

Cranbrook Timber Supply Area Timber Supply Analysis Discussion Paper

September 2016

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



Ministry of
Forests, Lands and
Natural Resource Operations

Cover photograph of Steeles Range
Ministry of Forests, Lands and Natural Resource Operations
Rocky Mountain Natural Resource District
Courtesy of Mike Daigle

Introduction

The British Columbia (BC) Ministry of Forests, Lands and Natural Resource Operations (FLNRO) regularly reviews the timber supply^a for all timber supply areas^b (TSA) and tree farm licences^c (TFL) in the province. This review, the fourth for the Cranbrook 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 the province. Based on this review the chief forester will determine a new allowable annual cut^d (AAC) for the Cranbrook 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 (BC).

The objectives of the timber supply review are to:

- examine relevant legal requirements, 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 an overview of the timber supply review process and timber harvest projections for the Cranbrook TSA. 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 during this review process.

Information about the data and management assumptions used in the timber supply analysis were provided in a data package (October 2015). The technical details of the analysis are available on request from FLNRO, Forest Analysis and Inventory Branch. Contact information is provided at the end of this document.

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 FLNRO has responded to the special committee's recommendations.

^aTimber supply

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

^bTimber supply areas (TSAs)

Timber supply areas are integrated resource management units established in accordance with Section 7 of the Forest Act.

^cTree 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.

^dAllowable 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.

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 Cranbrook TSA timber supply review, forest management objectives are provided by the *Forest and Range Practices Act* (FRPA), the Kootenay Boundary Higher Level Plan Order (KBHLPO), and subsequent order variances for specific objectives. 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.

Public comments are encouraged and will be accepted until the end of the 60-day review period, on November 7, 2016.

Timber supply review in the Cranbrook TSA

In 2005 the chief forester set the AAC for the Cranbrook TSA at 904 000 cubic metres effective November 1, 2005. The AAC is partitioned as follows:

- 838 000 cubic metres is attributable to conventional harvesting; and,
- 33 000 cubic metres from marginal stands outside of the timber harvesting land base.

In October 2015, a data package documenting the data and forest management assumptions to be used in this timber supply analysis was released for public review and to assist with First Nations consultation. This discussion paper is being released in order to provide an overview of the timber supply review and to highlight the key findings of the timber supply analysis for the Cranbrook TSA. Before setting a new AAC, the chief forester will review all relevant information, including the results of the timber supply analysis and input from government agencies, the public, licensees and First Nations. Following this review, the chief forester's determination will be outlined in a rationale statement that will be publicly available.

The actual AAC that is determined by the chief forester during this timber supply review may differ from the harvest projections, including the base case, presented in this discussion paper as the chief forester must consider a wide range of information, some of which is not quantifiable. Ultimately, the chief forester's AAC determination is an independent, professional judgement based on the legal requirements set out in Section 8(8) of the *Forest Act*.

^ePartition

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.

^fTimber 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.

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

Description of the Cranbrook TSA

The Cranbrook Timber Supply Area (TSA) is within the Kootenay-Boundary Natural Resource Region - Rocky Mountain Natural Resource District and is administered out of the district office in Cranbrook. The Rocky Mountain Natural Resource District is situated in the southeastern corner of British Columbia and was created in 2003 by amalgamating the old Invermere and Cranbrook Forest Districts (Figure 1). The district contains approximately 2.63 million hectares, of which 1.24 million hectares falls within the Cranbrook TSA.

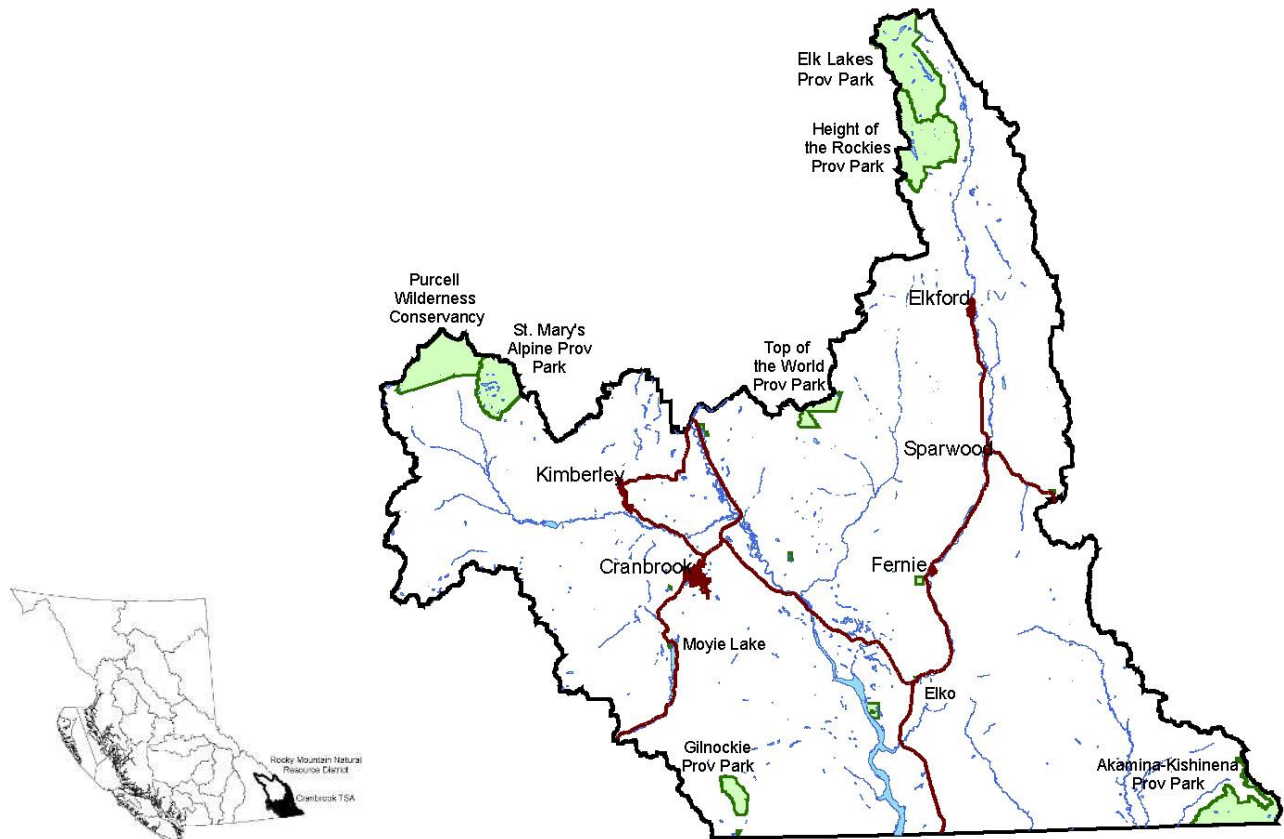


Figure 1. Cranbrook Timber Supply Area.

