



Fort Nelson Timber Supply Area Timber Supply Analysis Discussion Paper

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

The British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development (the “Ministry”) 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 Fort Nelson 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. Information gathered in this review will be used by the chief forester to determine a new allowable annual cut^d (AAC) for the Fort Nelson TSA.

According to Section 8 of the *Forest Act* the chief forester must review and determine an AAC for each TSA and TFL in the Province of British Columbia (BC).

The objectives of the timber supply review (TSR) are to:

- examine relevant forest management practices, environmental and social factors, and input from First Nations, forest licensees and the public;
- support the chief forester’s AAC determination; and
- identify information to be improved for future timber supply reviews.

The decision to revisit the AAC decision before the legislated timeline (every 10 years) may be undertaken in response to extenuating circumstances such as drastic changes in new information or catastrophic losses due to pest and disease or wildfire.

This discussion paper provides a summary of the results of the timber supply analysis for the timber supply review of the Fort Nelson TSA. Details about the data and assumptions used in the analysis were provided in a February 2017 publicly released data package (https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/stewardship/forest-analysis-inventory/tsr-annual-allowable-cut/fort_nelson_tsa_data_package_2017.pdf). Updates to the information used and technical details as described in the data package are available on request from the Ministry’s Forest Analysis and Inventory Branch.

As such, the timber supply analysis presented in this discussion paper should be viewed as a “work in progress”. Prior to the chief forester’s AAC determination for the TSA, the existing analysis will be reassessed as a result of input received on this discussion paper and if necessary further analysis will be completed.

For the purposes of the Fort Nelson TSA timber supply review, forest management objectives are provided by the *Forest and Range Practices Act* (FRPA); the *Muskwa-Kechika Management Area Act*; the Fort Nelson Land and Resource Management Plan (LRMP); and ministerial orders for specific objectives such as caribou.

^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.

The chief forester does not have the legal authority to establish or modify land use objectives. Consequently, timber supply reviews undertaken in support of AAC determinations are based on current resource management objectives that have been formalized by government. However, the information compiled to support this timber supply review can be made available to support land use planning activities outside of the timber supply review process. 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 Fort Nelson TSA

On November 10, 2006, the chief forester set the AAC for the Fort Nelson TSA at 1 625 000 cubic metres, which was eight percent higher than the previous AAC. At that time, the increase was made to account for harvested volumes of Grade 3 endemic (the 'normal' mortality observed in a mature stand) and Grade 5 (dead tree with less than 50 percent firmwood and/or less than 50 percent merchantable lumber) logs that were being charged to the AAC (starting April 1, 2006). In addition, the AAC partitions that specified separate harvest volumes attributable to deciduous-leading and coniferous-leading stands were discontinued with the decision, due to difficulties in separating the billing of mixed-species stands.

In February 2017, 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 Fort Nelson 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 First Nations, government agencies, licensees, and the public. 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 cannot be quantified. Ultimately, the chief forester's AAC determination is an independent, professional judgment based on the legal requirements set out in Section 8(8) of the *Forest Act*.

Once the chief forester has determined a new AAC, the Minister of Forests, Lands, Natural Resource Operations and Rural Development 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 Fort Nelson TSA

The Fort Nelson TSA is the second largest TSA in British Columbia and covers an area of almost 9.9 million hectares. It is located in the north-eastern corner of the province, within the Northeast Region (Figure 1). The TSA is bordered to the north by the Northwest Territories and the Yukon Territory; to the east by the province of Alberta, to the south by the Fort St. John and Mackenzie TSAs, and to the west by the Cassiar TSA and the Rocky Mountains. The TSA is administered from the Fort Nelson Natural Resource District office in Fort Nelson.

The Fort Nelson TSA, is located entirely in the Boreal forest. The forests in this area consist mainly of old and mature stands of spruce, pine, aspen, cottonwood, and birch, in a wide variety of landscapes. The topography of the TSA forms a gradient of increasing relief from east to west, encompassing parts of the Alberta plateau, the Rocky Mountain Foothills, the Liard Plateau, the Liard Plain, the Kechika River Valley and a portion of the Cassiar Mountains. The entire region lies within the Arctic watershed and is largely drained by the Liard River and its major tributaries, including the Fort Nelson, Prophet, Muskwa, Toad, Kechika, and Petitot rivers.

Three-quarters of the people that reside within the TSA live in the town of Fort Nelson. Outside of Fort Nelson, the region is sparsely populated but does contain a number of smaller settlements situated adjacent to the Alaska Highway, Prophet River, Toad River, Muncho Lake, Liard River, Coal River, and Fireside.

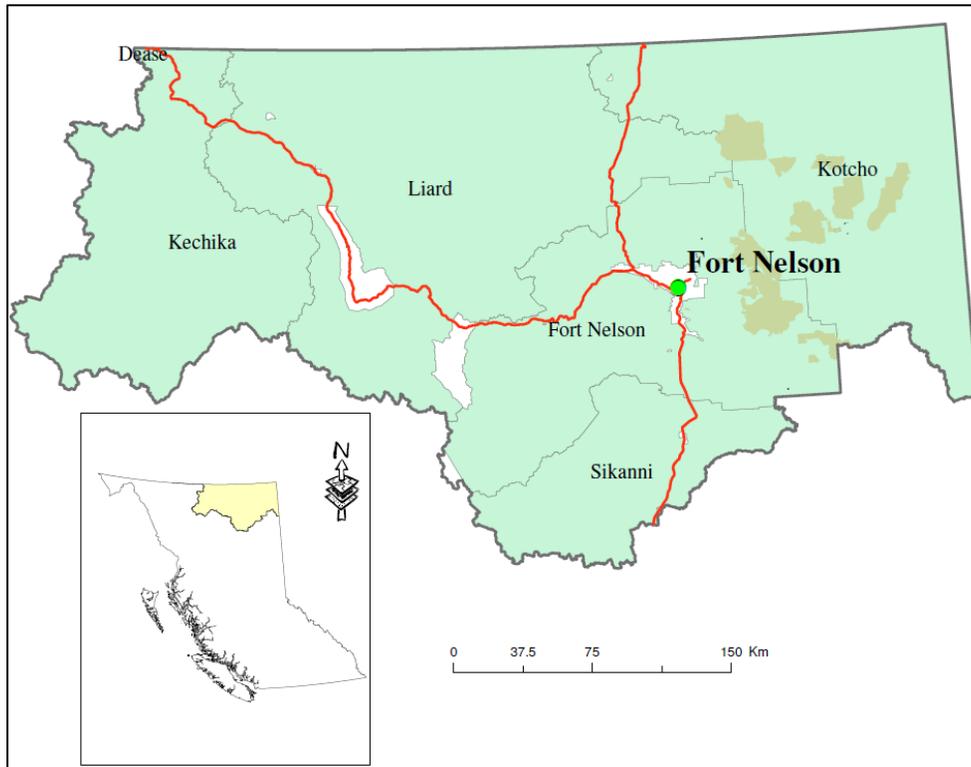


Figure 1. Overview map of the Fort Nelson TSA.

