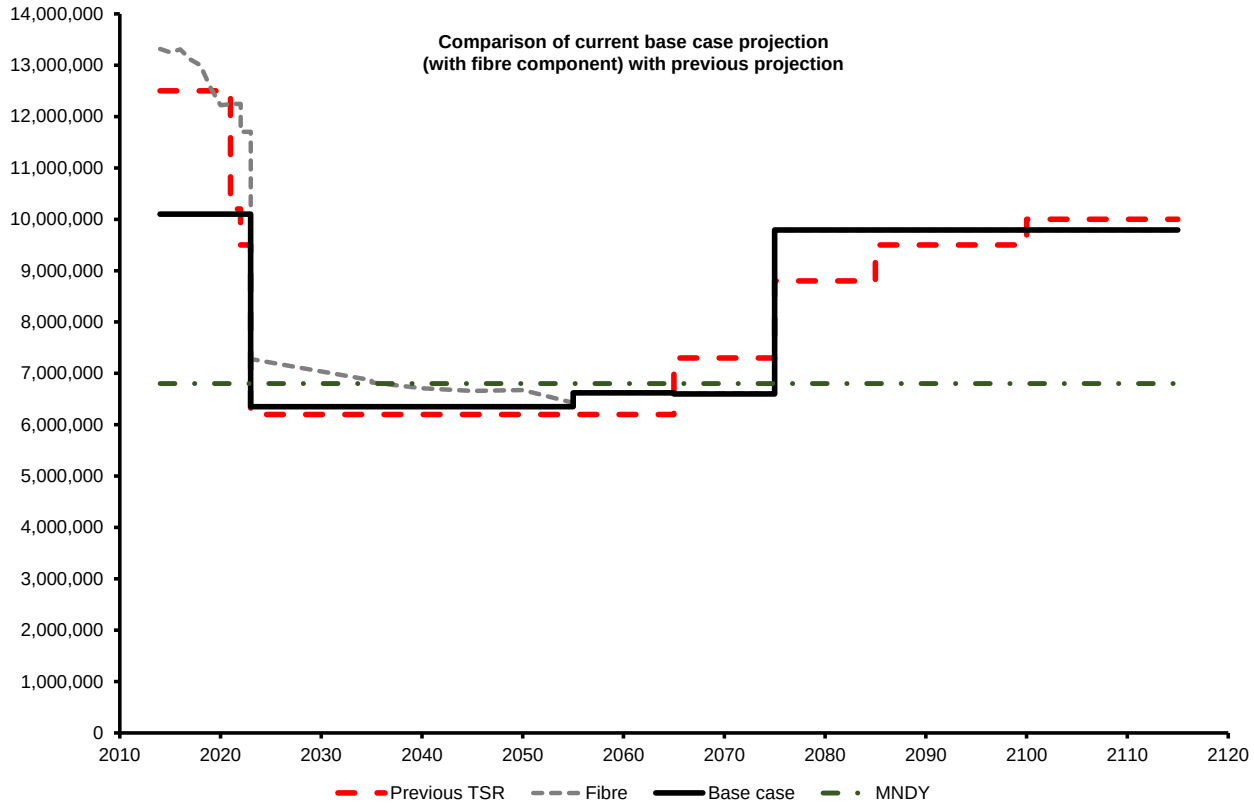

Figure 9. Base case forecast for the Prince George TSA.

The dark line represents the base case harvest forecast while the red-dashed line represents the base case from the previous TSR. The green-dashed line represents the maximum non-declining yield (MNDY) for the Prince George TSA. The dotted-grey line represents the fibre by-catch (additional incidental dead pine fibre volume harvested in order to achieve the base case harvest level) resulting from the shelf life assumption. There is uncertainty as to the economic viability of this fibre. The initial harvest level is 10.1 million cubic metres with an additional 3.2 million cubic metres harvested as fibre by-catch.

The base case salvage phase collapses in the latter part of first decade of the projection. The mid-term harvest level is 6.35 million cubic metres per year for 50 years, after which time it climbs to 9.85 million cubic metres per year. While the harvest of today's oldest managed plantations are projected to begin to occur 45 years into the future, an increase in projected harvest level does not occur until the large cohort of stands salvaged in response to the MPB epidemic regenerate and reach merchantable size.