The Cranbrook TSA is bounded by the Skookumchuck Valley to the north, the Canada–U.S. border to the south, the Alberta border to the east, and the southern Purcell Mountains height-of-land to the west. Three major physiographic regions characterize the varied terrain of the Cranbrook TSA: the Rocky Mountains in the east, the Purcell Mountains in the west, and the Rocky Mountain Trench in the middle. The trench varies in width from five kilometers in the north to 27 kilometers near Cranbrook. The western side of the trench features irregular, comparatively low foothills gradually rising until they merge with the extremely rugged backbone of the Purcell Mountains. In contrast, the eastern side of the trench is characterized by an abrupt rise and continuous wall of mountains broken only by tributary valleys.

The major drainage in the Cranbrook TSA is the Kootenay River which flows southward through the Rocky Mountain Trench. Its major tributaries are the Moyie, St. Mary, Wildhorse, Bull and Elk Rivers. The Flathead River flows south into the U.S. in the southeastern part of the TSA. The Libby Dam on the Kootenay River, just south of the U.S. border, forms Lake Koocanusa which extends into the Cranbrook TSA. Moyie Lake is the largest natural lake in the TSA, followed by St. Mary and Wasa Lakes.

The Cranbrook TSA includes the cities of Cranbrook, Kimberley and Fernie, and the smaller communities of Sparwood and Elkford. Some small, unincorporated communities and a number of rural residences are dispersed throughout the TSA.

The Cranbrook TSA offers many and varied opportunities for recreation and tourism, due to its lakes, parks and spectacular mountains. The area is well travelled as major highways provide access to Alberta and the national and provincial parks in the Canadian Rockies. Within the Cranbrook TSA, there are the Akamina–Kishinena, Elk Lakes, and Gilnockie Provincial Parks as well as numerous smaller parks and recreation areas and portions of the Purcell Wilderness Conservancy, Height of the Rockies Provincial Park, and Top of the World Provincial Park.

First Nations

The member bands of two First Nation Councils have territories that encompass areas within the Cranbrook TSA: the Ktunaxa Nation Council and the Shuswap Nation Tribal Council.

Archaeological evidence suggests the Ktunaxa have inhabited the East Kootenay region, adjacent to the Columbia and Kootenay Rivers, since the last glaciation over 10,000 years ago. The Ktunaxa engaged in subsistence activities throughout their traditional territory and beyond.

Two Ktunaxa communities lie within the Cranbrook TSA. These include the ?Aq'am community located 15 kilometers northeast of Cranbrook, which has a population of approximately 375 people; and the Tobacco Plains Indian Band located 60 kilometers southeast of Cranbrook and 12 kilometers south of Grasmere, which has a population of approximately 200 people.

The Ktunaxa Nation Council is represented in treaty negotiations by the Ktunaxa Kinbasket Treaty Council (KKTC), and is nearing completion of Stage 4 – Agreement–in–Principle negotiations.

The Shuswap Nation Tribal Council (SNTC) is an organization that includes most of the Southern Secwepemc bands. As an organization, it works on matters of common concern, including the development of self-governance and recognition of aboriginal title. SNTC is involved in resource management within the Secwepemc Nation Territory and also provides technical support to member communities to improve services in health, child welfare, employment and training, research on traditional territories and community development.

The Shuswap Indian Band, located 80 kilometers north of the Cranbrook TSA at Invermere, is a member of the Shuswap Nation Tribal Council.

The Ministry of Forests, Lands and Natural Resource Operations has been communicating with First Nations about this timber supply review and intends to continue to fulfill its legal obligations to consult with First Nations in conjunction with the release of this discussion paper.

Environmental values

Current forest management is governed by the legislative requirements of the *Forest and Range Practices Act* (FRPA) and associated regulations and the land use objectives established by government. All forested lands, whether they contribute to timber supply or not, help to maintain critical habitats for many species. In the Cranbrook TSA, about 55 percent of the Crown forest management land base (CFMLB)[§] is neither suitable nor available for timber harvesting.

The Cranbrook TSA contains six biogeoclimatic zones, an indication of the climatic and biological diversity in this area. The six biogeoclimatic zones are:

- The Ponderosa Pine Zone occurs at low elevations (700 to 900 metres) in very dry valleys of the Rocky Mountain Trench.
- The Interior Douglas-fir Zone also occurs in the Rocky Mountain Trench, generally between the Ponderosa Pine Zone and the Montane Spruce Zone (between 800 and 1200 metres).
- The Montane Spruce Zone is found at mid-elevations, often between the Interior Douglas-fir Zone and the Engelmann Spruce-Subalpine Fir Zone (between 1200 and 1600 metres).
- The Interior Cedar-Hemlock Zone occurs at low to middle elevations (700 to 1500 metres) in the wetter portions of the Purcell and Rocky Mountains.
- The Engelmann Spruce-Subalpine Fir Zone is the uppermost forested zone, lying below the Alpine Tundra from 1600 to 2000 metres.
- The Alpine Tundra Zone lies above the Engelmann Spruce-Subalpine Fir Zone, and is by definition treeless although stunted (or krummholz) trees are common at the lower elevations of this zone. Overall, rock, ice and grassy meadows dominate this zone.

The Cranbrook TSA is part of the East Kootenay region, which is unique in North America for its density and diversity of wild ungulate and large predator populations. Other large mammals, small mammals and birds are also abundant in the TSA. This wealth of wildlife is made possible by the great variety of habitat types available in the area. The valley floor of the Rocky Mountain Trench offers high quality ungulate habitat due to its limited snowfall and low elevation (800 metres above sea level). Ungulate species include elk, mule deer, whitetail deer, moose, Rocky Mountain bighorn sheep, mountain goat, and caribou. Other large mammals include mountain lions, wolves, coyotes, black bear, and grizzly bear. Small furbearers include beaver, mink, muskrat, otter, fisher, marten, skunk, weasel, badger, wolverine, bobcat, lynx, squirrel, fox, and raccoon.