Environmental values

The Fort Nelson TSA contains 33 parks, protected areas and ecological reserves, including Muncho Lake Provincial Park, Stone Mountain Provincial Park, the Northern Rocky Mountains Provincial Park, the Liard River Corridor, Klua Lakes, and Maxhamish Lake, totalling over 10% of the area of the TSA. The southwestern portion of the TSA overlaps a large portion of the more than six million hectare Muskwa-Kechika Management Area, with wildlife habitat that supports sizeable diverse populations of large mammals. Within the TSA, there are vast tracts of relatively undeveloped land that support abundant and diverse, internationally significant wildlife populations.

There are three biogeoclimatic zones in the TSA: Boreal-White and Black-Spruce (BWBS) is the dominant zone, covering about two-thirds of the total TSA land base; the Spruce-Willow-Birch (SWB); and the Alpine Tundra (AT). Over the years, frequent forest fires have formed a mosaic of upland forests of different ages that provide a variety of wildlife habitat. The BWBS zone is very important for wintering ungulates and has the least snowfall of all the northern zones in BC. The extensive deciduous forests, which frequently achieve advanced ages here, are important for ungulates, birds and small mammals.

The TSA is home to 11 endangered or threatened species, and 16 species of concern. Large mammals, including moose, black bear and grizzly bear, are common, as are smaller furbearers such as wolverine, wolf, lynx, weasel, mink, river otter, beaver, and coyote. The TSA also contains a unique range of bird species including the Bay-breasted Warbler, Black-throated Green Warbler, Cape May Warbler, Connecticut Warbler, Nelson's Sharp-Tailed Sparrow, Trumpeter Swan, and others, many of which are not found elsewhere in BC. The abundant rivers, lakes, and wetlands provide important staging grounds during the migration of waterfowl such as Pintails, Widgeons, Geese, Sandhill Cranes, and Teal. Fish species in the TSA include trout, whitefish, burbot, arctic grayling, northern pike and walleye, with rare occurrences of salmon. Approximately 15 fish species occur only in this area of the province. There are few species of reptiles and amphibians.

Protection and management of environmental values are addressed under provincial and federal legislation. The *Forest and Range Practice Act* (FRPA) is the primary provincial legislation regulating forestry practices. Under FRPA, the Forest Planning and Practices Regulation identifies objectives set by government for environmental values including fish, wildlife, biodiversity, soils, and water that are to be addressed within forest stewardship plans. Orders may be established under the Government Actions Regulation (GAR) or the Land Use Objectives Regulation for specific land uses such as ungulate winter ranges (UWR), wildlife habitat areas (WHA), critical habitat for fish, and old growth management areas. Approximately 41 percent of the Crown forest management land base^c (CFMLB) of the Fort Nelson TSA is provincially designated for the protection of its natural environment.

Natural resources

The forests, lands and natural resources of the TSA provide a wide range of benefits including: forest products, water, fish, wildlife, recreation, tourism timber, and natural gas.

Crown range provides forage for both livestock and wildlife. In the TSA, grazing occurs in early seral stage openings where forage is temporarily available for a few years following fires (wildfire and prescribed burns), and timber harvest.

Parks, recreation sites, and trails, and roaded and non-roaded areas provide opportunities for numerous outdoor activities including: hiking, canoeing, camping, guided horse tours, fishing, hunting, snowmobiling, cross-country and backcountry skiing.

First Nations

Eight First Nations reside in or have traditional territory within the Fort Nelson TSA (Table 1). Four of these—the Fort Nelson First Nation, the Dene Tsa'a Tse K'Nai (Prophet River) First Nation, the Dena Tha' First Nation, and the Halfway River First Nation—are signatories to Treaty 8, which covers three-quarters of the TSA. Two Kaska-Dena First Nations (the Daylu Dena, also known as the Lower Post First Nation, and the Dease River First Nation), the Tahltan First Nation, and the Fort Liard First Nation also have traditional territory in the TSA.

^cCrown 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. Parks contribute to the accounting for biodiversity targets and are therefore included in the CFMLB.

Table 1. First Nations and related treaties

Treaty 8 Signatory	Treaty 11 (Northwest Territories)	Non-treaty First Nations
Fort Nelson First Nation	Fort Liard First Nation	Dease River First Nation
Dene Tsaa Tse K’Nai (Prophet River)		Tahltan First Nation
Dena Tha’ First Nation		Daylu Dena First Nation (Lower Post)
Halfway River First Nation		

Land-use planning

The Fort Nelson TSA lies within the area covered by the Fort Nelson LRMP. Forest development in the TSA is required to be consistent with the established goals and objectives of this strategic land use plan. Approved in 1997, the plan identified resource management zones under four categories: protected areas, special management, general resource development, and enhanced resource development. Subsequent legislation and orders, such as the *Muskwa-Kechika Management Area Act*, have addressed specific objectives. The timber supply analysis assumes that forest management and timber harvesting will be consistent with the LRMP.

Significant changes since the last timber supply review

The timber supply analysis presented in this discussion paper differs from the analysis used in the 2006 AAC determination. Significant changes include the following:

- establishment of Government Action Regulation (GAR) Orders for the provision of wildlife habitat areas (WHA) and ungulate winter range (UWR) for boreal caribou, northern caribou, and Stone’s sheep;
- legal establishment of landscape biodiversity objectives;
- updated wildlife range burn areas;
- reduction in timber harvesting activity resulting from the closure of Canfor’s Polarboard oriented strand board plant and Tackama plywood mills in 2008.

