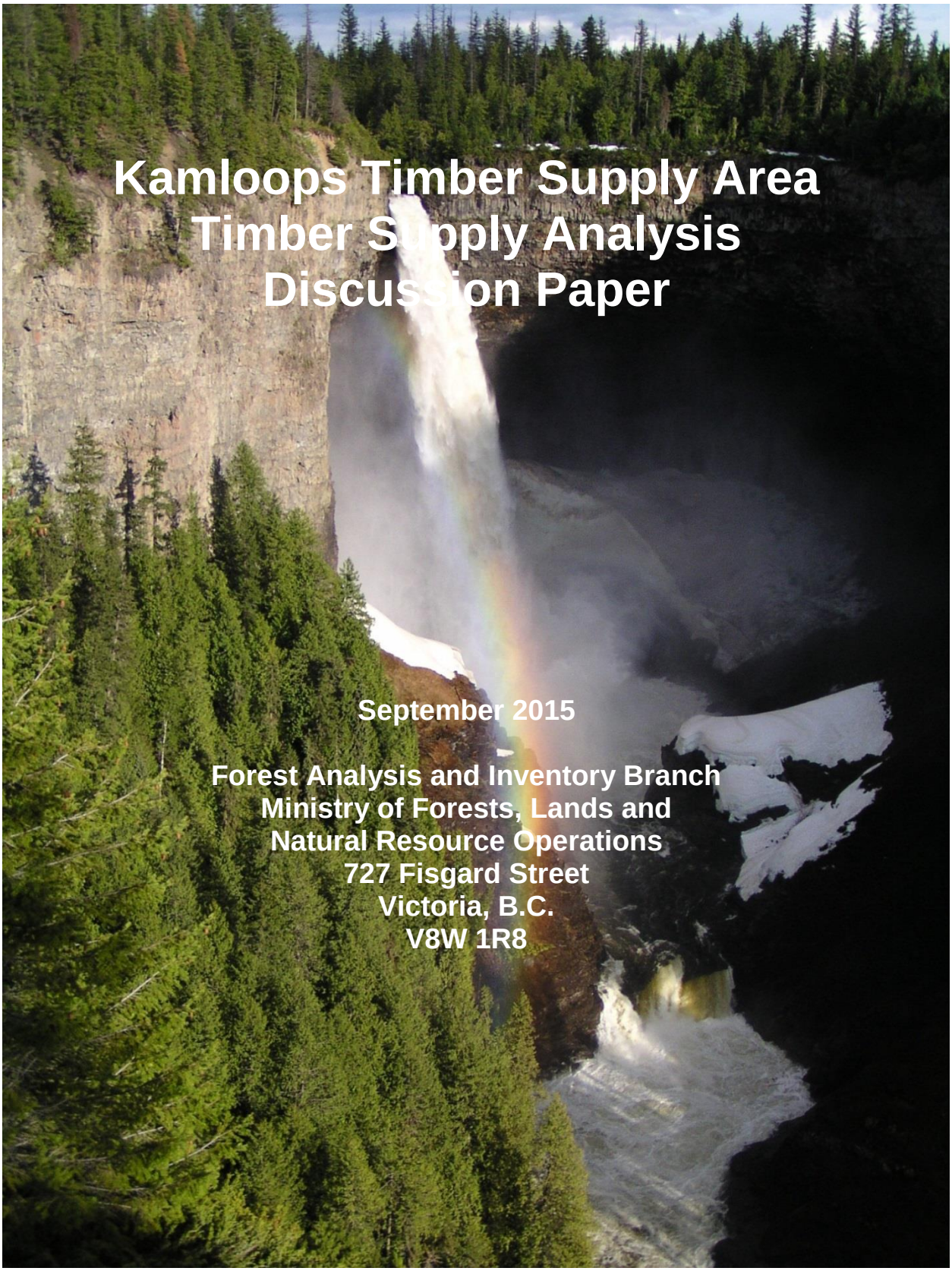

Kamloops Timber Supply Area
Timber Supply Analysis
Discussion Paper

September 2015

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

Cover photograph of Helmcken Falls, Wells Gray Park
Ministry of Forests, Lands and Natural Resource Operations
Thompson Rivers Natural Resource District

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, the fifth for the Kamloops TSA, examines the impacts of current legal requirements and demonstrated forest management practices on the timber supply, economy, environment and social conditions of the local area and province. Based on this review the chief forester will determine a new allowable annual cut[d] (AAC) for the Kamloops 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, 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 Kamloops TSA. Details about the data and assumptions used in the analysis were provided in a data package (September 2014). Updates to the information used and technical details regarding the analysis are available on request from the Ministry of Forests, Lands and Natural Resource Operations, Forest Analysis and Inventory Branch. The timber supply analysis should be viewed as a "work in progress". Prior to the chief forester's AAC determination for the TSA, further analysis may need to be completed and existing analysis reassessed as a result of input received on this discussion paper.

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

[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.

- 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 (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.

Information on the potential contribution of marginally-economic stand types to timber supply is discussed later in this document under the section '*Opportunities*'. It is expected that this discussion paper will stimulate discussion of resource management objectives and practices within the Kamloops TSA and relevant information will be provided to the chief forester for consideration in determining a new AAC.

Timber supply reviews undertaken in support of AAC determinations are based on the current resource management objectives established by government in legislation and by legal orders. For the purposes of the Kamloops TSA timber supply review, forest management objectives are provided by the *Forest and Range Practices Act*, the Kamloops Higher Level Plan Order initially approved by Cabinet in 1996, and subsequent orders for specific objectives such as mountain caribou. The information compiled to support this timber supply review can be made available to support land use planning as required. However, land-use planning and land-use decisions are outside the scope of the chief forester's AAC determination. In the event that resource management objectives and practices change, these changes can be reflected in future timber supply reviews.

Timber supply review in the Kamloops TSA

On June 1, 2008, following an urgent timber supply review in response to the MPB infestation, the chief forester set the AAC for the Kamloops TSA at 4 000 000 cubic metres. This AAC included a partition which specified that the non-pine harvest must not exceed 1 700 000 cubic metres. The intent of the non-pine partition was to encourage the salvage of dead pine while conserving non-pine volume to mitigate the projected decrease in mid-term timber supply.

In September 2014, 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 Kamloops TSA. Before setting a new AAC, the chief forester will review all relevant information, including the results of the timber supply analysis and input from government agencies, the public, licensees and First Nations. Following this review, the chief forester's determination will be outlined in a rationale statement that will be publicly available. The actual AAC that is determined by the chief forester during this timber supply review may differ from the harvest projections, including the base case, presented in this public discussion paper as the chief forester must consider a wide range of information, some of which is not be quantifiable. Ultimately, the chief forester's AAC determination is an independent, professional judgment based on the legal requirements set out in Section 8(8) of the *Forest Act*.

[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.*

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

Description of the Kamloops TSA

The Kamloops TSA is located in south-central British Columbia and extends from Logan Lake in the south to Wells Gray Provincial Park in the north-west, including the Blue River area, and is bounded by the Columbia Mountains to the east and the Cariboo Regional District to the west. The topography of the Kamloops TSA is diverse, ranging from hot, dry grasslands in the valley bottoms in the south to wet rugged mountains in the north, and is bisected by the North Thompson River which joins the South Thompson River at Kamloops.

The Kamloops TSA is administered by the FLNR, Thompson Rivers Natural Resource District offices located in Kamloops and Clearwater. Fifty woodlot licences, three community forest agreements and two tree farm licences have been issued for areas within the boundaries of the TSA. First Nations Woodland Licences are also in the proposal stage. The AACs for these area-based tenures are determined through separate processes and they are not included within the AAC for the TSA. The information provided in this discussion paper pertains to the remainder of the TSA only, unless otherwise specified.

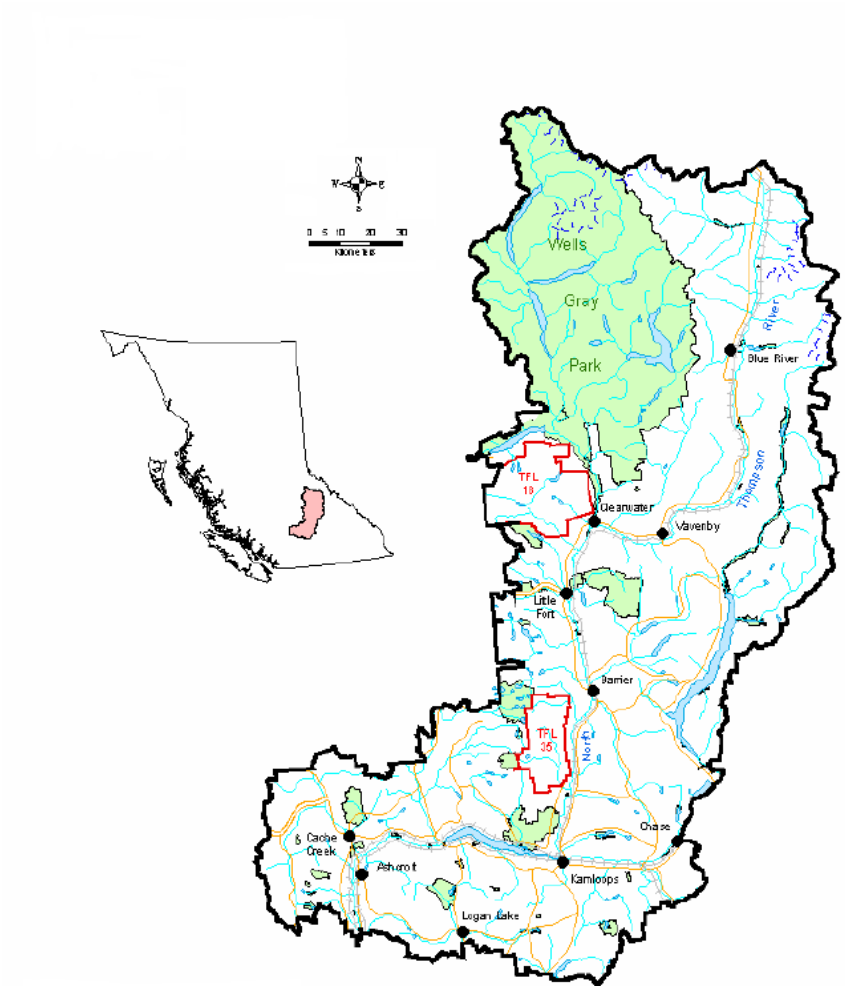

Figure 1. Map of the Kamloops TSA.