[§]Crown forest management land base (CFMLB)

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

This region also supports 70 percent of the bird species known to occur in BC and 62 percent of all the bird species that breed in the province. The lakes and streams of the TSA not only provide valuable bird habitat, they also support a wide range of fish species, including bull trout (Dolly Varden), cutthroat trout, rainbow trout, eastern brook trout, kokanee, mountain whitefish, burbot, walleye, and smallmouth bass. The Cranbrook TSA also supports a high value sport fishery in its lakes and river systems, particularly the Kootenay and Flathead Rivers and their tributaries. The most common game fish are cutthroat trout, rainbow trout, bull trout, Rocky Mountain whitefish and kokanee.

There are wildlife species in the TSA which are at risk due to declining populations across the province. The BC Species and Ecosystems Explorer system lists approximately 20 red-listed (Endangered or Threatened) and 64 blue-listed (Species of Concern) species found in the Rocky Mountain Natural Resource District which incorporates both the Invermere and Cranbrook TSAs. (see <http://a100.gov.bc.ca/pub/eswp/jsp/results.jsp?pager.offset=90>)

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

Land use planning in the Cranbrook TSA

The Cranbrook TSA lies within the area covered by the Kootenay Boundary Higher Level Plan Order (KBHLPO). Forest development in the TSA is required to be consistent with legally established goals and objectives of this higher level plan. The timber supply analysis assumes that forest management and timber harvesting will be consistent with the KBHLPO.

Regional economy

The Cranbrook TSA lies within the Kootenay-Boundary Regional District. According to the 2011 Canadian Census, the total population of the TSA is approximately 45,960 residents, with the largest populations located in Cranbrook (19,319), Kimberley (6,652), Fernie (4,448), Sparwood (3,667) and Elkford (2,523), with smaller rural communities surrounding municipalities and along the TSA highway networks contributing approximately 11,000 of the resident total. (see ftp://ftp.rdek.bc.ca/pdf/2011CensusPopulation_DwellingCount_Feb12.pdf).

The 2006 economic dependency estimates provided by BC STATS show that the main sources of employment in the Rocky Mountain Natural Resource District are the public sector (27 percent), tourism (23 percent), mining (16 percent), construction (14 percent) and forestry. In 2006, the forestry and forest manufacturing sectors accounted for about 12 percent of the employment in the district. Since then, employment in the timber processing sector has decreased, with the largest impact in the Invermere TSA due to the closure of the Canal Flats Canfor sawmill in 2015, preceded by the Tembec planer mill closure in Cranbrook in 2010.

Logs harvested in the Cranbrook TSA are mostly processed domestically at sawmills in the East Kootenay's. In the past five years, less than 0.5 percent of the harvested volume in the Southern Interior Region was deemed to be surplus to the needs of domestic processors and was permitted for export. The level of log export fluctuates depending on local demand and global log markets. (from http://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/log-exports/bc_log_export_permit_report_2011_2015.pdf).

Land base and forest management changes since the last TSR

The timber supply analysis presented in this discussion paper differs from the analysis used for the previous (2005) AAC determination. Some of the significant changes include:

- The management and reserve buffer outlined in the *Riparian Management Area Guidebook* (1995) were applied in the analysis.
- Predictive Ecosystem Mapping (PEM) and associated SIBEC estimates were completed in 2015 and used in the analysis.
- Only 50 percent of the eligible THLB on slopes between 40 and 70 percent were used in the base case whereas 100 percent were used in the last analysis.
- Old growth management areas (OGMA) area reductions were used in the analysis for old growth biodiversity requirements. Forest cover constraints were applied in the last analysis.
- Wildlife habitat areas (WHA) have been spatially located and their corresponding management requirements were applied in this analysis.

Harvest performance

The current AAC is 904 000 cubic metres of which 871 000 cubic metres is attributable to the conventional land base and 33 000 is attributable to marginal stands outside of the THLB.

Data from the Harvest Billing System (HBS) and the Electronic Commerce and Appraisal System (ECAS) maintained by the Timber Pricing Branch, FLNRO were summarized for the last six years and are presented in the following graphs.



Figure 2. Harvest summary for the Cranbrook TSA.

- (A) Total harvest, total non-pine harvest, and total pine harvest;
- (B) Live and dead volumes of total and pine harvest. The blue line in (B) represents the AAC level.

The Mountain Pine Beetle (MPB) is currently at low population levels. As shown in the above graphs little dead pine has been harvested as licensees promptly harvest the impacted stands.

The above graphs indicate that the actual harvest is above the current AAC. Review by district staff conclude that the actual harvest is below the cut control level due to varying cut control periods and that licensees may harvest more than the AAC in a given year but the overall harvest in a cut control period (typically five years) needs to be at or below the amount apportioned to their licence.

Further review of the harvest by partition shows that only 50 percent of the volume expected to be harvested on higher slopes (40-70 percent) is being harvested. Additionally, there has been no harvesting in the marginal stands outside of the THLB due to the lack of sizeable, viable stands. Together, this means the conventional land base (0-40 percent slopes) is being over harvested. The harvest contribution of these areas is assessed in sensitivity analyses.

The current AAC has a 33 000 cubic metre partition for harvesting marginal stands outside of the THLB. Licensees have not been able to locate stands of sufficient size or quality; therefore there has been no harvest performance in these stands. The chief forester will determine if or at what levels marginal stands contribute to the new AAC.

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.

The total land area (excluding large water bodies) within the boundaries of the Cranbrook TSA, is 1 484 998 hectares. After accounting for lands that are under area-based tenures, not Crown land or forested, the Crown forest land base is 782 474 hectares. After further reductions for areas not suitable or available for timber harvesting because of ecological, economic or social considerations, the current THLB is 351 773 hectares, which is 13 percent smaller than in 2005. Major reasons for the reduction are more area removed for steep slopes, area removed for old growth management areas (OGMA) and more wildlife habitat areas (WHA). 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.