Timber harvesting land base

Timber harvesting land base

The Fort Nelson TSA data package, published as part of this TSR, provides background information about the land base within the TSA and about forest management.

As part of the process used to define the modelled timber harvesting land base^f (THLB) in the timber supply analysis, a series of deductions are made from the TSA (Table 2).

^f**Timber harvesting land base (THLB)**

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

The total area within the boundaries of the Fort Nelson TSA is 9 860 959 hectares. After accounting for large water bodies, land administered under separate area-based tenures, private land and non-forested land, the CFMLB is 5 902 494 hectares (60 percent of the total TSA).

After further reductions for areas not suitable or available for harvesting because of ecological, economic, or social considerations, the THLB area is 705 761 hectares (12 percent of the CFMLB or seven percent of the total TSA). These land reductions include parks, lands designated for the protection of wildlife, riparian reserves, old growth values and archaeological sites, inoperable conditions and uneconomic stands or areas otherwise unsuitable for timber harvesting.

The THLB is a strategic-level estimate of the area available for timber harvesting for the purposes of modelling timber supply. However, inclusion or exclusion of an area in the THLB does not imply a change in operational management and consultation must occur before any operational decisions are made. Operationally, there may be areas that were not included in the THLB where harvesting does occur. Likewise, there may be areas within the THLB that never actually are harvested. Where government is expected to issue a land use order or the ownership classification of an area may change prior to the AAC determination, a sensitivity analysis may be prepared to assess what, if any, effect it may have on timber supply.

Current forest management must be consistent with the requirements of the FRPA and associated regulations that are designated 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, recreation features, riparian management and protection of environmentally sensitive areas. These requirements are applied to the CFMLB in the timber supply analysis.

Table 2. Fort Nelson TSA land base classification

Classification	Total area (ha)	Sequential net area removed (ha)	Sequential percent of total TSA area (%)	Sequential percent of CFLB (%)
Total TSA area	9 860 959	9 860 959		
Private lands (woodlots, federal, Indian reserves)	38 858	38 858		
Area managed by the Crown		9 822 101	100.00	
Reductions to TSA:				
Non-forest and non-productive	3 777 546	3 777 546	38.46	
Existing roads, trails and landings	39 270	39 270	0.40	
Existing oil, gas, wells, facilities and seismic lines	131 620	102 791	1.05	1.74
Total Crown forest management land base (CFMLB)		5 902 494	60.09	100
Parks, UREPs and ecological reserves	3 886 117	1 391 148	14.16	23.57
Agricultural land reserve	48 466	30 284	0.31	0.51
Wildlife range burn areas	22 388	491	0.00	0.01
Recreational sites	1 605	873	0.01	0.01
Recreational trails	2 776	964	0.01	0.02
Ungulate winter ranges	696 218	401 103	4.08	6.80
Archeological sites	4 684	2 753	0.03	0.05
Wildlife habitat protection area	287 781	16 794	0.17	0.28
Unstable terrain	19 123	18 743	0.19	0.32
Environmental sensitive areas	599 341	286 747	2.92	4.86
Non-operable areas	7 156 357	2 103 748	21.42	35.64
Low timber productivity areas	2 427 810	88 130	0.90	1.49
Non-merchantable	3 440 578	779 439	7.94	13.21
Stand level retention/riparian (non-spatial)		75 516	0.77	1.28
Total reductions to the FMLB		5 196 733	52.91	88.04
Current timber harvesting land base		705 761	7.19	11.96
Future reductions				
Future roads, trails and landing		32 465	0.33	0.55
Future timber harvesting land base		673 296	6.85	11.41

Figure 2 shows the current age class distribution of forest stands in the CFMLB separated by THLB and non-THLB.

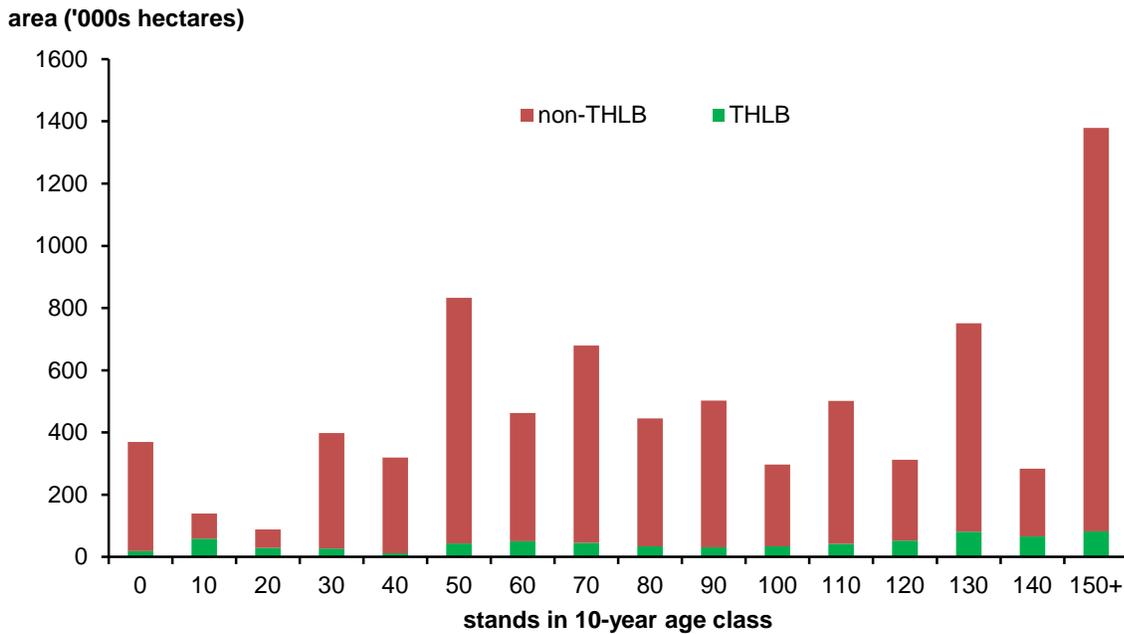


Figure 2. Age class distribution of the Crown forest management land base in the Fort Nelson TSA.