Alternative harvest flows

Four harvest projections were developed to assess the timber supply implications of alternative partitioning or salvage strategies to the base case:

- Flow # 1 - Step down to mid term; create an intermediate step between base case initial harvest level and mid term;
- Flow # 2 - salvage focus: maximizes pine salvage while restricting harvest in all other stand types (excluding deciduous) during the first 10-year period;
- Flow # 3 - balsam partition: include an additional partition for balsam-leading stands where balsam is greater than or equal to 80 percent of the stand composition; and
- Flow #4 – MNDY: maintain the maximum mid-term timber supply by lowering the short-term harvest level.

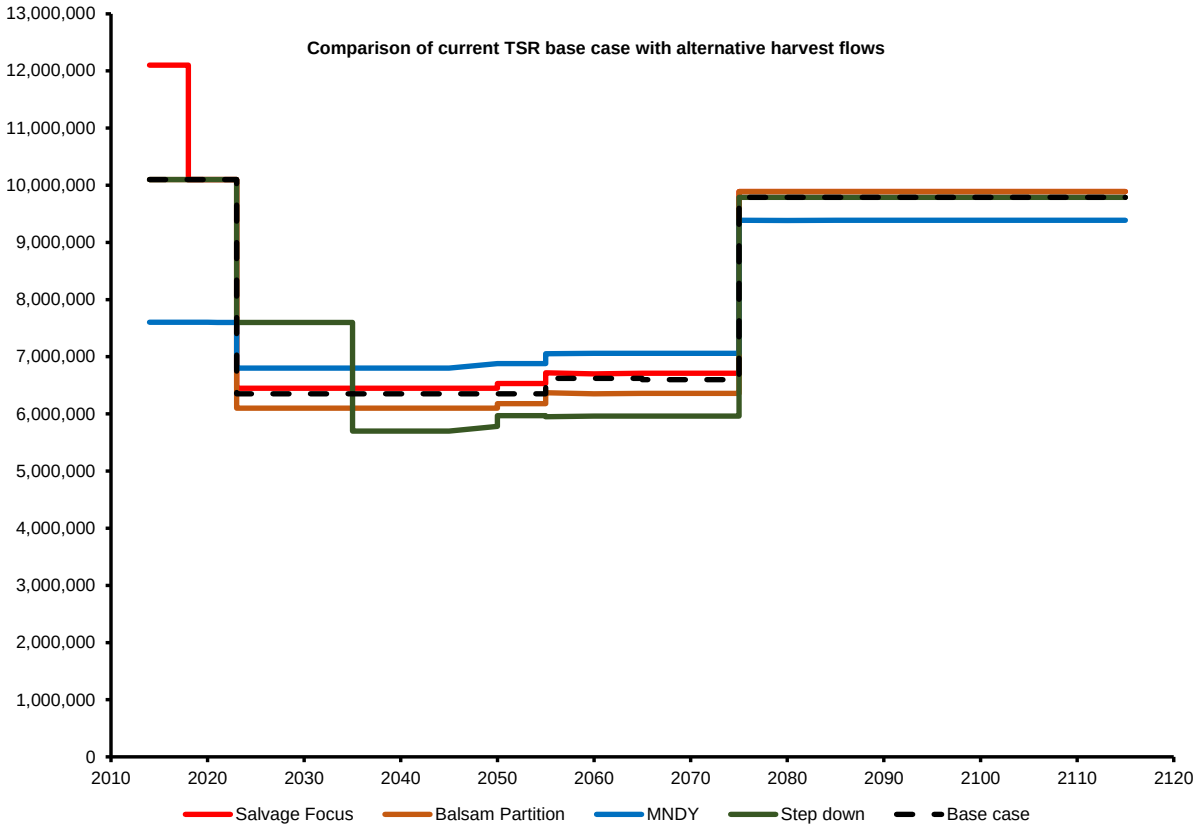

Figure 10. Comparison of current base case project and alternative harvest flows.