Table 1. Cranbrook TSA netdown table

Land classification	Gross area (hectares)	Net area		
		Area (hectares)	Percent (%) of total	Percent (%) of CFMLB
Total	1,484,998			
Non-Crown	208,684	208,685	14.05%	
Non-TSA land	29,944	0	0.00%	
Non-productive land	603,144	480,141	32.33%	
Existing roads	27,836	13,698	0.92%	
Crown forest management land base (CFMLB)	782,474			
Parks	283,055	20,179		2.58%
Non-commercial brush	4,337	3,611		0.46%
Old growth management area	88,317	84,148		10.75%
Inoperable	777,468	193,891		24.78%
Steep slope	397,143	43,248		5.53%
Low site	671,517	9,180		1.17%
Wildlife habitat area		19,733		2.52%
Environmental sensitive area	116,339	5,268		0.67%
Unstable terrain	11,572	345		0.04%
Riparian area	52,651	10,742		1.37%
Problem forest type	133,970	11,041		1.41%
Non-merchantable stand type	51,857	6,882		0.88%
Wildlife tree patches		22,434		2.87%
Timber harvesting land base (THLB)	351,773			44.96%
Future roads		7,154		
Open range conversion		16,290		
Long-term timber harvesting land base	328,329			

The total TSA area (1 484 998 hectares) is approximately the same size as the last Timber Supply Review (TSR) (1 484 302 hectares).

The Crown forest land base (782 474 hectares) is also about the same size as the last TSR (760 590 hectares). The largest different is more area in existing roads in the last TSR.

The current THLB is considerably smaller (351 773 hectares) than the last TSR (416 196 hectares). The major changes are:

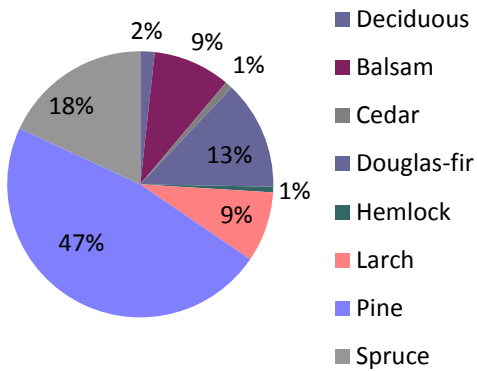
- accounting for OGMAs as an area reduction instead of as a forest cover constraint in the last TSR;
- fifty percent reduction for slopes between 40 and 70 percent instead of no reduction in the last TSR;
- WTPs removed as area reduction instead of a combination of area and volume reductions in the last TSR;
- increased area removed for WHAs.

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.

Forest composition

The dominant tree species in both the CFMLB and THLB (Figure 2) are pine, spruce, Douglas-fir. The minor species are cedar, hemlock, larch, balsam and deciduous.

Total volume in CFMLB by leading species (%)



Total volume in THLB by leading species (%)

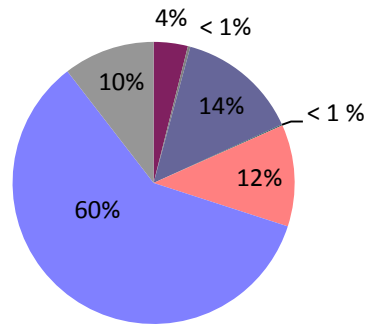
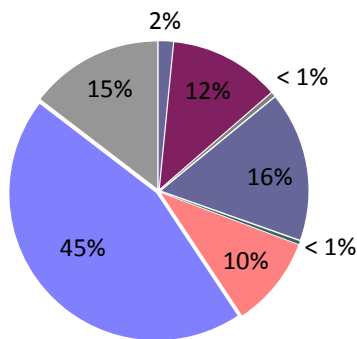


Figure 3. Crown forest management land base (CFMLB) and timber harvesting land base (THLB) inventory volume by species.

CFMLB area by leading species(%)



THLB area by leading species(%)

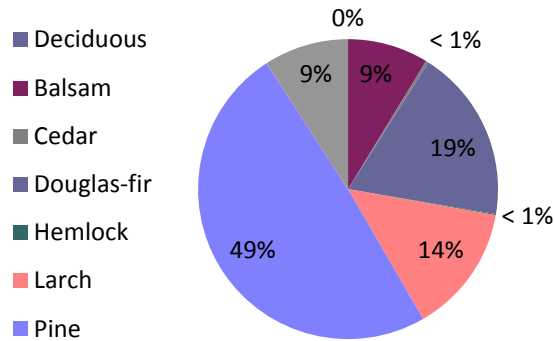


Figure 4. Crown forest management land base (CFMLB) and timber harvesting land base (THLB) area by species.

Figure 5 shows the current age class distribution of stands in the CFMLB. The age class distribution is not uniform. There is a higher proportion of stands in the 61 to 100 year age classes compared to the other age classes.

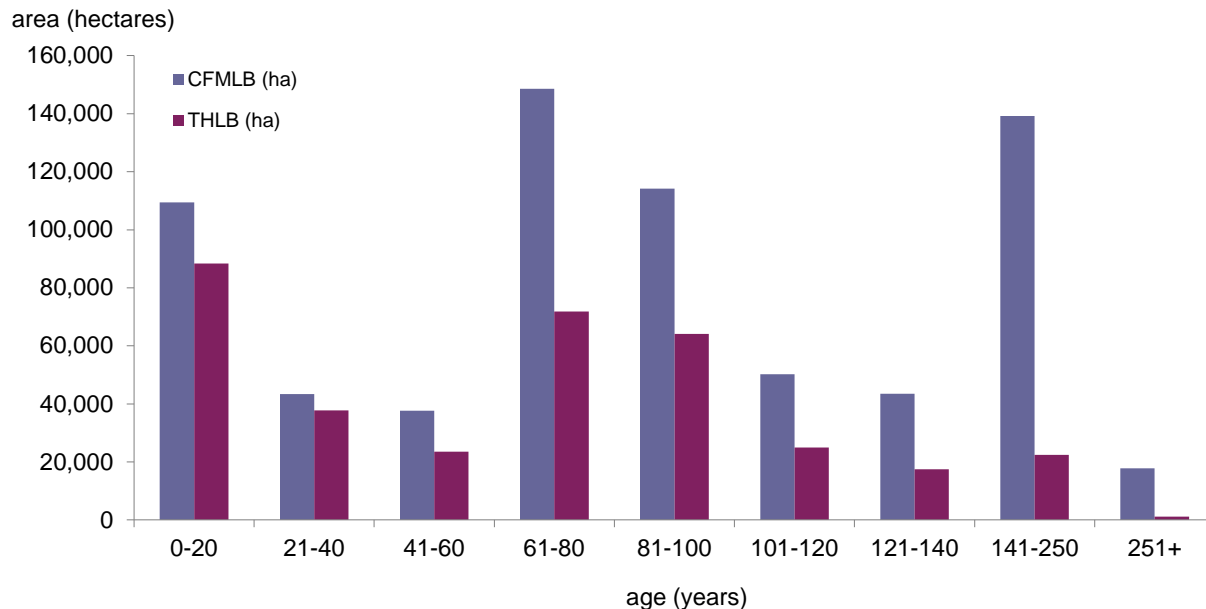


Figure 5. Age class distribution for the CFMLB of the Cranbrook TSA (hectares).