Figure 3 summarizes the area and the volume by leading species on the THLB. Aspen is the most common species. The total growing stock on the THLB is 140 million cubic metres.

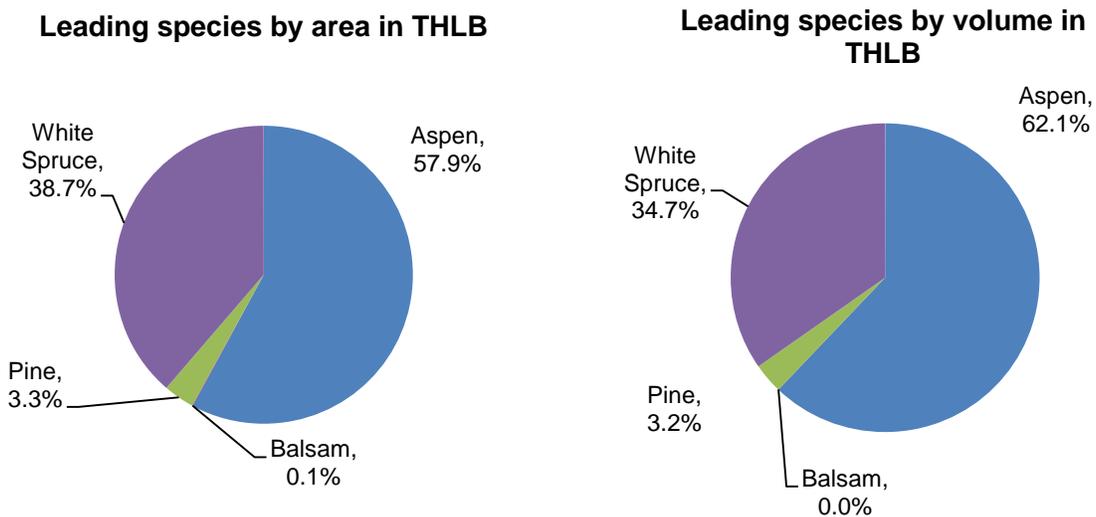


Figure 3. Proportion of leading species composition for the timber harvesting land base of the Fort Nelson TSA.

Allowable annual cut and harvest performance

The allowable annual cut (AAC) for the Fort Nelson TSA was first established in 1989 at 972 000 cubic metres, of which 750 000 cubic metres were attributed to harvesting in coniferous-leading stands and 222 000 cubic metres were attributed to deciduous-leading stands. In 1994, when the economic prospects for utilizing aspen were improved, the AAC was increased to 1 500 000 cubic metres, of which 600 000 cubic metres were attributable to coniferous-leading stands (with at least 80 000 cubic metres assumed from lodgepole pine-leading stands) and 900 000 cubic metres were attributable to deciduous-leading stands. In 2000, the AAC of 1 500 000 cubic metres and partitions[§] for coniferous- and deciduous-leading stands were maintained. In 2006, the current AAC of 1 625 000 cubic metres was set and the partitions were discontinued.

Following the 2006 AAC determination, the Minister apportioned the AAC as shown in Table 3.

Table 3. *Apportionment of current AAC*

Form of agreement	Volume allocated	Percentage
Forest Licence - Replaceable (Canadian Forest Products Ltd.)	553 716	34.1
Pulpwood Agreement - Timber Sales Licences (Canadian Forest Products Ltd.)	610 000	37.5
BCTS - Timber Sale Licence/ Licence to Cut	299 668	18.5
Community Forest	18 000	1.1
Forest Licence - Non-replaceable (Tsa Cho Timber Ltd.)	83 000	5.1
Forest Service Reserve	60 616	3.7
Total	1 625 000	100.0

Timber harvesting in the Fort Nelson TSA has dramatically decreased since the 2006 AAC determination. In 2008, due to poor wood product markets and record low oriented strand board (OSB) prices, Canfor Corporation indefinitely closed its PolarBoard OSB and Tackama plywood mills in Fort Nelson. Following the closure of the Canfor mills, a low level of harvesting continued mainly for oil and gas exploration and development activities. Although small amounts of wood were processed by a small local sawmill, most of the harvested wood was not utilized and left onsite. Recently, activity by forest licensees in the Fort Nelson TSA has been minimal, with less than 1000 cubic metres harvested annually in 2016 and 2017 (Table 4).

Currently, there are efforts being made to revitalize the forestry sector in Fort Nelson. The local municipality in partnership with a local First Nation is working on an application for a Community Forest Agreement, with submission targeted for mid-September, 2018. Additionally, First Nations are working on an application for a First Nations Woodlands Licence (FNWL) which may be submitted in December, 2018. General interest has also been expressed in determining if sufficient timber volume could be made available to enable the start of a small business locally.

[§]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.

Table 4. Harvest performance since the 2006 AAC determination

Year	Total harvested volume (m ³ /year)
2007	750 042
2008	436 748
2009	64 156
2010	109 468
2011	99 139
2012	28 007
2013	1 023
2014	6 910
2015	1 005
2016	244
2017	151

Timber supply analysis

As part of the TSR, a timber supply analysis is typically 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 projections are produced to reflect different starting harvest levels, rates of increase or decrease, and potential trade-offs between short- and long-term harvest levels.

From a range of possible projections, 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’ projection and forms the basis for comparison when assessing the effects of uncertainty of the information modelled in the timber supply analysis. The base case is designed to reflect current management practices.

The base case is not a recommendation because it represents only one in a number of possible projections, and incorporates information and modelling assumptions about which there may be some uncertainty. The validity of the base case - as with all the other projections 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 projections are usually prepared to test the effect of changing some of the assumptions or data used in the base case. These harvest projections 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. For the current analysis, a forest estate model created with the Spatially Explicit Landscape Event Simulator (SELES) was used to conduct these projections.

The base case

Based on the current forest management and inventory information used to prepare the base case, a maximum even-flow harvest of 1 970 000 cubic metres, which includes 1 000 000 cubic metres for aspen-leading stands, was deemed possible.

This differs from the previous TSR where the base case even-flow level was 3 163 000 cubic metres (which included 1 443 500 cubic metres from deciduous-leading stands). In the previous AAC decision, the chief forester identified a number of factors that suggested the available timber supply in the TSA was less than half the volume modelled in the previous base case. These factors included the removal of areas of low productivity aspen-leading stands, and the exclusion of the Fort Nelson west portion of the TSA. The current base case applies assumptions consistent with the chief forester previous decision while utilizing updated information on forest resources.