Environmental values

The Kamloops TSA has diverse ecosystems ranging from hot and dry grasslands in the south to wet rugged mountains in the north. The biogeoclimatic zones include Bunchgrass (BG), Ponderosa Pine (PP), Interior Douglas-fir (IDF), Engelmann Spruce – Subalpine Fir (ESSF), Interior Cedar – Hemlock (ICH), Montane Spruce (MS) and Alpine Tundra (AT).

These diverse ecosystems provide a variety of wildlife habitats, including grasslands, lakes, wetlands, forests, and alpine areas. These habitats support a diversity of mammals, birds, amphibians, insects and plants. Twenty-eight species of designated identified wildlife are found in the TSA; these include mountain caribou, grizzly bear, American badger, bull trout, burrowing owl and western rattlesnake. See the Ministry of Environment BC Species and Ecosystem Explorer (http://www.env.gov.bc.ca/atrisk/toolintro.html) for a full list of designated wildlife species.

Water is a primary and fundamental resource of the TSA. Numerous rivers, lakes and streams support many species of fish including rainbow trout, kokanee, steelhead, and brook trout. The North and South Thompson Rivers, through which several species migrate, wind through the interior of the TSA to a confluence with the Fraser River in the southwest.

Protection and management of environmental values are addressed under provincial and federal legislation. The *Forest and Range Practices Act* (FRPA) is the primarily provincial legislation regulating forestry practices. Under FRPA, the *Forest Planning and Practices Regulation* identifies objectives set by government for environmental values including fish, wildlife, biodiversity, soils and water that are to be addressed within forest stewardship plans. Orders may be established under the *Government Actions Regulation* or the *Land Use Objectives Regulation* for specific land uses such as ungulate winter ranges, wildlife habitat areas, fisheries sensitive watersheds, temperature sensitive streams and old growth management areas. Over 22% of the Kamloops TSA is provincially designated for the protection of its natural environment.

Natural resources

The forests of the TSA provide a wide range of natural resource benefits, including forest products, minerals, recreation and tourism amenities, fish and wildlife and ranching.

Parks, recreation sites and trails, and roaded and non-roaded areas provide opportunities for numerous outdoor activities including mountain biking, all terrain-vehicle use, hiking, hunting, camping, boating, cross-country skiing and snowmobiling. Parks range from the internationally recognized Wells Gray Provincial Park to the tiny Monte Creek Provincial Park that protects a treed riparian area.

The ranching industry has a large presence in the TSA both within the grasslands and forested lands. Over one-third of all provincial grazing leases are found within the TSA.

First Nations

There are 31 First Nations communities with asserted territories within the Kamloops TSA reflecting a rich cultural history and active community and economic influence within the area. Those communities belong to six Nation groups, including the Secwepemc (Shuswap) Nation, Nlaxa'pamux (Thompson) Nation, Stat'imc Nation, Syilx (Okanagan) Nation, Tsilhqot'in and Carrier. Most First Nations communities affiliate with a tribal association. Tribal associations of note within the TSA include Shuswap Nation Tribal Council, Northern Shuswap Tribal Council, Nlaxa'pamux Nation Tribal Council, Nicola Tribal Association, Okanagan Nation Alliance, Stat'imc Chiefs Council, and Lillooet Tribal Council.

Ten First Nations have communities located within the TSA, with a total population of about 5000 people. These include the Adams Lake Indian Band, Bonaparte Indian Band, Tk'emlups te Secwepemc, Simpcw First Nation, Neskonlith Indian Band, Skeetchestn Indian Band, Whispering Pines/Clinton Indian band, Little Shuswap Indian Band, Ashcroft Indian Band and Oregon Jack Indian Band. Other First Nations communities have traditional interests within the Kamloops TSA, but their main communities reside outside the TSA.

The majority of the bands in the Kamloops TSA are not involved in the Treaty process; rather, ministry staff work with non-treaty First Nations through engagement and economic agreements, working groups, and other non-treaty processes. As of August 2015, Forest Consultation and Revenue Sharing Agreements have been achieved with 15 First Nations within the TSA and another six agreements are under active negotiation. There are also five First Nation signatories to the Secwepemc Reconciliation Framework Agreement which overlaps a significant portion of the TSA: Tk'emlups te Secwépemc, Skeetchestn Indian Band, Splats'in First Nation, Adams Lake Indian Band and Shuswap Indian Band.

Regional economy

The Kamloops TSA has a population of 113,730 (BC Stats, 2013). The major population centres in the TSA are Kamloops, Clearwater, Logan Lake, Chase, Barriere, Cache Creek and Ashcroft. Smaller communities include Vavenby, Little Fort and Blue River and 10 First Nations communities that are listed below. Between 2013 and 2036 the population within the TSA is projected to increase by 28,000 residents, primarily within the City of Kamloops.

In 2011 the largest portion of the labour force in the City of Kamloops and other incorporated communities was involved in retail and sales, health and social assistance and accommodation (35.2% for City of Kamloops, 38% for other incorporated communities). Mining and oil and gas accounted regionally for a further 11.6% of the labour force. The direct agriculture and forestry industry only contributes a small (1.6%) of the labour force within the City of Kamloops and 4.0% of the other incorporated communities. However, these statistics lump the sizeable wood processing labour force (e.g., pulp mill, sawmills and value added wood processors) within the manufacturing sector.

According to the *British Columbia Local Area Economic Dependencies: 2006*, the forest sector accounted for 30% of the after-tax income of North Thompson Local Area residents while Kamloops was more diversified with the forest sector only contributing 9%.

Land use planning

The Kamloops Land and Resource Management Plan (KLRMP) was designated a higher level plan on January 23, 1996. This plan and subsequent amendments provides legal land use direction to the Kamloops TSA. All major forest tenure holders are required to prepare legally binding Forest Stewardship Plans (FSP) that reference the objectives of the KLRMP.

Management of the forest and range within the Kamloops TSA is also guided by the Thompson Nicola Fraser Sustainable Forest Management (SFM) Plan. Forest tenure holders who retain or seek environmental certification of their management practices by the Canadian Standards Association participate in the plan. The SFM plan sets performance values, objectives, indicators and targets addressing environmental, social and economic aspects of forest management in the TSA. The SFM plan is monitored by a SFM advisory group which is made up of a cross-section of local interest groups. Participants in the plan report annually to the public.

Forest management

Timber harvesting land base

As part of the process used to define the modelled timber harvesting land base (THLB) in the timber supply analysis, a series of deductions are made from the TSA land base. Table 1 shows categories of land that are considered not to contribute to the THLB. The table presents the area of the categories within the gross TSA boundary and the area for each factor that is uniquely (i.e., no overlaps with other factors) considered excluded from timber harvesting. This presentation differs from land base classification tables in previous timber supply reviews that showed a sequential modelled netdown value associated with each category.

The TSA covers about 2.7 million hectares, of which approximately 1.7 million hectares is Crown managed forest land base[f] (CMFLB) considered within this AAC determination. The CMFLB excludes land base whose timber resource is not controlled by the province (e.g., private or federal lands) or for which the timber harvest is accounted otherwise (e.g., tree farm licences, community forests). Within the CMFLB, there are areas that are either unsuitable for harvesting or have been reserved from harvest to provide for other resource values (e.g., riparian areas, wildlife tree patches, wildlife habitat, etc.). These unsuitable or reserved areas are netted out of the CMFLB and the modelled area remaining that is suitable and available for timber harvesting is referred to as the 'timber harvesting land base[g] (THLB). In the Kamloops TSA the THLB is about 931 000 hectares - or 34% of the total TSA area.