Timber supply analysis

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

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

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

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

The base case

The harvest sequencing rule used for the base case is: first harvest 50 percent of the volume from pine stands, second harvest open forest and open range stands, and finally oldest first.

In an October 27, 2010 letter from the FLNRO Minister to the chief forester, the Crown’s economic and social objectives in areas affected by the MPB were outlined. Specifically for the time after shelf life of the infected timber and the time when the forest has regrown - direction was provided to mitigate mid-term timber supply shortfalls. It is for this reason the base case harvest projection is modelled as an even-flow harvest; i.e., highest mid-term level.

The impact of the mountain pine beetle (MPB) was not modelled in the base case as the licensees have promptly harvested impacted stands. Where there is minor damage to a stand, the growth and yield model VDYP 7 accounts for any losses.

The initial harvest level in the base case from the last timber supply review was 904 000 cubic metres and is not shown in the graph below (Figure 4). This level decreased to 838 000 cubic metres after 10 years and is the initial level shown in the graph below.

The base case (Figure 4) begins in 2014 with an even-flow harvest level of 824 700 cubic metres per year, which is 8.6 percent lower than the current AAC. The base case does not include marginal stands outside of the THLB.

The current AAC is 904 000 cubic metres per year. The base case projection from the previous analysis indicated that after 10 years the harvest would decrease to 838 000 cubic metres per year. This is the initial harvest level shown in the graph below. The initial level for the current base case is 1.6 percent less than initial level from the previous analysis.

harvest volume (million m³/year)

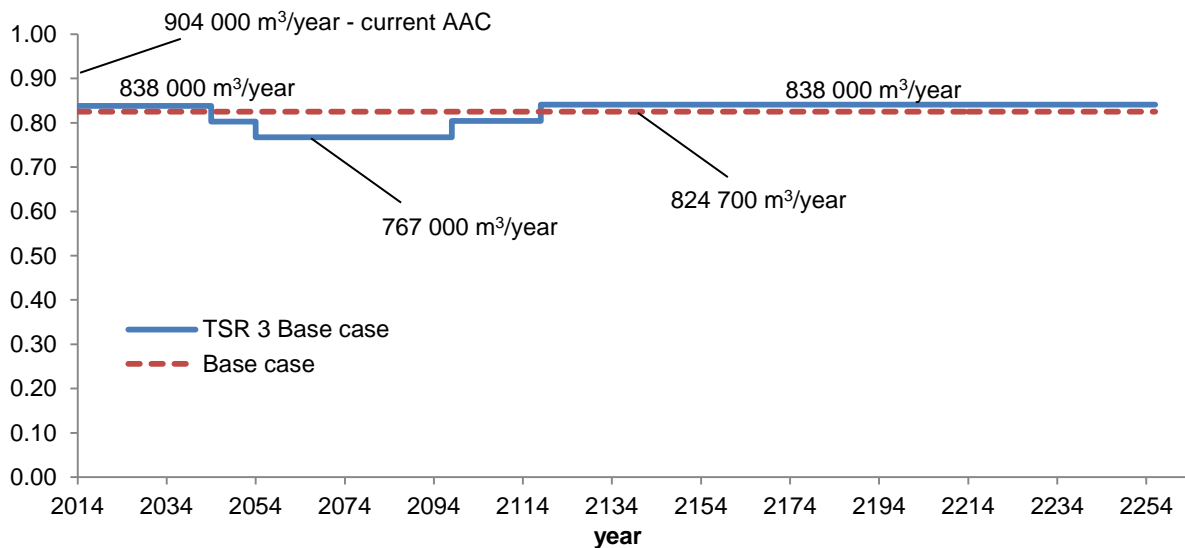


Figure 6. Base case projection - Cranbrook TSA.

Alternative harvest flows

The base case is one of many alternative harvest flows possible. Two alternative projections are shown in the graphs below (Figure 11). In the alternative harvest projections, the harvest flow allows the harvest level to increase initially with a subsequent drop below the base case level as long as the base case long-term harvest level is maintained.

The first alternative projection shows the highest initial harvest for 10 years. The level is maintained for 60 years before increasing to the base case long-term harvest level. The second alternative projection was performed to assess whether or not the decrease below the base case level in the first 10 years could be reduced by only allowing the highest initial harvest for five years.

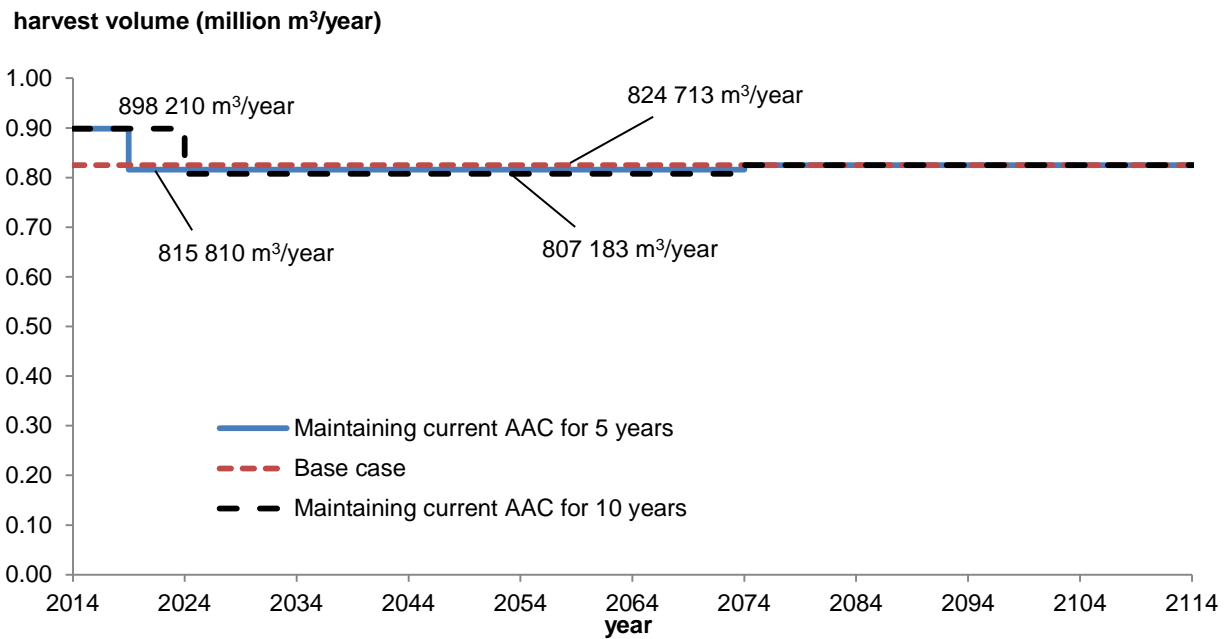


Figure 11. Alternative harvest projections – Cranbrook TSA.

The following table shows the percent impact in the short-, mid- and long-term for the alternative harvest projections. Both projections fall below the base case mid-term harvest level.

Table 2. Alternative harvest projections – Cranbrook TSA

Issue	Change	Initial harvest (m ³ /year)	Percent impact		
			Short term	Mid term	Long term
Highest initial harvest level	Set the initial harvest for 10 years	898,200	+8.9%	-2.1%	0%
Highest initial harvest level	Set the initial harvest for 5 years	898,200	+8.9%	1.1%	0%

Note: Short-term = decade 1; mid-term = decades 2-5; long-term = decades 6-10.

Attributes of the base case projection

The following graph shows the total and merchantable growing stocks. Both growing stock volumes are very stable over time.

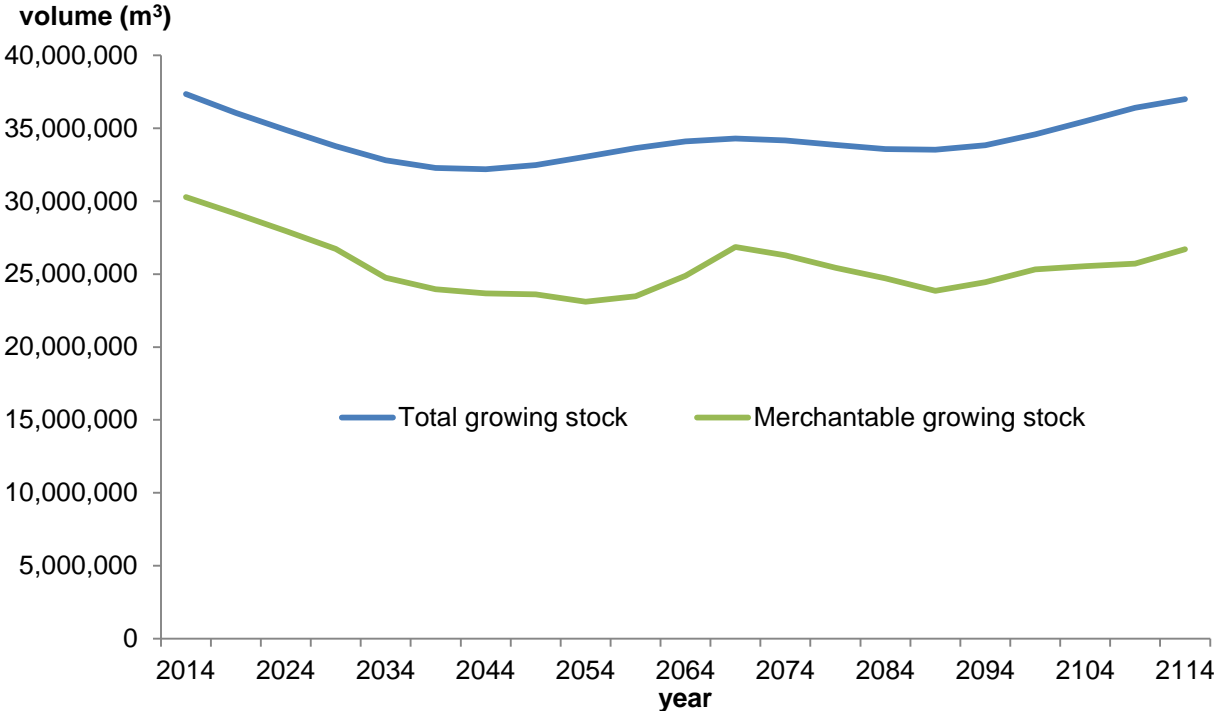


Figure 7. Total and merchantable growing stock – Cranbrook TSA.

Figure 8 shows the transition of the shift from natural and managed growing stock volumes. There is an equal amount of each growing in about 40 years which occurs just over 40 years from 2014. Currently there is little managed stand growing stock as the regenerated stands must meet minimum utilization criteria (e.g., diameter).

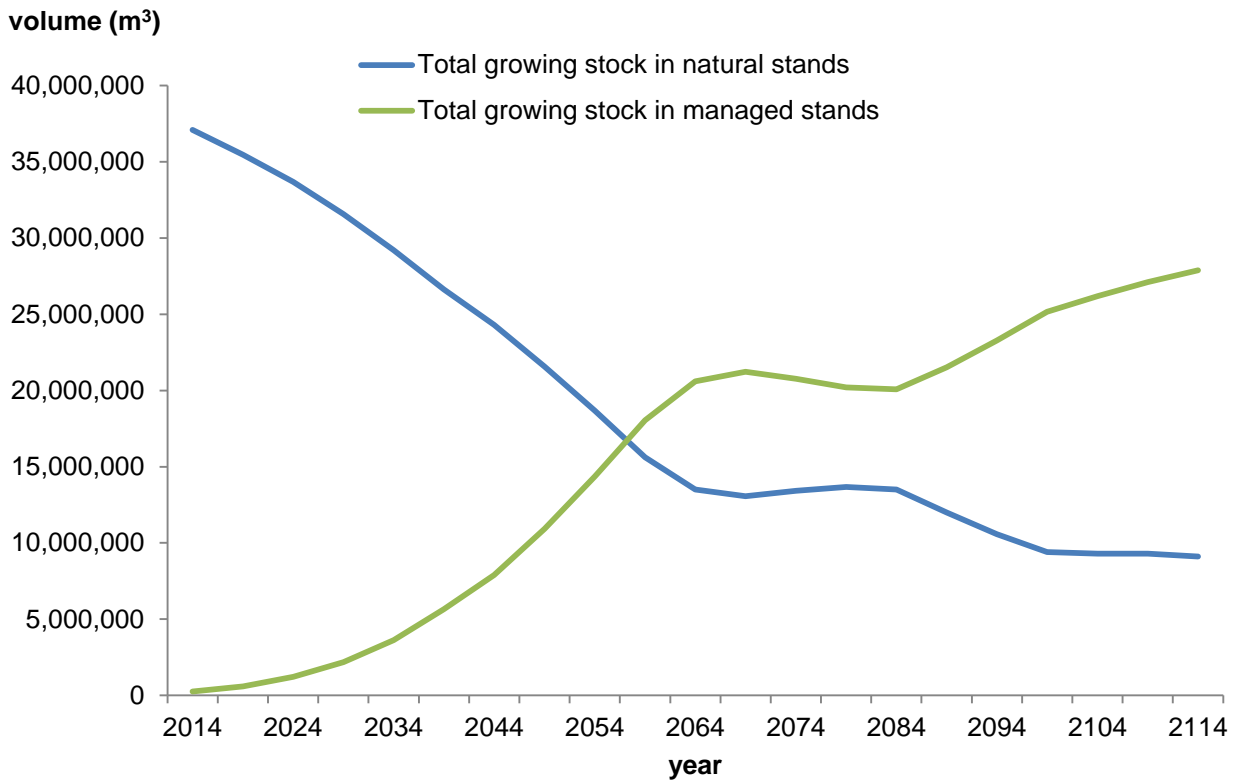


Figure 8. Transition from natural to managed stands – Cranbrook TSA.

The average volume harvested over time is shown in Figure 9. The harvest is fairly consistent over time.

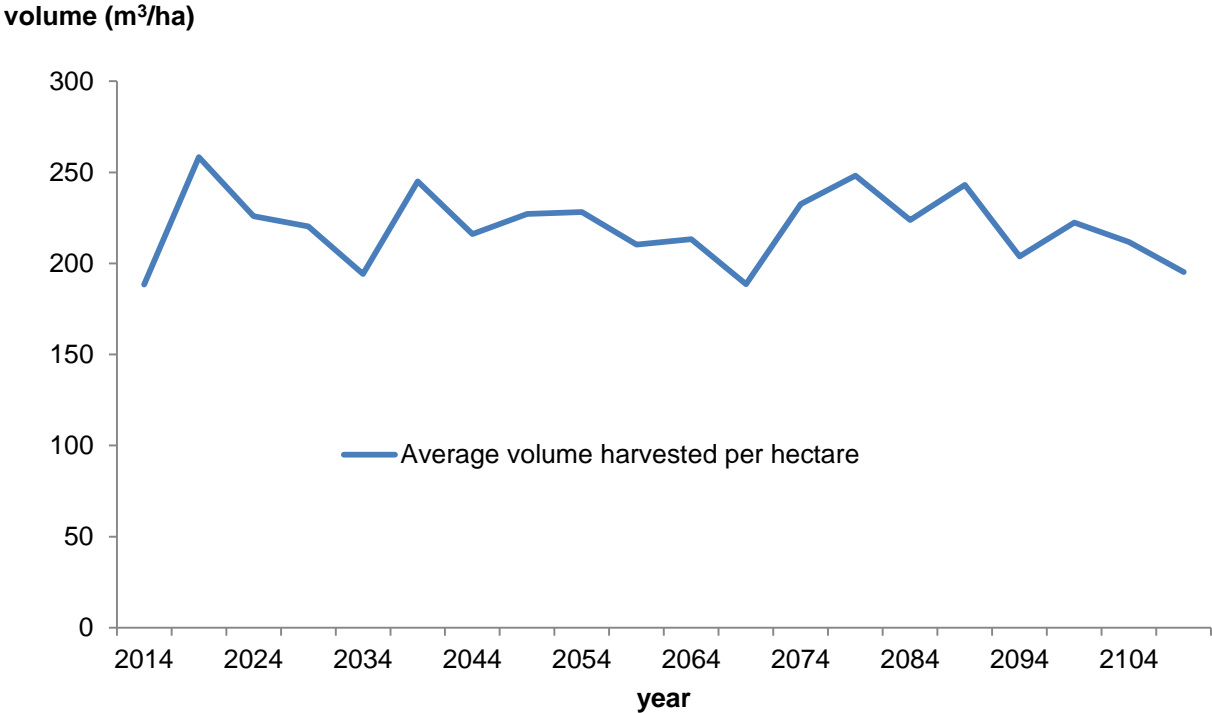


Figure 9. Average volume harvested per hectare – Cranbrook TSA.

Figure 10 shows the area-weighted harvest age over time. Around 2039 the area-weighted harvest age spikes to just under 180 years. The reasons for the spike are that some older stands that are being held for forest cover constraints (e.g., biodiversity) are freed up. Also, the timber supply model selects the most productive stands first. By 2039 stands selected for harvest are considerably older and less productive.

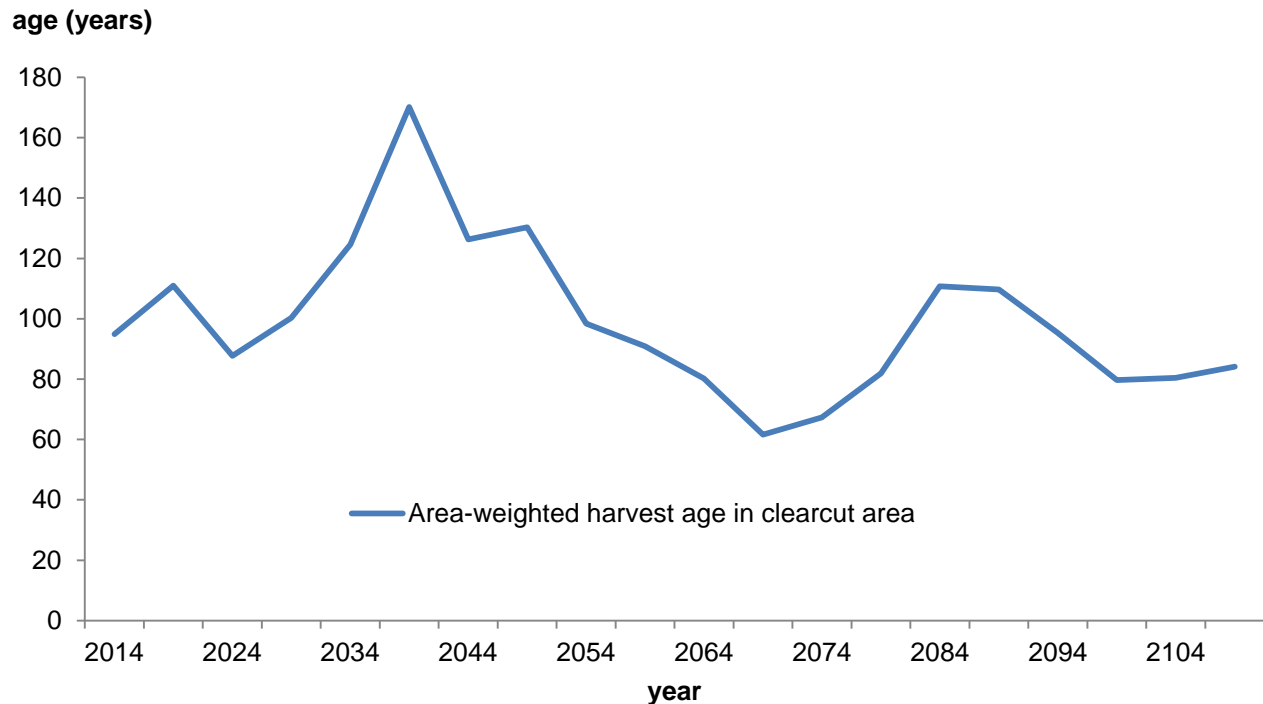


Figure 10. Average area-weighted harvest age – Cranbrook TSA.

Other attributes of the base case are:

- The current base case is 1.6 percent below the level projected for 2004 analysis.
- The transition of harvest contribution from natural stands to managed stands meets in about 45 years.
- The average area harvested fluctuates between 3500 and 4500 hectares.

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 Cranbrook TSA, there is uncertainty about some management information and the modelling framework. Therefore, sensitivity analyses are used to provide further understanding by examining the effect on timber supply of uncertainty in data and assumptions.

The key issues for the Cranbrook TSA timber supply review are:

Uncertainty associated with managed stand yields

District staff have observed that some plantations are not growing as fast as predicted by TIPSYS growth and yield model. While there is little quantitative data to support this observation, a sensitivity analysis was performed to assess the risk to timber supply if the growth rates are not as good as projected. A 10 percent reduction in managed stand yield reduces the even-flow projection by 6.7 percent.

Economic operability

Current performance in the 40 to 50 percent slope stands is approximately 50 percent, therefore only 50 percent of eligible steep slope THLB was allowed to contribute to the base case.

A sensitivity analysis was performed to assess the contribution of the 50 percent allowance of steep slopes to the base case. Therefore, all steep slope stands were removed from the THLB. Results show that the base case harvest decreases by 9.8 percent.

Licensees may find harvesting steep slope stands more feasible with new technology or the economics of harvesting may improve. A sensitivity analysis was performed to assess the impact of including all the eligible THLB on steep slopes was performed. Results showed that the base case harvest increased by 9.1 percent.

Increase regeneration delay

Licensees are proposing not to plant Natural Disturbance Type (NDT) 4 sites as there have been many failures. The alternative is to let these sites regenerate naturally over time. The estimated time is 15 years. The problem sites are typically south slopes and stands below 1000 metres in elevation. A sensitivity analysis was performed to assess the impact of increasing the regeneration delay to 15 years from two years. Results showed that the base case harvest decreased by 4.5 percent.

Problem forest types

There has been little to no performance in the problems forest types (identified by age and height). A sensitivity analysis was performed to assess their contribution to the base case projection by removing all these stands from the THLB. Results showed that the base case harvest decreased by seven percent.

Table 3 provides a summary of the key issues that were explored using sensitivity analysis. It provides the percent change in the short-, mid- and long-term harvest levels compared to the base case harvest projection.

Table 3. Sensitivity analysis results - Cranbrook TSA

Issue	Change	Initial harvest (m ³ /year)	Percent impact		
			Short term	Mid term	Long term
Decrease managed yields	Decrease managed stand yields by 10%	769,400	-6.7%	-6.7%	-6.7%
Reduce economic operability	Exclude all THLB on slopes between 41 and 70%	744,000	-9.8%	-9.8%	-9.8%
Increase economic operability	Include all eligible THLB on slopes between 41 and 70%	900,000	+9.1%	+9.1%	+9.1%
Increase regeneration delay	Set regeneration delay for Natural Disturbance Type (NDT) 4 stands to 15 years	787,600	-4.5%	-4.5%	-4.5%
Problem forest types (PFTs)	Remove remaining PFTs from the THLB	766,500	-7.0%	-7.0%	-7.0%

Note: Short-term = decade 1, mid-term = decades 2-5, long-term = decades 6-10.

Wildlife habitat study

A wildlife habitat study is currently being conducted by FLNRO. It will assess the change in habitat due to harvesting for seven species: grizzly bear, elk, mule deer, marten, Williamson's sapsucker, flammulated owl and northern goshawk. Habitat for each species will be defined using predictive ecosystem mapping (PEM) and preferred characteristics (e.g., mature and old growth age classes). The study will track the amount of habitat which changes over time as harvesting in the base case forecast changes the distribution of forest age classes. This study is not spatial. The results will be presented along with the timber supply analysis results for consideration by the chief forester at the AAC determination meeting

Summary

The even-flow base case harvest projection indicates that the 2005 AAC of 904 000 cubic metres cannot be maintained. It is 8.6 percent lower than the 2005 AAC. The major reason for the differences is a reduction in the THLB and change in harvest flow assumptions.

Currently the conventional harvesting land base is being over harvested as harvest performance is lower than expected on steep slopes and no harvest performance in problem forest types and marginal stands.

Increasing the short-term harvest level for five or 10 years can increase the base case to 5800 cubic metres below the current AAC. However, this will result in a small decrease in mid-term harvest level below the base case.

An additional way to increase the base case harvest projection is to have better performance harvesting on steep slopes.

There is risk to the base case, individually or in combination, if there is less harvest performance on steep slopes, if there is no harvesting in the problem forest stands, if the regeneration delay is increased for NDT 4 stands or if the projections for the managed stand yields are not realized.

The provincial chief forester's AAC determination is a judgement based on professional experience and 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 the harvest level in the base case.

Your input is needed

Public input is a vital part of establishing the allowable annual cut. The information and comments received from this review will be provided to the chief forester prior to determination of the new allowable annual cut. Feedback is welcomed on any aspect of this discussion paper or any other issues related to the timber supply review for the Cranbrook 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 7, 2016.

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

For more information or to send your comments, contact:

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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>