Alternative harvest forecasts identify that the initial harvest levels may be increased without lowering the mid- or long-term levels (Figure 4). Nevertheless, for the purposes of modelling within the TSR, the even-flow harvest was chosen as the base case.

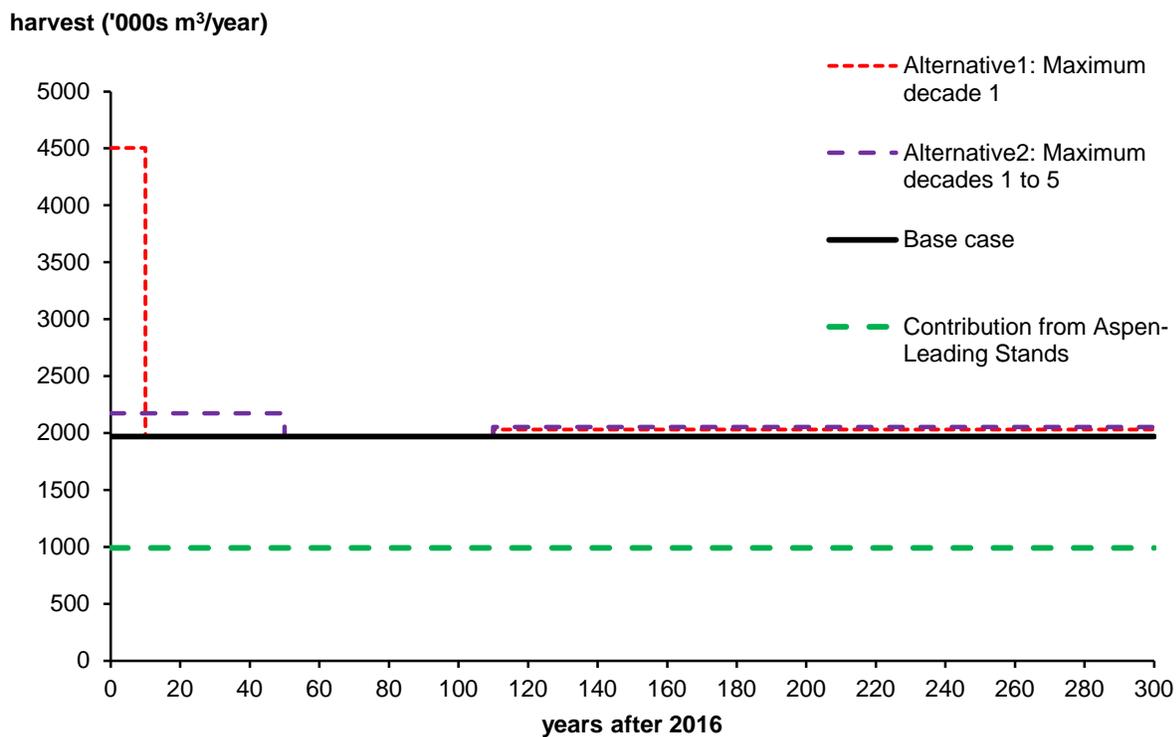


Figure 4. Base case and alternative harvest flow forecasts – Fort Nelson TSA, 2016.

The total volume of growing stock within the THLB is initially about 140 million cubic metres (Figure 5). Following the harvest forecast in the base case, the total volume decreases over the first 80 years of the planning horizon before stabilizing at a long-term level of 110 million cubic metres. A similar pattern is shown for the available growing stock (i.e., above minimum harvest criteria and not reserved for other management objectives) (Figure 5). The stabilization of the long-term growing stock is a desired model characteristic that indicates the sustainability of the long-term harvest flow given the base case modelled harvest, land base, and forest management.

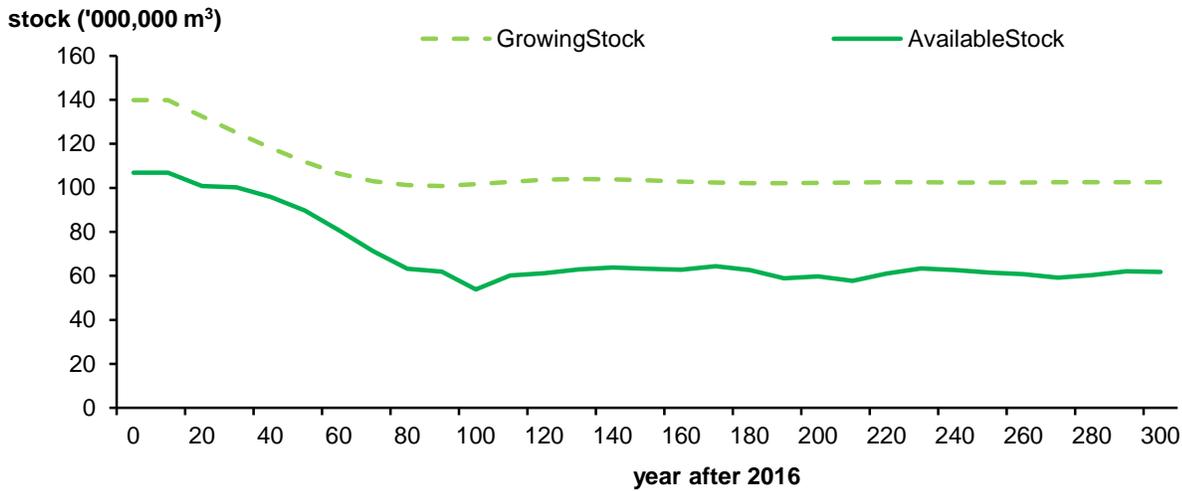


Figure 5. Growing stock of the base case - Fort Nelson TSA, 2016.

The average age of stands harvested in the base case is approximately 110 years over the long term (Figure 6). The large amount of mature forest older than 155 years contributes to the first 90 years of the harvest flow, and then the average age of harvest decreases to around 110 years for the remaining periods.