[f] **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

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

Table 1. Kamloops TSA land base classification

Land classification	Total area	Percent of total area	Unique area excluded
Total area	**2 769 436**		
Land not managed by FLNR	219 846	7.9	63 360
Land not considered with TSA AAC	186 193	6.7	149 027
Non-forest areas (including water)	798 668	28.8	122 241
Roads, trails, landings	34 708	1.3	20 126
Transmission lines	6 368	0.2	515
Total Crown managed forest land base	**1 686 363**	**60.9**	
Parks and miscellaneous reserves	624 731	22.6	220 629
Hudson Bay Trail	261	0.0	144
Inoperable areas	325 784	11.8	19 803
Sites with low growing potential	175 869	6.3	11 571
Problem forest type - balsam	86 356	3.1	10 250
Problem forest type - deciduous	84 207	3.0	26 944
Old growth management areas	201 451	7.3	85 122
Wildlife habitat areas	2 793	0.1	213
Wildlife management areas	5 961	0.2	315
Mountain caribou habitat	236 299	8.5	46 924
Archaeological sites	3 399	0.1	696
Research installations and sample plots	2 785	0.1	2 329
Unstable terrain areas	111 202	4.0	27 719
Riparian areas	68 241	2.5	15 207
Wildlife tree retention	N/A	N/A	19 274
Current timber harvesting land base	**931 373**	**33.6**	

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

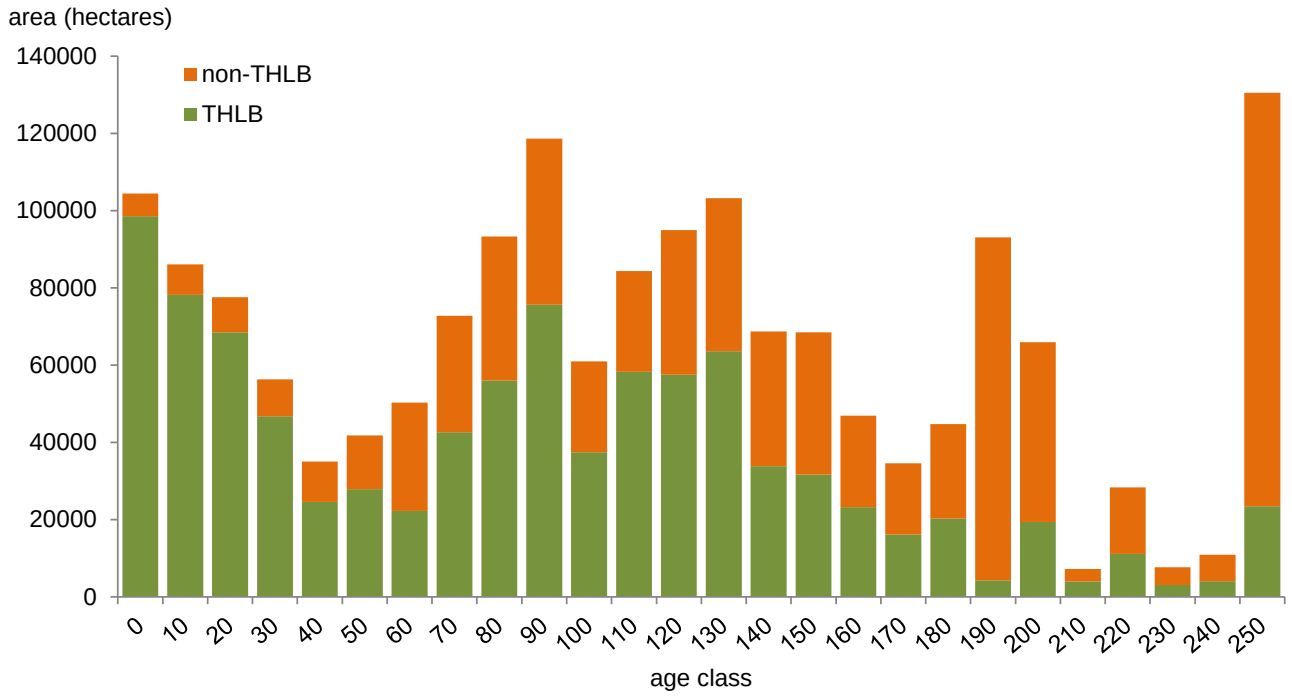

Figure 2. Age class distribution for the Crown managed forest land base in the Kamloops TSA.

Figure 3 summarizes the area and current volume by leading species on the THLB and illustrates the loss of mature pine volume due to the MPB epidemic in the province. For modelling purposes, the species composition of a stand with a harvest history was identified as the average species composition based on silviculture records rather than the inventory label. Deciduous-leading stands were excluded from the THLB and as such are not identified. Stands with other leading species (e.g., Ponderosa pine) represent less than one percent and are not shown in the figure.

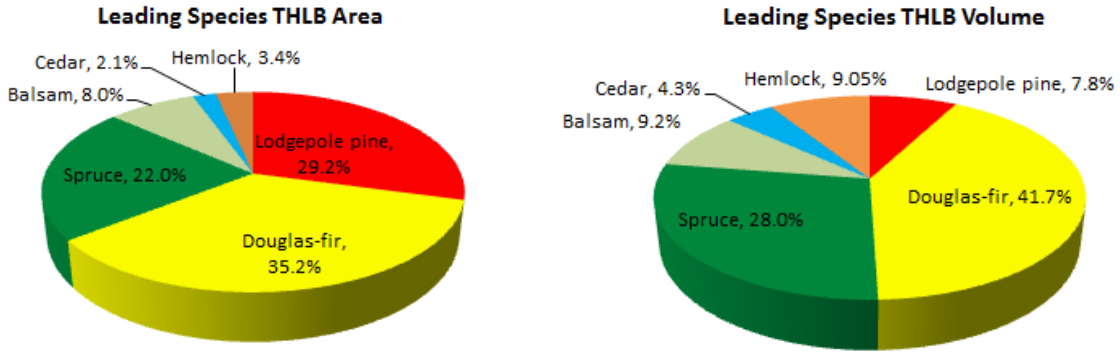

Figure 3. Leading species composition of the timber harvesting land base – Kamloops TSA 2015.

Land base and forest management changes since 2008

The last AAC determination for the Kamloops TSA on June 1, 2008, was necessitated as part of an ongoing assessment of the MPB epidemic in the central interior. Since then, several changes have occurred to the land base and forest management data and practices, including:

- the end of the mountain pine beetle epidemic;
- a new vegetation resource inventory completed in 2014;
- legal establishment of old-growth management areas in 2013;
- legal establishment of Logan Lake Community Forest;
- establishment of *Government Action Regulation* (GAR) Orders to assist with the recovery of mountain caribou;
- establishment of GAR orders for two research installations; and
- expiry of Pulpwood Agreement (PA) 16.

Mountain pine beetle

The MPB is a species of bark beetle that occurs naturally at endemic levels throughout western North America. 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. The magnitude of the most recent outbreak was 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 during the epidemic allowed large populations of beetles to survive the winters under the bark of pine trees.

The MPB infestation increased rapidly in the Kamloops TSA, starting in 2000 and peaking in 2006. The infestation then declined throughout the TSA. Since 2010 minimal areas of infestation have been recorded; only 67 hectares of trace red attacked were mapped in 2013. In the Kamloops TSA the outbreak is now considered to be over.

Forest licensees and government have made significant efforts in the Kamloops TSA to salvage MPB-infested stands. At the time of the initial infestation the estimate of the percent of the management unit with pine-leading stands was 35%. As reported in the series of "*Monitoring harvest activity across 28 mountain pine beetle impacted management units"* reports following the peak infestation in 2007 60% of the harvest was pine and has since gradually decreased to about 43% in 2014.

History of the allowable annual cut

In 1981, the AAC for the TSA was determined at 2 350 000 cubic metres. On January 1, 1989, the AAC was increased by 62 280 cubic metres to 2 412 280 cubic metres, to account for a transfer of harvesting rights and land base from 100 Mile House TSA to the Kamloops TSA. In 1994, the AAC was increased by 4400 cubic metres to 2 416 680 cubic metres, accounting for a transfer of land from TFL 35 to the Kamloops TSA for the Small Business Forest Enterprise Program (SBFEP). In 1996, the AAC was determined at 2 679 180 cubic metres, including a partition of 200 000 cubic metres for cedar and hemlock stands and a partition of 86 000 cubic metres for Pulpwood Agreement (PA) 16.

In 2003, the AAC was determined at 2 682 770 cubic metres, with a new partition of 20 000 cubic metres for deciduous stands outside the current boundary of PA 16, with 14 870 cubic metres specified as attributable to innovative practices and activities within the Adams Lake Innovative Forest Practices Agreement Area, and with all woodlot licence volumes issued since the 1996 determination (31 280 cubic metres) excluded, as required by the *Forest Act*.

In 2004, the AAC was determined at 4 352 770 cubic metres, with partitions specifying harvest volumes attributable as follows: to the salvage of fire-damaged timber, 670 000 cubic metres; to the salvage of timber damaged by the Mountain Pine Beetle (MPB), 1 000 000 cubic metres; to the harvest of old cedar- or hemlock-leading stands, 200 000 cubic metres; to PA 16, 86 000 cubic metres; to stands predominated by deciduous species, 20 000 cubic metres.

Effective June 1, 2008, the AAC was set at 4.0 million cubic metres that reflected adjustments in respect to the accounting of interior log grades and the continued need to address the mountain pine beetle infestation and the end of the need for the salvage of fire damaged timber. This decision maintained several partitions (PA 16, old cedar- or hemlock-leading stands and deciduous stands) and provided partitions of a maximum of 1 700 000 cubic metres for stands predominated by Douglas-fir, spruce or balsam and 1 994 000 cubic metres for the harvesting of pine with the possibility of an increase to the extent of any under-harvesting in the "non-pine" partition.

Data from the Ministry's Harvest Billing System show that the volume harvested from the Kamloops TSA since the last AAC determination (2009-2013) averaged 2.68 million cubic metres per year, which is 67% of the current AAC.

Timber supply forecast

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

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

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

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

The base case forecast

The timber supply analysis for the Kamloops TSA recognizes the current AAC of 4 000 000 cubic metres was a short-term uplift to address the MPB infestation. As such, an initial harvest level of 2 500 000 cubic metres was selected (Figure 4), though other alternatives were possible (Figure 5). This initial harvest level is in line with average harvest level of 2.68 million cubic metres per year for the period 2008-2013 and the AAC prior to the mountain pine beetle infestation.

In the base case (Figure 4), the initial harvest level of 2.5 million cubic metres per year can be maintained for one decade before decreasing over the next two decades to a mid-term level of 1.78 million cubic metres per year that is maintained for six decades. Following this mid-term level, the harvest level is projected to increase to a stable long-term level of 2.1 million cubic metres per year.

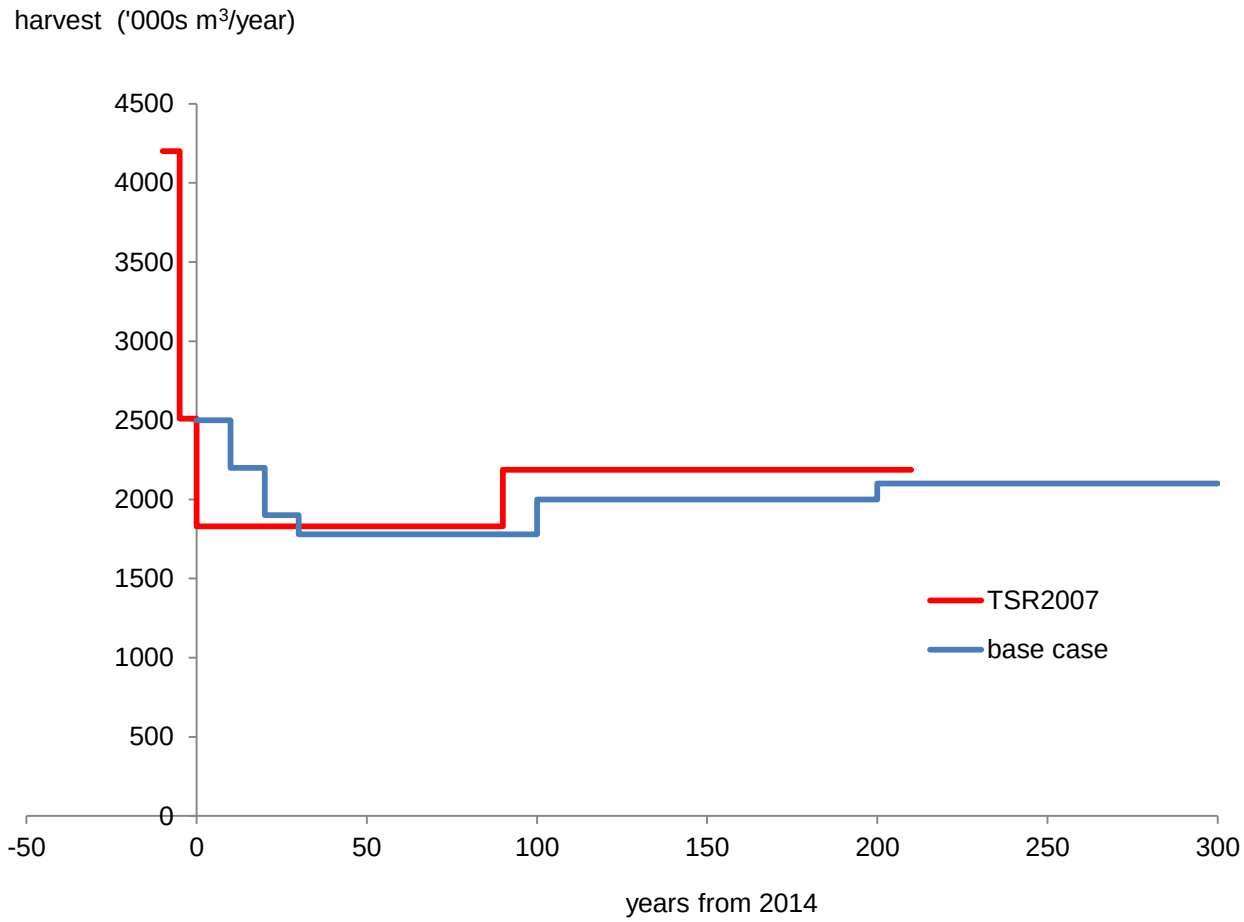

Figure 4. Base case — Kamloops TSA, 2015 compared to TSR 2007 base case.

The base case is one of many alternative harvest flows possible. Figure 5 presents several alternatives that demonstrate how a higher initial harvest level is primarily a trade-off with the following decades. The selection of an initial level of 2 500 000 cubic metres per year enables an orderly step down to the mid-term level with a relatively small reduction in the mid-term.

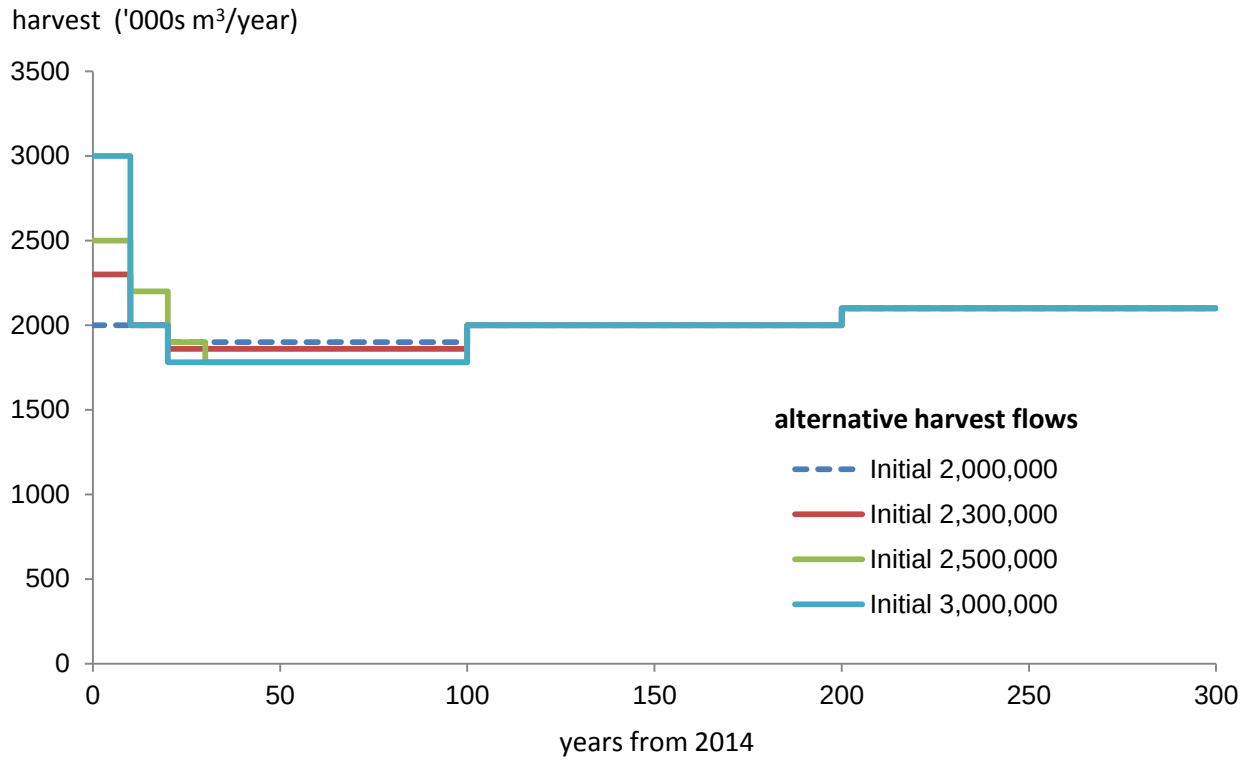

Figure 5. Harvest flows based on alternative initial harvest levels – Kamloops TSA 2015.

In the base case, the oldest stands available for harvesting in a landscape unit have the highest priority for harvesting. While there is recognition that operationally substitution of stand with different characteristics is often feasible without affecting the harvest flow, it is important to reflect on the timing of the contribution of different stand types to the harvest flow in the base case *versus* current operational expectations. Figure 6 demonstrates the expectations under the base case for six stand characteristics.

Managed *versus* Existing Stands: In the base case, managed (i.e., stands harvested after 1987) stands are expected to start contributing to the harvest flow after three decades.

Harvest Age: As harvesting moves from existing natural stands to managed stands, the age at which stands are harvested is expected to become younger. To meet the mid-term harvest level of the base case, there is an expectation that a significant portion of the harvest will be from stands less than 80 years. These are the stands on the more productive sites and are expected to reach the peak of their cumulative growth rate at this age.

Harvest Volume: A consistent distribution of stand volumes is seen in the base case. In the initial decades, some harvest is expected from older low volume existing stands. These older low volume stands are not present in the later periods given the growth expectations of managed stands.

Harvest Volume by Dead and Live: The harvest in the first decade is expected to include a significant portion of standing dead and a small component of live lodgepole pine. The non-recoverable loss of standing dead volume that is initially present but not harvested in the first decade would not have significantly added to the harvest flow.

Slope: In the base case, stands are generally harvested proportionate to the slope[a] within the THLB. Operationally, only about 10% of stands in the THLB on slopes greater than 35% have been harvested whereas 22% of stands on slopes less than 35% have been harvested. District staff and some licensees have expressed concerns about the harvest of some areas, particularly steeper slopes and lower volume pine stands with a dead component.

BEC Zone: Harvesting through all time periods is expected from all BEC zones.

[a] Slope area calculations are based on an average slope for the modelled resultant polygon.

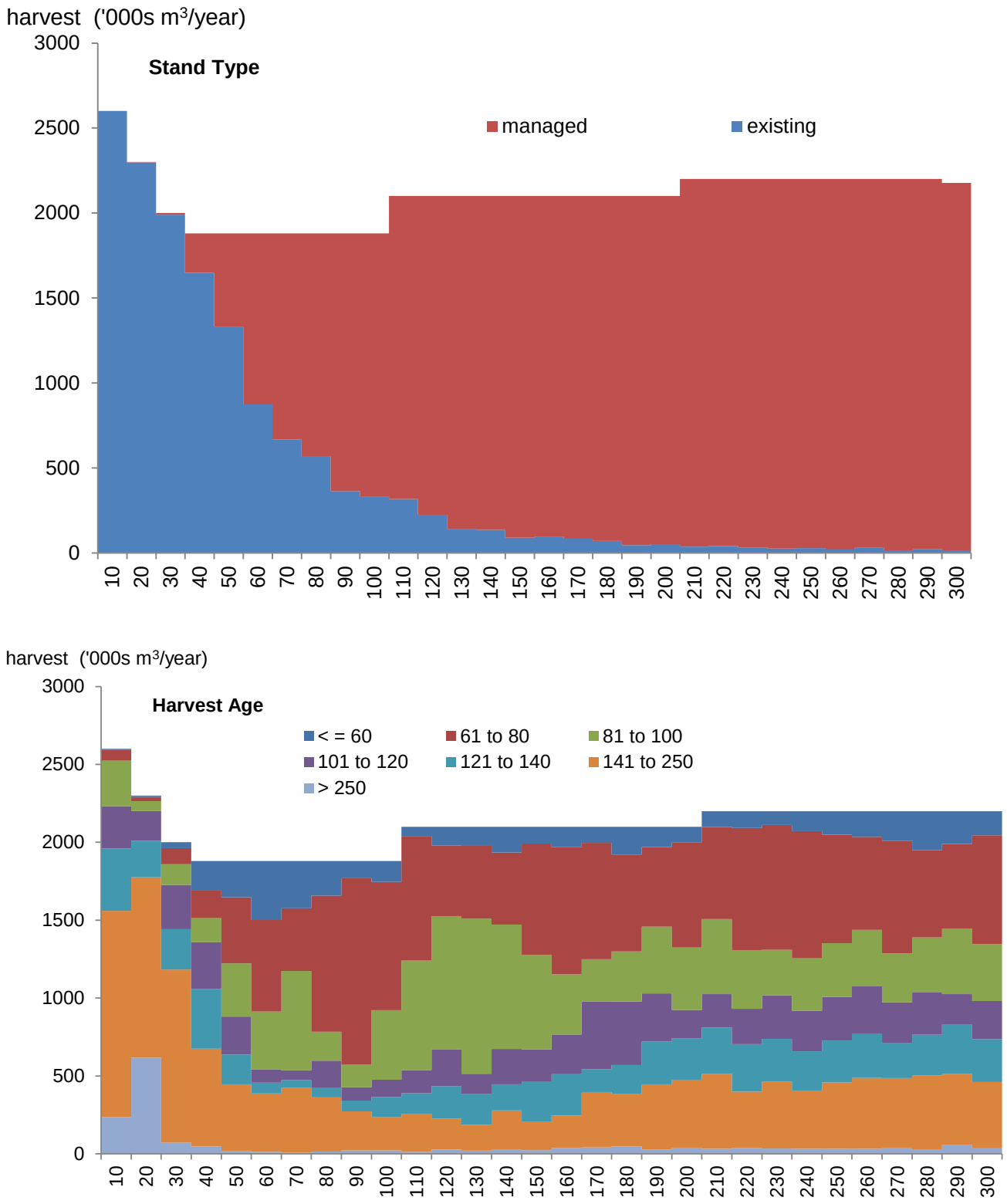

Figure 6. Harvested stand characteristics of the base case — Kamloops TSA, 2015 (continued).

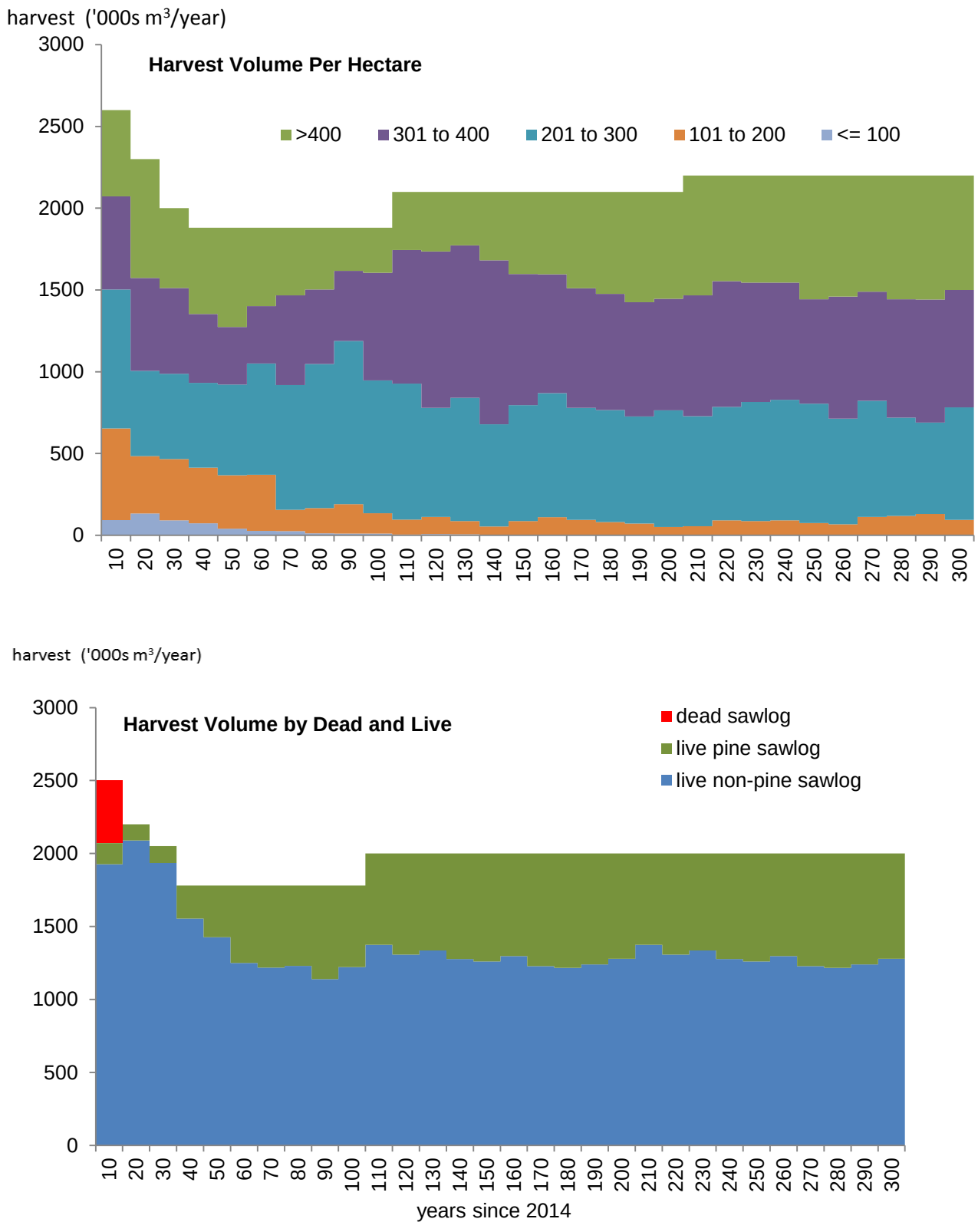

Figure 6. Harvested stand characteristics of the base case — Kamloops TSA, 2015 (continued).

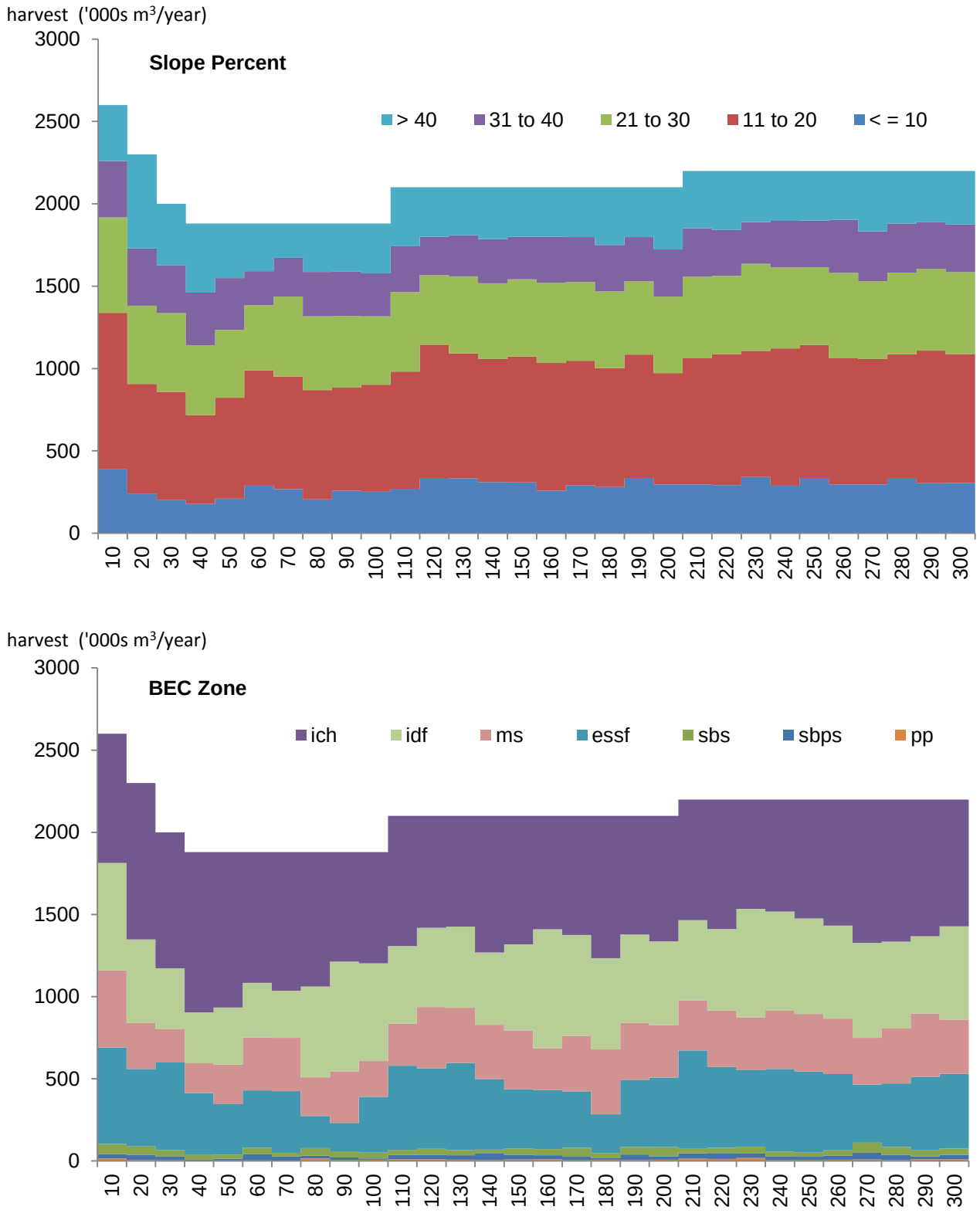

Figure 6. Harvested stand characteristics of the base case — Kamloops TSA, 2015 (concluded).

Key sensitivity analyses

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

Forest inventory/existing stand volumes

In 2014, a Phase 1 vegetation resource inventory (VRI) was completed in the Kamloops TSA. The Phase 1 inventory is based on the interpretation of aerial photography that was flown in 2010 and 2011 (i.e., post-MPB epidemic). The base case timber supply analysis used the FLNR 2014 projection of this inventory and incorporates harvesting and silviculture updates available as of August 2014.

Subsequent to the Phase 1 interpretation, a Phase 2 vegetation resource inventory was completed. The Phase 2 inventory is a statistically based ground sample that can be compared to the Phase 1 estimates. The results of the Phase 2 sample identify a ratio of Phase 2 to Phase 1 of 0.967 for all species volume net decay waste and breakage at the 12.5+ cm utilization level. This suggests that overall volumes in the Phase 1 inventory are reasonable estimated.

Sensitivity analyses are usually conducted to show the effect of uncertainty in estimates of existing stand volumes. While there was no evidence for uncertainty in volume estimates for existing stands in the Kamloops TSA, sensitivity analyses show that a proportionate change in timber supply in the short- and mid-term can be expected with changes in the existing stand volume estimates.

Site productivity

Site productivity information is a key input for projecting growth of managed forests and has implications for modelling stand volumes but also for the modelling of resource management objectives (e.g., time to reach green-up height). Provincially, many studies have demonstrated that site indices from older and younger stands in the forest cover inventory underestimated the potential site productivity. In the 2008 AAC determination (TSR 4), the chief forester recognized that there was likely an underestimation in the modelled site productivity and made an instruction that the results of available site productivity studies should be accounted for in the next timber supply review.

In the base case, the potential site indices for the Kamloops TSA were extracted from a provincial data layer of site productivity that is maintained by the FLNR Forest Analysis and Inventory Branch. This provincial layer primarily consists of site productivity estimates based on the long-term research project Site Index by BEC site series, commonly referred to as SIBEC. Where site series mapping or field based data is insufficient, a biophysical model has been used as a temporary substitute. For the Kamloops TSA potential site indices were derived from the biophysical model as it was felt that existing studies and data collection were incomplete to generate consistent TSA wide estimates.

In a sensitivity analyses, the potential site index estimate was changed by plus or minus two metres for all stands, resulting in updates to volume tables and constraints for non-timber objectives (i.e., age to reach specific stand heights). As seen in the figure below, differences in site index assumptions have significant mid-term as well as long-term implications on possible harvest projections.

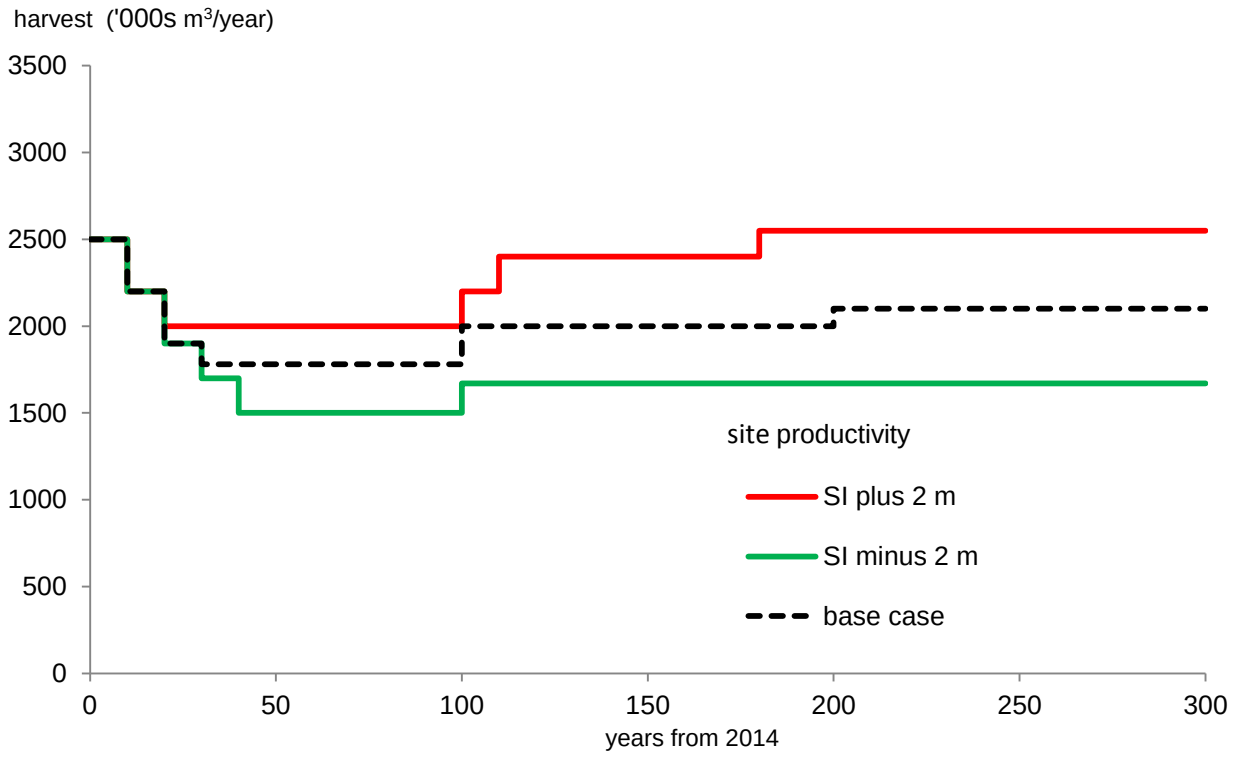

Figure 7. Two metre increase and decrease of site indices (SI) - Kamloops TSA, 2015.

The previous AAC determination rationale stated that the Kamloops TSA forest licensees had completed a site index adjustment (SIA) project that found the potential site index estimates were significantly higher in lodgepole pine, Douglas-fir and spruce-leading stands. This study had a target population that covered much of the crown productive forest land base but excluded several ecosystems.

A second sensitivity analysis that applied the results of the SIA project showed (see Figure 8) that it may be possible to increase mid-term and long-term timber supply (the short term was fixed to the base case levels) by 7% and 18% respectively.

A third sensitivity analysis investigated applying managed volume tables using the previous TSR4 (i.e., 2007) regeneration assumptions that did not incorporate improved site productivity information. This sensitivity analysis results in a lower harvest flow around 1.5 million cubic metres through all periods. Improved site productivity information is the major reason why given THLB reductions, the current base case harvest flow is similar to TSR4 base case harvest flow.

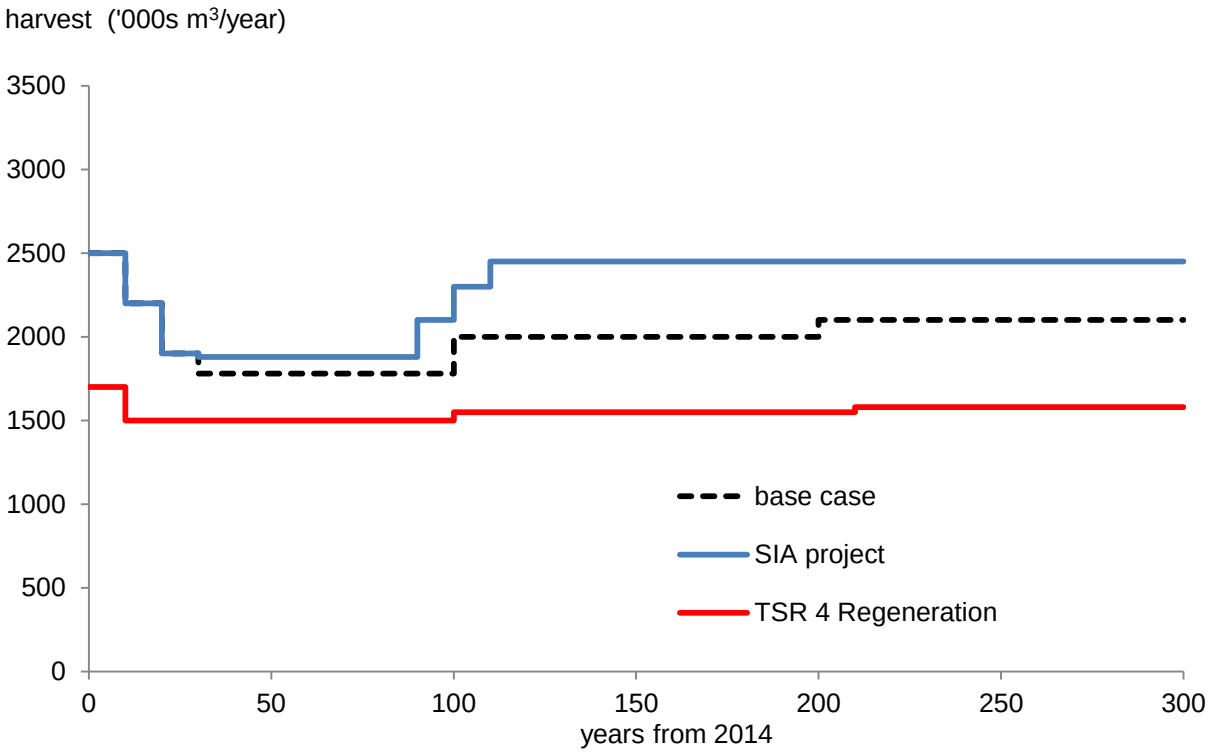

Figure 8. Applying results of a site index adjustment project and TSR4 regeneration assumptions for managed stand volumes - Kamloops TSA, 2015.

Contribution of dead pine

The 2014 VRI Phase I classified not only live tree layers but also classified a standing dead tree layer. To be included in the standing dead tree layer, the dead component of a stand must be greater than 30% of the stand density.

About 8.5 million cubic metres of standing dead volume were identified on the THLB in the Kamloops TSA. The dead volume includes a variety of species but is predominantly pine.

In the base case it was assumed that the remaining shelf life of the current standing dead volume is 10 years; after 10 years any remaining dead volume would not be harvestable. All species with standing dead were modelled similarly. No reductions for decay since the time of death were made to the current volumes. No specific harvest priorities were made for stands with high dead volumes or for pine in the base case; nevertheless, pine-leading stands and their associated dead volumes were harvested significantly in the first decade.

Given the simplicity of how standing dead was modelled in the base case and the uncertainty around shelf life (i.e., the decay) of the standing dead, several sensitivity analyses were prepared. The first sensitivity analysis was to assume that dead volumes would not be used. A second sensitivity analysis used an extended decay function that might be appropriate for a dry zone that decreased available volume from 95% in year one to 20% in year 20. These sensitivity analyses result in only minor impacts to the mid-term harvest flow (Figure 9).

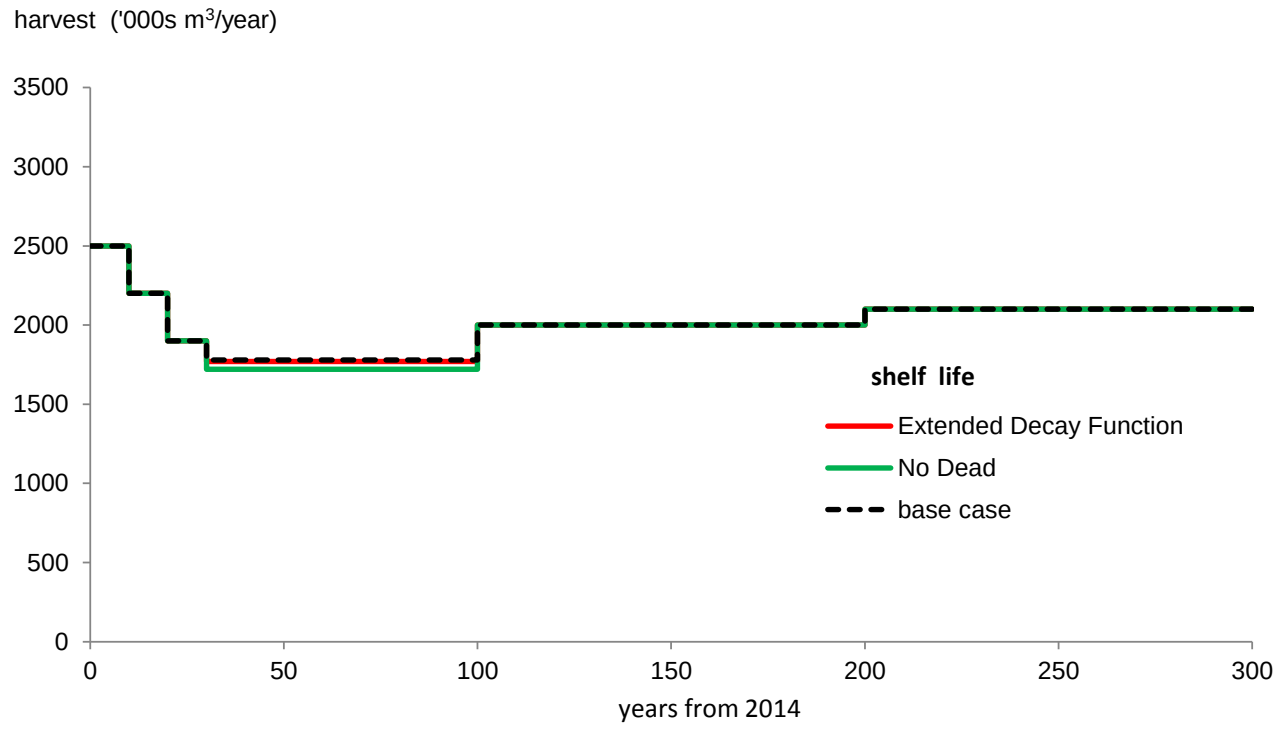

Figure 9. Standing dead shelf life changes – Kamloops TSA, 2015.

About 4.5 million cubic metres of available dead wood contributed to the base case harvest flow. As a sensitivity analysis, it was investigated whether a harvest priority on stands with higher percentages of standing dead pine would improve timber supply (i.e., use the standing dead before it is lost to decay). For this analysis, first priority was given to stands with at least 50 cubic metres per hectare of dead pine and greater than 50% standing dead, second priority was given to stands with greater than 30% standing dead, and final priority was to all other stands. This harvest priority resulted in similar amounts of dead wood being harvested as the base case.

Minimum harvestable age and volume

Factors such as lumber price and haul distance determine whether a stand has enough volume (and consequently minimum age) necessary for harvesting to be economical. In the simulation model either a minimum harvestable age or minimum harvestable volume is applied to prevent the model selecting stands younger or with less volume than the minimums specified.

In the base case, a minimum harvestable age was used based on when managed stands reached 95% of the age when the stand would have had its optimal growth. For existing stands, a minimum harvestable age of 60 years was used.

As a sensitivity analysis the minimum harvestable age was adjusted by plus or minus 10 or 20 years. No significant harvest flow impacts were observed with changes of 10 years. An increase of 20 years resulted in about a 12% decrease in mid-term timber supply whereas a decrease of 20 years resulted in a 4% decrease in long-term timber supply.

The change in minimum harvestable age can have different effects depending on the timing of the harvest. For example, the effect of an increase in minimum harvestable age in the mid-term may reduce the amount of stands eligible for harvest at a time when availability is low. Alternatively, in the long term, a decrease in minimum harvestable age could result in volume lost as managed stands are harvested before their optimal rotation ages.

Sensitivity analyses that replaced minimum harvestable age with a minimum harvestable volume demonstrated harvest flow differences, likely due to similar reasons as for the above age changes. Low minimum harvestable volumes did not enable greater timber supply but led to lower future timber supply as stands were harvested before their optimal rotation ages (Table 2).

Visual management

Visual quality is one of the 11 values to be managed under the *Forest and Range Practices Act*. In the Kamloops TSA visual resource management objectives were formalized under the KLRMP and the subsequent higher level plan orders.

In the base case, visual resource management was modelled according to the *Procedures for Factoring Visual Resources into Timber Supply Analyses* (MOF 1998). This methodology adjusts the modelled maximum disturbance based on the visual quality objective (VQO) and the visual absorption capacity (VAC); the visually effective green-up (VEG) height is based on the slope class of the visual unit. Operationally, visual management is likely more viewpoint specific as such may differ from this planimetric value by visual unit designation.

The FLNR Multiple Resource Value Assessment (MRVA) published in December 2013 reported that 37% of 19 landforms in the Kamloops TSA did not meet visual quality objectives as sampled from designated viewpoints. Similarly, from a planimetric perspective in the base case, 36% of the visual units at initiation were exceeding the maximum disturbance constraints as modelled. However, as the model strictly enforces constraint objectives, only a few visual units remain in violation after the first two decades as the VEG height is reached.

Figure 10 shows sensitivity analyses of relaxing (VQO high) and tightening (VQO low) the maximum disturbance constraint by assigning alteration percentages based either on all low visual absorption capability (VAC) or on all high VAC criteria. A sensitivity analysis was also completed that used a three metre VEG height rather than the variable slope based VEG height (3 to 8.5 metres).

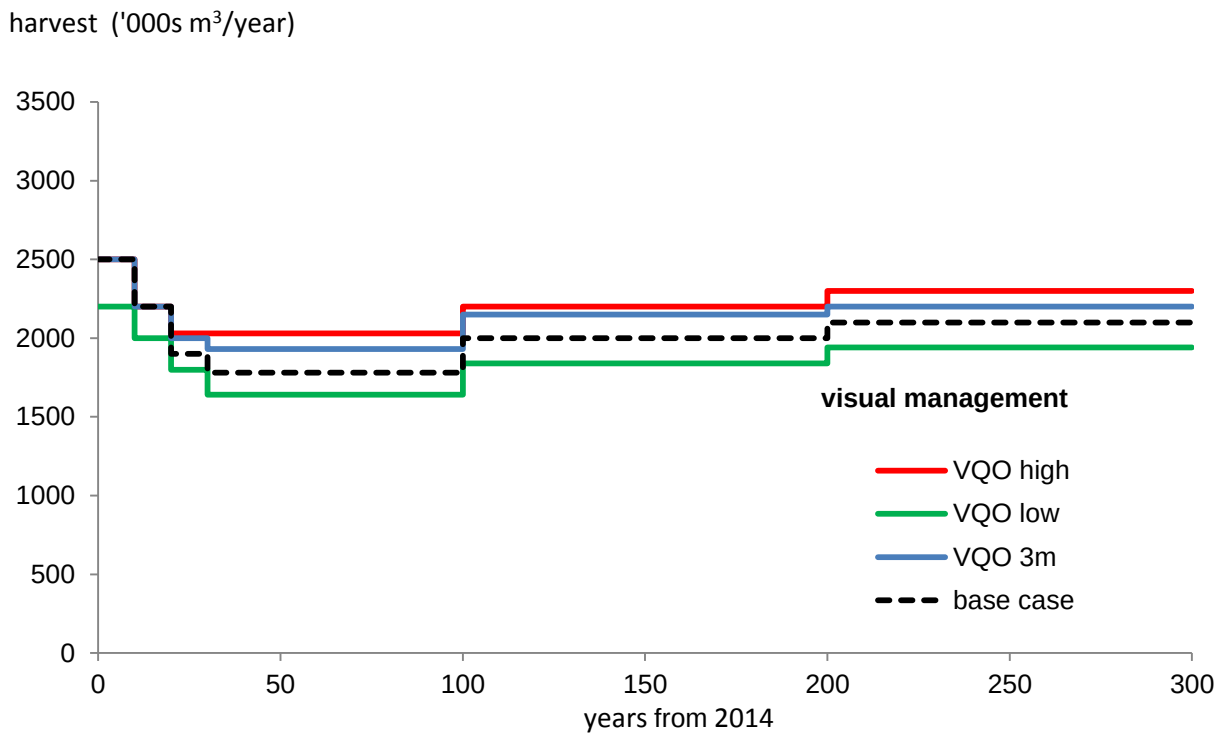

Figure 10. Visual management assumption changes - Kamloops TSA, 2015.

Other

The public discussion paper provides an opportunity to view the primary findings of the timber supply analysis that supports information presented to the chief forester for consideration during the determination of the allowable annual cut for the Kamloops TSA. Further analysis beyond that highlighted in this document may be conducted as a need is identified to provide additional insights for the determination. Table 2 summarizes sensitivity analyses that have been completed.

Table 2. Adjusted harvest flow sensitivity analyses where short = years 1-30, mid-term low = years 31-100, long = years 101-300

Issue tested	Sensitivity levels	Percent impact		
		Short	Mid	Long
Stand volume projections	Existing stands plus 10%	10	6	0
	Existing stands minus 10%	-9	-7	0
	Managed stands plus 10%	0	4	10
	Managed stands minus 10%	0	-4	-10
Timber harvesting land base	Plus 10%	10	12	10
	Minus 10%	-10	-11	-10
Minimum harvestable age	Plus 20 years	0	0	-4
	Minus 20 years	0	-14	0
Minimum harvestable volume	100 cubic metres	0	0	-16
	200 cubic metres	0	0	-2
Visual quality objectives	All at high VAC	3	13	9
	All at low VAC	-9	-7	-7
	3 m VEG height	1	8	6
Standing dead	No dead harvested	0	-3	0
	Available 20 years	0	1	0
	Decay since 2007	0	-1	0
	Harvest priority on dead	0	0	0
Site productivity	Plus 2 m site index	1	12	20
	Minus 2 m site index	0	-13	-18
	SIA application	0	7	18
	TSR 4 regeneration assumptions	-28	-15	-23

Opportunities

In response to the Special Committee on Timber Supply, the ministry is to review marginally economic forest types that might justifiably be included in a partition and also to provide information to enhance public discussion of resource management objectives, where appropriate and feasible.

The base case harvest flow for the Kamloops TSA represents an interpretation of the current resource management objectives, forest management and the land base composition. This interpretation requires identifying land base and forest types that are expected to not be available or desirable for harvesting and simplifying resource management objectives to model constraints.

The intent of the Special Committee on Timber Supply recommendation was to investigate whether any of the stand types not considered with the current allowable annual cut might potentially contribute to the timber supply of the timber supply area. Table 1 identifies the land base that was excluded from the timber harvesting land base either for a resource management objective that excludes harvesting (e.g., mountain caribou) or for modelling convenience for land base unlikely to be harvested (e.g., problem forest types).

In the analysis any harvest opportunities would only be available from areas that can be legally logged and for which logging is not avoided due to economics, physical limitations or environmental concerns. Table 1 also identifies the area that was excluded from the THLB uniquely for each netdown factor. This unique area provides a general indication of the magnitude of contribution of these stand types if considered in the AAC determination.

Deciduous stands have been identified as a possible harvesting opportunity in the past, and in the previous AAC determination a partition for deciduous volume was established. Tenure for deciduous-leading stands has been awarded but to date only a small amount of deciduous-leading stands had been harvested. Given the small amount of recent deciduous harvest, for modelling purposes deciduous volume was excluded in the current base case. If deciduous-leading stands had been included, the timber harvesting land base would be 2.9% larger.

Old balsam- and spruce-leading stands with low crown closure are excluded from the THLB in the current and in past timber supply reviews. About 10 000 hectares of this stand type was uniquely excluded from the THLB in the base case. Since the last determination, little harvesting (i.e., 84 hectares since 2006 based on inventory description) in these stand types has occurred.

Other stand types that can be logged but have been identified unsuitable or likely to be unsuitable have been defined based on historical inoperability mapping, environmentally sensitive area designation, or terrain stability mapping classification. Stands identified as these netdowns comprise less than one percent past or recent harvesting activity.

The above show that currently there is little use of those areas excluded from the THLB. This is the expectation given the decision process upon which the base case of the AAC determination is built. There is also further expectation that, while some of these exclusions may have been harvested, there also are areas within the THLB that will not be harvested. This reflects the different uncertainties in the various data and assumptions used to identify areas that are not considered in the THLB. Further, the requirement to determine the allowable annual determination every 10 years recognizes that changes in management practices related to non-timber management objectives and economic viability do occur and that the AAC determination should reflect such.

Conclusion

The 2015 TSR base case initial harvest level was chosen to start at 2 500 000 cubic metres and to step down over three decades to a mid-term level that is maintained for seven decades. After the mid-term period, in which the harvest transitions from predominately natural stands to managed stands, the harvest levels increase in the long term to over 2.1 million cubic metres per annum.

In spite of reduced land base available for timber harvesting due to recent non-timber resource management objectives for mountain caribou and stand composition changes due to mountain pine beetle, the timber supply projections are similar to previous timber supply review projections (e.g., used in 2008 AAC determination) given new information on potential site productivity.

The mountain pine beetle infestation, though slightly less severe than expected has impacted the growing stock and management options of the Kamloops TSA. The base case models harvesting over four million cubic metres of dead wood in the first decade - including about 50% of the identified volume of currently standing dead. Given that the harvest timing may be restricted to meet other resource management objectives and that the shelf life of standing dead trees could be optimistic, it is reasonable to expect that the current standing dead may not be fully utilized.

The base case and key sensitivity analyses prepared for this timber supply review indicate that operationally it is necessary to be cognizant of the timber harvesting land base, the harvest profiles and stand growth. The base case forecast is a simulation based on the data and expectations modelled, if the expectations are optimistic the forecast will be optimistic and vice versa.

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

Your input is needed

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

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

Your comments will be accepted until November 23, 2015.

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

For more information or to send your comments, contact:

Thompson Rivers Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations
1265 Dalhousie Drive,
Kamloops, B.C. V2C 5Z5

Telephone: 250-371-6500 Fax: 250-371-6565

Or contact:

Alan Card, Stewardship Forester
Thompson Rivers Natural Resource District
Ministry of Forests, Lands and Natural Resource Operations

Phone: (250) 371-6531

Electronic mail: Alan.Card@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

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