Figure 10 contrasts the base case with the four alternative harvest flows:

Implementing flow scenario #1 – Step down (which steps from the initial base case AAC of 10.1 million cubic metres to 7.6 million cubic metres for one decade before falling to new mid-term level of 5.7 million cubic metres). Stepping down to an intermediate level for a decade after the salvage phase reduces the projected mid-term harvest flow by 10 percent over a 40-year period.

Relative to the base case, flow scenario #2 (a focus on salvage which queues stands based on maximum salvageable volume per hectare with no additional non-pine harvest) increases the recovered volume from damaged pine-leading stands by two million cubic metres per year over the first five years of the salvage phase. The total difference in dead volume and fibre salvaged over the first five-year period is 15 million cubic metres. Although a salvage focus achieves a higher AAC during the salvage phase and mid-term, the necessary assumptions are not consistent with current practice or the billing history.

Flow scenario #3 features a partition for balsam-leading stands where balsam constitutes 80 percent or more of the stand volume. The maximum non-declining yield from this profile is estimated to be 400 000 cubic metres per year. The application of a balsam partition causes a four percent reduction (250 000 cubic metres/year) in the mid-term harvest flow relative to the base case (removing the profile altogether causes an eight percent reduction [500 000 cubic metres/year]). This suggests that, in the absence of performance in this profile, the base case overestimates the mid-term timber supply.

Flow scenario #4 maximizes the mid-term harvest flow (MNDY) by lowering the short-term harvest level. Maximizing requires reducing the initial harvest level from 10.1 million cubic metres/year to 7.6 million cubic metres/year or a 25 percent reduction from the base case initial harvest level. The mid-term harvest level increases to 6.8 million cubic metres per year, a seven percent increase over the base case mid-term harvest flow.

Additional sensitivity analysis

The base case uses a specific set of available data and forest management assumptions that attempts to capture current forest composition and management. Sensitivity analysis is used to examine the effect on timber supply of uncertain information or known differences in the assumptions used in the base case.

Table 4. Key results from the sensitivity analysis for the Prince George TSA

Analysis projection	Assumption change	Impact to mid-term harvest level	Impact to growing stock volume	Other comment
Base case (reference forecast)		None	Stable	
Minimum harvest age (MHA)	MHA = 60 years	12 percent increase	Stable 20 percent reduction in long-term GS	22 percent decrease in long-term productivity gains
Minimum harvest volume (MHV)	MHV = 140(gross) cubic metres /100(net) cubic metres	8 percent increase	Increasing 11.2 percent increase in available GS	7 percent increase in THLB 13 percent increase in volume salvage 25 percent increase in area logged
Combination	MHA = 60 years & MHV = 140(gross) cubic metres /100(net) cubic metres	24 percent increase	Stable 16 percent increase in available GS	39 percent increase in area logged
Non-declining shelf life	Shelf life losses stabilize at 40 percent loss at year 15	2 percent increase	Stable	Additional 22 cubic metres of salvageable volume in 2030
100 percent shelf life loss	Shelf life losses 100 percent loss at year 15	4 percent decrease	Stable	12 million cubic metres less salvageable volume in 2022
Geographic partition	Supply block partition during salvage phase	Mid-term expanded 20 years	Stable	25 percent more salvage comes from salvage zone (supply blocks C, D F) in first 5 years of projection
No partition No salvage	No spatial pine partition and no pine harvest preference: maximum volume/ha only	6 percent decrease	Stable	17 million cubic metres less total salvage/40 percent more MPB-related NRL in 2029
Remove deciduous profile	Remove deciduous profile from THLB	12 percent decrease	Stable 8 percent less initial GS	7 percent reduction in THLB
Remove balsam-leading stands	Remove balsam-leading with > 79 percent balsam composition from THLB	12 percent decrease	Stable 8 percent less initial GS	6 percent reduction in THLB
Remove problem forest types (PFT) from THLB	Remove balsam-leading with > 79 percent balsam composition and deciduous-leading stands from THLB	20 percent decrease	Declining 16 percent less initial GS 23 percent reduction in long-term GS	13 percent reduction in THLB
Combination with removal of PFT	MHA = 60 years and MHV = 140 (gross) cubic metres/100 (net) cubic metres and remove balsam-leading with >79 percent balsam composition and deciduous-leading stands from THLB	12 percent increase	Declining 12 percent less initial GS 38 percent reduction in long-term GS	7 percent reduction in THLB

Analysis shows that the base case projection is highly sensitive to changes in both the minimum harvest age (MHA) and minimum harvest volume (MHV) thresholds used to define merchantability. Reducing the minimum harvest to 60 years increases the mid-term projection by 12 percent (750 000 cubic metres/year). Elevated mid-term harvest levels are achieved by transitioning from the natural to managed stands earlier in the projection. The elevated mid-term harvest level comes at the cost of reduced long-term productivity, as stands are harvested before culminating in volume. The harvested mean long-term volume per hectare under the reference scenario is 328 cubic metres per hectare while the harvested mean long-term volume per hectare associated with reducing the MHA is 248 cubic metres per hectare, an average 22 percent reduction in productivity.

Based on a review of licensee cutting permit data since 2002 (the large scale salvage period), the average volume of harvested stands in the Prince George TSA exceeded net volumes of 293 cubic metres per hectare. In addition, 99 percent of the harvested blocks had net volumes of more than 149 cubic metres per hectare.

Reducing the MHV entails expanding the THLB by decreasing the merchantability threshold from 182 cubic metres per hectare to 140 cubic metres per hectare (gross). The stand availability threshold (the volume per hectare necessary to be considered merchantable) is also reduced to 100 cubic metres per hectare (gross volume net shelf life losses). Implementing the MHV scenario increases the mid-term projection by eight percent (550 000 cubic metres per year). Lowering the definition of merchantability to 140 cubic metres per hectare (gross) increases the THLB by seven percent (222 431 hectares) and the available merchantable volume at the beginning of the projection by 11 percent (32 387 886 cubic metres). The elevated mid-term harvest level is achieved through forcing the harvest into low yield stands within the pine partition during the salvage phase of the projection, which serves to reserve non-pine volume for future harvest. The elevated mid-term harvest flow also benefits from the addition of substantial volumes from low yield stands that were previously excluded from the THLB. Although including low yield stand achieves a higher mid-term harvest flow, these stand types make an exceedingly small portion of the historic harvest profile and the necessary assumptions for including this profile are not consistent with current practice or the billing history.

The combined affected of relaxed thresholds releases previously deferred younger, lower volume stands for harvest, elevating the mid-term timber supply and harvest flow. Concomitantly, the area harvested to achieve the elevated mid-term harvest flows (with low volume stands) increases by 39 percent (approximately an additional 10 000 hectares annually) over the mid term, and 31 percent (approximately an additional 9400 hectares annually) over the long term. The implications of elevated disturbance and associated access for other resources value could be significant.

Table 5 summarizes the additional volume harvested in the combined relaxed merchantability threshold scenario during the first 45 years of the projection.

Table 5. Volume harvested over the first 45 years of the combined relaxed merchantability threshold scenario

Category	Volume	Area	Median yield per hectare
Less than 182 m^3/ha	37,201,949	284,699	125
Less than 75 years	66,894,045	334,585	187
Less than 75 years and 182 m^3/year	8,297,527	61,981	132

Volume from stands less than the base case merchantability threshold of 182 cubic metres (gross) yielded an additional 37 million cubic metres to the projection. Stands less than 75 years of age (area weighted age CMAI) contributed 67 million cubic metres. Although these stands represent an opportunity to mitigate mid-term shortfalls in available growing stock, they are not representative of the current or historic harvest profile.

Summary

The AAC for the Prince George TSA was accelerated in 2002 and again in 2004 to allow for the salvage of mountain pine beetle-killed pine while it retained economic value. In 2011, the AAC was decreased (but still higher than the pre-2002 level) and a partition was instituted in the AAC to conserve non-pine (live) timber. Since the current AAC was determined, licensees have focused on the harvest of pine-leading stands and salvage of dead pine. However, this dead pine volume is increasingly dispersed throughout stands that include significant volumes of live timber. Concurrently, harvest in spruce-leading stands has increased in various parts of the TSA while Spruce Beetle mortality has begun to expand markedly within the Prince George Natural Resource District. Based on the information reported, the chief forester concluded that there is a need to re-examine the Prince George timber supply and to determine a new AAC.

The base case harvest projection indicates that an initial harvest of 10.1 million cubic metres can be maintained for 10 years after which it declines to 6.35 million cubic metres for 50 years, climbing to a long-term level of 9.85 million cubic metres. The maximum non-declining yield for the TSA is 6.8 million cubic metres. In addition to the base case, alternative harvest projections show that maximizing the mid-term harvest flow by lowering the short-term harvest requires a 25 percent reduction from the base case initial harvest level. The mid-term harvest level increases seven percent over the base case mid-term harvest flow. Additionally, focusing on maximizing salvage increases the recovered volume from damaged pine-leading stands by two million cubic metres per year over the first five years, while removing the pine partition reduces the mid-term projection by seven percent.

The harvest level achieved in the base case forecast is sensitive to changes in the assumed minimum harvest volume and minimum harvestable age. Relaxing merchantability assumptions increases available growing stock creating a significant upward pressure in timber supply. Although these stands represent an opportunity to mitigate mid-term shortfalls they are not representative of the current or historic harvest profile.

The provincial chief forester's AAC determination is a judgment based on her professional experience and her 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 projections included in this document.

Your input is needed

Public input is a vital part of establishing the allowable annual cut. Feedback is welcomed on any aspect of this public discussion paper or any other issues related to the timber supply review for the Prince George timber supply area. Ministry staff would be pleased to answer questions to help you prepare your response. Please send your comments to the District Manager at the address below (via email if possible).

Your comments will be accepted until May 24, 2016.

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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B.C. Ministry of Forests, Lands, and Natural Resource Operations
Prince George Natural Resource District
2000 S Ospika Boulevard
Prince George BC V2N 4W5
Telephone: 250-614-7400

B.C. Ministry of Forests, Lands, and Natural Resource Operations
Stuart Nechako Natural Resource District
2537 Stones Bay Road
Fort St. James, BC V0J 1P0
Telephone: 250-567-6363

B.C. Ministry of Forests, Lands, and Natural Resource Operations
Vanderhoof Office
Stuart Nechako Natural Resource District
Mailing address: P.O. Box 190, Vanderhoof, BC V0J 3A0
Physical address: 1560 HWY 16 East, Vanderhoof, BC V0J 3A0
Telephone: 250-567-6363

If you have any comments or questions, contact:

Shawn Rice
A/District Manager
Prince George Natural Resource District
Electronic mail: Shawn.Rice@gov.bc.ca

Dave Van Dolah
District Manager
Stuart Nechako Natural Resource District
Electronic mail: David.VanDolah@gov.bc.ca

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

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

Appendix 1

Harvest flow

- Harvest projections for the Prince George TSA follow the FAIB catastrophic flow policy. Generally, the base case for management units that have experienced some form of catastrophic loss will consist of three phases:
    - a short term (the salvage phase);
    - a mid term (the transition phase); and
    - a long term (the managed stand phase).
- The short term ends when the growing stock rapidly declines (typically at the end of the salvage phase).
- The mid term ends when 75% of the stands projected to be harvested come from stands established since the onset of the catastrophe and a subsequent salvage program (if applicable). In the case of MPB, the year 2000 approximately corresponds to the onset of the epidemic provincially.
- The short-, mid- and long-term harvest flows were modelled as even-flows with the objective of maximizing the mid term. This was achieved by initially modelling an even-flow across the entire planning horizon. This even-flow set the harvest level for the mid term. For the current analysis the short term was elevated to current harvest levels and the mid-term projection is adjusted. Alternatively, the short term was only increased to the extent that it does not negatively impact the mid term. Both projections are contrasted for discussion.
- No gradual transitions were modelled—all transitions were instantaneous.
- The short-term harvest level will be set at the current AAC if is fully utilized (or exceeded). If the AAC has not been fully utilized it will be set at the average realized harvest level over the past five years. The total planning horizon depicted will be 100 years.