Although, the average harvest age decreases over the planning horizon, the average harvest volume per hectare in the base case increases from about 325 cubic metres for the first 90 years from primarily natural stands, to about 350 cubic metres in the long-term harvesting from primarily managed stands. These higher stand volumes reflect the expectations that managed stands are more productive given management to ensure prompt regeneration, improved site occupancy (i.e., reduced non-forested gaps), and the use of trees selected for better growth.

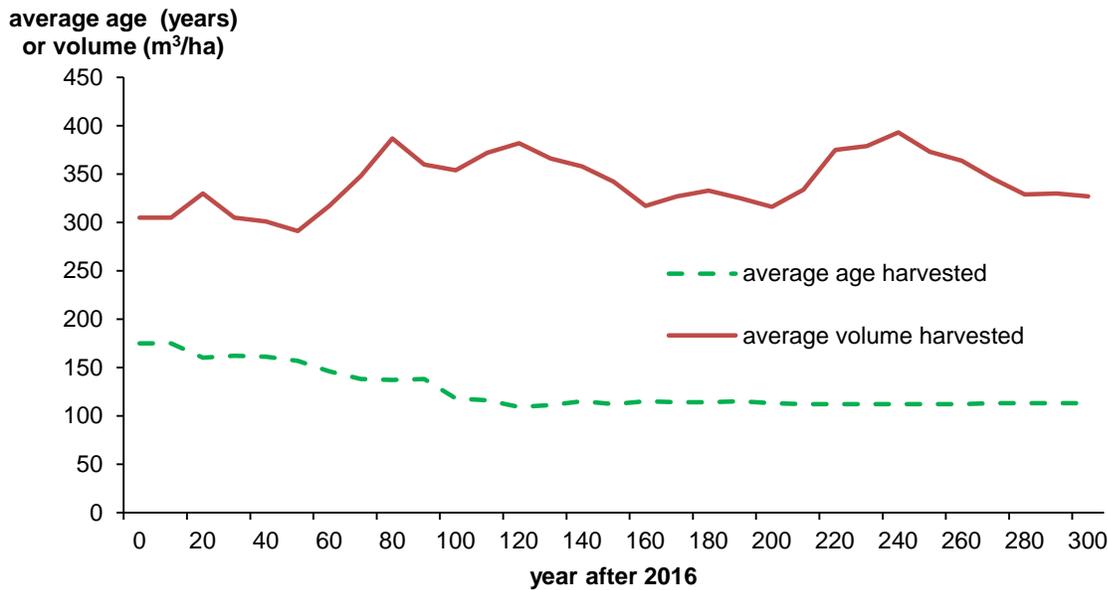


Figure 6. Average harvest age and volume of the base case — Fort Nelson TSA, 2016.

Given that future stands have a higher volume per hectare, the area harvested in the base case is initially slightly higher than in the long term (Figure 7).

average area harvested (ha)

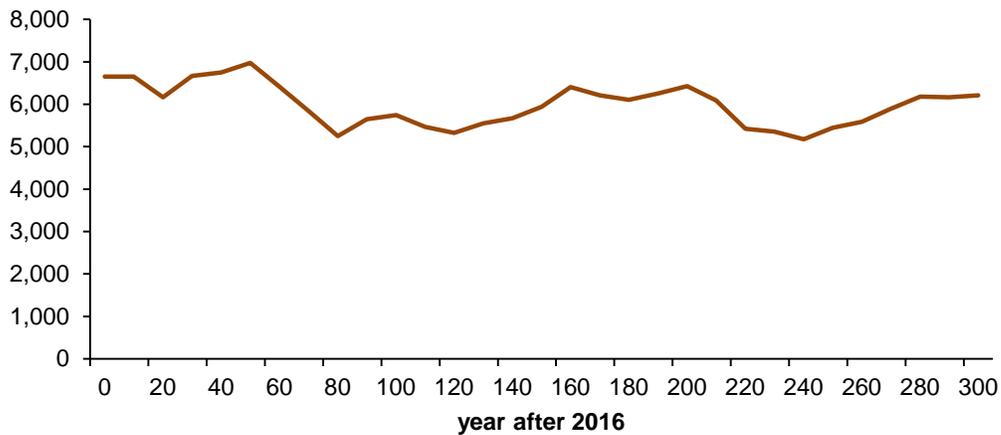


Figure 7. Average harvest area of the base case — Fort Nelson TSA, 2016.

Figure 8 shows that in the base case, managed stands start to contribute to harvest at year 100. At year 110 about 95 percent of the harvest comes from managed stands.

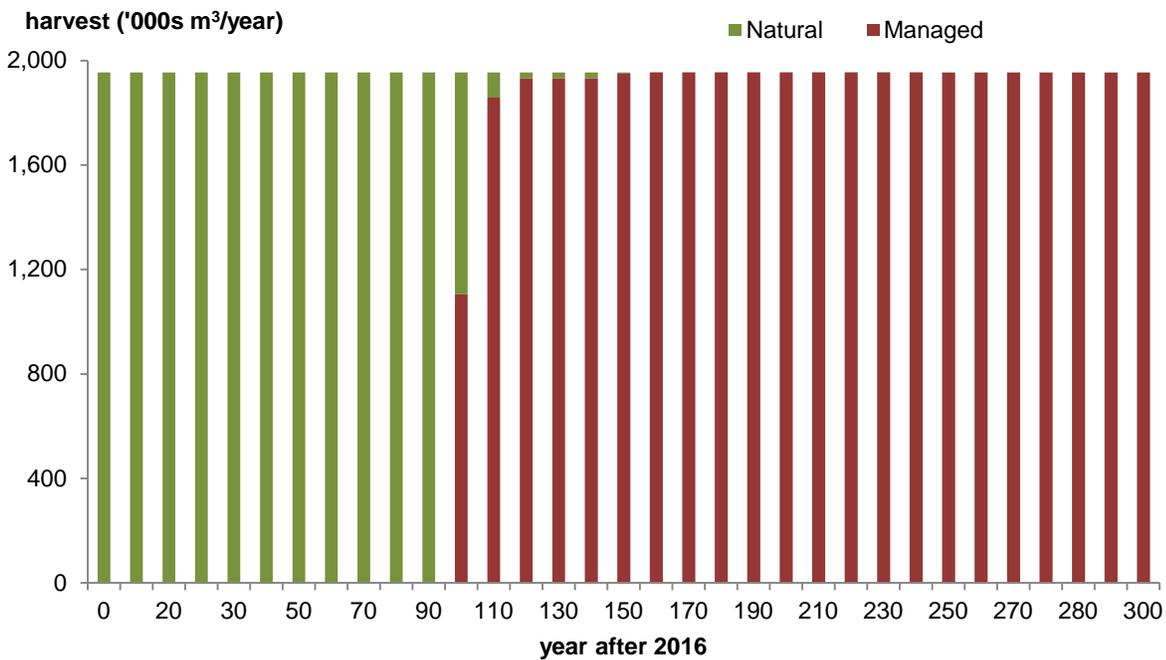


Figure 8. Contribution from managed stands in the base case – Fort Nelson TSA, 2016.

Figure 9 shows the harvested volume components of deciduous and coniferous in the harvest flow of the base case scenario.

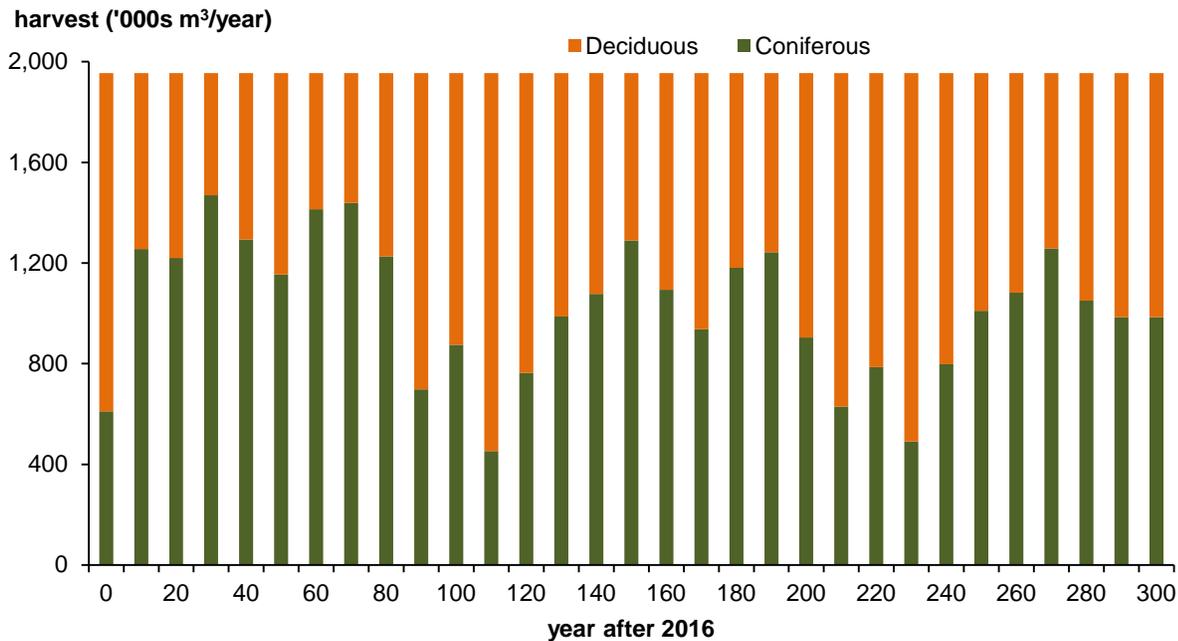


Figure 9. Harvest profile from coniferous and deciduous in the base case – Fort Nelson TSA, 2016.

Sensitivity analyses

The base case uses a specific set of available data and forest management assumptions that are intended to reflect current forest composition and growth, legally-established management objectives, and management practices. The factors used as inputs to timber supply analysis have differing levels of uncertainty associated with them, due in part to variation in physical, biological and social conditions. Therefore, sensitivity analyses are used to examine the potential impacts of different uncertainties about, or changes to, resource information and management practices. Key issues for the Fort Nelson TSA are described in the sensitivity analyses following with results presented in Table 5.

Uncertainty of natural and managed stand volume projections: A sensitivity analysis was conducted to examine the effect of increasing or decreasing natural and managed stand volumes by +/- 10 percent. Typically, an increase or decrease in natural stand volumes would result in a corresponding increase or decrease in short-term timber supply, and an increase or decrease in managed stand volumes would result in a corresponding increase or decrease in long-term timber supply.

The base case analysis for the Fort Nelson TSA however, applied an even-flow modelling objective; therefore, changes in volume were likely contingent upon the mid-term where the timber supply is most restricted. As shown by the results in Table 5, changes in volume did not necessarily result in proportionate adjustments to timber supply. In the sensitivity analysis, increasing the natural or managed stand yields by 10 percent resulted in an increase in even-flow harvest levels of 7.5 percent and 12.8 percent respectively. Conversely, decreasing the natural or managed stand yields by 10 percent resulted in no change and a 3.5 percent decrease respectively, relative to the harvest levels projected in the base case.

Uncertainty of deciduous stand volume projections: The utilization of deciduous species is highly variable across British Columbia. Although considered an uneconomical species in many TSAs, aspen has been economical in the Fort Nelson TSA, particularly from pure stand types. Modelling the inclusion of aspen as a merchantable species leads to questions regarding the economic merchantability of mixed-species stands and the application of an appropriate growth and yield model.

Growth and yield models such as TIPSYS can provide reasonable volume projections of pure deciduous stands such as aspen and birch however; there is uncertainty with regards to modelling the natural succession which acts to convert these stands to coniferous species. In TIPSYS volume tables, the natural mortality that occurs in deciduous-dominated stands will decrease stand volume after maturity since the model does not incorporate the natural in-growth of coniferous species. If these stands are not harvested before the point at which the volume falls below the minimum harvestable amount, they will remain unharvested for the duration of the projection. Due to this issue, and given the current lack of harvesting in the TSA, the growth and yield model VDYP7 was used to estimate volumes for aspen- and birch-leading stands as it provides the best estimate of stand volume decline in deciduous species over time.

A sensitivity analysis was conducted to address uncertainty in the volume projections for aspen- and birch-leading stands, particularly for older stands that may transition to coniferous-leading stands. Deciduous species were projected using TIPSYS v4.3 to investigate the timber supply dynamics where no succession is assumed.

The application of TIPSYS, instead of VDYP, to create managed stand volume tables resulted in harvest levels 15.5 percent lower than projected in the base case. This difference in volume demonstrates the need to explore how best to model mixed-species stands. Although other growth and yield models for mixed species are available, currently, there is uncertainty as to the method for relating starting conditions to the existing inventory.

Operability in the western portion of the TSA: In the base case, the Grayling, Smith, Hilgren, and Tsia operating areas were excluded from the THLB to reflect past harvest performance. Assuming future interest in operating in these areas, a sensitivity analysis was conducted where these areas were added to the THLB. The operability criteria for the western portion of the TSA, was determined similar to the rest of the TSA, except that cycle time and historical harvesting activities were not applied. Adding the western operating areas back into the THLB resulted in a 4.1 percent increase in the THLB and harvest levels 8.3 percent higher than projected in the base case. Contingent upon the results of further detailed analysis that considers cycle time and historic harvesting, this increase indicates potential opportunities in the western portion of the TSA.

Harvest priority: Typically, the modelled harvest priority rule is chosen based on current and expected harvesting practices. In the base case, harvest priority was given to the oldest-first stands. A sensitivity analysis was conducted to investigate the impact of changing to a highest-volume-first priority rule. The result was an even-flow harvest level that was 8.7 percent lower than projected in the base case. In addition to less harvest flow, some stands that were harvested in the base case remained unharvested in this sensitivity projection since they were continuously placed behind higher-volume young stands in the harvest priority queue.

Proposed Caribou habitat protection: Proposals for boreal caribou habitat protection suggest a reduction of the current THLB. A sensitivity analysis was conducted that reduced the THLB, based on proposed boreal caribou habitat, to investigate the impact to timber supply. Modelling components of the proposed boreal caribou protection plan resulted in decrease of 17.6 percent in THLB area and harvest levels 15 percent lower than projected in the base case.

Mixed-species stand management: Mixed-species stand management is a challenge across the TSA, due to the economic merchantability of the deciduous species in these stands. A sensitivity analysis was conducted to demonstrate the impact to timber supply if harvesting focused on stands in the THLB where the leading species was greater than 80 percent of the composition. The result of excluding all stands from harvest except for ‘pure stands’ was a 45 percent decrease in the THLB area and harvest levels, highlighting the importance of deciduous commercial species in the harvest profile for the Fort Nelson TSA.

Spruce-leading stands: Although little harvesting has occurred recently in the TSA, there is future interest in the harvest of spruce-leading stands. A sensitivity analysis was completed that focused harvest priority on these stands. Excluding all stands from harvest except for ‘pure spruce stands’, where leading spruce species is greater than 80 percent resulted in harvest levels 60 percent lower than projected in the base case.

Birch-leading stands: Future interest in the harvest of birch stands has also been proposed. A sensitivity analysis was conducted that included birch-leading stands in the THLB. Including birch-leading stands in the THLB resulted in harvest levels 13.9 percent greater than projected in the base case.

Table 5. Sensitivity analyses

Issue tested	Sensitivity levels	Percent impact (THLB area)	Even-flow timber supply impact
General volume changes	Change VDYP volume tables by + 10%	0%	+7.5%
	Change VDYP volume tables by -10%	0%	-0%
	Change TIPSYP volume tables by +10%	0%	+12.8%
	Change TIPSYP volume tables by -10%	0%	-3.5%
General THLB change	Change THLB for all polygons by -10%	-11.4%	-7.0%
Deciduous-leading volume	Use TIPSYP instead of VDYP to create managed stand volume tables	0%	-15.5%
Opportunity in western TSA	Incorporate Grayling, Smith, Hilgren, and Tsia operating areas in THLB	+4.1%	+8.3%
Highest priority (volume)	Model harvest priority based on highest volume than older first stands	0%	-8.7%
Caribou	Model components of the proposed boreal caribou protection plan	-17.6%	-15.0%
Non-mixed stands	Exclude all stands from harvest except for “pure stands” (leading species > 80%)	-45.5%	-45.0%
Spruce-leading stands	Exclude all stands from harvest except spruce-leading stands	-62.9%	-60.0%
Birch-leading stands	Include birch-leading stands in THLB	+16.9%	+13.9%

Conclusion

The base case analysis demonstrates that an annual harvest level at or above the current AAC of 1 625 000 cubic metres of up to 1 970 000 cubic metres can be sustained on the Fort Nelson TSA while accommodating currently established management practices for all forest resources in the short and longer terms.

Although there has been a lack of recent harvesting activity, due to the indefinite closure of local plywood and OSB mills, efforts are being made to revitalize the forestry sector in Fort Nelson. The local municipality, in partnership with First Nations, is working on applications for a Community Forest Agreement as well as a First Nations Woodlands Licence.

For the Fort Nelson TSA TSR, several sensitivity analyses were conducted to demonstrate the timber supply implications of harvesting different stand types and operating areas. These sensitivity analyses resulted in a wide range of possible harvest flows, highlighting the importance of understanding which stands are likely to be harvested. This information assists the chief forester in understanding the timber supply implications of harvesting certain stand types or operating areas; however, further insight provided by ministry staff, public input and First Nation consultation is necessary for the chief forester to determine how such information is incorporated within the AAC decision.

As discussed throughout this discussion paper, there are a number of sources of uncertainty affecting the timber supply. To a large extent, the timber supply in the Fort Nelson TSA will depend on the ability of the licensee to utilize deciduous species and manage mixed-species stand types. Additional uncertainty is associated with the amount of future caribou habitat protection.

The provincial chief forester's AAC determination 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*. This includes information obtained through the consultation process with First Nations. An AAC is neither the result of a calculation nor limited to the results of timber supply analysis; therefore, the new AAC may not be the same as any of the initial harvest levels depicted in any of the scenarios included in this document.

Your input is needed

Public input is an important part of establishing the 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 issue related to the timber supply review for the Fort Nelson 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 September 11, 2018.

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 submit comments, contact:

Resource District Manager
BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Fort Nelson Natural Resource District

RR 1 Mile 301 Alaska Highway
Fort Nelson, BC V0C 1R0

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Or 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 timber supply review web site: <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut>