Prince George Timber Supply Area

MID-TERM MITIGATION TIMBER SUPPLY ANALYSIS

November 17, 2011

Ministry of Forests, Lands and Natural Resource Operations

Omineca Region

BRITISH COLUMBIA

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Contents

Executive Summary

The recent (January 2011) Timber Supply Review set the current allowable annual cut (AAC) for the Prince George Timber Supply Area (TSA) at 12,500,000 cubic metres, of which a maximum of 3,500,000 cubic metres can be attributed to non-pine coniferous volume. The base case mid-term timber supply projection, completed for this project, shows the harvest level dropping to approximately 6,430,000 cubic metres per year by 2026 and remaining at that level for 25 years as a result of the mountain pine beetle (MPB) epidemic. This mid-term level is similar to what was achieved in the timber supply review.

Significant economic and social repercussions are expected during the transition to a lower AAC, especially compared to the current AAC or the pre-MPB AAC of approximately 9.3 million cubic metres.

Mid-term timber supply mitigation opportunities explored as part of this project fall within three distinct categories:

1. Improvement in forest sector economics reflected in expansion of the timber harvesting land base as a result of a lower minimum stand volume and higher maximum cycle time.
2. Relaxation of objectives for non-timber forest values including landscape level biodiversity, visual quality objectives and ungulate winter range.
3. Forest management practices including fertilization and regeneration.

Improvements in forest sector economics

Not all of the forested land in a timber supply area is available to support harvesting activities. Of note is the 940,000 hectares of forest land netted out in the previous timber supply review (TSR) because it was 'Not Economic'. For the purposes of defining the current economic landbase, the TSA was divided up into two geographic areas: the area accessed by road from milling centres and the area that is accessed mainly by a railway haul. The railway haul occurs in the northern portion of the Fort St. James forest district and has, in recent times, been shut down as timber companies have focused harvest on salvaging the vast quantity of MPB damaged timber closer to the sawmills. Road haul (logging truck) cycle time and volume per hectare were the attributes used to define the economic land base. Criteria were established based on examining attributes of 1600 cutting permits logged in the TSA since 1992. In the TSR maximum cycle time was defined as 7.7 hours for the road portion and 3.9 hours for the rail portion of the TSA. Minimum volume per hectare was defined as 182 cubic metres per hectare (m^3/ha) on the road portion and 246 m^3/ha on the rail portion of the TSA.

Mid-term timber supply is improved significantly if forest companies can increase the distance that they can afford to haul logs. Similarly if economics improve such that the minimum volume per hectare required to break even on the logging phase of costs, mid-term timber supply can be increased. Improvements in mid-term timber supply related to improvements in economics are as follows:

Scenario number	Maximum cycle time (hours)		Minimum volume criteria (m^3/hectare)	Projected mid-term harvest level (millions of m^3/year)	Increase in projected mid-term harvest level over base case	
	Road haul	haul to railhead			million of m^3/year	%
Base case	7.7	3.9	182	6.43		
1.1	7.7	3.9	140	8.19	1.76	27%
1.2	none	3.9	182	7.18	0.75	12%
1.3	none	3.9	140	8.68	2.25	35%
1.4	none	none	182	7.43	1.00	16%
1.5	none	none	140	8.93	2.50	39%

By lowering the minimum volume criteria to 140 m^3/ha and maintaining cycle times consistent with the previous timber supply review the mid-term timber supply can be increased by 1.76 million cubic metres per year (m^3/year). It should be noted that the 2004 timber supply analysis for the Prince George TSA (2004) used a minimum volume per hectare criteria of 140 m^3/ha for harvest on conventional ground based skidding and 250 m^3/ha for cable harvest. Further, the Lakes TSA recently used 140 m^3/ha and the Quesnel used 120 m^3/ha whereas the recently released data package for the Dawson Creek TSA uses 120 m^3/ha conventional ground and 200 m3/ha on cable[1]. To date, none of the other TSA in the northern portion of the province have used a maximum haul cycle time.

Relaxation of old Forest requirements for Landscape Level Biodiversity, Visual Quality and Ungulate Winter Range

At the on-set of the Mid-term Timber Supply project, The *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area – October 20, 2004,* often referred to as the Prince George TSA old growth order (*PG OGO),* was identified as a legal objective that, if modified, had a significant impact to mid-term timber supply, in the PG TSA. The PG OGO was adopted to protect a broad range of species is as follows:

- The more that managed forests resemble the forests that were established from natural disturbances, the greater the probability that all native species and ecological processes will be maintained.
- A coarse filter approach to managing biodiversity protects ecosystem function and provides for a broad range of habitats for a broad range of species. The *PG OGO* is an example of a coarse filter approach to biodiversity management.
- Some species and ecological communities (plant associations) in the Prince George Timber Supply Area are endangered or of concern and some of these are supported by old forests.

[1] See: http://www.for.gov.bc.ca/hts/tsa/tsa41/2011_Current/41ts11dp.pdf

The PG OGO contains three main objectives: old, old interior and young patch size. The base case and the mid-term timber supply mitigation scenarios have only incorporated considerations for requirements for old forest. Results of the sensitivity analyses are summarized below. This summary includes an assessment of the risks to biodiversity and an assessment of the administrative changes that would be required to implement the given scenario.

Scenario number	Scenario Description	Risk to Biodiversity				administration changes required	Timber Supply Impact		
		risk classes for percent representation of natural range of variability for old forest	risk for mBEC units impacted by future timber harvesting at 2058				Projected mid-term harvest level (millions of m^3/year)	Increase in projected mid-term harvest level over base case	
			relative risk classes	# units deficit	# ha deficit			million of m^3/year	%
Base Case	Prince George TSA Old Growth Order	moderate	low	assumed to be zero	assumed to be zero	No change required; continuous improvement of specific issues encouraged	*6.43*		
2.1	Turn off the Prince George TSA Old Growth Order	high	high	7	-102,000	Significant amendment required to legal order	*9.19*	2.76	**43**
2.2	Prince George TSA Old Growth Order where the definition of 'old forest age' is reduced by 20 years	unknown	moderate	6	-24,000	Amendment of non-legal Implementation Policy required	*7.44*	1.01	**16**
2.3	Replace the Prince George TSA Old Growth Order with the Provincial Old Growth Order	moderate	moderate	9	120,000	Significant amendment required to legal order	*6.69*	0.26	**4**
2.4	Prince George TSA order with requirements based Table 1-3 of the Order	moderate	low	assumed to be zero	assumed to be zero	Significant amendment required to legal order	*5.68*	-0.75	**-12**
3.1	100% of minimum Natural Range of Variability *	very low	unassessed but assumed to be low	assumed to be zero	assumed to be zero	Significant amendment required to legal order	*6.41*	-0.02	**0**
3.2	70% of minimum Natural Range of Variability *	low	unassessed but assumed to be low	unknown	unknown	Significant amendment required to legal order	*6.43*	0	**0**
3.3	50% of minimum Natural Range of Variability	moderate	moderate	5	-37,000	Significant amendment required to legal order	*7.19*	0.76	**12**
3.4	30% of minimum Natural Range of Variability	high	high	7	-106,000	Significant amendment required to legal order	*8.44*	2.01	**31**

Relaxation of objectives for visual quality objectives results in a mid-term timber supply increase of 250,000 m^3/year whereas relaxation of ungulate winter range objectives does not appear to increase

mid-term timber supply significantly. This may be partly because high value caribou habitat, a 100% net down from the timber harvesting land base (THLB) was not part of this assessment. Only areas where the rate harvest of timber is restricted because other values require a defined disturbance percentage, are assessed in this mid-term timber supply study. For ungulate winter range this would include mule deer winter range and some caribou corridor areas. Ungulate winter range and Visual Quality objectives are established and amended through Government Action Regulation (GAR) orders.

Forest Management Practices

If all stands harvested since 1987 (existing stands and those harvested and regenerated by the timber supply model in the future) are fertilized, mid-term timber supply is expected to increase by one million m^3/year (16%). Approximately 650,000 hectares has been harvested and reforested since then. Last year, in the Prince George Forest District, well over one million dollars was spent on aerial fertilization. The fertilization program has been growing over the past several years with the objective of increasing mid-term timber supply.

Acknowledgements

Thank you to the following groups and individuals for valuable input.

PG TSA Licensee technical working group:

Doug Perdue (Dunkley Lumber Ltd.), Sandor Buchi (West Fraser Timber Ltd.), Jonathan Armstrong (Sinclar Group), Phil Smith (Conifex), Kevin Bedford (Carrier Lumber Ltd.), Andrew Fraser (BCTS Nechako Business Unit), Darwyn Koch (BCTS Prince George Business Unit), Terry Lazaruk (Canfor)

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1.0 Introduction

The recent Timber Supply Review (TSR4) set the current allowable annual cut (AAC) for the Prince George timber supply area (TSA) at 12,500,000 cubic metres, of which a maximum of 3,500,000 cubic metres can be attributed to non-pine coniferous volume. Using current forest management assumption recent timber supply projections estimate that the harvest level will drop by 50% to approximately 6,200,000 m^3 per year by 2021 and will remain at that level for 40 years as a result of the mountain pine beetle (MPB) epidemic (Figure 4.1).

A strategy was adopted as part of a MPB control initiative to salvage as much MPB impacted pine as possible while limiting harvest of non-pine to reduce the impact of the MPB salvage actions on the mid-term timber supply. Key to this was constraining the Non-replaceable Forest Licenses (NRFL) issued after the AAC uplifts to stands with at least 70% pine content and having at least 50 to 70% MPB of the pine killed by mountain pine beetle (MPB). Another key element of the strategy included a commitment from replaceable license holders to focus harvesting on the salvage of MPB impacted pine. This strategy is considered successful; pine volume salvaged, as a percentage of total volume billed, averaged approximately 70% over the six year period from 2004 to 2009.

Harvest continues to focus on MPB impacted pine, but the harvest will transition to lower levels over the next decade as the MPB impacted pine is either harvested or deteriorates beyond economic value before being salvaged. Significant economic and social repercussions are expected during the transition to a lower AAC, especially compared to the current AAC, the previous uplifted harvest levels, or the pre-MPB AAC.

Timber supply analyses have shown significant mid-term timber supply shortfalls in areas affected by the mountain pine beetle (MPB) infestation. The 'mid-term' being defined as 10 to 50 years from now. Preliminary analyses completed in 2010 for the Williams Lake, Quesnel, Prince George and Lakes timber supply areas have revealed potential opportunities for decreasing mid-term supply impacts through review and modification of the following factors:

1. Improvement in forest sector economics reflected in expansion of the timber harvesting land base as a result of a lower minimum stand volume and higher maximum cycle time.
2. Relaxation of objectives for non-timber forest values including landscape level biodiversity, visual quality objectives and ungulate winter range.
3. Forest management practices including fertilization and regeneration.

As potential opportunities are unique to each timber supply area, a Technical Working Group was formed for each of the four TSAs to examine mitigation opportunities and their related implications. The preliminary analysis was reviewed by the Prince George TSA Midterm Timber Supply Technical Working Group (Working Group) and by major licensees operating in the TSA. Following the reviews, the Working Group selected opportunities that have potential to mitigate mid-term timber supply impact and outlined the implications of these opportunities. The biophysical and economic situation of the Prince George timber supply area (TSA) is described in this document along with its land use management objectives and anticipated mid-term timber supply shortfalls. This report also

provides an overview of a range of options for mitigating mid-term timber supply shortfalls in the Prince George TSA and explores implications related to these options. The document was prepared for the Provincial Mid-Term Timber Supply Oversight Committee by the Prince George TSA Technical Working Group as part of the Mid-Term Timber Supply Project.

In summary, this document provides an overview of various opportunities for mitigating the forecasted mid-term timber supply shortfall in the Prince George timber supply area (TSA) and explores the timber and non-timber implications related to these opportunities. This analysis focuses on scenarios examining changes to economic assumptions and biodiversity objectives.

1.1 Limitations of this project

It is important to document several limitations of this report. This is a timber supply analysis with limited assessment of the potential impact on other values. The Prince George TSA Landscape Objectives Working Group (LOWG) has provided a very cursory review of impacts to old growth values (Section 5.2, 5.3 and Appendix 8.4) but a more detailed assessment is required prior to implementation of changes to forest management actions that are documented in the hypothetical scenarios presented here.

No assessment of impact to other values including tourism/recreation, guiding/hunting, wildlife habitat, maintenance of First Nations values, etc. has been done. Current objectives for other values were established through land use planning processes which often involved considerable public consultation. This document constitutes phase I of the mitigation of timber supply impacts project and is limited to exploring the possible options and scenarios that may result in a more favourable timber supply. Phase II of this project, if it is initiated, is envisioned as a more detailed analysis of the impact to these other non-timber values along with a public consultation phase.

This report focuses on mid-term timber supply mitigation (10 to 50 years from now). No assessment has been made of short term impacts to timber supply during salvage period. This is mainly because there is no apparent shortage of unconstrained dead and damaged pine stands available to meet the current AAC or the current milling demand (see sections 2.6 and 2.8)

2.0 Description of the Timber Supply Area

The Prince George TSA, as shown in Figure 2.1, is in north-central British Columbia (B.C.) and covers approximately 7.97 million hectares of the Northern Interior Forest Region. Ranging from the Blackwater River in the south to the headwaters of the Skeena River in the north, the TSA is a diverse landscape of mountains and interior plateau. The TSA also geographically encompasses multiple woodlots, several community forests, two research forests and TFLs 30, 42 and 53 but these forest management units are not included in this timber supply analysis.

The forest and range resources of the TSA are administered by the Fort St. James, Prince George and Vanderhoof Forest Districts (Figure 2.1).

Fort St James District

The Fort St. James District comprises 3.18 million hectares, which represents approximately 40 percent of the Prince George timber supply area. Of this area, 2.01 million hectares are provincial Crown forest land and, assuming a continuation of recent practices, 0.98 million hectares may eventually be harvested.

The town of Fort St. James is the primary community within the Fort St. James Forest District, along with numerous smaller aboriginal communities including Nak'azdli (Nak'azdli First Nation), Binche, Tache, Middle River (Tl'azt'en First Nation), Yekooche (Yekooche First Nation), Takla Landing and Buckley House (Takla Lake First Nation).

The Fort St. James Forest District presents a diversity of landscapes, from the rolling plateaus in the southern portion of the district to the extremely mountainous and largely non-roaded landscapes of the north. Large lake systems include Takla, Trembleur, Stuart, Inzana, Pinchi, Tezzeron and Nation (Tsayta, Indata, Tchentlo, and Chuchi) Lakes.

The Fort St. James District covers parts of the headwaters of three major river basins: the Skeena, the Fraser, and the Peace. The first two drain to the Pacific Ocean while the Peace River flows, via the Mackenzie River, to the Arctic Ocean.

Forests are mostly lodgepole pine and spruce, with balsam at higher elevations and scattered patches of aspen. There are some areas of Douglas-fir, particularly along the shores of Stuart Lake. A history of frequent wildfires has left a mosaic of forest ages. Old- and mature-balsam stands predominate in the northern portion of the district.

Timber harvesting to date has concentrated on the southern portion of the district, in areas around the larger lakes, and along valley bottoms in old spruce stands, with increasing emphasis on lodgepole pine-dominated stands. Historical lack of access, mountainous terrain and a predominance of less preferred commercial tree species, such as balsam, have limited harvesting in the north.

Vanderhoof District

The total area within the Vanderhoof District is 1.39 million hectares which represents about 17 percent of the Prince George TSA. Of this area, 1.04 million hectares are considered provincial Crown forest land and assuming a continuation of recent practices 0.74 million hectares may be eventually harvested.

The area is marked by the landscapes of the central interior plateau and the Nechako valley. The lacustrine soils in the valley bottom are fertile agricultural lands while the low-rolling to upland terrain of the plateaus is mostly forested with sub-boreal pine and spruce.

The largest community in the district is Vanderhoof. First Nations communities include Saik' uz, Stellat'en and Nadleh Whut'en.

A history of frequent wildfires helped to maintain a forested state dominated by lodgepole pine which has since succumbed to the mountain pine beetle epidemic. Old forests are relatively

uncommon except for scattered groves of Douglas-fir and the few higher elevation mature Engelmann spruce sub-alpine fir forests. Small patches of trembling aspen, black cottonwood and white birch occur throughout the district.

Prince George District

The total area within Prince George Forest District is 3.40 million hectares, which is 43 percent of the Prince George timber supply area. Of this area, 2.19 million hectares are considered provincial Crown forest land and, assuming a continuation of recent practices, 1.38 million hectares may eventually be harvested.

The City of Prince George is the largest community within the district and is situated at the junction of two major highways: 16 and 97. Smaller communities include Hixon, Bear Lake, McLeod Lake, Willow River and Dome Creek. First Nations communities include the Lheidli T'enneh and McLeod Lake.

Landscapes within the district are diverse and include rugged alpine terrain and sub-alpine forests in the Cariboo and Rocky Mountains, ancient cedar-hemlock rainforests in the Rocky Mountain Trench, spruce forests in wetter ecosystems east of Prince George and dry pine dominated forests on the interior plateau. The predominant tree species in the district include white spruce, lodgepole pine, sub-alpine fir and Douglas-fir. Deciduous species include aspen, cottonwood and birch.

The recent mountain pine beetle epidemic has caused significant mortality in pine forests and timber harvesting has been directed to these stands which are located, for the most part, south and west of the City of Prince George.

2.1 First Nations

First Nations within the Prince GeorgeTSA are Carrier and Sekani. The asserted territories of the Carrier and Sekani First Nations comprise approximately 76,000 square kilometres located in what is now known as the Interior Plateau Region, which is bound to the east by the Rocky Mountains, to the north by the Omineca Mountains, and to the west by the Coast Mountains. The asserted territories of the Carrier First Nation surround the Nechako, Stuart, and Fraser River watersheds, while those of the Sekani First Nation coincide with the Finlay, Parsnip and Peace Rivers. The asserted traditional territories of their Southern Carrier First Nation neighbours surround the basins of the Dean, Blackwater, and Quesnel Rivers.

First Nations communities that are located within the Prince George TSA include: the Nak'azdli, Takla Lake, Tl'azt'en, Nadleh Whut'en , Stellat'en, Saik'uz, Lheidli T'enneh, Yekooche and McLeod Lake. Each First Nation has its own distinct traditional territory, usually corresponding to a watershed or lake system. Other First Nations whose communities are outside of the Prince George TSA but whose territories extend into the Prince George TSA include: the Cheslatta, Lhoosk'uz Dene, Ulkatcho, Toosey, Anaham, Skin Tyee, West Moberly, Halfway River, Gitxsan, Lake Babine, Kaska Dena, Tsay Key Dene, Red Bluff, Nazko, and Tahltan First Nations.

2.2 Land Use Planning and Old Growth Management

The Fort St. James Land and Resource Management Plan (LRMP) was approved by the provincial government in 1999, the Vanderhoof LRMP in 1997 and the Prince George LRMP in 1999. A number of the important values identified in the LRMPs, including ungulate winter ranges for caribou and mule deer, landscape-level biodiversity and visual quality, have legally-established management objectives, which have been reflected in the recent analysis in support of the allowable annual cut determination.

In 2002, Craig DeLong, Regional Ecologist for Ministry of Forests and Range, researched and authored a paper titled Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management2. Later that year the report was formally endorsed and supported by the Regional Managers of the Provincial Natural Resource agencies. As a result the Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area – October 20, 2004[3], often referred to as the Prince George TSA old growth order (PG OGO) was developed and approved. This was achieved over two years by a working group consisting of representatives from PG TSA timber licensees, the Ministry of Sustainable Resource Management (MSRM) and the Ministry of Forests. The PG OGO was a negotiated outcome that attempted to balance the use of natural range of variability to manage landscape biodiversity values and timber supply impacts.

Key information regarding the reason that the PG OGO was adopted to protect a broad range of species is as follows:

- The more that managed forests resemble the forests that were established from natural disturbances, the greater the probability that all native species and ecological processes will be maintained.
- A coarse filter approach to managing biodiversity protects ecosystem function and provides for a broad range of habitats for a broad range of species. The *PG OGO* is an example of a coarse filter approach to biodiversity management.
- Some species and ecological communities (plant associations) in the Prince George Timber Supply Area are endangered or of concern and some of these are supported by old forests.

In establishing the old growth order several important clauses were included that are designed to balance the ecological and timber supply impacts. Section D of the Order "Contributions, Interpretations and Alternatives" contains a clause: "D.3. Epidemic or Catastrophic Events: A representative portion of stands that have been affected by an epidemic or catastrophic event may

[2]The information in the 2002 document was published in 2010 as *Technical Report 059 - Land units and benchmarks for developing natural disturbance-based forest management guidance for northeastern British Columbia.* http://www.for.gov.bc.ca/hfd/pubs/Docs/Tr/Tr059.pdf

[3]The Order and Implementation Policy can be found at: http://archive.ilmb.gov.bc.ca/slrp/srmp/north/prince_george_tsa/pg_tsa_biodiversity_order.pdf

contribute to meeting the Old Forest Retention and the Old Interior Forest objectives. ..." This clause was added due to the Mountain Pine Beetle epidemic and to balance ecological and economic pressures in the mid-term. Section D of the Order contains two other clauses: "Where it can be demonstrated that equal or better conservation benefits would result, up to 20% of the Old Forest Retention and Old Interior Forest objectives may be comprised of younger age classes." and "Where either the old forest retention or the old interior forest objectives cannot be achieved, with consideration of the timely and economic harvesting of timber rights, then a recruitment strategy must be submitted and complied with. ..." These later two clauses have not be exercised to the extent possible at this point and timber supply analysis has not modeled this.

The PG OGO is the focus of several scenarios in this mid-term timber supply mitigation analysis.

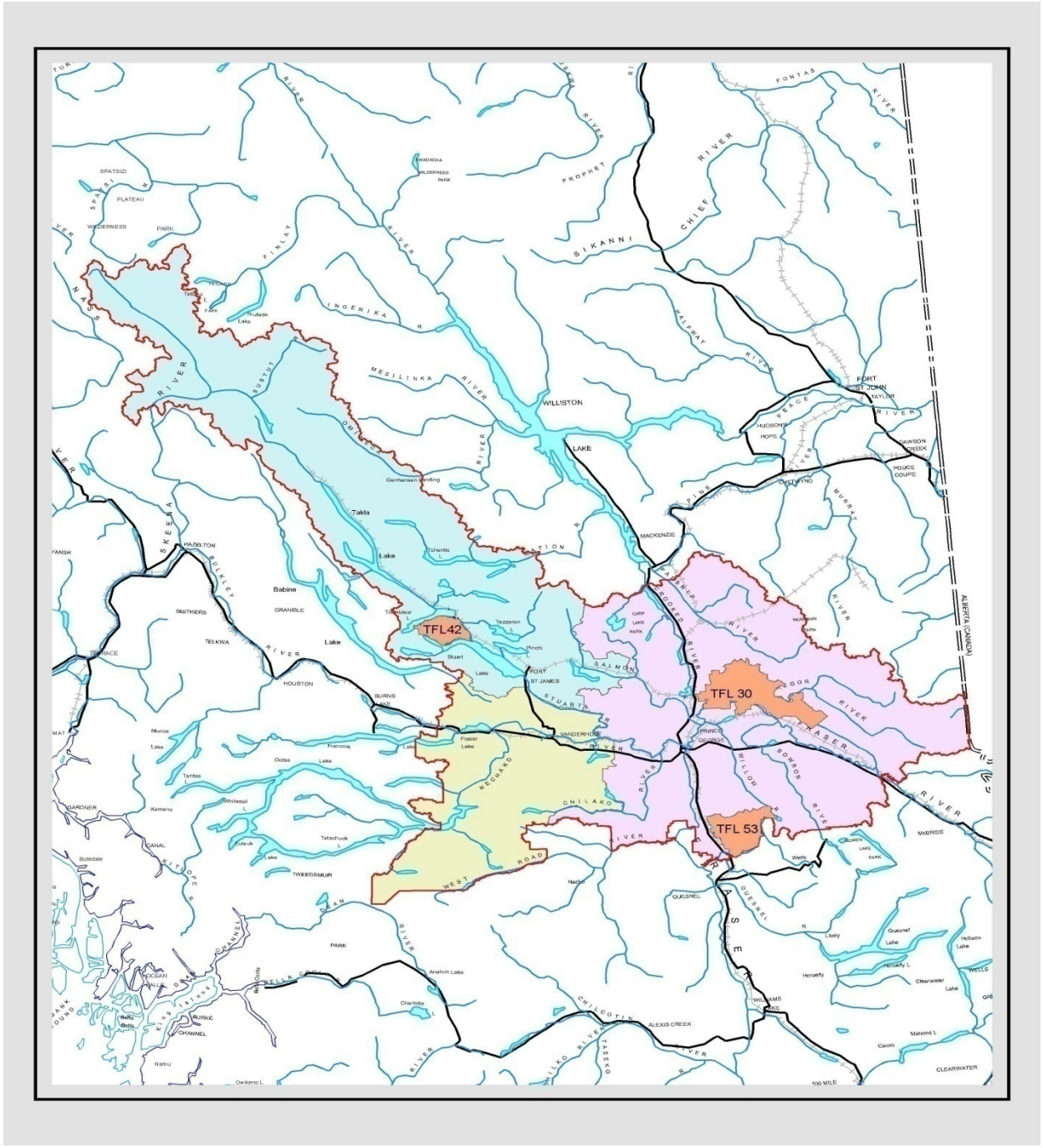
2.3 History of Allowable Annual Cut and Timber Harvest

Since its creation in 1978, the Prince George TSA's AAC has been re-determined several times (Figure 2.2). Prior to the current MPB infestation, on January 23, 1996 the chief forester set the AAC for the Prince George TSA at 9 363 661 cubic metres (Figure 2.2). This AAC included a partition of 290 000 cubic metres per year for harvesting cedar and hemlock stands. Of this, 250 000 cubic metres per year was to be directed to the salvage of stands heavily damaged by the hemlock looper over five years. The remaining 40 000 cubic metres was to be directed to stands with lower levels of looper infestation for an indefinite period of time to control future outbreaks. This AAC was supported by a timber supply analysis that indicated that the AAC could be maintained at over 9 million cubic metres into perpetuity.

Effective June 1, 2002, the AAC for the Prince George TSA was increased by about 30 percent to 12 244 000 cubic metres per year (Figure 2.2). This increase of three million cubic metres per year was intended to facilitate the salvage of timber damaged by mountain pine beetle and diminish the extent of further damage. Of the total AAC, 110 000 cubic metres were attributable to cedar and hemlock stands, 160 000 cubic metres to deciduous-leading stands, and 400 000 cubic metres to supply block 'A' located in the northwest portion of the Fort St. James Forest District.

Effective October 1, 2004, the AAC was set at 14 944 000 cubic metres or 22 percent above the previous level. The purpose of this large increase in AAC was to salvage timber killed by the MPB epidemic. Of this total AAC, 160 000 cubic metres were attributable to deciduous-leading stands, 110 000 cubic metres to cedar and hemlock-leading stands, and 400 000 cubic metres.

Effective January 1, 2011, the AAC was reduced to 12 500 000 cubic metres or 16 percent below the previous level. The purpose of this decrease was to recognise the declining quality of MPB damaged timber in a primarily sawlog based manufacturing forest industry.



	Prince George Forest District
	Vanderhoof Forest District
	Fort St. James Forest District

Figure 2.1: Map of the Fort St. James, Vanderhoof and Prince George Forest Districts within the Prince George Timber Supply Area.

In all AAC determinations since 2002 the chief forester has recognized the importance of focusing the majority of harvest on dead and dying MPB attacked lodgepole pine forests through what is know as 'partitioning the cut'. This was in an effort to preserve as much of the green (live) timber as possible as he recognized that this would be critical to preserving the mid-term timber supply. Forest Companies have complied with the chief forester direction in the Prince George TSA and have attained over 70% of the harvest from lodgepole pine (Figure 2.3).

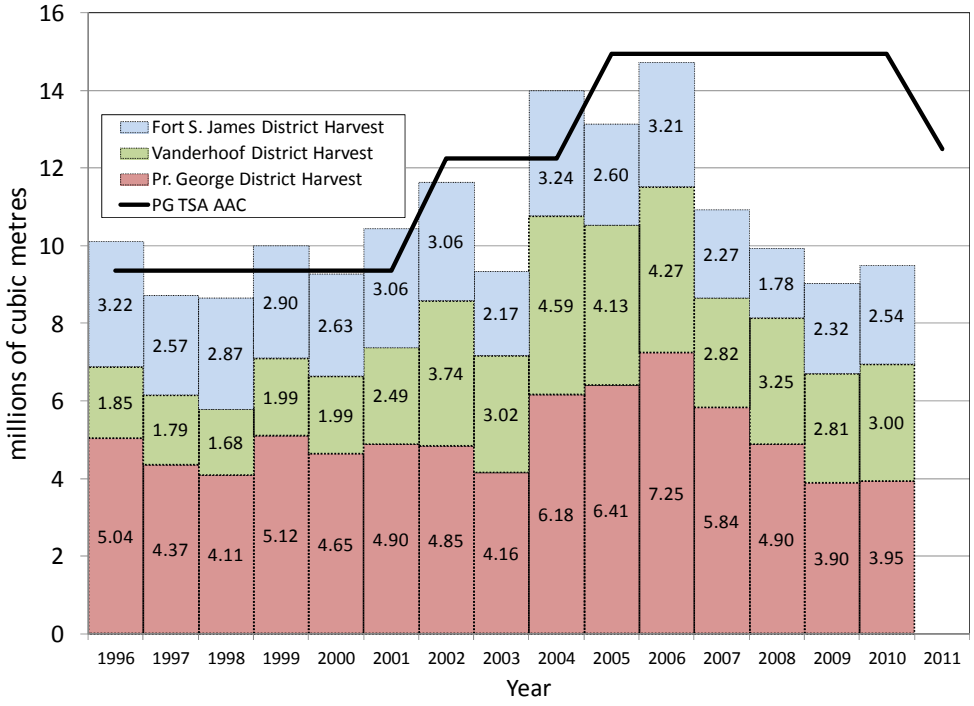


Figure 2.2: Allowable annual cut (AAC) and volume harvested by district in the Prince George TSA.

Since 2007 the average volume harvested in the TSA has been approximately 30% below the allowable annual cut (Figure 2.2). One major reason for this undercut is non-performance of several non-replaceable forest licences (NRFLs) that were awarded to bio-energy proponents. The current economic downturn has also contributed to reduced lumber demand and reduced harvest levels of the major licensees.

For the TSA, pine harvest has increased from 46 percent (between 1996 and 2000) to over 76 percent in 2009 as licensees focused on MPB salvage (Figure 2.3).

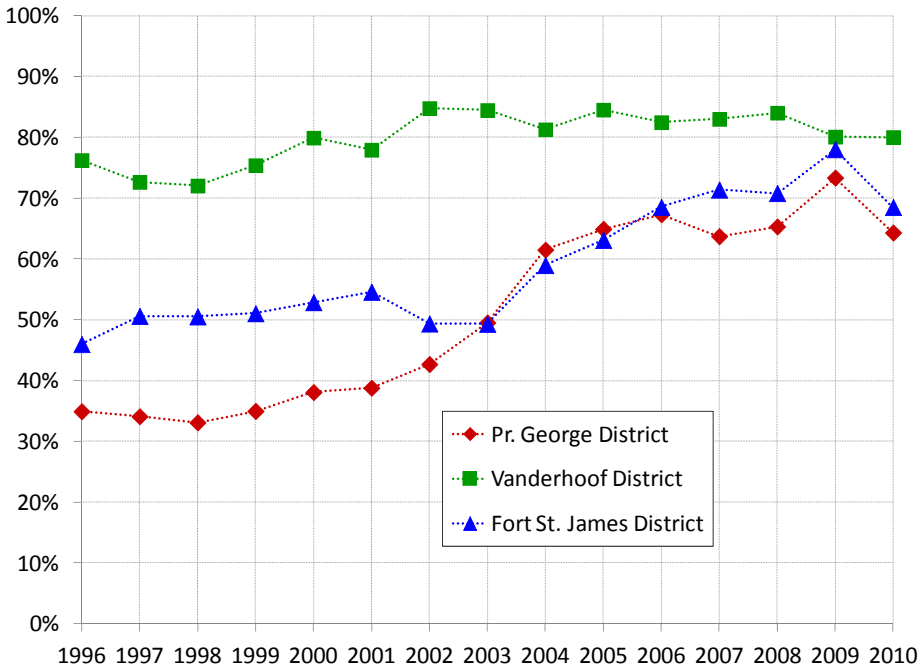


Figure 2.3: Percent that pine volume represents of total harvest by Forest District based on data from the Ministry of Forests, Lands and Natural Resource Operations Harvest Billing System (HBS) database.

2.4 Natural Resources

The diverse forests and landscapes of the Prince George TSA are home to a wide variety of wildlife species. Although best known for its moose population, the TSA also supports mule deer and, to a lesser extent, whitetail deer, grizzly and black bear, mountain goat, wolves, coyotes and relatively small herds of caribou. Significant populations of small mammals also exist, with pine marten, beaver and lynx being the most common. The rivers and lakes of the TSA support many fish species, including four species of salmon, steelhead, rainbow trout, kokanee, lake trout, Dolly Varden, bull trout, cutthroat trout, and whitefish. Numerous lakes in the TSA also provide a range of fishing opportunities. Many of these fish and wildlife species are regionally or provincially significant while others are commercially important.

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

2.5 Economic Profile of the Prince George Timber Supply Area

In 2006 employment related to the forest industry in the Prince George TSA was estimated at 16,230. This represents 28.3 percent of the total labour force of 57,342 jobs. Forest industry employment includes all phases of logging (including trucking), pulp and paper manufacturing, forest consulting, and wood manufacturing. Employment estimates combine not only the direct jobs supported by the forest sector, but also the so called indirect and induced employment related to the direct business and employee spending. The community of Fort St James is the most reliant with 49 % of all jobs directly of indirectly related to the forest industry. Vanderhoof follows a close second with 44% and Prince George has 26% of employment related to the forest industry. Appendix 8.3 is a detailed social and economic assessment of the Prince George TSA which was done to inform the recent AAC decision.

Table 2.1 provides this labour force data for the 2006 census year by total employment in each basic sector. [4] Employment estimates by basic sector combine not only the direct employment supported by, for example the forest or agriculture sector, but also the so called indirect and induced employment related to the direct business and employee spending. Thus, employment in wholesale/retail trade, transportation, and other supply and service employment is allocated to each basic sector. The allocation of this indirect and induced employment is based on the level of income associated with each basic sector, thus for example the forest sector will have a larger number of indirect and induced jobs associated with forestry activity than the tourism sector which brings a lower per job level of income into the region.

The indirect/induced employment ratios in Table 2.1 show this spending effect by direct sector, where available. A direct sector with a larger ratio indicates higher income and spending levels, thus generally supports more indirect and induced spending, hence jobs in the region.

In 2010 for the Prince George TSA, the average harvest and milling employment ratios were estimated at 1.19 person-years employment per 1000 cubic metres harvested (direct, indirect and induced jobs - Appendix 8.3 Table 14). For example, a drop in harvest of a million cubic metres may result in a reduction of approximately 1190 person years of employment. This is only an estimate as it has been shown that Pulp mill employment has been very stable over the last 5 years despite harvest level reductions of over 5 million cubic metres (Figure 2.2). During the latter part of this time the Prince George pulp mills benefitted from the residual chips that no longer flowed to the Eurocan pulp mill in Kitimat as that mill was closed in January 2010. The International WOOD MARKETS Group Inc., a consultant that specializes in economic forecasting for BCs wood fibre based industries, has predicted that pulp production and employment would not necessarily drop

[4] An economy can be divided into two components: basic and non-basic. The basic sector is supported by income flowing into the region and includes direct activity associated with a particular sector (forestry, agriculture for example) and the resulting indirect activity supported by company purchases of goods and services. The non-basic sector is supported by employees in the basic sector spending their incomes at local stores for example. Total employment as provided in Table 2 includes both basic and non-basic components. The basic sector is considered the driver of economic activity and growth in a region. For a more in-depth discussion of the methodology used to generate these figures and the publications on which this discussion is based see http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

with decreasing mid-term wood supplies in the Prince George TSA as pulp chip supplies are sourced from a much broader geographic area including the Mackenzie, Lakes and Houston regions[5]. In this way the general employment ratios are not applicable to the pulp sector and a drop in timber harvest in the Prince George TSA can not necessarily be tied to a proportional drop in pulp employment. If timber supplies are reduced in these other regions there also may be substitutions in sources from residual Sawmill chips to whole log chipping of logs depending on the economics at that time. Currently, between 500,000 and 700,000 m3 per year of total PG Pulp mill fibre requirements of approximately 6.2 million m3 are sourced from whole log chips.

Fishing and Trapping and *Tourism* are two other sectors often linked to the forests of a local area. First Nations peoples consider trapping as an employment activity. A small portion of tourism employment includes guiding for both hunting and fishing. Similarly, a portion of tourism employment is linked to hiking and trekking. Total employment in these sectors represents approximately eight percent of all jobs in the TSA. As stated previously not all of these jobs are dependent on having forests to recreate or work in.

Table 2.1: Total employment by basic sector and indirect/induced employment ratios for the Prince George TSA, 2006

Forest District Sector	Fort St. James	Prince George	Vanderhoof	Prince George TSA	TSA Indirect/ induced ratios*
LOGGING	354	4,096	1,004	5,454	1.23
PULP AND PAPER	14	3,383	76	3,473	1.63
OTHER WOOD MFG	545	5,346	1,412	7,303	1.29
MINING (& PROC.)	13	671	369	1,053	1.36
OIL & GAS(& PROC)	-	641	-	641	(incl. mining)
HIGH TECH	-	738	-	738	1.04
FISHING & TRAPPING	-	33	1	34	NA
AGRICULTURE & FOOD	52	767	395	1,214	1.12
TOURISM	102	3,880	432	4,414	1.07
PUBLIC SECTOR	662	17,695	1,483	19,840	1.14
CONSTRUCTION	41	4,467	242	4,750	1.30
FILM & SOUND PROD.	12	65	-	77	NA
OTHER (UNALLOCATED)	40	4,589	104	4,733	NA
NON-EMPLOYMENT	30	3,430	157	3,617	NA
TOTAL	1,865	49,801	5,676	57,342	NA

Source: Horne, Garry. 2009. 2006 Economic Dependency Tables for Forest Districts, February 2009. Victoria, BCStats.

*The indirect/induced employment ratios are weighted averages of the forest district ratios.
NA=not available

Another way of looking at this employment data is in terms of how a local economy depends on any one basic sector in terms of the level of income introduced into the local economy. Table 2.2

[5] Personal communication with Jim Girvan MDT Inc.

provides the latest economic dependency data for forest districts based on the 2006 Census of Canada. In terms of basic employment, the forest sector remains the single most important sector in the TSA's economy. While the Prince George forest district depends to a much lesser extent on forestry, it is still the largest industrial sector in the district, and the second largest employer behind the public sector.

Table 2.2: Prince George TSA forest district basic employment dependency ratios, 2006.

Forest District	Forestry	Mining & Min Proc	Agric. & Food	Tourism	High Tech	Public Sector	Construc-tion	Other
Fort St. James	49%	1%	3%	6%	0%	36%	2%	3%
Prince George	26%	3%	2%	9%	2%	38%	10%	10%
Vanderhoof	45%	6%	7%	8%	0%	27%	4%	2%

Source: Garry Horne (2009) Economic dependency tables for forest districts.
Note: percentages may not add due to rounding.

Sawmill demand for logs and available supply has been projected by the BC Fibre Model v.2 (2011) employed by International WOOD MARKETS Group Inc in a recent report *BC Interior: Mountain Pine Beetle Attack (2010).* Figure 2.4 shows demand and available sawlog AAC for the Prince George TSA which reflects the current inflow and outflow of logs from the TSA.[6] The figure shows actual harvest in years 2005 to 2010 as orange bars and is indicative of falling demand coupled with several permanent mill closures including Stuart Lake Lumber (May 2007), North Central Plywood (May 2008), Winton Global (June 2008), CANFOR Rustad (July 2009) and CANFOR Clear Lake (January 2011). Sawmill demand is forecast to remain relatively stable from the present time through to 2017. This prediction of mill demand is based on mills running at approximately 90 to 95% of production capacity throughout this period. As MPB attacked forests continue to deteriorate past the point where the volume of recoverable sawlogs makes harvesting prohibitive from an economic break-even point of view, available log supply is predicted to decrease to approximately 8.5 million cubic metres annually. The WOODS MARKETS report predicts that this will occur by approximately 2020 and that the wood supply of 8 to 8.5 million cubic metres consists of 6.2 million of mid-term AAC, 1.5 million designated as a bio-energy partition plus smaller volumes from TFLs, Community Forests and Woodlots. This would result in further sawmill closures predicted by the year 2017 unless the midterm timber supply is increased.

Similar but slightly more optimistic predictions regarding available AAC and mill capacity have recently been made (spring 2011) by Forest Economic Advisors, LLC[7] in *Beetlemainia? North American Wood and Timber Markets in the wake of Mountain Pine Beetle Infestation.* This report predicts AAC available in 2020 at 8.8 million for the TSA alone and 9.3 million including Tree Farm Licences No. 53 (Dunkley Lumber) and No. 30 (CANFOR)[8]. Mill capacity is predicted at 2600 million board feet (mmbf) or 9.45 million cubic metres.

[6] Figure 2.1 used with permission from International WOOD MARKETS Group Inc.

[7] www.getFEA.com

[8] Table S1, p 58

Many sources including International WOOD MARKETS Group Inc predict increased medium-term demand as the economics of the sawlog manufacturing industry improve with improving world (and US) financial growth. As will be demonstrated later in this report significant opportunities may exist for improving the mid-term timber supply as the economics of the forest industry improve (Section 5.1). This may be achieved by accessing timber that is currently considered uneconomic and outside the timber harvesting landbase because it is currently too far from a processing facility or has insufficient volume per hectare.

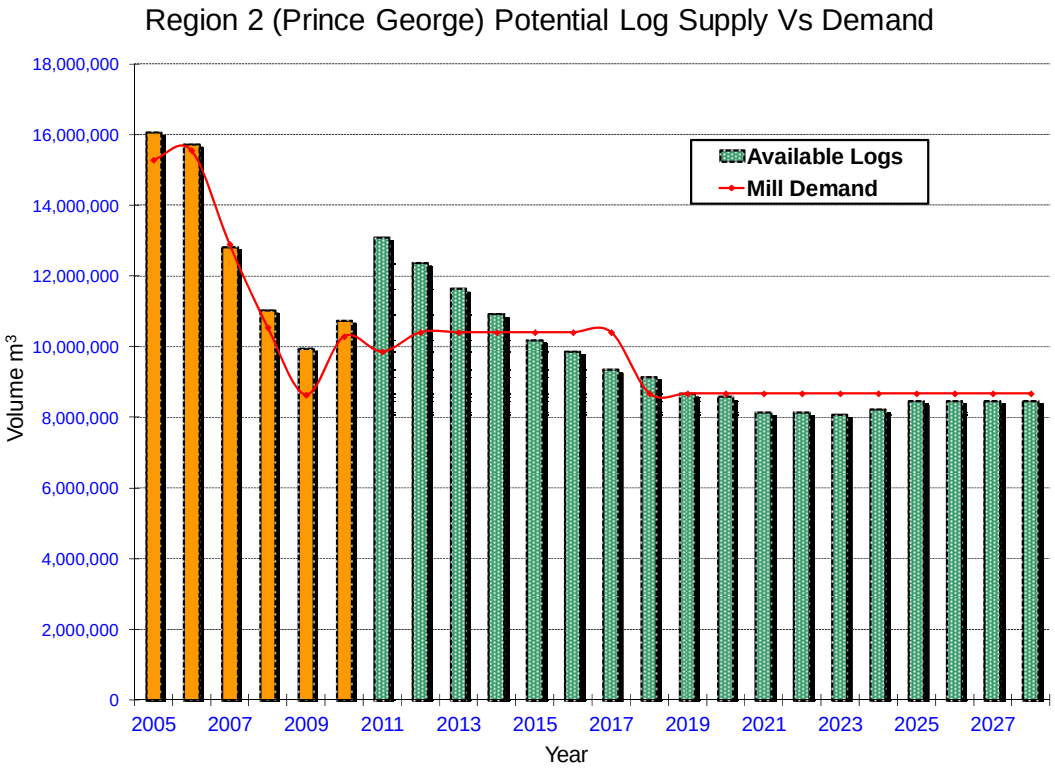


Figure 2.4: Prince George TSA Actual (2005 to 2010) and Predicted (2011 to 2028) Log Supply and Sawmill demand (source: MDT Ltd. B.C. Fibre Model v.2 updated to September 2011).

3.0 Methodology of Timber Supply Analysis

3.1 The timber supply model

The analysis was completed with a model called PYSIM created by Barry Snowdon of the Forest Analysis and Inventory Branch of the Ministry of Forests, Lands and Natural Resource Operations. The model is a basic inventory projection and harvest scheduler that considers non-timber objectives as constraints on harvest rate. The input is raster data and the model can recruit stands if an area of interest falls below some minimum specified condition. The model offers flexibility regarding the harvest queue and can simulate natural disturbances. Operability is defined via harvest rules rather than a static timber harvest land base definition. The supply model is written in a combination of "Python" and "C" computer languages.

The precision used for this analysis is increments of +/- 250,000 m^3/year in the mid-term harvest forecast. This means that if a change in management assumptions does not result in an increase in mid-term timber supply of over 250,000 m^3/year it is not identified. 250,000 m3/year is 3.9 % of the mid-term base case forecast of 6.4 million m3 per year.

3.2 Timber Supply analysis principles

All forested lands, whether they contribute to timber supply or not, help to maintain critical habitats for many species. Therefore, the timber supply analysis includes constraints or forest cover requirements for biodiversity, visual quality, community watersheds, recreation features, riparian management and protection of environmentally-sensitive areas.

Current forest management must be consistent with the requirements of the *Forest and Range Practices Act* (FRPA) and associated regulations, which are designed to maintain a range of biodiversity and wildlife values. In the Prince George TSA approximately 50 percent of the productive forest land is excluded from harvesting because it occurs in a park, reserve, or on unstable terrain. Other forested areas are excluded from harvesting because the volume of wood per hectare is too low or they are too distant from milling facilities. Although this land is not commercially suitable for timber harvesting, it does provide for other values.

No combination scenarios were done for this project. This will be an important phase of subsequent analysis when government considers the next steps as changes in management assumptions are not additive. For example, maintenance of area in mature stands for visual quality may also be providing old growth which satisfies the Prince George TSA Old Growth Order. In this case relaxation of objectives for both of these other values would not produce the mid-term impact associated with relaxation of each one separately.

Testing the impacts on timber supply of turning off various constraints or altering economic criteria was done from the start of the scenario throughout the entire forecast period (from year 2011 to 2100). This may not consistent with analysis that was done for other of the pilot mid-term timber supply area assessments where temporary relaxation of constraints on timber supply occurred throughout salvage period or the mid-term (year 2021 to 2080) period only. In the case of Prince George the model used prohibited turning constraints off and on during the forecasting period.

3.3 Uncertainty in Timber Supply Forecasting

Timber supply modeling depends on a suite of forest management assumptions that define scenarios which predict possible future outcomes regarding the flow of timber from an area. Because of the complexity of these models, small changes to assumptions like shelf-life of dead MPB-attacked timber can result in large changes in forecast supply. Current BC policy recognizes uncertainty by requiring AACs to be revisited and re-determined, at minimum, every ten years.[9] A striking example

[9] British Columbia Forest Act sec. 8. Accessed on June 20, 2010 at:
http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/96157_00

of this is that, 15 years ago the 1996 timber supply review of the PG TSA predicted a flat-line harvest forecast of just over nine million m^3/year for 250 years (Figure 4.1). No mention was made of possible mid-term fall-down associated with a future MPB epidemic.[10] Over 15 short years, the MPB epidemic has come and gone leaving predictions of significant short falls in mid-term timber supply. Uncertainty in prediction increases with time from the present as factors that influence forest management arise, change, or disappear (Figure 3.1). Changes can include refinements in biophysical attributes as well as social values and product requirements.

Historically as time progressed in BC, technology increased and allowed for expansion of the economically viable forested land base (timber harvesting land base (THLB)). At the same time, the forest was recognized as providing values other than timber supply which, as incorporated into forest analysis modelling, has tended to decrease the available timber supply.

Despite this uncertainty we rely on timber supply analysis and modeling such as is used here to guide forest managers in setting sustainably based AACs to the extent possible incorporating considerations for what is known at the present time.

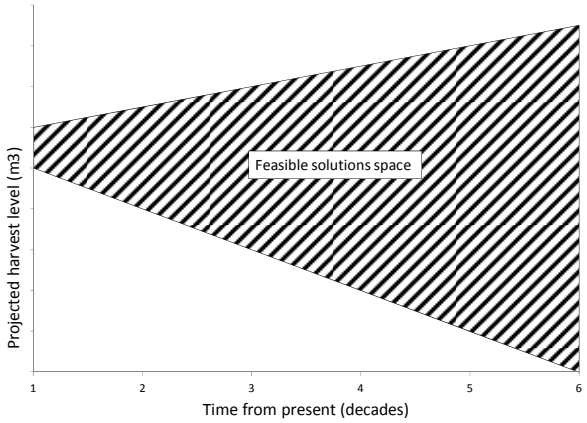


Figure 3.1: Hypothetical harvest forecast showing uncertainty in feasible solutions with time.

4.0 Description of the Base Case Harvest Forecast

The basis for most of the assumptions used in this analysis is the recently completed Prince George Timber Supply Review. Documentation can be found in the 2008 Data Package, 2010 Public Discussion Paper and AAC Rationale documents available on the MFNRO Forest Analysis and Inventory web site[11]. Where assumptions differ from the timber supply review process they are documented.

[10] Documented in the executive summary of the PG TSA Timber Supply Analysis Report. Accessed on June 10, 2010 at: http://www.for.gov.bc.ca/hts/tsr1/tsasea/tsa/tsa24/httoc.htm

[11] http://www.for.gov.bc.ca/hts/tsa/tsa24/index.htm

A key assumption used for this analysis (and the previous timber supply review) is that the shelf life of MPB attacked mature pine trees is 15 years with no degradation to recoverable sawlog. Fifteen years after attack the trees are assumed to fall over and no longer be useful for processing in a sawmill. This may make this analysis an optimistic projection of the near future sawlog timber supply as licensees have indicated timber degradation is fairly rapid after the initial MPB attack after which it trails off depending on the moisture regime of the stand (Appendix 8.2). On the other hand fibre may be able to be used for a longer period of time for use in bio-energy or other non-sawlog based manufacturing process.

Not all of the forested land in a timber supply area is available to support harvesting activities. Table 4.1 shows the netting down of the total area in the Prince George TSA to derive the current timber harvesting land base (THLB).

Table 4.1: Net-down table for each Forest District and the Prince George TSA.

Area(ha)	Districts			TSA
	Fort Saint James	Prince George	Vanderhoof	
Gross Area	**3,180,864**	**3,396,671**	**1,387,969**	**7,965,504**
Netdowns				
Area based tenures, private land etc.	104,014	523,948	172,457	800,419
Non-forest *(rock, ice, alpine, water etc.)*	1,051,256	651,826	163,225	1,866,307
Roads, Rail, Transmission lines	12,605	28,034	15,658	56,297
Contributing Forest Land Base	**2,012,989**	**2,192,863**	**1,036,629**	**5,242,481**
Netdowns				
Parks and protected areas	128,253	125,290	78,601	332,144
Unstable Terrain etc.	80,244	75,018	6,887	162,149
Problem Forest Types	38,373	57,233	48,340	143,945
Ungulate Winter Range *(w. 100% exclusion)*	15,202	97,471	15,267	127,941
Resource Management Zones *(w. 100% exclusion)*	4,305	11,851	327	16,483
Preservation VQO *(w. 100% exclusion)*	1,252	532	-	1,784
Recreation *(w. 100% exclusion)*	674	1,501	1,893	4,068
Old Growth Management Areas	-	15,361	-	15,361
First Nations *(w. 100% exclusion)*	5,458	18,860	-	24,318
Agricultural Development and Settlement Reserve Areas	5,290	14,037	5,686	25,013
Not Economic *(based on past performance)*	621,532	246,708	71,150	939,390
WTPs and Riparian	133,489	151,549	68,721	353,759
Timber Harvesting Land Base	**978,917**	**1,377,451**	**739,757**	**3,096,125**

A key assumption in this mid-term timber supply analysis is the maintenance of protection of several key non-timber values including parks and protected areas, stand level biodiversity (wildlife tree

patches) and riparian habitat zones, high value recreation areas, certain of the ungulate winter range including high value caribou habitat, and a small portion of stands with high visual quality (VQO = 'Preservation''). These areas are indicated in Table 4.1 as *'(w. 100% exclusion)'*. Spatially located old growth management areas (included in the Dome, Humbug and Slim Landscape Units) were also not analysed as part of the old growth scenarios but remain protected throughout all scenarios tested.

Economic Net Down

Of note in Table 4.1 is the nearly 940,000 hectares of forest land netted out because it is 'Not Economic'. Appendix 8.1 is a detailed account of the derivation of the criteria used to define forested areas that are currently deemed to be 'Not Economic'. For the purposes of defining the current economic landbase, the TSA was divided up into two geographic areas: the area accessed by road from milling centres and the area that is accessed mainly by a railway haul. The railway haul occurs in the northern portion of the Fort St. James forest district and has, in recent times, been shut down as timber companies have focused harvest on salvaging the vast quantity of MPB damaged timber closer to the sawmills. Road haul (logging truck) cycle time and volume per hectare were the attributes used to define the economic land base as is shown in Table 4.2. Criteria were established based on examining attributes of 1600 cutting permits logged in the TSA since 1992.

Table 4.2: Criteria used to define the crown forested area that is excluded from the timber harvesting land base because it is not economic.

	Road portion of the TSA	Rail Portion of the TSA
Maximum cycle time (stump to rail loadout or stump to sawmill)	7.7 hours	2.9 hours
Minimum volume	182 cubic metres/hectare	246 cubic metres/hectare

Base Case Harvest Forecast

The harvest forecasting documented in the recent timber supply review (2008 Public Discussion Paper) suggests that the timber supply would decline rapidly beginning in year 2021 based on a scenario where licensees follow the MPB related pine mortality from Prince George and Vanderhoof up into the Fort St James District (Figure 4.1 – black dashed line: Scenario 2A – Shift to Fort St James to Salvage). The forecast mid-term timber supply was slightly over 6 million beginning in 2025 and extending out for 20 years prior to a gradual increase to the pre-MPB level of 9 million in 2075. This scenario was later corrected because of a computer modeling error and a lower mid-term harvest level was indicated for a period of 10 years beginning in approximately 2037 (Figure 4.1 – Red dashed line).

As discussed, the harvest forecasting model used for this analysis is PYSIM whereas the model used for the recent timber supply review was SELES (Spatially Explicit Landscape Event Simulator)[12]. As discussed in section 3.3 above, models are abstractions of reality and as such are only as accurate as the input information and algorithms used to predict future outcomes. The PYSIM model was created to allow expedited review of the mid-term timber supply and determine which management assumptions are the key drivers. These models are excellent at informing how changes to management assumptions effect timber supply outputs and results but, as is seen in the differences in the 'base cases' between the timber supply review using SELES and the PYSIM, produce slightly different results. For this reason all results documented in this analysis are first displayed as cubic metres of annual harvest but are followed by an indication of the percent change. Results for all scenarios are compared to the mid-term base case and not the recent timber supply review base case.

One major difference between the mid-term base and the timber supply review is the way requirements for old forest are modeled. Whereas the timber supply review modeling used MPB attacked mature dead pine stands (referred to as *natural forest areas* in the PG OGO) to provide for old forest, the PYSIM model is not able to do so. To compensate for this shortcoming only the non-pine old forest requirements were applied in the mid-term modeling. This was done for the mid-term base case and all other scenarios tested except where the PG OGO was dropped altogether. This modelling difference is the main reason the mid-term base case is significantly more optimistic than the timber supply review scenario 2A (Figure 4.1).

Another difference between the timber supply review and this mid-term analysis is in the forecast period length. The timber supply review used one year periods for the first 30 years to allow for a more in depth assessment of the salvage period dynamics. The mid-term timber supply benefitted from the learning's gained in the timber supply review and used 5 year period throughout the entire forecast.

The mid-term base case forecast indicates a severe drop in timber supply beginning 10 years from now and persisting for 30 years at which time there is a slow climb over 20 years to a level of 9.2 million cubic metres which is comparable to the sustainable harvest predicted prior to the MPB epidemic (Figure 4.1). The mid-term timber supply is predicted to be 6.4 million cubic metres per year.

The AAC determination set an expectation that 23,000 m^3/year is to come from cedar leading stands and 160,000 m^3/year from deciduous leading stands. These are the current sustainable harvests level throughout the next 100 year planning horizon. The mid-term timber supply analysis is consistent with this direction and has not tried to achieve higher harvest levels in these profiles.

[12] http://seles.info/index.php/Main_Page

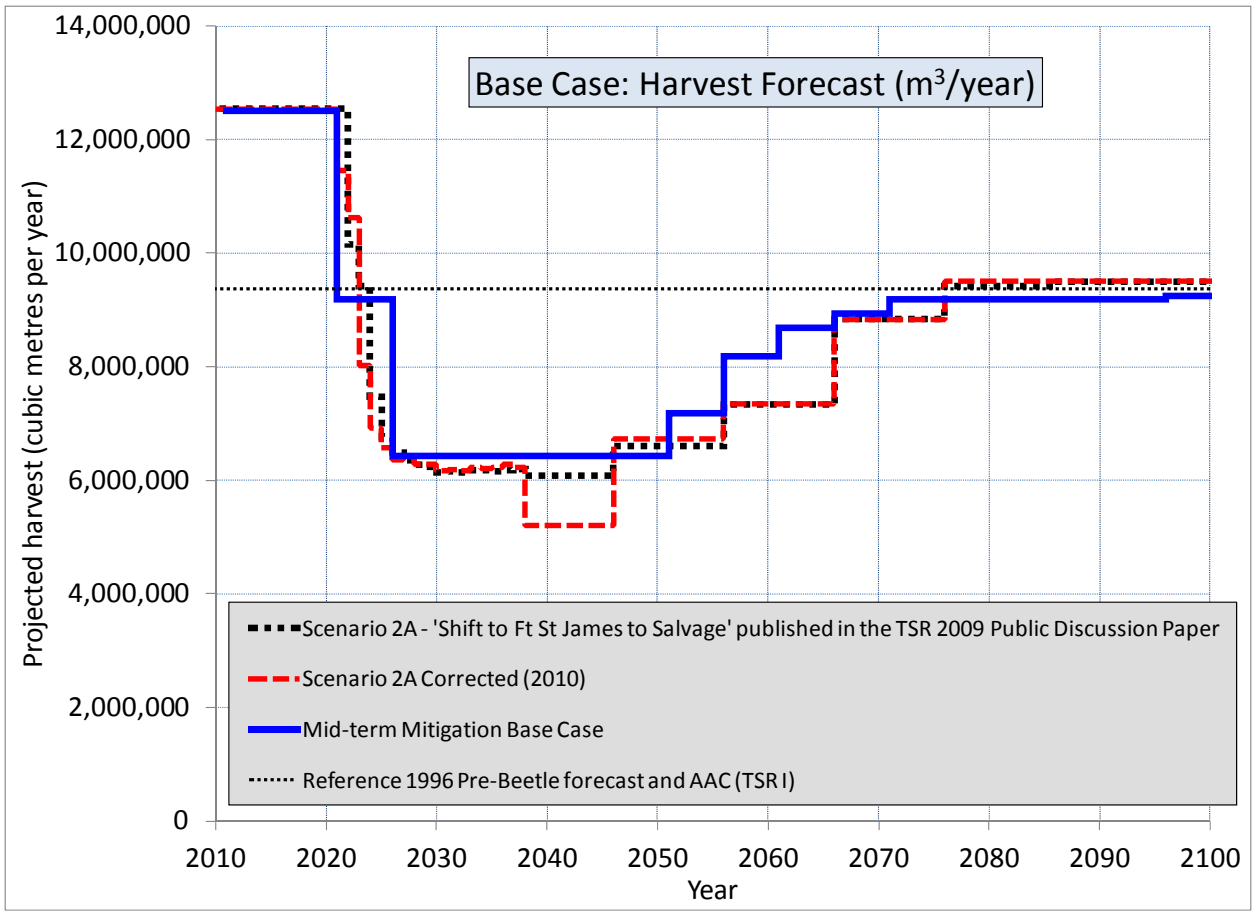


Figure 4.1: Base case harvest with previous timber supply reference forecasts including the 1996 AAC.

The length of time that short term harvest level is achieved (10 to 15 years) is directly related to the assumed 15 year shelf life. Maintaining the harvest level of 12.5 million cubic metres in the first 10 years followed by 9 million m^3 in years 11 to 15 would achieve approximately 160 million cubic metres of salvage from pine leading stands. This is 70% of the remaining leading pine mature stand volume of 230 million m^3 (Figure 4.2). At the same time this would result in approximately 70 million m^3 left unsalvaged as a result of deterioration of dead timber past what is currently considered to be usable for sawlog or pulp. Current economics and manufacturing facilities capacity limitations discourage additional salvage (Figure 2.4). It is anticipated that much of the unsalvaged mature pine volume will be in the southern part of the Vanderhoof Forest District where the small tree size and longer haul distances make salvage for sawlog, pulp or bio-energy uneconomic at current or near term product prices.

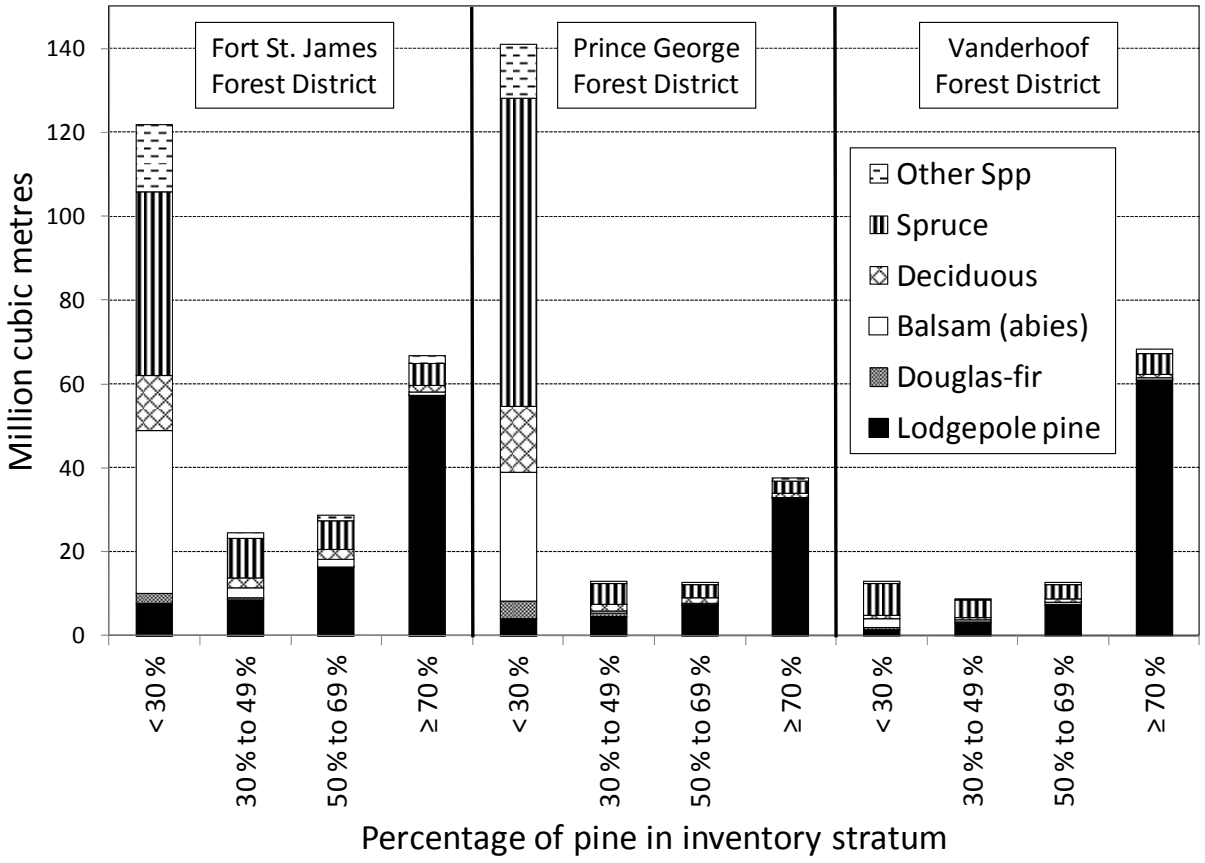


Figure 4.2: Standing mature volume by species in the Prince George TSA timber harvesting land base: stratified by the percentage that pine represents of the forest inventory polygon label.

5.0 Analysis Results

5.1 Economic Scenarios

The timber supply base case scenario is predicated on management practices of an industry largely focused on sawlogs and pulpwood. Opportunities to improve mid-term timber supply include moving into mature stands of lower volume than traditionally utilized, accessing stands further afield than historically accessed, encouraging new industries capable of utilizing fibre not currently considered merchantable and promoting silviculture investments in appropriate stands to yield additional mid-term volume.

As discussed in section 4.0, it was assumed that the minimum criteria for a road-accessible stand to be harvested were that it should have at least 182 cubic metres per hectare and a round trip transport time (cycle time) of 7.7 hours. For rail-accessible stands, the minimum criteria were 246 cubic metres/hectare and 3.9 hours of road transport (round trip) to the railhead. For the scenarios

shown in Figure 5.1 where the minimum volume per hectare was reduced to 140 m^3/hectare it was done so for both the road and rail portions of the timber supply area.

Five scenarios test the impact of changing the minimum volume per hectare and maximum cycle time criteria. If economics improve such that forest companies can afford to access stands with lower volumes and longer cycle times the mid-term timber supply can be all but be eliminated (Scenario 1.5, Figure 5.1). The largest single gain is achieved if the minimum volume per hectare is adjusted down to 140 m^3/ha while keeping the road and rail cycle times the same as the timber supply review. Table 5.1 is a summary of the various economic scenarios.

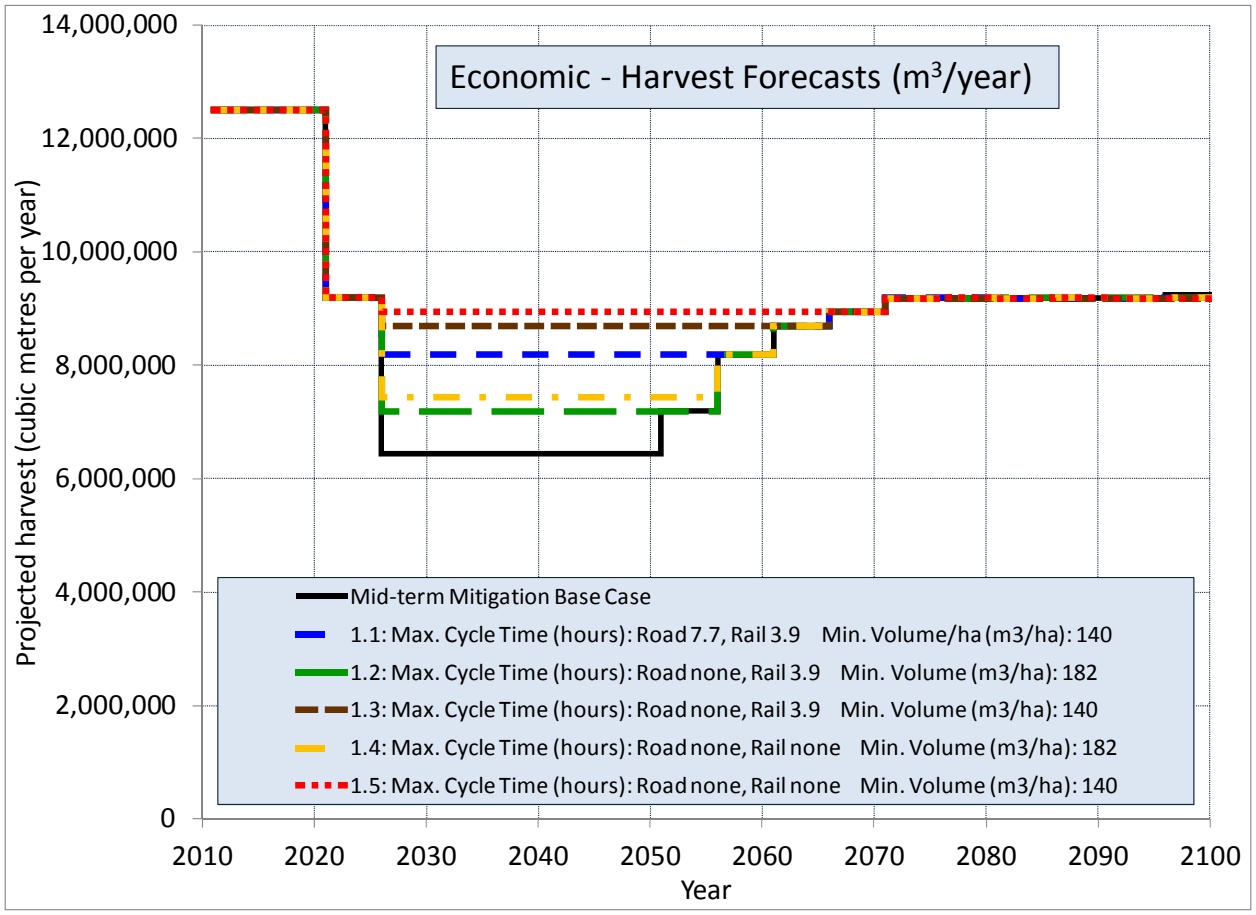


Figure 5.1: Prince George TSA Economic harvest forecasts by scenario number with a brief description of the key assumptions.

In the 2008 errata to the public discussion paper[13] the relationship between timber supply and the economic criteria are discussed in detail:

If the volume criterion was lowered by 10 percent to 164 cubic metres/hectare and 221 cubic metres/hectare respectively, and the round trip time increased by 10 percent to 8.5 hours and 4.3 hours respectively, relative to scenario 2A, mid-term timber supply could be increased by 10 percent. If the volume criterion was lowered by 20

[13] http://www.for.gov.bc.ca/hts/tsa/tsa24/tsr4/24ts10pdp_Errata.pdf

percent and the round trip time was increased by 20 percent, then mid-term timber supply could be increased by 21 percent. Finally, if the volume criterion was lowered by 30 percent and the round trip time was increased by 30 percent, then mid-term timber supply could be increased by 31 percent. It was noted that most of this increased volume was from balsam-leading stands. Currently, balsam comprises about four percent of the total harvest or 16 percent of the non-pine harvest. If these low-volume, long-haul distance stands could be harvested economically then they could contribute to timber supply.

Table 5.1: Summary of results for the Prince George TSA economic harvest forecasts.

Scenario number	Maximum cycle time (hours)		Minimum volume criteria (m^3/hectare)	Projected mid-term harvest level (millions of m^3/year)	Increase in projected mid-term harvest level over base case	
	Road haul	haul to railhead			million of m^3/year	%
Base case	7.7	3.9	182	6.43		
1.1	7.7	3.9	140	8.19	1.76	27%
1.2	none	3.9	182	7.18	0.75	12%
1.3	none	3.9	140	8.68	2.25	35%
1.4	none	none	182	7.43	1.00	16%
1.5	none	none	140	8.93	2.50	39%

It should be noted that the 2004 timber supply analysis for the Prince George TSA (2004) used a minimum volume per hectare criteria of 140 m^3/ha for harvest on conventional ground based skidding and 250 m^3/ha for cable harvest. Further, the Lakes TSA recently used 140 m^3/ha and the Quesnel used 120 m^3/ha whereas the recently released data package for the Dawson Creek TSA uses 120 m^3/ha conventional ground and 200 m3/ha on cable[14]. To date, none of the other TSA in the northern portion of the province have used a maximum haul cycle time.

5.2 Landscape Level Biodiversity (Old Growth Requirements)

At the on-set of the Mid-term Timber Supply project, The *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area – October 20, 2004,* often referred to as the Prince George TSA old growth order (*PG OGO),* was identified as a legal objective that, if modified, had a significant impact to mid-term timber supply, in the PG TSA.

The PG OGO contains three main objectives: old, old interior and young patch size. To date, timber supply analysis procedures has not incorporated the interior old or the patch size objectives because of the complexities faced in modelling. Similarly, the base case and the mid-term timber supply mitigation scenarios have only incorporated considerations for requirements for old forest.

[14] See: http://www.for.gov.bc.ca/hts/tsa/tsa41/2011_Current/41ts11dp.pdf

Eight scenarios were explored with regard to landscape biodiversity, specifically, old forest. Appendix 8.4 identifies and documents the risks to landscape biodiversity from the different scenarios being explored.

For this analysis two measures of risk to landscape level biodiversity were assessed:

- environmental analysis using the amount of old forest in comparison to Natural Range of Variability as a indicator of ecological integrity (low, moderate and high); and,
- Data was provided by the timber supply analyst for five of the scenarios; the data indicated which merged Biogeoclimatic (mBEC) units would be most impacted, if future harvesting occurs consistent with the assumptions in the timber supply model.

A summary table (Table 5.4) presents the estimated mid-term timber supply impact and documents risks to biodiversity. In order to more fully understand the anticipated implications and risks to landscape level biodiversity readers may wish to see details of the full report in the Appendix 8.4. Administrative changes required to implement these scenarios is shown in column 8 of Table 5.4.

The first four Old Growth scenarios tested are (Figure 5.2):

Scenario 2.1: Turn off Prince George Old Growth Order

Scenario 2.2: Reduce age of old forest by 20 years (for most units old forest definition changes from 141 to 121 years)

Scenario 2.3: Replace the PG OGO with the Provincial Old Growth Order

Scenario 2.4: Implement the full order including the requirement for old non-pine and old crown forest and do not allow MPB killed dead pine to contribute to the Old Forest requirement.

Scenario 2.1: Turn off the Prince George TSA Old Growth Order

Timber supply modeling forecasts that by turning off the PG OGO the mid-term fall down can be eliminated. If this were to be done there would be significant impacts to biodiversity.

By turning off the Prince George TSA Landscape Old Growth Order, there is a risk to the values managed through the coarse filter (i.e. "ecosystem function and the habitats for a broad range of species"). At highest and most immediate risk are those species and plant associations reliant on old growth habitats and structures.

Based on the risk classes (identified in Appendix 8.4), if the landscape is allowed to be managed to 0% of the Natural Range of Variability (or turning off the Prince George TSA Landscape Old Growth Order), the relative comparison of risks to landscape level biodiversity is very high (Table 5.4).

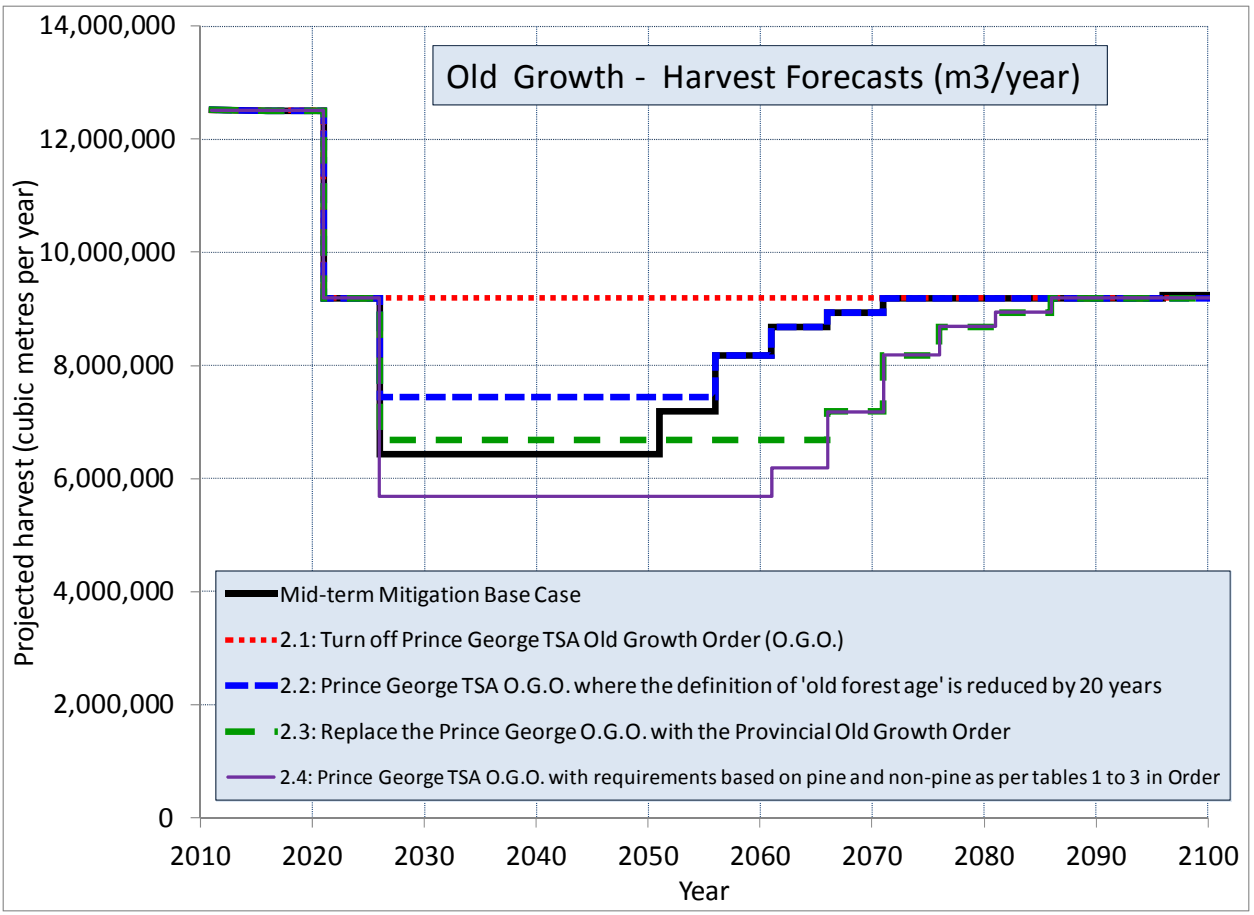


Figure 5.2: Old Growth harvest forecasts by scenario number with a brief description of the assumptions.

Scenario 2.2: Reduce the definition of Old Forest by 20 years

For the scenario where the definition of 'old forest age' is reduced by 20 years (mainly from 140 to 120 years) timber supply in the mid-term in increased by 16% or slightly over 1 million cubic metres per year.

Applied without ground-based assessments across the TSA, reduction of "old-forest" by 20 years will impact biodiversity. The amount of impact is difficult to quantify and will depend on the location. Since age is used as a surrogate for the multitude of attributes that make up old growth, lowering the age results in an increase in the risk to maintaining "old-growth" and old-forest attributes.

It is difficult to provide a relative comparison of risks to landscape level biodiversity for this scenario because the relationship to NRV is unclear. However, additional risk information is available through the data provided by the timber analyst and is included in Appendix 8.4. It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033

there may be one mBEC unit impacted to a relatively minor level and in 2058 there may be 6 mBEC units impacted to a relatively moderate level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. Map 1 in Appendix 8.4 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Scenario 2.3: Replace the Prince George TSA Old Growth Order with the Provincial Old Growth Order

For the scenario where the PG OGO is replaced by the Provincial order, timber supply in the mid-term in increased by 4% or 260,000 cubic metres per year but the mid-term trough is extended for an additional 15 years making this scenario less favourable for overall timber supply.

The Order Establishing Provincial Non-Spatial Old Growth Objectives was established June 30, 2004. For the PG TSA, it was superseded by the PGTSA landscape order due to more recent and relevant science on the topic. A comparison between the PG OGO and the Provincial order indicates the the PG OGO requires more old forest retention than the Provincial Order (Table 5.2) making it potentially more constraining. Whereas, the definition of the age of forests eligible to provide old forest attributes is less for the PG OGO compared to the Proovincial order making the PG OGO less constraining to timber supply. This later fact may cause the mid-term timber supply to be reduced for a much longer period of time (40 years) for this scenario.

In addition, the Provincial Old Growth Order allowed for "landscape units with a low biodiversity emphasis, to be reduced by up to 2/3, to the extent necessary to address impacts on timber supply". To draw down to the low Biodiversity Emphasis Option would provide additional increase the risk to landscape biodiversity.

Table 5.2: Simplistic Comparison of the Provincial Old Growth Order (June 2004) and the PG TSA Landscape Biodiversity Order (October 2004)

Provincial Old Growth Order			**PG TSA Landscape Biodiversity Objectives for Old Forest Retention**		
Biogeoclimatic Zone	**Age of Old Forest**	**Percent Old Forest Retention Range**	**Biogeoclimatic Zone**	**Age of Old Forest**	**Percent Old Forest Retention Range**
BWBS	> 140 yrs	11-16	BWBS	> 120 yrs	16
ESSF	> 250 yrs	9-28	ESSF	> 140 yrs	29-84
ICH	> 250 yrs	9-19	ICH	> 140 yrs	23-53
SBPS	> 140 yrs	7-10	SBPS	> 120 yrs	17
SBS	> 140 & 250 yrs	9-16	SBS	> 120 and 140 yrs	12-50

(source: *Background Information and Supporting Documentation for the Process Involved in Developing the Recommended Biodiversity Objectives in the PG TSA*, Prepared by: Ministry of Sustainable Resource Management, April 2004 (revised December 2005)

Additional risk information is available through the data provided by the timber analyst and is included in Table 5.4 and Appendix 8.4. It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be two mBEC unit impacted to a relatively moderate level and in 2058 there may be 9 mBEC units impacted to a relatively high level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. Map 2 in Appendix 8.4 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Scenario 2.4: Implement the full order including the requirement for old non-pine and old crown forest – no application of Section D.3 of the Order

For the scenario where *Section D.3* of the PG OGO is not allowed to fulfill the old forest requirement timber supply in the mid-term in decreased by 12% or 750,000 cubic metres per year.

Section D.3 of the PG OGO allows MPB killed dead pine stands to contribute to old forest requirements. Specifically, a representative portion of stands that have been affected by an epidemic or catastrophic event may contribute to meeting the Old Forest Retention and the Old Interior Forest objectives. Due to the current Mountain Pine Beetle epidemic, licensees and BC Timber Sales must ensure a representative portion of stands that have not been affected by the epidemic (i.e. non-pine forest) are used to meet the Old Forest Retention and the Old Interior Forest objectives."

The above clause is in the Order to balance the economic and ecological values available with the "non-pine" mature and old forest, especially through the mid-term period. If dead pine is not allowed to contribute to the old forest objectives, in a representative portion to the amount of dead pine in the mBEC units, then there will be additional impact to timber supply. A method is required to track the areas of dead pine being used to contribute to the old forest objectives.

5.3 Landscape Level Biodiversity (Old Growth Requirements): Natural Range of Variability

There is a large body of literature available that substantiates the theory of managing the landscape based on the natural disturbance processes or the natural range of variability. The Natural Range of Variability (NRV) for different age forests for each Natural Disturbance Unit was determined using estimated fire cycles and a simulation model. Fire cycles for each Natural Disturbance Unit were either obtained directly from the literature if local data was available or if not then from adjacent forested landscapes that were felt to have a similar disturbance history.

The PG OGO established the minimum percent of the range provided for Natural Range of Variability for old forest (Table 5.3). An example to illustrate this is the Moist Interior - Mountain Natural Disturbance Unit indicates that in a natural state the landbase would have had between 41 and 61 % of the forest in stands greater than 140 years old. For this unit, it was the 41% that was used if we were assuming 100% of NRV. For some units a compromise between establishing 100%

of NRV and something less than that was established in order to maintain mid-term timber supply. The old forest requirements established in the approved PG OGO meant that 16 merged BEC units are at 100% of the minimum NRV, 23 units are at 70% of the minimum NRV, 7 units are at 60 % of the minimum NRV and 3 units are below 60% of the minimum NRV. Those that are below the 60% were deemed acceptable based on similar ecological characteristics of adjacent units.

Table 5.3: Natural Range of Variability of Old Forest Retention as recommended by DeLong (2002)

Forest District	Natural Disturbance Units (NDU's)	Natural Range of Variability (NRV) for Old Forest Retention – percent of forest >140 yrs
Vanderhoof	Moist Interior - Plateau	17-33
	Moist Interior - Mtn	41-61
Prince George	Wet Trench - Valley	76-84
	Wet Trench - Mtn	80-88
	Moist Interior - Plateau	17-33
	Moist Interior - Mtn	41-61
	McGregor Plateau	43-61
	Wet Mountain	84-89
Fort St. James	Moist Interior - Mtn	41-61
	Moist Interior - Plateau	17-33
	Omineca - Valley	23-40
	Omineca – Mtn.	58-69
	Northern Boreal Mountain	37-60

Although the NRV research was based on all units >140 years the old forest was defined (in the Implementation Policy for the Order) as >140 years old for all units except Moist Interior – Plateau, some SBS units in the Omineca Valley and McGregor Plateau where old was defined as 120 years old.

Four scenarios regarding natural range of variability are tested in this analysis; Scenario 3.1 (100% NRV), Scenario 3.2 (70% NRV), Scenario 3.3 (50% NRV) and Scenario 3.4 (30% NRV). An example would be for the Moist Interior – Mtn for Fort St. James where the old forest requirement tested would be 41%, 28.7%, 20.5% and 12.3% NRV. Results of these scenarios are shown in Figure 5.3 and summarized in Table 5.4.

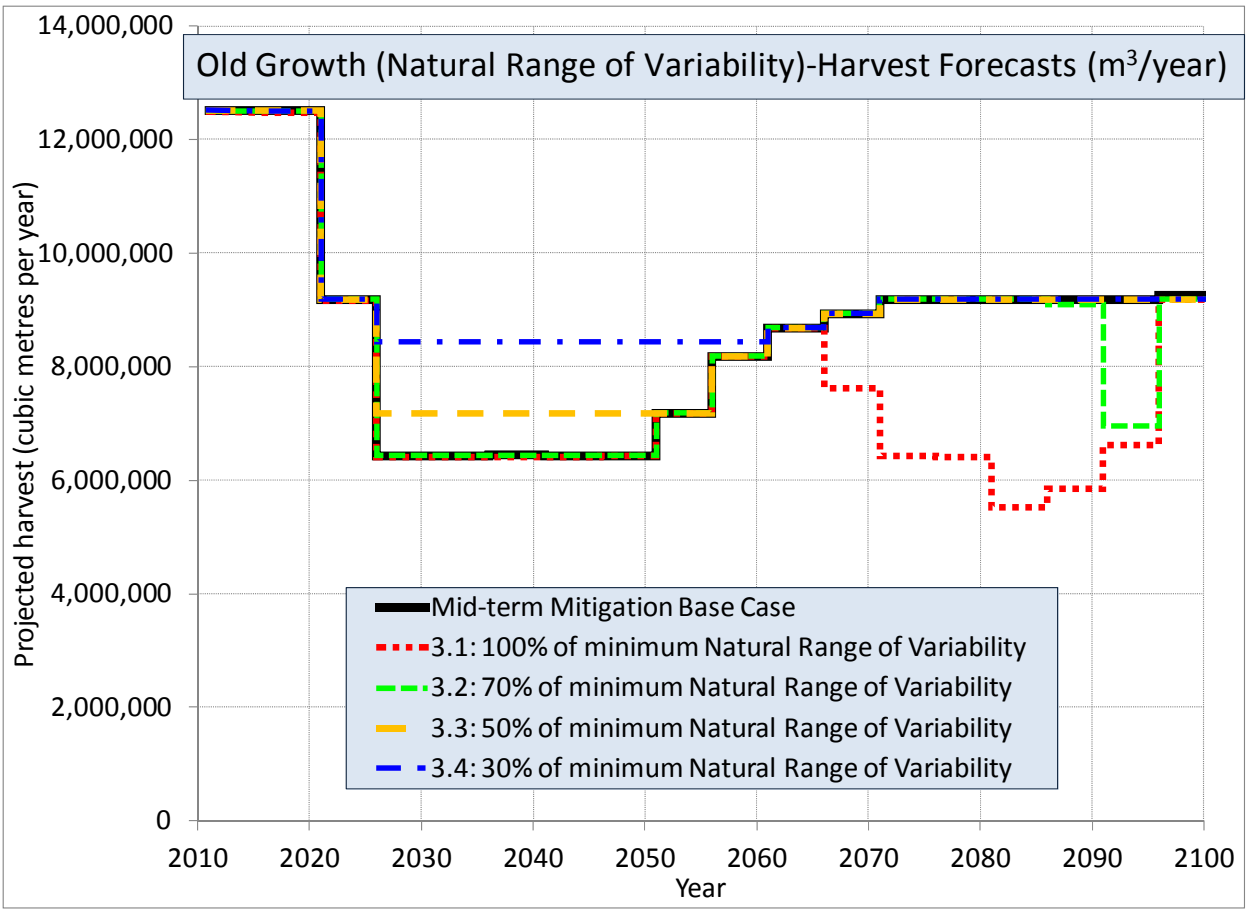


Figure 5.3: Old Growth harvest forecasts testing minimum natural range of variability by scenario number with a brief description of the assumptions.

Scenario 3.1: 100% of minimum Natural Range of Variability

For the scenario where 100% of the minimum natural range of variability is applied to establish old forest objectives in the PG OGO timber supply in the mid-term in decreased slightly or 20,000 cubic metres per year. For this scenario, severe timber supply impact occurs in the long term, 70 to 100 years from now, where the annual timber supply is reduced by approximately 3 million cubic metres.

Based on the risk classes, if the landscape is managed to maintain the Natural Range of Variability to 100% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is very low.

Scenario 3.2: 70% of minimum Natural Range of Variability

For the scenario where 70% of the minimum natural range of variability is applied to establish old forest objectives in the PG OGO timber supply in the mid-term unchanged from the base case.

Based on the risk classes (identified in Section IV.A, above), if the landscape is managed to maintain the Natural Range of Variability to >70% the relative comparison of risks to landscape level (i.e.

coarse filter) biodiversity is low. This is indicative that on average the old forest objectives established in the PG OGO are equivalent to approximately 70% of the minimum NRV.

Scenario 3.3: 50% of minimum Natural Range of Variability

For the scenario where 50% of the minimum natural range of variability is applied to establish old forest objectives in the PG OGO, timber supply in the mid-term is increased by 12% or 760,000 cubic metres per year.

Based on the risk classes (identified in Section IV.A, above), if the landscape is managed to maintain the Natural Range of Variability >50% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is moderate.

If future harvesting occurs consistent with the assumptions in this scenario, then in 2033 there may be one mBEC unit impacted to a relatively low level and in 2058 there may be 5 mBEC units impacted to a relatively moderate level (Table 5.4 and Appendix 8.4). Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District.

Scenario 3.4: 30% of minimum Natural Range of Variability

For the scenario where 30% of the minimum natural range of variability is applied to establish old forest objectives in the PG OGO, timber supply in the mid-term is increased by 31% or 2.1 million cubic metres per year.

If the landscape is managed to maintain the Natural Range of Variability to >30% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is high.

If future harvesting occurs consistent with the assumptions in this scenario, then in 2033 there may be two mBEC unit impacted to a relatively moderate level and in 2058 there may be 7 mBEC units impacted to a relatively high level (Table 5.4 and Appendix 8.4). Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. The map shown in Appendix 8.4 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Table 5.4: Summary of results for the Prince George TSA Old Growth Scenarios.

Scenario number	Scenario Description	Risk to Biodiversity				administration changes required	Timber Supply Impact		
		risk classes for percent representation of natural range of variability for old forest	risk for mBEC units impacted by future timber harvesting at 2058				Projected mid-term harvest level (millions of m^3/year)	Increase in projected mid-term harvest level over base case	
			relative risk classes	# units deficit	# ha deficit			million of m^3/year	%
Base Case	Prince George TSA Old Growth Order	moderate	low	assumed to be zero	assumed to be zero	No change required; continuous improvement of specific issues encouraged	*6.43*		
2.1	Turn off the Prince George TSA Old Growth Order	high	high	7	-102,000	Significant amendment required to legal order	*9.19*	2.76	**43**
2.2	Prince George TSA Old Growth Order where the definition of 'old forest age' is reduced by 20 years	unknown	moderate	6	-24,000	Amendment of non-legal Implementation Policy required	*7.44*	1.01	**16**
2.3	Replace the Prince George TSA Old Growth Order with the Provincial Old Growth Order	moderate	moderate	9	120,000	Significant amendment required to legal order	*6.69*	0.26	**4**
2.4	Prince George TSA order with requirements based Table 1-3 of the Order	moderate	low	assumed to be zero	assumed to be zero	Significant amendment required to legal order	*5.68*	-0.75	**-12**
3.1	100% of minimum Natural Range of Variability *	very low	unassessed but assumed to be low	assumed to be zero	assumed to be zero	Significant amendment required to legal order	*6.41*	-0.02	**0**
3.2	70% of minimum Natural Range of Variability *	low	unassessed but assumed to be low	unknown	unknown	Significant amendment required to legal order	*6.43*	0	**0**
3.3	50% of minimum Natural Range of Variability	moderate	moderate	5	-37,000	Significant amendment required to legal order	*7.19*	0.76	**12**
3.4	30% of minimum Natural Range of Variability	high	high	7	-106,000	Significant amendment required to legal order	*8.44*	2.01	**31**

*Note: Significant long term timber supply falldown (Post mid-term) is forecast for scenarios 3.2 and 3.2 (See Figure 5.3)

5.4 Other Values: Visual Quality and Ungulate Winter Range Scenarios

Two other scenarios were tested where objectives for other values were turned off. This includes ungulate winter range and visual quality objectives.

Of note for these scenarios is the precision of forecasting is 250,000 m3/year. Generally if turning off an objective did not result in a minimum of 250,000 of mid-term impact the timber supply model did not report it. 250,000 cubic metres per year represents slightly less that 4 percent of the predicted mid-term harvest level of 6.43 million cubic metres. This may be why the forecast showing the elimination of ungulate winter range objectives shown in Figure 5.4 shows no impact. In reality the impact may lie somewhere between zero and 249,999 m^3/year.

Turning off the visual quality requirements results in a harvest forecast in the mid-term of 6.68 million cubic metres per year or 250,000 higher that the base case. Amendments to the Land Use Order would be required under the *Land Act* to cancel or amend the VQOs. These amendments would require consultation with the public and with First Nations.

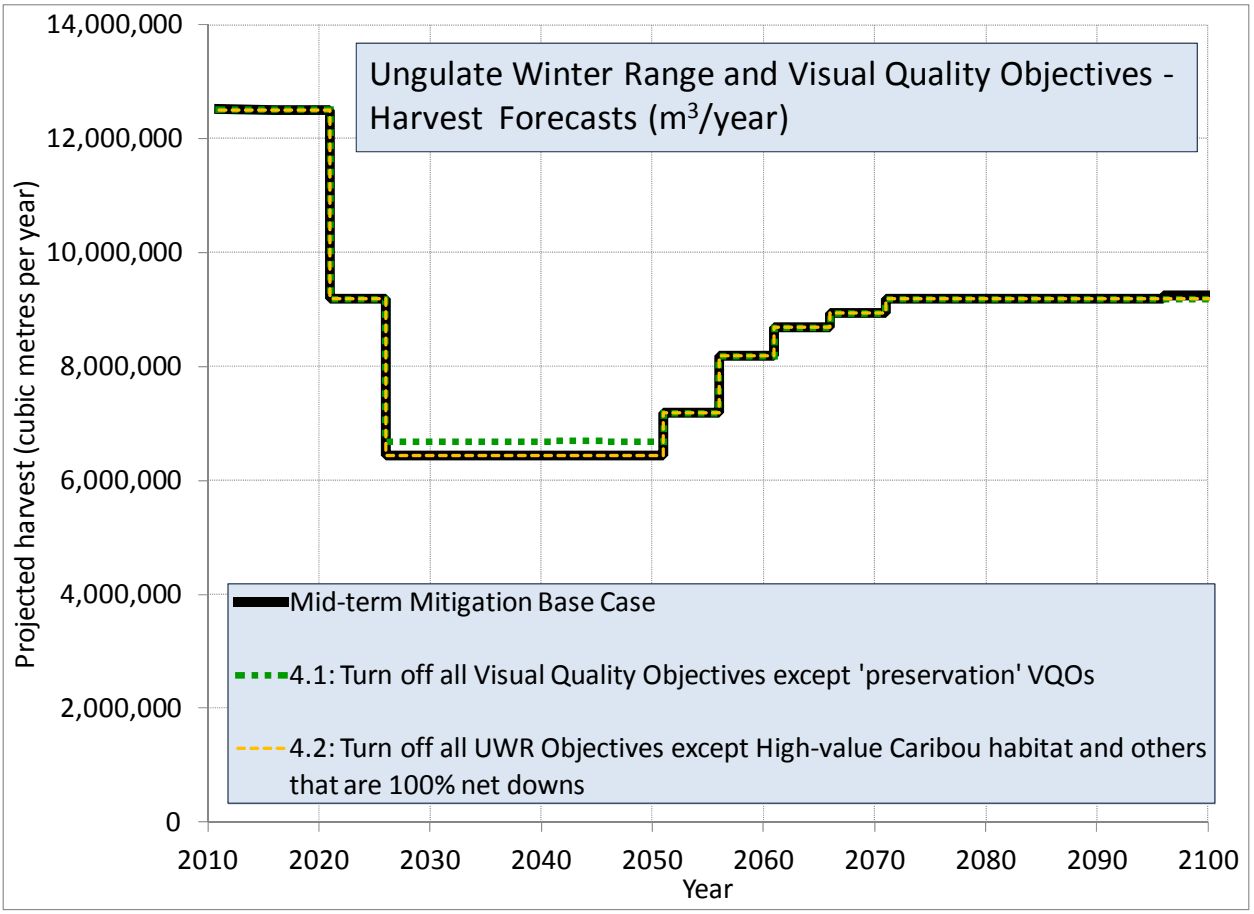


Figure 5.4. Visual quality and ungulate winter range harvest forecasts by scenario number with a brief description of the assumptions.

5.5 Fertilization and Volume Yields from Regenerated Stands Scenarios

In the most recent past in B.C. there has been considerable effort with respect to improvement of mid and long term timber supply through forest management activities such as brushing, thinning, planting genetically improved seed and fertilization. Because of the short history of harvest in the interior of BC (approximately 40 to 45 years) second growth stands will not yet be available to harvest in much of what has been defined as the mid-term time period. Timber supply forecasts indicate that the mid-term timber supply may be able to be increased by one million cubic metres per year (16%) if all stands harvested and planted after 1987 are fertilized (Scenario 5.1, Figure 5.5). This includes the fertilization of stands harvested and regenerated by the model in the future. No administrative or legislative change would be required to implement this action.

An additional scenario was undertaken where the dependency on managed stand second growth is illustrated (Scenario 5.2, Figure 5.5). In this scenario second growth stands are modeled to grow as if they mimicked existing mature stands of natural origin. It is assumed that no stand tending would take place, stands would not be well spaced and tended as assumed in the base case and productive potential of these stands would suffer significantly as a result. The analysis indicates that timber supply can be maintained in the mid-term but that long term timber supply falls to approximately 4 million cubic metres per year until at least 100 years from now (Scenario 5.2, Figure 5.5).

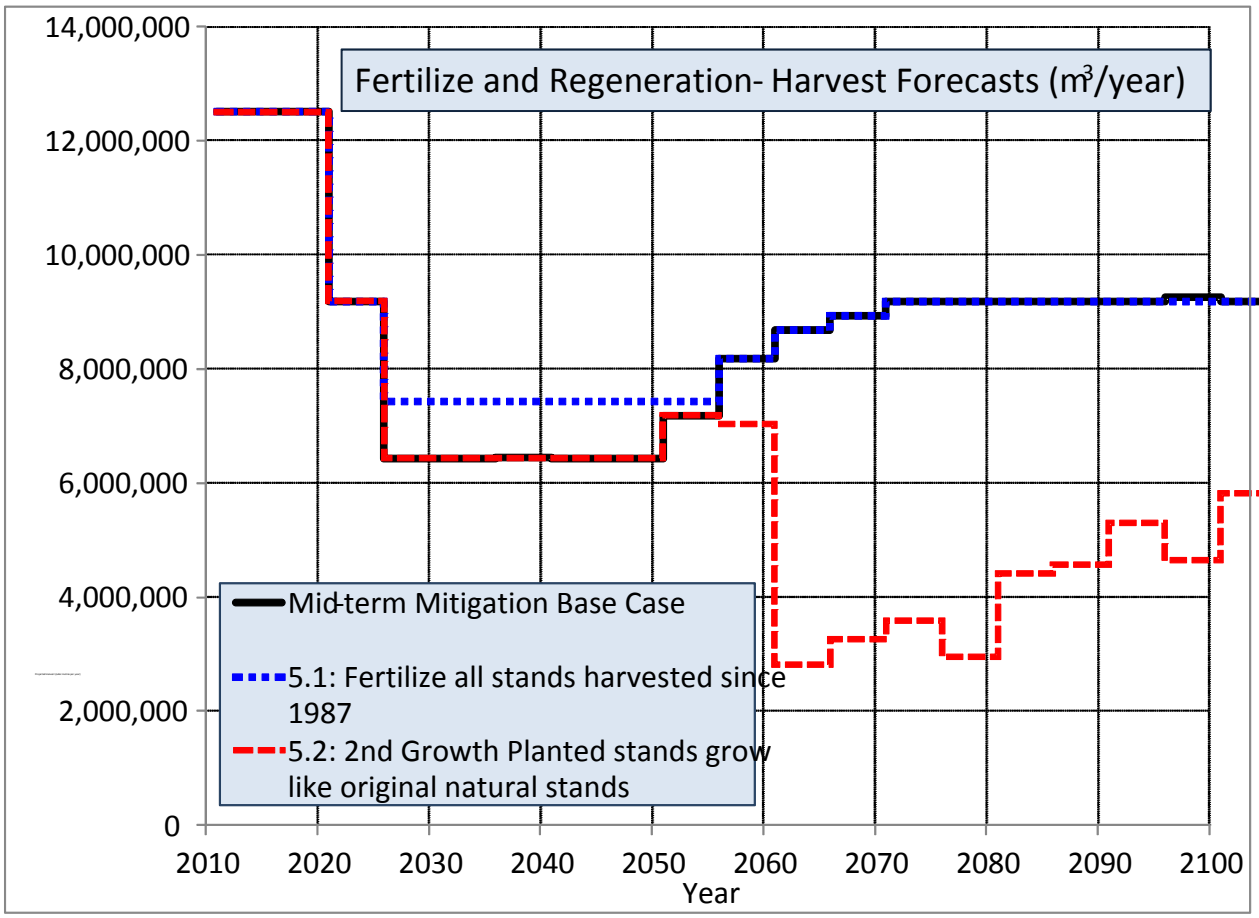


Figure 5.5: Fertilization and 2nd growth stand yield harvest forecasts by scenario number with a brief description of the assumptions.

8.0 Appendicies

8.1 Derivation of the criteria to define the 'Not Economic' land base for the Prince George Timber Supply Area

In this analysis past harvest preferences have been used as a surrogate for knowledge regarding whether a stand is economic to harvest.

Assumptions

- Tree species and volume per hectare captured most of the variation in value; and
- cycle time captured most of the variation in cost
- economic thresholds would differ for the road and rail portion of the TSA.

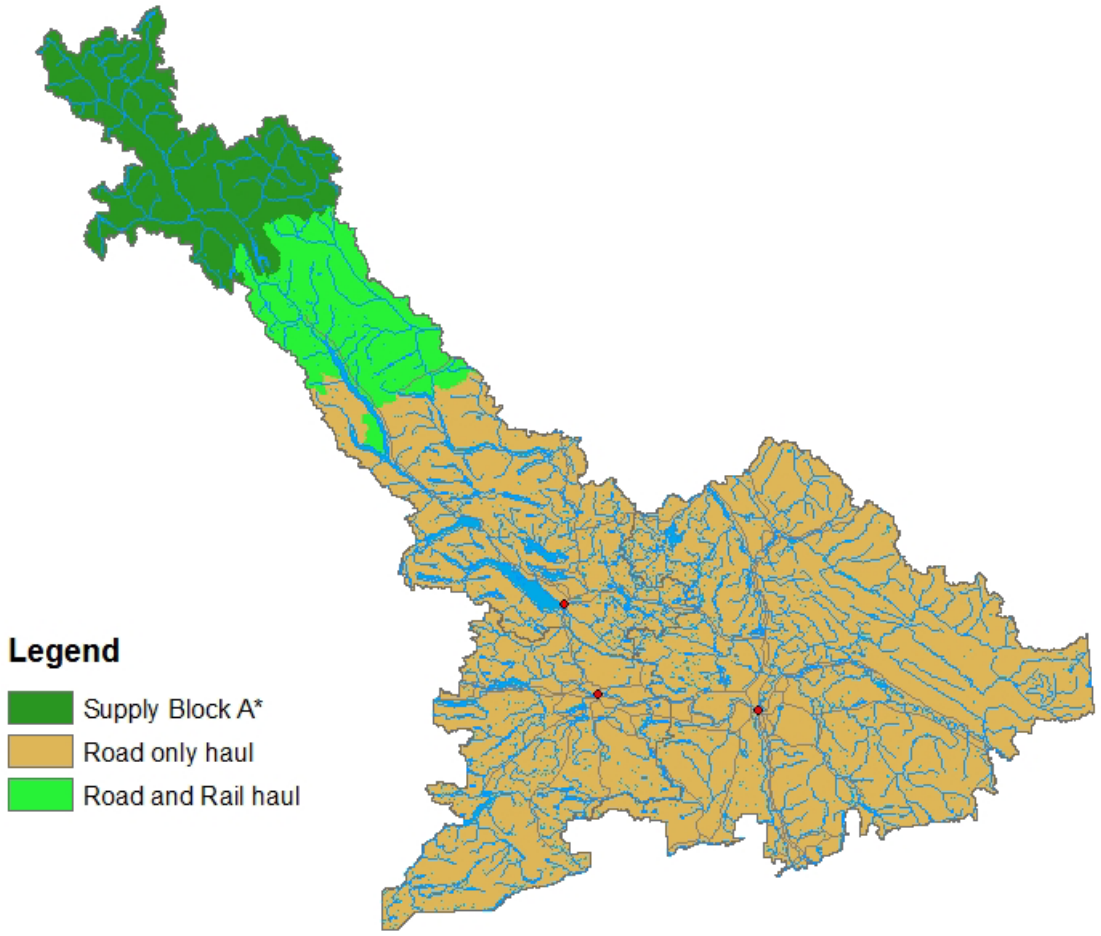


Figure 1: Location of supply block "A", and the road and rail zones of the Prince George TSA.
Note: Supply block "A" falls entirely within the rail zone.

Problem forest types previously netted out and are:

- deciduous leading stands that were neither aspen, birch nor cottonwood;
- black spruce leading stands; and
- hemlock leading stands.

Information from 1613 logged timber marks were used to determine a reasonable upper limit to cycle times and a lower limit to volume per hectare harvests. Distribution of date of harvest for the data used is shown in Figure 2 below.

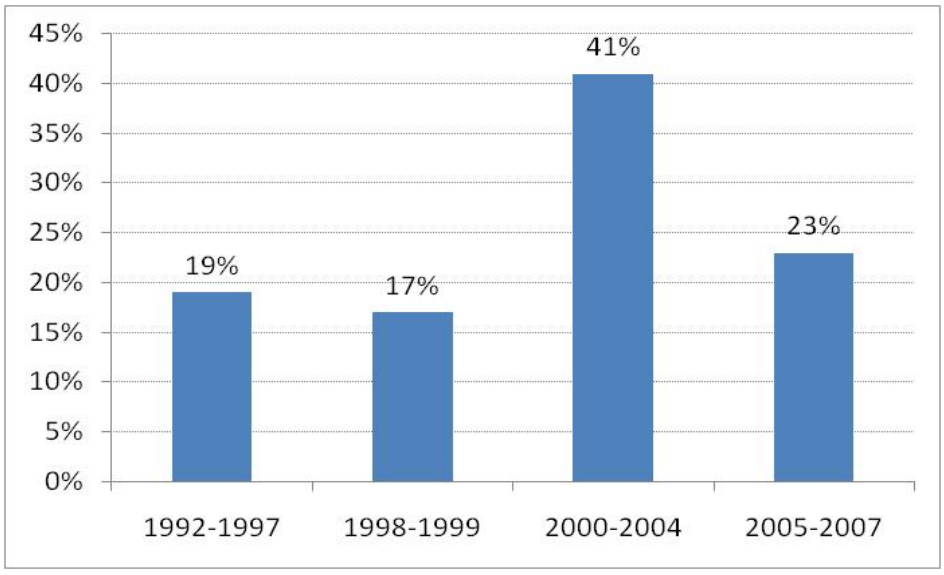


Figure 2: Composition of appraisal dataset by year

Boxplots also known as box and whisker plots were made for the cycle time and volume per hectare data and are shown in Figure 3 below.

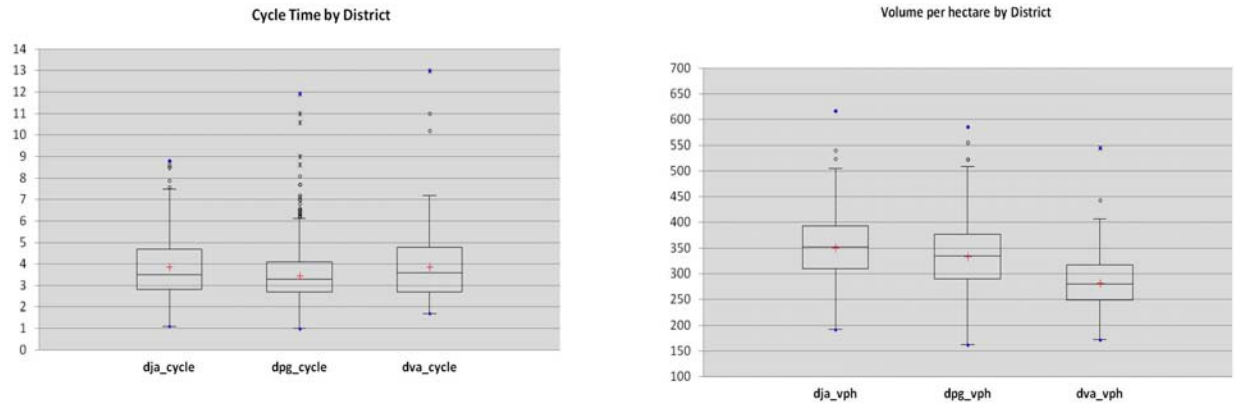


Figure 3: Box and Whisker plot of the appraisal data for cycle time and volume per hectare analysed to define the economic criteria for the timber harvesting landbase of the Prince George TSA.

Area (cut block area) weighted distributions of volumes and cycle times for the 1613 logged timber marks are presented in Tables 1 and 2 respectively. The highlighted columns contain the values used as the economic thresholds.

Table 1: Area weighted distribution (lower half) of volumes (m^3/ha) for 1613 logged timber marks permitted between 1992 and 2007.

	Min.	1st %tile	5th %tile	10th %tile	25th %tile	50th %tile
Road only haul	162	182	211	236	276	318
Road and Rail haul	209	246	265	270	316	358

Table 2: Area weighted distribution (upper half) of cycle times (hrs) for 1613 logged timber marks permitted between 1992 and 2007.

	50th %tile	75th %tile	90th %tile	95th %tile	99th %tile	maximum
Road only haul	3.5	4.4	5.7	6.6	7.7	13.0
Road and Rail haul	2.4	3.1	3.2	3.3	3.9	4.0

Due to the very large difference between the 99th percentile of cycle time and the absolute maximum (on the road portion of the TSA) it was decided to base the cycle time limit on 99th percentile.
By basing the upper limit on the 99th percentile, the overwhelming majority of the harvest experience was used while protecting against possible one-off events or possible errors in the dataset.
Using the same logic the 1st percentile was used as the minimum volume per hectare threshold.
In order to assess whether the netdown criteria did a good job of presenting observed practice, the modeled THLB was overlaid with 30 years of cutblocks identified using RESULTS, satellite depletion, FTA and licensee data (see Figure 4).

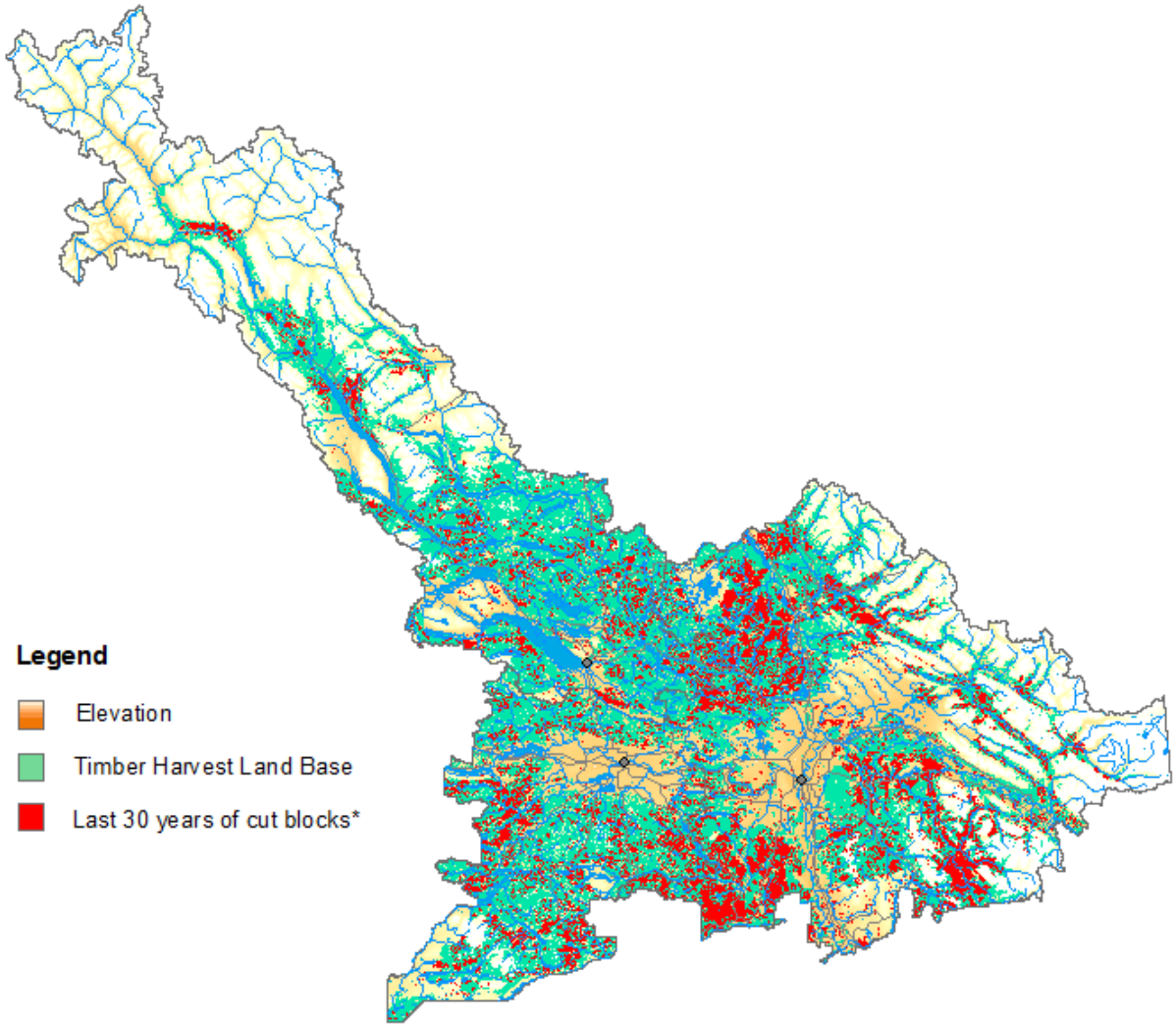


Figure 4: The timber harvesting land base compared to the extent of harvesting over the past 30 years.

Sensitivities

During the recent Prince George Timber Supply Review process the following sensitivity analyses were used to assess the impact of these economic thresholds on timber supply relative to the uncorrected Base Case scenario 2A (Shift to Fort St. James to Harvest).

- If the volume criterion was lowered by 10 percent, and the cycle time increased by 10 percent, then mid-term timber supply could be increased by at least 10 percent.
- If the volume criterion was lowered by 20 percent and the cycle time was increased by 20 percent, then mid-term timber supply could be increased by at least 21 percent.
- Finally, if the volume criterion was lowered by 30 percent and the cycle time was increased by 30 percent, then mid-term timber supply could be increased by at least 31 percent.

When decreasing the volume per hectare threshold in the initial years of the mid-term the increase in land base showed the ratio of spruce to balsam leading stands was 1:4. Four times as many balsam leading stands were added as spruce leading stands. This is because most spruce leading stands have a higher volume per hectare to begin with so are already included in the THLB at the 182 m3/ha threshold.
It is informative to consider where these gains in timber supply would come from.

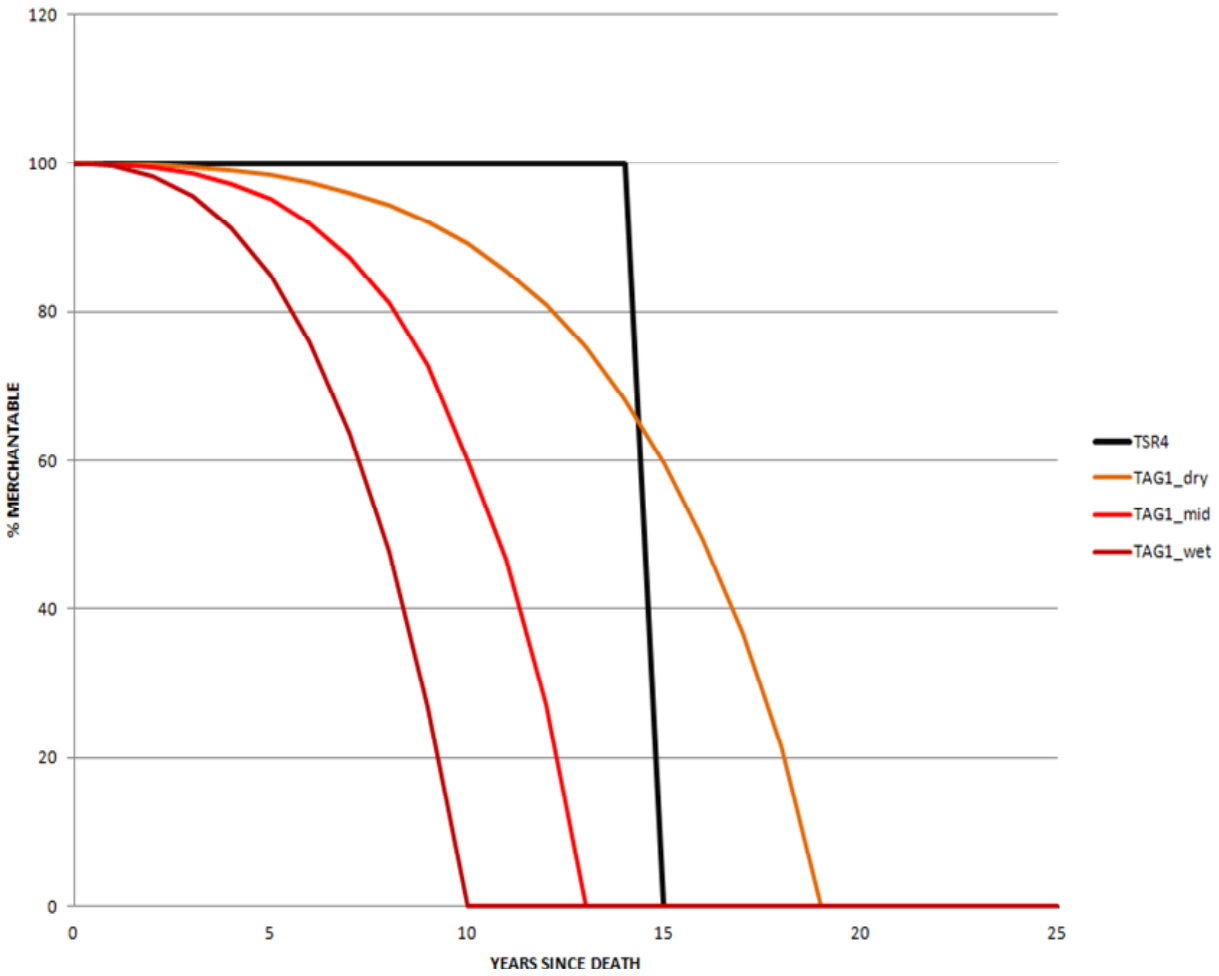
In all the forecasts discussed above the most critical part of the forecast occurred between 30 and 40 years. Therefore, the composition of the aforementioned sensitivities was examined during the 4th decade.
In the case that cycle time as economic criteria were relaxed from a 20% relaxation to a 30% relaxation the contribution from stands with more than 6 hour cycle times declined from 152% to 142% and contribution from stands with lower cycle times sharply increased by 16 to 27% depending on the cycle time class. In the later years of the mid-term the timber, closer to the milling centres is forecast to come from young regenerating stands with low volumes (see Table 1).

Volume and Cycle time	Increase over uncorrected Base Case scenario 2A		
Relaxation %	Stands <200 m3/ha	Stands <60 yrs old	Stands 60-79.9 yrs old
10%	182%	241%	272%
20%	258%	391%	414%
30%	487%	754%	546%

If the modeled productivity gains associated with managed stands do not materialize apparent gains in mid-term timber supply due to relaxing minimum volumes considered economic to harvest may not materialize.

8.2 Shelf Life Curves used for Economic Scenario 1.6 where only sawlog remaining in 2011 is salvaged.

The following shelf life curves are used in the economic scenario titled: *Only salvage sawlog remaining in 2011 (approximately half of MPB damaged pine unsalvaged)*



8.3 Prince George TSA Social and Economic Assessment

The socio-economic assessment (SEA) that follows provides a profile of the region, its demographic and labour force trends, a focus on development efforts in the region, and the potential forest sector activity and employment changes that may result from the forecast declines in the Prince George TSA timber supply. This assessment was done in 2010.

1.1. Demographic trends

In 2008, the Prince George TSA had a population of about 102,428 people (see Table 1). The City of Prince George is the largest community in the TSA and acts at the northern hub for transportation, supply and services. In 2008, the City of Prince George had an estimated population of about 74,000, accounting for about 72% of the total TSA population. Vanderhoof is the second largest community with an estimated 2008 population of 3,865. Fort St. James and Fraser Lake have populations of about 1,350 and 1,120, respectively. Combined, these communities account for close to 78% of the TSA's population. Since the 2006 Census period, the population of the TSA has increased marginally. The region has yet to return to population levels of the late 1990s and early 2000s.

Table 1: Prince George Timber Supply Area population estimates, by community, 1999-2008*

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Change 1999-2008	Annual average change
Fort St. James	2,035	2,023	1,968	1,832	1,718	1,614	1,500	1,362	1,361	1,351	-34%	-3.4%
Fraser Lake	1,264	1,299	1,277	1,233	1,164	1,214	1,176	1,129	1,136	1,118	-12%	-1.2%
Prince George	76,800	76,762	75,206	74,066	74,554	74,880	73,389	72,889	73,846	74,092	-4%	-0.4%
Vanderhoof	4,617	4,597	4,560	4,447	4,309	4,270	4,214	4,172	3,920	3,865	-16%	-1.6%
Community sub total	84,716	84,681	83,011	81,578	81,745	81,978	80,279	79,552	80,263	80,426	-5%	-0.5%
Prince George TSA*	108,884	108,306	106,231	104,479	104,003	104,309	102,237	101,182	101,946	102,428	-6%	-0.6%
TSA Annual % change		-0.5%	-1.9%	-1.6%	-0.5%	0.3%	-2.0%	-1.0%	0.8%	0.5%		

*The population estimates are based on information from BCStats, query date May 1, 2009. BCStats does not provide estimates by forest district or TSA, subsequently the TSA's population estimate in Table 1 is a combination of the Fraser-Fort George and Bulkley-Nechako Regional Districts prorated by the % of regional district area in each forest district, from the 2001 Economic dependency table for forest districts httphttp://www.for.gov.bc.ca/HET/tsr_sea/index.htm

There are numerous other smaller communities located in each district, including many First Nations communities. Annual population data for these communities are not available, but 2006 census data does provide an indication of rural populations. In the Fort St. James forest district, the First Nations communities of Nak'azdli, Pinchi, and Tachie have populations of 495, 110, and 375, respectively. The Fort St. James forest district also has an additional rural population of about 1,355 (Bulkley-Nechako Regional District Area C). Additional areas in Vanderhoof include Fort Fraser and the adjacent Nautley First Nations community with a combined population of about 325, and Dog Creek with a 2006 population of 157. Other First Nations communities include Stellaten and Saikuz. The Vanderhoof forest district also has an additional rural population of about 4,792 (Bulkley-Nechako Regional District Areas D and F). Rural areas and a small First Nation's reserve population in the Prince George forest district accounted for about 13,300 people in 2006.

BC Stats estimates a slow rate of growth in the region's population to 2020, with the TSA population increasing by about 2% from the 2008 level. Provincially, the population is expected to increase 16% by the year 2020.[15] The BCStats population projections are based on an understanding of historical in- and out-migration from the region and an assessment of events that may change that pattern. In the Prince George region, net out-migration has been the prevailing trend and an expectation of declining timber supplies puts further downward pressure on growth expectations. However, opportunities in other sectors may help to reverse or at least mitigate this downward trend.

1.2. The TSA economy

Census labour force data for the Prince George TSA indicates that in 2006 the total number of people in the labour force (i.e., either employed or unemployed but waiting to return to or looking for work) was 59,965. Between 2001 and 2006, the total labour force increased by a modest 0.2%. However, growth was restricted to the Prince George forest district portion of the TSA. Table 2 provides a summary of this data by forest district.

[15] For additional information go to the BCStats website at http://www.bcstats.gov.bc.ca/

Table 2: Total employment by forest district, 2001 2006 census

	Fort St James FD		Prince George FD		Vanderhoof FD		Prince George TSA	
	2001	2006	2001	2006	2001	2006	2001	2006
All Industries - Total	2,330	1,845	47,565	48,455	5,935	5,665	55,830	55,965
Total percent change 2001-2006		-21%		2%		-5%		0.2%

Source: Census of Canada, 2001, 2006.

In Fort St. James the labour force declined by 21% to 1,845 positions from 2,330. In the Vanderhoof forest district the decline was 5% to 5,665 positions from 5,935. The largest industrial sector decline was in the forest sector with a 4.5% decline across the TSA, although this trend was not equal across the three districts. The largest decline occurred in the Forest St. James forest district where forest sector jobs declined by 24% between 2001 and 2006. Vanderhoof experienced a 6% increase in its forest sector labour force. The TSA declines indicated in Table 2 were offset by the large 38% employment increase in the mining/oil and gas sector, and a seven% increase in health and education related employment. However, much has happened since 2006. Non-Census data can be used where available and anecdotal information from local communities helps to supplement the statistical picture and bring the profile more up to date and relevant. The forestry section to follow provides some of this update.

Table 3 provides this labour force data for the 2006 census year by total employment in each basic sector. [16] Employment estimates by basic sector combine not only the direct employment supported by, for example the forest or agriculture sector, but also the so called indirect and induced employment related to the direct business and employee spending. Thus, employment in wholesale/retail trade, transportation, and other supply and service employment is allocated to each basic sector. The allocation of this indirect and induced employment is based on the level of income associated with each basic sector,

[16] An economy can be divided into two components: basic and non-basic. The basic sector is supported by income flowing into the region and includes direct activity associated with a particular sector (forestry, agriculture for example) and the resulting indirect activity supported by company purchases of goods and services. The non-basic sector is supported by employees in the basic sector spending their incomes at local stores for example. Total employment as provided in Table 2 includes both basic and non-basic components. The basic sector is considered the driver of economic activity and growth in a region. For a more in-depth discussion of the methodology used to generate these figures and the publications on which this discussion is based see http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

thus for example the forest sector will have a larger number of indirect and induced jobs associated with forestry activity than the tourism sector which brings a lower per job level of income into the region.

The indirect/induced employment ratios in Table 3 show this spending effect by direct sector, where available. A direct sector with a larger ratio indicates higher income and spending levels, thus generally supports more indirect and induced spending, hence jobs in the region. Employment and income ratios for each forest district can be found at http://www.bcstats.gov.bc.ca/pubs/econ_dep.asp

Table 3: total employment by basic sector and indirect/induced employment ratios for the Prince George TSA, 2006

Forest District Sector	Fort St. James	Prince George	Vanderhoof	Prince George TSA	TSA Indirect/ induced ratios*
LOGGING	354	4,096	1,004	5,454	1.23
PULP AND PAPER	14	3,383	76	3,473	1.63
OTHER WOOD MFG	545	5,346	1,412	7,303	1.29
MINING (& PROC.)	13	671	369	1,053	1.36
OIL & GAS(& PROC)	-	641	-	641	(incl. mining)
HIGH TECH	-	738	-	738	1.04
FISHING & TRAPPING	-	33	1	34	NA
AGRICULTURE & FOOD	52	767	395	1,214	1.12
TOURISM	102	3,880	432	4,414	1.07
PUBLIC SECTOR	662	17,695	1,483	19,840	1.14
CONSTRUCTION	41	4,467	242	4,750	1.30
FILM & SOUND PROD.	12	65	-	77	NA
OTHER (UNALLOCATED)	40	4,589	104	4,733	NA
NON-EMPLOYMENT	30	3,430	157	3,617	NA
TOTAL	1,865	49,801	5,676	57,342	NA

Source: Horne, Garry. 2009. 2006 Economic Dependency Tables for Forest Districts, February 2009. Victoria, BCStats.

*The indirect/induced employment ratio are weighted averages of the forest district ratios.

NA=not available

The labour force data used to develop the information in Tables 2 and 3 can also be used to look deeper into the specific components of each basic sector, such as changes in transportation related sectors (included in some basic sectors), wholesale or retail trade (included in all basic sectors), health care (included with other public sector related jobs under 'public sector'), education or federal and provincial public sector jobs. Comparisons can be made with the 2001 Census year to see which sectors have been experiencing employment increases or decreases. Appendix 1 provides the labour force data for Census years 2001 and 2006 so the reader can examine any particular employment category. The following analysis of changes in employment levels uses that information where classifications appear relatively consistent. [17]

In terms of non-forest sector direct employment, the Vanderhoof forest district experienced the largest absolute non-forest sector decline followed by Fort St. James; however, while smaller in absolute terms the Fort St James decline accounted for 18% of its total non-forest labour force versus 9% in Vanderhoof. Direct non-forestry manufacturing employment declined about 10% across the TSA. Wholesale/retail trade experienced an overall increase across the TSA growing by about 2%; however, that growth was confined to the Prince George area and the wholesale sub-sector. The retail sub-sector declined by about 8.5% across the TSA. Wholesale/retail trade related employment declined by about 22% in Vanderhoof (a decline to 535 from 685), while Fort St. James endured a 61% decline in its wholesale/retail trade sector (to a labour force of 85 from 220).

The transportation sector includes jobs related to air, water, truck and rail transport, and also sub-sector specific transportation such as pipeline transport, transit and other ground related transportation, and scenic and sightseeing related transport. There is no specific transportation sector for the forest sector; some log transport is included in the logging sub-sector while other activity is included in rail and truck transport. The census data indicates a 5% increase (150 jobs) in total transport related employment. Individual sub-sectors vary, however, with rail transport declining in the TSA by 47% - a labour force reduction of 405. Truck transport grew by 27% or 370 jobs. Each forest district experienced different changes as well. Fort St. James had the largest increase,

[17] Comparing Census labour force information can be problematic as employment sector definitions change. For example, the 2001 Census uses an employment classification system based on the North American Industrial Classification System (NAICS) from 1997 while the 2006 Census uses 2002 definitions. While for some sectors the changes can be minimal, for others the differences can lead to incorrect analyses of change.

mostly in support services for transport. The Prince George forest district transportation related labour force increased by 5%, while the Vanderhoof sector declined by 2%, mainly in the rail and truck transport sub-sectors.

Health and education increased by about 7% across the TSA, with the largest increase in Fort St. James of 19%. Prince George's health and education labour force increased by about 8%, while it declined by 8% in Vanderhoof. Federal government employees were also not immune to reductions with 17%, or 165 positions removed from the TSA's labour force between 2001 and 2006.

There are no regional forest district labour force statistical data available from either Statistics Canada or BCStats since 2006. More recent forestry processing data is available and is discussed in the forestry section below. From the 2006 Census period to 2008, the population across the TSA increased by a very modest 1%. However, Fort St. James and Fraser Lake declined at more significant levels of 8% and 4%, respectively. This population decline suggests that employment opportunities have likely declined precipitating this out-migration.

1.3. Economic dependency and community vulnerability

Another way of looking at this employment data is in terms of how a local economy depends on any one basic sector in terms of the level of income introduced into the local economy. Table 4 provides the latest economic dependency data for forest districts based on the 2006 Census of Canada. In terms of basic employment, the forest sector remains the single most important sector in the TSA's economy. While the Prince George forest district depends to a much lesser extent on forestry, it is still the largest industrial sector in the district, and the second largest employer behind the public sector.

Table 4: Prince George TSA forest district basic employment dependency ratios, 2006.

Forest District	Forestry	Mining & Min Proc	Agric. & Food	Tourism	High Tech	Public Sector	Construc-tion	Other
Fort St. James	49%	1%	3%	6%	0%	36%	2%	3%
Prince George	26%	3%	2%	9%	2%	38%	10%	10%
Vanderhoof	45%	6%	7%	8%	0%	27%	4%	2%

Source: Garry Horne (2009) Economic dependency tables for forest districts.

Note: percentages may not add due to rounding.

The basic employment dependency data can also be used to measure forest district economic diversity and its subsequent level of vulnerability to changes in forest sector employment. Table 5 shows two indices, one showing the diversity of the forest district, the other its forest sector vulnerability. Diversity measures how dependent a forest district is on each of its sectors. An index of 100 indicates that the forest district depends equally on each sector for its income. Thus, the higher the number the more diverse the economy and the more able it may be to rely on other sectors in times of sectoral downturns. The forest vulnerability index is based on the dependency and diversity data. A higher number indicates that when the forest sector experiences a downturn, the communities are more likely to experience greater economic difficulties than other areas with lower scores. None of these indicators suggest that a particular district is any more likely to experience reductions in forestry activity; the data helps understand which forest districts may experience greater difficulty if or when a downturn occurs.[18]

[18] For a more detailed discussion of these indices and associated methodology see Horne, Garry. 2009. British Columbia Local Area Economic Dependencies, 2006. BCStats. http://www.bcstats.gov.bc.ca/pubs/econ_dep/2006/2006_all.pdf

Table 5: Basic sector diversity and forest sector vulnerability, 2006.

Northern Interior Forest Region by Forest	Diversity	Forest Vulnerability
Fort Nelson	68	43
Fort St. James	48	132
Kalum	69	20
Mackenzie	28	264
Nadina	55	100
Peace	72	13
Prince George	68	39
Skeena Stikine	69	32
Vanderhoof	60	79

Source: Horne, Garry. 2009. 2006 Economic Dependency Tables for Forest Districts, February 2009. Victoria, BCStats.

A 2005 study by MacKendrick and Parkins expands on the diversity and vulnerability indicators shown in Table 5. Table 6 shows the aggregated results of their study. The study bases its evaluation of vulnerability on four dimensions: physical, socio-economic, political, and economic. A community with a high vulnerability score will experience greater difficulty adapting to sudden or catastrophic changes, such as the mountain pine beetle.

The study found that communities within or on the fringe of mountain pine beetle affected forests have a relatively higher level of community vulnerability than communities located farther from affected areas. The communities of Cheslatta, Burns Lake and Quesnel have the highest vulnerability scores. Vanderhoof is the only community from the Prince George TSA represented in this study and was found to have medium to high vulnerability. For Vanderhoof, however, the measure of susceptible pine used in the physical vulnerability analysis is based on the Prince George TSA and does not reflect the more pine-dominated timber profile of the Vanderhoof forest district and the source of supply for Vanderhoof mills. Nearby Burns Lake and Quesnel provide some regional diversity to the study's results. Dimensions of the vulnerability index may suggest similar results for Fort St. James and Fraser Lake given their level of dependence on the forest sector and proximity to mountain pine beetle affected areas. Conclusions from this study are not surprising: smaller, less diversified communities within beetle damaged areas are more vulnerable to economic shocks. The challenge for

communities revolves around having the local capacity to support and seek economic opportunities to maintain populations and local services.

Table 6. Community vulnerability index scores.

Community	Final vulnerability scores	Vulnerability level
Cheslatta	7.4	High
Burns Lake	7.3	
Quesnel	7.2	
Vanderhoof	6.5	Medium
Williams Lake	6.4	
Mackenzie	6.3	
100 Mile House	6.2	
Cache Creek	5.7	
Houston	4.9	Low
Salmon Arm	4.4	
Invermere	4.2	

Source: MacKendrick and Parkins 2005.

2. Forest sector activity

2.1. Forest sector labour force

The following table provides forest sector labour force data for the two most recent census periods for the three Prince George TSA forest districts. The labour force data in Table 7 indicates a decline in forest sector employment for the TSA as a whole, but an increase in Vanderhoof. Only logging and forestry services show an increase across the TSA. Processing employment experienced a decline despite increases in harvesting and processing activity (see Figure 2).

Table 7: Labour force statistics, direct forest industry by sub-sectors, 2001, 2006 Census.

	Fort St James FD		Prince George FD		Vanderhoof FD		Prince George TSA	
	2001	2006	2001	2006	2001	2006	2001	2006
All Industries - Total	2,330	1,845	47,565	48,455	5,935	5,665	55,830	55,965
Forest Industries - Total	980	740	6,940	6,650	1,625	1,730	9,545	9,120
Forest industries by sub-sector								
Forestry and logging	200	210	1,460	1,575	465	505	2,125	2,290
Support activities for forestry	80	80	1,005	770	150	170	1,235	1,020
Wood product manufacturing	685	440	3,005	2,855	970	1,010	4,660	4,305
Pulp and paper manufacturing	15	10	1,415	1,340	10	45	1,440	1,395
Total forest sector percent change 2001-2006		-24%		-4%		6%		-4%

Source: BCStats. 2001, 2006 Census of Canada.

This forest sector activity depends not only on the harvest of timber from the Prince George TSA, but also tree farm licences, community forest tenures, woodlots, federal and private timber lands. Table 8 provides a summary of these harvests from 2000 to 2008. Table 9 shows this harvest by forest district. The increase in the volumes harvested among all land types follows the pine beetle harvest strategy and market demand. Declining demand for wood products clearly affected the region after markets peaked in 2005. Note the responsiveness to market demand in the Crown-other (mainly woodlots and Community Forests Agreements), Federal Crown and private volumes harvested.

Table 8: Volume of timber harvested from all sources in the Prince George, Fort St. James and Vanderhoof Forest Districts, 2000-2008.

Tenure/Land type	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average 00-08
Crown - TSA	9,139,982	9,569,161	11,081,993	12,134,241	10,777,598	12,908,461	13,371,078	10,070,341	9,396,844	10,938,855
Crown - TFL	640,590	556,346	824,455	1,038,295	770,809	1,082,598	784,372	1,086,787	680,570	829,425
Crown - other	208,292	314,026	495,840	1,078,121	1,534,189	1,633,419	941,962	1,106,527	678,556	887,881
Federal Crown	1,232	-	2,363	3,879	90,534	99,118	124,285	12,699	1,328	37,271
Private	327,488	619,590	704,460	740,183	878,225	1,012,184	659,858	665,323	431,403	670,968
Total	10,317,585	11,059,123	13,109,109	14,994,718	14,051,355	16,735,780	15,881,556	12,941,677	11,188,701	13,364,401

Source: Revenue Branch, B.C. Ministry of Forests and Range, Victoria.

Table 9: Volume of timber harvested from all sources by forest district of origin, 2000-2008.

Forest District	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average 00-08
Fort St James	2,723,360	3,163,869	3,292,570	3,327,028	2,937,634	3,002,202	3,303,483	2,666,526	2,175,869	2,954,727
Prince George	5,364,686	5,376,720	5,773,447	7,156,040	6,900,943	8,783,838	8,459,940	7,054,435	5,645,692	6,723,971
Vanderhoof	2,229,539	2,518,534	4,043,092	4,511,650	4,212,778	4,949,740	4,118,133	3,220,716	3,367,141	3,685,703
Total	10,317,585	11,059,123	13,109,109	14,994,718	14,051,355	16,735,780	15,881,556	12,941,677	11,188,701	13,364,401

Source: Revenue Branch, B.C. Ministry of Forests and Range, Victoria.

The timber harvested in each district supports processing operations in a number of forest districts. Figure 1 provides an indication of the destination of timber cut in the three forest districts. The dominant presence of Prince George as a processing centre is illustrated with about 90% of the timber harvested in the Prince George Forest District remaining there for processing. About 22% and 27% of the timber harvested in Fort St. James and Vanderhoof districts, respectively, flows to the Prince George district for processing.

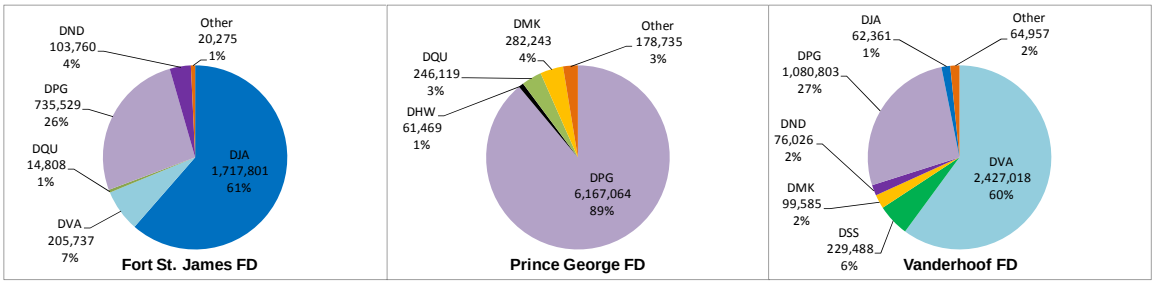


Figure 1: Fibre flow – destination of timber cut by forest district, average harvest 2003-08. Timber volumes from any source Crown or private.

Legend: DHW = Headwaters forest district; DJA = Fort St. James; DMK = Mackenzie; DND = Nadina; DPG = Prince George; DQU = Quesnel; DSS = Skeena-Stikine; DVA = Vanderhoof.

Source: Revenue Branch, Ministry of Forests and Range.

The data in Figure 1 shows where timber harvested in each of the TSA's forest districts was on average scaled from 2003 to 2008.[19] However, the average

[19] It is assumed in this analysis that the timber is processed in the same district where it is scaled.

volumes mask the trends that have occurred over the last ten years. Appendix 2 provides more detailed annual fibre flow data, with the main trends discussed here. The flow of timber harvested in the Fort St. James forest district has shifted from over 75% scaled within the district to less than 20%. The share flowing to the Vanderhoof and Prince George forest districts has correspondingly increased. In the Prince George forest district the volume remaining in the district for processing has increased slightly, with 85-90% being scaled in the district. The timber harvested in the Vanderhoof forest district has increasingly concentrated in the Vanderhoof and Prince George districts, with about 69% and 29% scaled in each district in 2008, respectively.

2.2. Primary processing

The processing sector in the Prince George TSA has been historically diverse including manufacturers of solid wood products, pulp and paper and other product types such as log homes and pellets. The past decade has been characterised by a consolidation of milling activity, mainly in the solid wood processing sector. In 1998, the Economics and Trade Branch identified 30 processing facilities in the TSA. By 2007, that number had dropped to 26 operations. However, lumber production increased by 31% over the ten year period to 3,577 million board feet from 2,726 million board feet. While harvests in the mid-2000s also increased, the point is that mills have become more productive and on average are producing more volume per mill. In the Prince George TSA, since late 2007 mills have been experiencing temporary and permanent shutdowns, as well as reductions in the number of shifts.

The Prince George forest district is the location of 11 lumber mills, three pulp mills, a log home, utility mill and two pellet operations. In 2007, the mills consumed over 8.5 million cubic metres of timber. Recent curtailments in operations have significantly reduced output however. Canfor's North Central Plywood mill closed permanently following a fire in May of 2008 and the mill will not be replaced. Other Canfor mills in the Prince George forest district have undergone temporary shutdowns and shift reductions throughout 2007-2009 to reduce total production. On May 29, 2009, Canfor announced the indefinite closer of its Prince George Rustad lumber mill. Other operators such as Dunkley and Carrier Lumber have reduced the number of daily operating shifts. Lumber

production peaked in 2006 at about 2,600 million board feet, declining to 2,500 million board feet in 2007.

The Fort St. James forest district is home to four mills, including Stuart Lake Lumber, Tl'oh Forest Products, Conifex and Apollo. Each of these mills has adjusted to the economic downturn by operating reduced shifts and days to meet the sporadic demand in the market. Stuart Lake has remained closed since May of 2007. Conifex reopened in March 2009 after an extended shutdown. Tl'oh, being dependent on trim ends relies on local producers. Combined these mills could consume from 1.7 to 2 million cubic metres of timber per year. In 2007 these mills operated well below capacity consuming a total of about 550,000 cubic metres.

The Vanderhoof Forest district has three large lumber mills: Canfor's Plateau mill and L&M Lumber located near Vanderhoof, and West Fraser's Fraser Lake Division located near Fraser Lake. One other small lumber mill, log home builder and Premium Pellet Ltd. are also located in the Vanderhoof forest district. Combined, under normal conditions these mills can consume close to 3 million cubic metres of logs per year. In 2007, these mills consumed about 2.5 million cubic metres of timber.

Since 2006, harvest rates and the volume of logs being processed into lumber have declined (see Figure 2). These trends in both harvesting and processing activity indicate that there will be or has been downward pressure on employment in these sectors as well. Between the 2006 and 2007, lumber manufacturing across the Prince George TSA declined by about 29%. No district was spared with Prince George lumber production declining by 26%, Vanderhoof by 19%, and Fort St. James by 65%. These declines are due to the severe downturn in the US housing market and economic recession, resulting in mill closures and temporary shutdowns. Note that Figure 2 includes only lumber manufacturing; as such the difference between the volume harvested and processed in Figure 2 includes wood used in other manufacturing processes such as pulp and other residual based processing, panel products, and log homes.

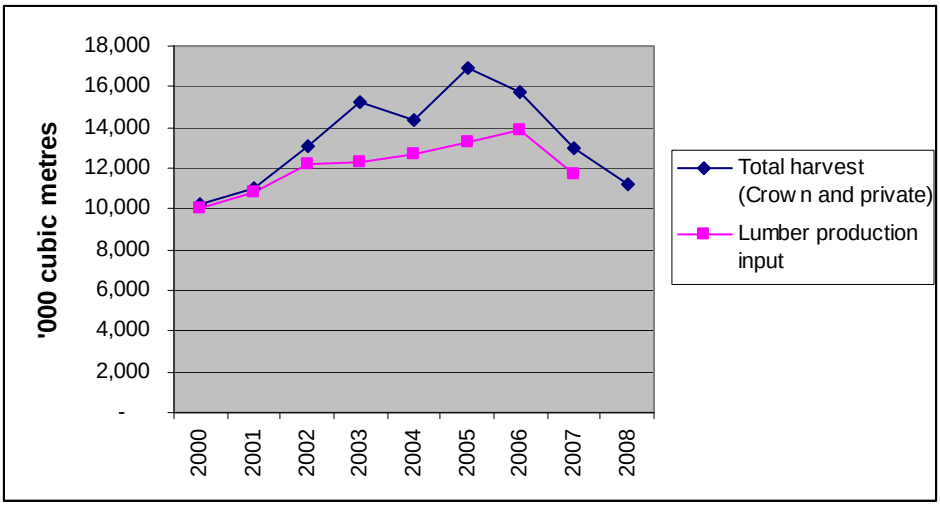


Figure 2: Prince George TSA - total lumber mill input and total timber harvest, 2000-2008.

Source: Economics and Trade Branch, Ministry of Forests and Range, Revenue Branch Ministry of Forests and Range.

Sectoral trends – lumber

BC's forest industry is currently experiencing one of the worst cyclical downturns in its history. The period 2001-2008 reflects highs and lows in prices and market conditions province-wide. In 2007-2008, access to U.S. lumber markets was affected by the strong Canadian dollar, a weak US housing market in the wake of the sub-prime mortgage crisis, subsequent low lumber prices and continuing softwood lumber export duties that exist when lumber markets are low.

Though exchange rates were favourable to trade in the first quarter of 2009 ($1CDN= 0.813$US as of Jan. 28, 09; and $1CDN = 0.783$US as of Mar. 4, 09), lumber sales have remained stalled with significantly reduced demand in North America - US softwood lumber consumption is closely tied to US housing starts which for December 2008 were reported at 550,000 units[20] (the lowest on record since reporting made available at the national level in January, 1959). Recent

20 Source: U.S. Department of Commerce: Census Bureau, Monthly New Residential Construction, Seasonally Adjusted Annual Rate, Date Range: 1959-01-01 to 2008-12-01, Last Updated: 2009-01-22 10:01 AM CST.

price increases have been offset by a rising Canadian dollar (over 0.96$US in early 2010).

Though not as strong a market for BC lumber, housing starts in Canada to December 2008 remained fairly stable at over 211,000 units, down from 227,400 units in 2007 and 228,300 in 2006. Seasonally adjusted annual rates of housing starts in Canada have fallen in January to 153,500 units, and further reduced in February to 136,400 units.[21] Some analysts expect North American lumber prices to remain low through 2009/10 because of continuing uncertainty in financial and housing markets, and expect to see markets begin to pick up again in 2011.

Sectoral trends – pulp

The pulp and paper industry in Canada employed an estimated 84,400 workers and contributed over $9.5 billion in GDP in 2008 - significantly less than in 2003 by 14,000 workers and $4 billion.[22] In 2005, Pricewaterhouse Coopers reported the pulp and paper industry was responsible for over $1 billion in wages and benefits to over 10,500 workers and over $600 million in payments to municipal, provincial and federal governments.[23]

In pulp markets, current supply and demand are now in close proximity due to closures of Canadian capacity over the past several years. Growth in key end-uses for northern bleached softwood kraft pulp (NBSK), although maturing in North America and Western Europe, is robust in developing regions. Core demand for NBSK is forecast to grow at about 1.6% per year over the medium-term.

Newsprint mills in BC represent moderate capacity and newer technology in comparison with the rest of Canada, however they lag behind Scandinavia in capacity and significantly behind Western Europe in the age of technology

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[21] http://www.cmhc-schl.gc.ca/en/corp/nero/nere/2009/2009-03-09-0815.cfm, accessed 2009-03-09

[22] Conference Board of Canada, *Canadian Industrial Outlook*, Autumn 2008

[23] Pricewaterhouse Coopers, *Report on the Economic Impact of the BC Pulp and Paper Industry*, Prepared for BC Pulp and Paper Industry Task Force, November 2007

employed. Between 2000 and 2006 consumption of newsprint in North America has fallen about 25% (3.2MM metric tons) and consequently industry capacity has been reduced on average by 630,000 metric tons per year. Demand is forecast to fall by a further 3.7 million metric tons by 2020, thereby creating serious viability challenges for the higher cost facilities in BC and elsewhere in North America.

Sectoral trends – bio-energy and wood waste

An indication of the development potential of wood waste in the manufacture of energy related products is the pellet market. Three manufacturers located in the Prince George TSA, Premium Pellet Ltd. in Vanderhoof, Pacific Bioenergy Corp. Pellet in Prince George, and Pinnacle Pellet Inc. in Strathnaver. The market for pellets is strongest in Europe. Prices in Europe peaked in 2006 at 250 Euros/tonne, but prices paid by German and Austrian buyers fell over 30% in 2007 as a result of increased production capacity in the two countries. Prices started to increase in the 3rd quarter of 2008. Prices in Sweden remained far more stable during this period, but in the 4th quarter of 2008 prices began to fall, closing the price differential. Investments in additional energy producing capacity in Europe are leading to increased demand in 2009 which is forecast to lead to higher prices.[24]

Biomass is also being considered by many jurisdictions in the production of electricity. Stennes and McBeath (2005) [25] provide an economic analysis of electricity generation using biomass. They found that with 2005 alternative energy prices, at any delivered wood cost above $0, other financial assistance would be required for a positive net return. Carbon credit markets may provide one option for this other financial assistance. With a modeled delivered wood cost of $117/Mwh a carbon credit value in the range of $80-130/credit may be necessary to broach profitability. They found that using biomass from forests for the production of the range of energy options is hampered in B.C. by several factors: 1) the low cost use of residual fibre from nearby facilities is limited; 3) the cost of biomass delivery to a mill gate is high and energy prices are too low, 2) the large area from which biomass may need to be collected; 4) the availability of

[24] Wood Resources International. www.woodprices.com

[25] See http://bookstore.cfs.nrcan.gc.ca/searchpubs_e.php?AuthorIDs=AU15709 to obtain a full copy of the Stennes/McBeath report.

low cost biomass alternatives; 5) the short term supply from beetle killed timber and the need for a dedicated supply source. Increasing energy prices and new technologies may eventually overcome these obstacles, but any development is subject to the relative cost changes and available supply of biomass.

The EPCOR Power L.P. bioenergy power plant in Wiliams Lake has been in operation since 1993, indicating that electricity can be produced efficiently when sufficient biomass is available nearby. Currently, local supply of residuals is significantly lower as a result of the current downturn in production in the Williams lake area, indicating the dependence of this type of energy production on the supply of residuals from the traditional lumber producing sector. Accessing standing timber or biomass located further away would significantly add to electricity generating costs making profitability a challenge. For new developments, the costs associated with new plant construction, access to a secure supply of cheap fibre within a competitive and finite supply market (with pulp, pellet, panel and other potential competitors), and obtaining a favourable price for the electricity output remain key factors of profitability. Citing new facilities in areas where alternative demand for residuals is low may offer the best opportunity for future bioenergy projects.

Investment in bio energy projects has significantly declined in recent months. CIBC World Markets reports that global investments declined from $5 billion in the 3rd quarter of 2008 to $0.5 billion in the 1st quarter of 2009. CIBC Wood markets reports that most investment has occurred in Brazil in the development of ethanol production, but low prices have led to financial losses even among the lowest cost producers. In the US about 20% of its ethanol production capacity has been shut down.

2.3. Prince George Timber Supply Area allowable annual cut, timber harvest and fibre flows

The previous section focussed on all forest activity within the three forest districts, including harvesting and processing associated with TSA timber from the Prince George and other TSAs, tree farm licences, Community Forest Agreement tenures, woodlots and other federal or private sources of timber. This section focuses on the Prince George TSA only. The TSA land base as

indicated in the timber supply section comprises a portion of the Fort St. James, Prince George and Vanderhoof forest districts.

The mountain pine beetle infestation led to significant increases in the annual allowable cut (AAC) in the Prince George TSA. The AAC has had two significant increases since 2002 to allow for the expedited salvage of pine stands. In 2002, the AAC was increased to 12,244,000 cubic metres, then in 2004 to 14,944,000 cubic metres. See Table 10 for the allocation of the current AAC, by tenure type.

Table 10: 2009 Allocation of Prince George Timber Supply Area Allowable Annual Cut

Tenure type	AAC	% of total
Replaceable Forest Licences	5,695,441	38.1%
Non-replaceable forest licences	5,471,488	36.6%
BC Timber Sales	3,485,106	23.3%
Timber Sale Licences < 10,000	5,859	0.04%
Community Forest Agreement	50,975	0.34%
Woodlot Licence	84,000	0.56%
Forest Service Reserve	151,131	1.01%
Total AAC	14,944,000	

Source: Resource Tenure and Engineering Branch, Ministry of Forests and Range, Report date 2009-01-09. http://www.for.gov.bc.ca/hth/apportionment/Documents/APTR011%2024.PDF

Harvest rates in the TSA initially reflected the increases to the allowable cut, climbing to 13.3 million cubic metres in 2006 from about 9.2 million cubic metres in 2000 (see Table 11). The Vanderhoof and Prince George forest districts experienced the largest increases in harvest rates. After 2006, however, rates began to decline rather sharply. The outlook for the forest sector in 2009 is for a continuation of the current downturn in demand for forest products.

Table 11: Prince George TSA harvest, by forest district, 2000-2008.

Forest District	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average 00-08
Fort St. James	2,491,466	2,962,524	2,974,515	2,803,105	2,479,124	2,648,283	2,998,574	2,145,500	1,834,162	2,593,028
Prince George	4,557,732	4,268,076	4,223,096	5,238,801	4,597,580	5,979,388	6,474,685	5,103,021	4,352,303	4,977,187
Vanderhoof	2,090,784	2,338,561	3,884,381	4,092,335	3,700,893	4,280,790	3,897,820	2,821,820	3,210,379	3,368,640
Total Prince George TSA	9,139,982	9,569,161	11,081,993	12,134,241	10,777,598	12,908,461	13,371,078	10,070,341	9,396,844	10,938,855

Source: Revenue Branch, BC Ministry of Forests and Range.

2.4. Forest sector development strategy and opportunities

The MPB takes both a biological and social toll on the Prince George TSA. In 2006, the Provincial Government released its Mountain Pine Beetle Action Plan that contained seven main objectives:

1. encourage immediate and long-term economic stability for communities;
2. maintain and protect worker and public health and safety;
3. recover the greatest value from dead timber before it burns or decays, while respecting other forest values;
4. conserve the long-term forest values identified in land use plans;
5. prevent or reduce damage to forests in areas that are susceptible by not yet experiencing epidemic infestations;
6. restore the forest resources in areas affected by the epidemic; and
7. maintain a management structure that ensures the effective and coordinated planning and implementation of mitigation measures.

The development of the provincially and federally funded Mountain Pine Beetle Action Plan is focused on the ecological, economic and social rejuvenation of pine beetle affected forests and the communities relying on those forests. This section will provide a summary of a variety of efforts that have evolved from this Plan. For additional information on the Mountain Pine Beetle Action Plan go to http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/can_bc_implement.htm.

For a March, 2008, progress report outlining activities under the Action Plan see http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/MPB_ActionPlan_ProgressReport.pdf

As part of the timber supply review process, the Omineca Beetle Action Coalition (OBAC) has provided a submission for consideration within the timber supply review process. It stresses the need to incorporate as best possible an understanding of community needs into the AAC determination process. The submission sets out a series of recommendations to support and increase community benefits, sector diversification, forest management that supports current and future needs, and using the MPB timber in the production of bio-energy. OBAC complete submission is included as Appendix 3.

A significant number of reports have been prepared examining various implications of the pine beetle related to wood products manufacturing (see the references section at the end of this report). In December of 2008, the Omineca Beetle Action Coalition (OBAC) released its "Future Forest Products and Fibre Use Strategy."[26] The OBAC report is a high level strategy document outlining six central objectives and four recommendations that focus on positioning the forest sector to have a continuing presence in the region. The recommendations are further divided into specific actions. While primary responsibilities are identified, such as the provincial government, local communities, First Nations and the forest sector, the greatest influence will come from market opportunities. Identifying the means to ensure the region is positioned to take advantage of those opportunities is at the core of the strategy.

Forest Innovation Investment is supporting a number series of research efforts have focused on the performance of mountain pine beetle affected timber on manufacturing (see Wang et al 2008; Cai and Oliveira 2008; Chang and Lam 2008; and Wang and Dai 2008). For access to and an up-to-date listing of these and other MPB product development research projects go to the FII website: http://www.bcfii.ca/industry_resources/mpb/product_development.htm. A few examples of that research follow.

The studies examine the impacts of mountain pine beetle killed wood on drying characteristics, use in veneer processing, plywood manufacturing, and wood-cement composite materials. The veneer and plywood studies found that mountain pine beetle wood does have a place in plywood production and can provide a specialty product where strength and stiffness is required in subsequent use. Drying time for veneer is shorter; however, material loss is

[26] http://www.ominecacoalition.ca/Strategies/ForestAndFibre/StrategyDocs.html

higher and appearance-based characteristics may be affected. The more specialty based nature of the product could offset any losses if sufficient volume is available and manufacturing is properly adjusted (see Wang et al, 2008). Representatives from the Prince George forest district question the ability to produce veneer from the pine timber, which can have a significant number of checks. Material loss and associated downtime hampered Canfor's Prince George veneer mill (prior to its burning down) from using more pine.

The use of wood fibres from mountain pine beetle timber in cement board manufacture could utilize more of the additional residue resulting from the processing of mountain pine beetle wood. Chang and Lam (2008) tested the use of mountain pine beetle fibres in the manufacture of cement board and found that mountain pine beetle wood performed better than other species in some mixtures, but that further study was required to test these conclusions under real processing conditions. In terms of structural lumber, Lum (2005) found that bluestain does not impact the mechanical properties of lodgepole pine.

The abundance of pine beetle killed timber has led to a significant amount of effort to find alternative uses for that timber. The production of pellets for use in heating and the focus on the potential for dead pine and other slash as bio-fuels in the production of energy has received a significant amount of interest both here and in the U.S.

To help foster the development of the emerging bio-energy sector, in January 2008 the provincial government introduced the BC Bioenergy Strategy. Affiliated with that strategy and to encourage the development of energy projects using bio-fuels, BC Hydro has embarked on a two phase call for proposal process. Phase I proposals are for electricity generating projects that could be developed immediately and would not need the allocation of any new forest tenure as its fuel source. On February 6, 2008, BC Hydro announced the accepted proposals under Phase I: two located in Prince George, one in Kamloops and the fourth in Castlegar. The two Prince George projects are the Canfor Pulp LTd. Partnership PGP bio-energy project and the PG Interior Waste to Energy Project.

On March 5, 2009, BC Hydro announced Phase II of its bio-energy development process. This second phase involves a two-stream process, the first of which is seeking larger scale projects, and the second is seeking proposals for smaller

community-level electricity supply projects using forest biomass. Final selection of Phase II projects is scheduled for early 2010.

Forest sector development not only focuses on post-harvest production activities, but also on investment in the forest resource itself. In response to the mountain pine beetle and wildfires of 2003-04, the provincial government introduced the $161 million, four-year Forests for Tomorrow program to reforest the most devastated areas. The program emphasizes surveying, site preparation and planting. These treatments are guided by strategic level program planning, seed supply planning, silviculture strategies and timber supply analyses. The up-front overview surveys and program planning, will formulate a clear and full picture of a cost-effective program and budget profile. It is anticipated that this will be a long term program with an annual budget that is projected to be $53.9 million by 2008/09, before gradually declining in later years as critical work is completed and not satisfactorily restocked (NSR) areas have been reduced to levels that do not pose serious timber supply problems. See the Forests for Tomorrow website for further information: http://www.forestsfortomorrow.com/fft/.

Assisting workers to transition from the forest sector to other job opportunities is another focus of the Action Plan through the Community Development Trust. The Trust has three components: Transitional Assistance Program for workers over 55 years of age who wish to pursue opportunities in other sectors; Tuition Assistance Program providing assistance with tuition and books, and the Job Opportunities Program providing up to six months funding to forest dependent communities and organizations for local recreation, fuel management and restoration projects. As of August 31, 2009, about $23 million has been spent in the Fraser-Fort George Regional District and $7.4 million in the Bulkley-Nechako Regional District. See http://www.cd.gov.bc.ca/cdt/ for further information on the Community Development Trust.

Achieving the MPB objectives is hampered at this time as a result of the economic recession, which unfortunately is coinciding with a surplus of significant volumes of mountain pine beetle timber. The downturn in demand has resulted in immediate wood processing curtailments rather than the originally forecasted mid-term wood supply declines related to the deterioration of mountain pine beetle infested trees. Market demand improvement is not expected until at least 2011[27]. It is possible the recovery in demand may coincide with declining availability of merchantable pine. The timing of the forestry sector downturn has

[27] Equity Research. December 2008. Forest Products Price-Forecast Monthly.

exacerbated already challenging and changing operating conditions in communities like Fort St. James.

2.5. Other sector development opportunities

Forestry is not the only economic sector being examined for development potential. OBAC has also commissioned studies looking at the contributions of the minerals and mining sector (OBAC 2008) and the alternative energy sector (OBAC 2008). In June and July, 2009, OBAC recently released its tourism and agriculture strategies, respectively. The focus of the tourism strategy is to promote activities beyond the region's traditional focus on forests, to diversify the tourism experience, and attract investment in alternative opportunities and tourism related infrastructure. The agriculture strategy is based on the objectives to increase opportunities and to attract greater interest in the agricultural sector as a source of employment and locally grown food.

Other development assistance comes from the Northern Development Initiative Trust (NDIT). The NDIT was developed in 2005 by the Provincial government from the proceeds of the sale of BC Rail. The objective of the NDIT is to provide funding and economic development support for northern communities. The NDIT has seven regional and cross regional funding envelopes. The economic development agency focuses on 10 priority areas: agriculture, economic development, energy, forestry, mining, Olympic opportunities, pine beetle recovery, small business, tourism, and transportation. In 2008, the NDIT released a manufacturing strategy that surveyed the region's strengths and identified promising manufacturing industries that could take advantage of the north's transportation corridor to markets in the east and west through to the Port of Prince Rupert. The report focused on a variety of metal processing, energy production, wood industries and most interestingly a whisky distillery in the Northeast. The report also sets out a strategy for attracting investment.

An example of a forthcoming development is the March, 2009, announcement that Terrane Metals Corp. was granted a provincial Environmental Assessment Certificate to develop its Mount Milligan copper-gold mine located about 90 kilometres north of Fort St. James. Other federal and provincial approvals are required but the project could eventually employ about 400 people in its construction and operational phases.

3. Employment coefficients

Employment coefficients are used to calculate estimates of employment that would be supported by alternative harvest levels. The coefficients indicate the number of person years of employment supported by each 1000 cubic metres of timber harvested (see Table 12).[28] These ratios can be applied to a timber harvest forecast to estimate the level of employment supported by a particular timber supply estimate or AAC decision. Employment coefficients were recently updated for the Prince George TSA (see Pierce Lefebvre Consulting, 2008).

Table 12: Prince George TSA direct employment coefficients (jobs per 1000 m^3 harvested).

Forestry sub-sector	Direct Impacts Within PG Region:		Direct Impacts Outside PG Region	Total Direct Impacts in BC	
Harvesting	0.21		0.01	0.22	
Silviculture	0.01		0.03	0.04	
Sub-total - Land Based Activity		0.22	0.04		0.26
Wood Products Processing	0.26		na	0.28	
Primary Pulp and Paper	0.07		na	0.07	
Sub-Total - Primary Processing		0.33	0.02		0.35
Total (Harvesting, Silviculture & Processing) in Prince George Region	0.55		0.06	0.61	

Source: Pierce Lefebvre Consulting. 2008. Prince George Region: Timber Harvesting and Processing Employment Survey. Final Report, December 15, 2008. The report and background information to this table can be found on-line at the Economics and Trade Branch website http://www.for.gov.bc.ca/het/.

The coefficients represent the direct employment supported by the forest sector; that is, jobs supported in timber harvesting, planting, planning, and at lumber and pulp mills for example. To determine the number of person years associated with a particular timber supply, the coefficients are multiplied by the timber supply. For example, if 1,500,000m^3 were harvested from the land base, the

[28] A person year is defined as a job lasting at least 180 days per year. Part-time jobs of less than 180 days are converted to full time person years prior to the calculation of the employment coefficient.

harvest would support 330 person years of harvesting and silviculture person years ([1,500,000/1000] * 0.22 = 330).

These employment coefficients do not include the indirect employment supported by the purchases of supplies and services by forestry-related companies, or the induced jobs supported by employees spending their salaries on food, housing, hair cuts and other products and services. These "spin-off" jobs as they are often called can be determined using employment multipliers. While they reflect a static or snap-shot of these spending effects, multipliers can be used to indicate (1) the magnitude of employment supported by a particular sector, or (2) the positive or negative employment impacts resulting from a change in a sector. For example, for the Prince George forest district the 330 logging and silviculture jobs would be multiplied by 1.43 to determine the total (direct + indirect + induced) number of person years supported by 1,500,000m^3 (330*1.43=472). The number of indirect and induced person years is found by subtracting the direct employment from the total employment (472-330=142). Alternatively, one could multiply the direct jobs by the indirect/induced portion of the multiplier (e.g., 330 * [1.43-1] = 142).

The most recent employment multipliers available are based on the 2006 census. See Table 13. These ratios will be used to estimate the indirect and induced impacts associated with timber supply levels.

Table 13: Short-term employment multipliers for the Prince George TSA.

	Logging	Pulp and paper	Wood mfg.
Fort St. James	1.18	1.39	1.26
Prince George	1.43	2.03	1.55
Vanderhoof	1.25	1.47	1.33

Source: Horne, Garry. Economic dependency tables for forest districts. BCStats, 2009.

4. Economic impact analysis of Prince George TSA timber supply scenarios

The timber supply scenarios for the Prince George TSA indicate that the current volume of timber available for harvest could be maintained for close to ten years. Table 14 shows employment levels, in person years, associated with selected time periods of the timber supply scenarios. Under Scenario 1, after 11 years the timber supply begins declining to the level shown in Year 15 then declines the following year eventually reaching the Year 20 level. The Year 20 level stays about the same until Year 40. The Scenario 2A Year 20 assumes that mature spruce is available for harvest to soften the pine related mid-term impact.

This magnitude of reduction in the timber supply would significantly reduce the level of activity in the TSA's traditional forestry sector and its associated employment. These scenarios assume a continuation of the forest sector's current focus on solid wood and pulp based products, and its level of productivity. The table shows the number of person years that the timber supply would support, not the number of person years lost as a result of the declining supply.

The estimates presented in Table 14 show the employment supported by the volume of timber harvested from the Prince George TSA only. Other sources of timber also support these mills. For example, from 2004-2008 an average of about 10% (360 thousand cubic metres) of the logs scaled in the Vanderhoof forest district came from outside the Prince George TSA, mainly from the Nadina forest district. About 7% (575 thousand cubic metres) of the logs scaled in the Prince George forest district came from outside the Prince George TSA, mainly from the Quesnel forest district. Timber also comes from TFLs 30, 42, and 53 accounting for about 6% of the total volume scaled in the Prince George, Vanderhoof and Fort St. James forest districts. Nonetheless, the Prince George TSA supplies from 85-90% of local mill requirements. To maintain current employment levels (i.e., those supported by TSA and non-TSA timber), other sources of timber would have to make up the short-fall forecast for the Prince George TSA.

Table 14: Prince George Timber Supply Area forest sector employment, in person years.

Forestry sub-sector	Pre-2002 AAC	5-year avg. harvest 04-08	Scenario 1* Years 1-11	Scenario 1 Year 15	Scenario 1 Year 20	Scenario 2A Year 20
Timber supply volume (cubic metres)	9,363,661	11,398,299	14,946,316	5,366,030	4,428,078	6,342,965
Employment (person years)						
Harvesting and silviculture	2,038	2,481	3,254	1,168	964	1,381
Wood Products Processing	2,448	2,980	3,907	1,403	1,157	1,658
Primary Pulp and Paper	671	817	1,072	385	317	455
Direct emlployment in the Prince George TSA	5,158	6,278	8,232	2,956	2,439	3,494
Direct impacts outside Prince George TSA	566	689	903	324	268	383
Total direct impacts in BC (TSA plus NON-TSA)	5,723	6,967	9,136	3,280	2,707	3,877
Indirect and induced impacts	2,150	2,617	3,432	1,232	1,017	1,456
Total direct, indirect and induced impacts	7,873	9,584	12,567	4,512	3,723	5,333

'* The Scenario 1 timber supply levels are points in time as the timber supply reduces to its mid-term level by year 20. The timber supply begins declining in Year 12 to the level shown in Year 15 then in Year 16 begins to decline to the Year 20 level. The Year 20 level stays about the same until Year 40. The Scenario 2A Year 20 assumes that mature spruce is available for harvest to soften the pine related mid-term impact.

Table 14 indicates that in 15 to 20 years the forest sector will support about 3,500 person years less than the recent average. In terms of indirect and induced employment, the declines in the timber supply could lead to a reduction of about 1,500 person years, unless other sector spending increases to offset these spin-off declines.

How might the structure of the sawmilling sector look in 20 years, given the indicated timber supply reduction? In 2006 and 2007, 13-15 medium to large mills in the Prince George TSA consumed an average of about 900 thousand cubic metres per year. A harvest of 4.4 million cubic metres would support four of today's average sized lumber mills, or three larger mills. In 2006 and 2007, five lumber mills each consumed in excess of one million cubic metres per year. Given the average productivity of these larger mills (i.e., less employment per unit of production) the level of lumber mill processing employment supported by a timber supply of 4.4 million would likely be less than indicated in Table 14. Some forest districts may fare better than others in this potential consolidation of milling activity.

In terms of chip production, from 2005 to 2007 TSA mills produced close to 1.7 million bone dry units (BDUs) of chips per year; three large mills would produce about 500-600 thousand BDUs, a reduction of at least one million BDUs of chips. This level of chip supply will significantly reduce the availability of cheaper chip, hog fuel and sawdust bi-products now being used in and envisioned for a variety of products, from pulp, to wood pellets and various forms of bio-energy production. Prince George's three pulp mills alone consume over 2 million BDUs per year, or about 5.8 million cubic metres of chips.

The pulp employment levels shown in Table 14 are those supported by the Prince George TSA timber supply. The employment is related to the traditional production and use of residual chips from sawmilling operations, supplemented by a portion of whole log chipping. As the supply from the TSA declines so too does the number of person years that the TSA supports. To maintain employment at current levels, other sources of fibre would be needed to offset TSA related declines. When the residual chip supply is low, and pulp prices sufficiently high, mills will source more of their supply through whole log chipping. As a result, the pulp employment reductions outlined in Table 14 may be offset by these alternate sources of fibre. For example, Canfor is currently supplying its pulp mills with a larger proportion of whole log chipping.

If chip supply shortages intensify, Canfor has three Pulpwood Agreements (PAs) located within and adjacent to the Prince George TSA that could form part of a fibre supply strategy to offset reductions in traditional sources of residual chips. Combined these Pulpwood Agreements may provide access to about 4 million cubic metres of deciduous fibre. Additional supplies of fibre could also come from dead pine stands that have been removed from the timber harvesting landbase in the Prince George TSA. As with all non-residual sources, however, the costs of accessing, harvesting, and transporting the fibre to the mill gate in addition to chipping the logs will influence the profitability, thus attractiveness of those sources at an alternative supply.

The federal Pulp and Paper Green Transformation Program provides a tax credit based on the amount of black liquor produced in the pulping process and is intended to encourage capital investments and may contribute to the way in which pulp mills source and use fibre inputs. This may help the future productivity and profitability of these mills, which may subsequently influence the fibre supply strategy.

Appendix 1: Census labour Force Data 2006

2006 Census Population 15 Years and Over by Industry - NAICS 2002, Labour Force Activity for BC Forest Districts (northern region), 2006 Census, 20% Sample-based Data

Source: Statistics Canada, 2006 Census, Custom Tabulation CRO0101646

Prepared by: BC Stats, January 2009

Both Sexes, 15 years and over	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
Industry												
Total - Industry - NAICS 2002	3035	1910	1640	68150	49130	45305	8325	5740	5205	79510	56780	52150
Not applicable	945	60	0	14680	675	0	2125	80	0	17750	815	0
All Industries - Total	2090	1845	1640	53470	48455	45300	6200	5665	5205	61760	55965	52145
Forest Industries - Total	775	745	670	7185	6650	5850	1845	1730	1520	9805	9125	8040
113 Forestry and logging	225	215	180	1780	1575	1065	555	505	355	2560	2295	1600
1131 Timber tract operations	0	0	0	20	15	15	0	0	0	20	15	15
1132 Forest nurseries and gathering of forest products	15	15	15	45	35	15	0	0	0	60	50	30
1133 Logging	210	195	170	1715	1525	1030	555	500	355	2480	2220	1555
1153 Support activities for forestry	85	85	75	825	765	655	175	170	120	1085	1020	850
321 Wood product manufacturing	455	440	410	3020	2855	2700	1055	1010	1000	4530	4305	4110
3211 Sawmills and wood preservation	410	400	380	2385	2250	2135	1020	975	970	3815	3625	3485
3212 Veneer, plywood and engineered wood product manufactu	10	0	10	355	345	320	0	0	0	365	345	330
3219 Other wood product manufacturing	30	30	25	280	265	240	30	35	35	340	330	300
322 Paper manufacturing	10	0	0	1440	1340	1325	45	45	45	1495	1385	1370
3221 Pulp, paper and paperboard mills	10	10	10	1445	1340	1325	40	40	40	1495	1390	1375
3222 Converted paper product manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
3371 Household and institutional furniture and kitchen cabinet ma	0	0	0	105	100	95	15	0	0	120	100	95
3372 Office furniture (including fixtures) manufacturing	0	0	0	10	10	0	0	0	0	10	10	0
Non-Forest Industries - Total	1315	1105	965	46285	41810	39450	4355	3935	3680	51955	46850	44095
111-112 Farms	45	45	45	555	510	485	320	320	310	920	875	840
114 Fishing, hunting and trapping	10	0	10	15	15	10	0	0	0	25	15	20
1151 to 1152 Support activities for farms	0	0	0	25	25	25	25	25	25	50	50	50
211 Oil and gas extraction	0	0	0	65	65	50	0	0	0	65	65	50
212 Mining (except oil and gas)	0	10	10	125	110	105	200	185	185	325	305	300
213 Support activities for mining and oil and gas extraction	0	0	0	205	195	175	20	15	15	225	210	190
219 Mining-unspecified	0	0	0	0	0	10	0	0	0	0	0	10
221 Utilities	0	0	0	250	235	235	10	10	10	260	245	245
236 Construction of buildings	25	20	20	1215	1050	980	60	45	45	1300	1115	1045
237 Heavy and Civil Engineering Construction	15	0	10	480	430	375	60	65	60	555	495	445
238 Specialty Trade Contractors	20	15	15	1745	1635	1525	165	160	125	1930	1810	1665

Both Sexes, 15 years and over - 2006 continued	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
2006 Census Population 15 Years and Over by Industry - NAICS 2002, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
311 Food manufacturing	0	0	0	65	50	50	0	0	0	65	50	50
312 Beverage and Tobacco Product Manufacturing	10	10	10	95	80	80	0	0	0	105	90	90
313 Textile Mills	0	0	0	0	10	0	0	0	0	0	10	0
314 Textile Product Mills	0	0	0	0	0	0	10	10	10	10	10	10
315 Clothing Manufacturing	0	0	0	25	25	25	0	0	0	25	25	25
316 Leather and Allied Product Manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
323 Printing and related support activities	0	0	0	85	85	85	0	0	0	85	85	85
324 Petroleum and coal products manufacturing	0	0	0	80	75	80	0	0	0	80	75	80
325 Chemical Manufacturing	0	0	0	120	115	115	0	0	0	120	115	115
326 Plastics and Rubber Products Manufacturing	0	0	0	40	40	40	0	0	0	40	40	40
327 Non-Metallic Mineral Product Manufacturing	0	0	0	55	55	55	20	15	15	75	70	70
331 Primary Metal Manufacturing	0	0	0	30	30	20	0	0	0	30	30	20
332 Fabricated Metal Product Manufacturing	10	10	0	290	275	250	35	40	35	335	325	285
333 Machinery Manufacturing	25	20	20	150	150	145	25	25	0	200	195	165
334 Computer and Electronic Product Manufacturing	0	0	0	20	20	20	0	0	0	20	20	20
335 Electrical Equipment, Appliance and Component Manufactur	0	0	0	15	0	0	0	0	0	15	0	0
336 Transportation Equipment Manufacturing	0	0	0	110	110	105	0	10	10	110	120	115
3379 Other furniture-related product manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
339 Miscellaneous Manufacturing	0	0	0	85	80	75	10	10	15	95	90	90
411 Farm product wholesaler-distributors	0	0	0	0	10	10	0	0	0	0	10	10
412 Petroleum product wholesaler-distributors	0	0	0	80	75	65	20	10	10	100	85	75
413 Food, Beverage and Tobacco Wholesaler-Distributors	0	0	0	250	210	200	10	10	10	260	220	210
414 Personal and Household Goods Wholesaler-Distributors	0	0	0	50	55	55	0	0	0	50	55	55
415 Motor Vehicle and Parts Wholesaler-Distributors	0	0	0	320	290	290	15	15	15	335	305	305
416 Building Material and Supplies Wholesaler-Distributors	20	15	10	410	370	375	30	30	25	460	415	410
417 Grossistes-distributeurs de machines, de matériel et de four	0	0	0	975	895	890	10	10	0	985	905	890
418 Miscellaneous Wholesaler-Distributors	10	10	0	275	250	235	10	0	0	295	260	235
419 Wholesale agents and brokers	0	0	0	35	30	25	15	0	0	50	30	25
441 Motor Vehicle and Parts Dealers	0	0	0	805	750	715	20	20	20	825	770	735
442 Furniture and Home Furnishings Stores	0	0	0	205	195	190	25	25	30	230	220	220
443 Electronics and appliance stores	0	0	0	210	190	175	20	25	25	230	215	200
444 Building Material and Garden Equipment and Supplies Deale	0	0	0	430	365	350	65	70	65	495	435	415
445 Food and Beverage Stores	70	45	40	1325	1205	1130	90	85	85	1485	1335	1255
446 Health and personal care stores	0	0	0	440	400	390	40	40	40	480	440	430
447 Gasoline stations	15	15	10	395	345	315	50	55	50	460	415	375
448 Clothing and Clothing Accessories Stores	0	0	0	440	390	350	0	0	0	440	390	350
451 Sporting Goods, Hobby, Book and Music Stores	0	0	0	325	285	265	25	25	20	350	310	285
452 General Merchandise Stores	15	15	15	865	790	720	80	75	75	960	880	810

Both Sexes, 15 years and over - 2006 continued	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
2006 Census Population 15 Years and Over by Industry - NAICS 2002, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
453 Miscellaneous Store Retailers	0	0	0	445	385	365	30	25	25	475	410	390
454 Non-Store Retailers	0	0	0	205	135	115	30	30	30	235	165	145
481 Air transportation	10	10	10	175	170	175	10	10	10	195	190	195
482 Rail transportation	10	0	0	510	450	445	10	10	10	530	460	455
483 Water Transportation	0	0	0	15	15	20	0	0	0	15	15	20
484 Transport par camion	35	30	20	1750	1610	1425	120	110	75	1905	1750	1520
485 Transit and Ground Passenger Transportation	10	10	10	330	330	330	35	30	35	375	370	375
486 Pipeline Transportation	0	0	0	30	30	25	0	10	10	30	40	35
487 Scenic and Sightseeing Transportation	0	0	0	0	0	0	0	0	0	0	0	0
488 Support Activities for Transportation	25	20	15	290	280	260	60	50	45	375	350	320
491 Postal service	0	0	0	235	220	225	15	15	15	250	235	240
492 Couriers and Messengers	0	0	0	240	225	205	0	10	0	240	235	205
493 Warehousing and storage	0	0	0	80	75	65	0	0	0	80	75	65
511 Publishing Industries (except Internet)	0	0	0	275	255	250	10	10	10	285	265	260
512 Motion Picture and Sound Recording Industries	10	10	0	45	35	30	0	0	0	55	45	30
515 Broadcasting (except Internet)	0	0	0	135	140	130	10	10	10	145	150	140
516 Internet publishing and broadcasting	0	0	0	0	0	0	0	0	0	0	0	0
517 Telecommunications	0	0	0	315	290	285	10	0	10	325	290	295
518 Data Processing, Hosting, and Related Services	0	0	0	35	35	30	0	0	0	35	35	30
519 Other information services	0	0	0	100	95	90	10	10	0	110	105	90
521 Monetary authorities - central bank	0	0	0	0	0	0	0	0	0	0	0	0
522 Credit Intermediation and Related Activities	20	20	20	685	655	625	60	60	60	765	735	705
523 Securities, Commodity Contracts, and Other Financial Inves	0	0	0	240	210	210	0	0	0	240	210	210
524 Insurance Carriers and Related Activities	10	0	0	495	460	450	25	20	25	530	480	475
526 Funds and Other Financial Vehicles	0	0	0	15	15	15	0	0	0	15	15	15
531 Real Estate	20	20	20	420	390	385	80	75	75	520	485	480
532 Rental and Leasing Services	0	0	0	255	245	235	15	15	15	270	260	250
533 Lessors of non-financial intangible assets (except copyrighte	0	0	0	0	0	0	0	0	0	0	0	0
541 Professional, Scientific and Technical Services	50	50	40	2660	2410	2275	130	125	120	2840	2585	2435
551 Management of companies and enterprises	10	0	0	60	60	60	0	0	0	70	60	60

Both Sexes, 15 years and over - 2006 continued	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
2006 Census Population 15 Years and Over by Industry - NAICS 2002, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
561 Administrative and support services	65	25	10	1960	1615	1510	105	90	90	2130	1730	1610
562 Waste Management and Remediation Services	0	0	0	130	125	120	10	10	10	140	135	130
611 Educational Services	250	235	220	3875	3435	3355	500	475	450	4625	4145	4025
621 Ambulatory health care services	60	50	50	1475	1410	1355	80	65	65	1615	1525	1470
622 Hospitals	50	35	30	1885	1755	1685	140	135	125	2075	1925	1840
623 Nursing and residential care facilities	0	0	0	795	760	685	45	45	45	840	805	730
624 Social assistance	40	35	40	1345	1270	1215	125	110	110	1510	1415	1365
711 Performing Arts, Spectator Sports and Related Industries	0	0	0	145	95	80	10	10	10	155	105	90
712 Heritage institutions	0	0	10	105	95	80	0	0	0	105	95	90
713 Amusement, Gambling and Recreation Industries	15	15	15	665	590	530	35	30	30	715	635	575
721 Accommodation Services	30	25	0	785	700	610	120	90	80	935	815	690
722 Food Services and Drinking Places	40	30	15	3530	3130	2815	325	275	230	3895	3435	3060
811 Repair and Maintenance	35	30	30	1285	1195	1155	135	110	100	1455	1335	1285
812 Personal and Laundry Services	10	10	10	545	450	440	70	65	60	625	525	510
813 Organismes religieux, fondations, groupes de citoyens et org	15	10	10	600	505	450	50	50	50	665	565	510
814 Private households	0	0	0	290	185	180	50	30	20	340	215	200
911 Administration publique fédérale	20	15	10	865	745	720	80	70	65	965	830	795
912 Provincial and territorial public administration (9121 to 9129)	55	45	45	1265	1170	1150	145	115	115	1465	1330	1310
913 Local, municipal and regional public administration (9131 to 9	10	10	10	670	625	605	50	45	45	730	680	660
914 Aboriginal public administration	135	110	100	180	135	105	120	90	75	435	335	280
919 International and other extra-territorial public administration	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 1: Census labour Force Data 2001

2001 Census Population 15 Years and Over by Industry - NAICS 1997, Labour Force Activity for BC Forest Districts (northern region), 2001 Census, 20% Sample-based Data

Source: Statistics Canada, 2001 Census, Custom Tabualtion CRO0101647 Prepared by: BC Stats, January 2009

Both Sexes, 15 years and over	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
Total - Industry - NAICS 1997	3445	2400	2095	67660	48815	43220	8895	6050	5250	80000	57265	50565
Not applicable	830	65	0	15705	1250	0	2310	115	0	18845	1430	0
All Industries - Total	2615	2330	2100	51955	47565	43225	6585	5935	5250	61155	55830	50575
Forest Industries - Total	1065	985	855	7500	6940	5895	1785	1625	1330	10350	9550	8080
113 Forestry and logging	240	200	145	1655	1460	805	530	465	275	2425	2125	1225
1131 Timber tract operations	0	0	0	15	15	15	0	0	10	15	15	25
1132 Forest nurseries and gathering of forest products	0	0	0	135	75	60	0	0	0	135	75	60
1133 Logging	240	195	145	1505	1365	725	525	460	270	2270	2020	1140
1153 Support activities for forestry	90	80	40	1080	1005	770	165	155	120	1335	1240	930
321 Wood product manufacturing	710	685	650	3200	3005	2875	1055	970	920	4965	4660	4445
3211 Sawmills and wood preservation	660	635	610	2600	2465	2365	1025	935	890	4285	4035	3865
3212 Veneer, plywood and engineered wood product manufacturing	0	0	0	260	240	235	0	0	0	260	240	235
3219 Other wood product manufacturing	50	50	40	340	300	280	35	35	35	425	385	355
322 Paper manufacturing	20	15	10	1505	1415	1390	0	0	0	1525	1430	1400
3221 Pulp, paper and paperboard mills	20	15	15	1505	1415	1395	10	10	0	1535	1440	1410
3222 Converted paper product manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
3371 Household and institutional furniture and kitchen cabinet manufacturing	0	0	0	45	40	40	25	30	20	70	70	60
3372 Office furniture (including fixtures) manufacturing	0	0	0	10	15	15	0	0	0	10	15	15
Non-Forest Industries - Total	1550	1350	1245	44455	40625	37325	4800	4310	3915	50805	46285	42485
111-112 Farms	15	15	15	635	565	480	340	310	310	990	890	805
114 Fishing, hunting and trapping	0	0	0	40	35	20	10	0	0	50	35	20
1150 Support activities for farms (1151 to 1152)	0	0	0	25	25	25	0	0	0	25	25	25
211 Oil and gas extraction	0	0	0	35	35	25	10	0	10	45	35	35
212 Mining (except oil and gas)	0	0	0	135	110	75	185	185	165	320	295	240
213 Support activities for mining and oil and gas extraction	0	0	0	95	70	50	10	0	0	105	70	50
219 Mining-unspecified	0	0	0	0	0	0	0	0	0	0	0	0
221 Utilities	0	10	10	320	290	280	35	30	30	355	330	320
231 Prime contracting	40	35	20	1390	1220	995	225	220	180	1655	1475	1195
232 Trade contracting	20	20	20	1745	1585	1315	185	185	165	1950	1790	1500
311 Food manufacturing	10	10	0	95	65	55	45	35	25	150	110	80
312 Beverage and tobacco product manufacturing	0	0	0	95	90	90	0	0	10	95	90	100
313 Textile mills	0	0	0	15	15	15	0	0	0	15	15	15
314 Textile product mills	0	0	0	10	10	10	0	0	0	10	10	10
315 Clothing manufacturing	0	0	0	20	15	20	0	0	0	20	15	20
316 Leather and allied product manufacturing	0	0	0	10	0	10	0	0	0	10	0	10

2001 Census Population 15 Years and Over by Industry - NAICS 1997, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
323 Printing and related support activities	10	10	10	155	145	125	0	0	0	165	155	135
324 Petroleum and coal products manufacturing	0	0	0	45	50	45	0	0	0	45	50	45
325 Chemical manufacturing	0	0	0	155	145	135	0	0	0	155	145	135
326 Plastics and rubber products manufacturing	0	0	0	30	30	20	0	0	0	30	30	20
327 Non-metallic mineral product manufacturing	0	0	0	70	70	65	10	10	10	80	80	75
331 Primary metal manufacturing	0	0	0	15	10	0	20	20	20	35	30	20
332 Fabricated metal product manufacturing	0	0	0	465	430	380	25	15	10	490	445	390
333 Machinery manufacturing	0	0	0	135	140	120	0	0	0	135	140	120
334 Computer and electronic product manufacturing	0	10	10	10	0	10	0	0	0	10	10	20
335 Electrical equipment, appliance and component manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
336 Transporation equipment manufacturing	0	0	0	65	65	55	0	0	0	65	65	55
3379 Other furniture-related product manufacturing	0	0	0	0	0	0	0	0	0	0	0	0
339 Miscellaneous manufacturing	0	0	0	105	90	80	10	0	0	115	90	80
411 Farm product wholesaler-distributors	0	0	0	15	10	10	0	0	0	15	10	10
412 Petroleum product wholesaler-distributors	10	10	0	50	50	50	0	0	0	60	60	50
413 Food, beverage and tobacco wholesaler-distributors	0	0	0	135	115	110	0	0	0	135	115	110
414 Personal and household goods wholesaler-distributors	10	10	10	20	15	10	0	0	0	30	25	20
415 Motor vehicle and parts wholesaler-distributors	10	10	0	365	355	325	80	50	45	455	415	370
416 Building material and supplies wholesaler-distributors	0	0	0	365	345	325	20	20	10	385	365	335
417 Machinery, equipment and supplies wholesaler-distributors	0	0	10	685	645	635	20	20	15	705	665	660
418 Miscellaneous wholesaler-distributors	0	0	0	165	155	145	10	0	0	175	155	145
419 Wholesale agents and brokers	10	0	0	60	55	55	0	0	0	70	55	55
441 Motor vehicle and parts dealers	10	0	10	760	725	695	40	40	40	810	765	745
442 Furniture and home furnishings stores	0	0	0	160	155	155	10	0	10	170	155	165
443 Electronics and appliance stores	0	0	0	135	130	115	15	15	15	150	145	130
444 Building material and garden equipment and supplies dealers	0	10	0	370	360	340	55	35	30	425	405	370
445 Food and beverage stores	85	80	75	1580	1360	1210	190	185	165	1855	1625	1450
446 Health and personal care stores	20	20	20	420	405	390	45	45	45	485	470	455
447 Gasoline stations	25	25	25	380	315	280	95	65	55	500	405	360
448 Clothing and clothing accessories stores	0	0	0	555	480	430	10	10	10	565	490	440

Both Sexes, 15 years and over - continued	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
2001 Census Population 15 Years and Over by Industry - NAICS 1997, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
451 Sporting goods, hobby, book and music stores	10	10	10	265	235	200	70	65	55	345	310	265
452 General merchandise stores	25	25	25	925	855	770	55	50	40	1005	930	835
453 Miscellaneous store retailers	30	20	20	555	515	440	60	50	45	645	585	505
454 Non-store retailers	10	10	10	255	225	220	0	0	10	265	235	240
481 Air transportation	0	0	0	205	175	165	10	10	10	215	185	175
482 Rail transportation	10	10	10	855	840	820	15	15	15	880	865	845
483 Water transportation	0	0	0	0	10	10	0	0	0	0	10	10
484 Truck transportation	60	50	40	1265	1165	970	175	165	110	1500	1380	1120
485 Transit and ground passenger transportation	0	0	0	295	285	265	10	0	0	305	285	265
486 Pipeline transportation	0	0	0	10	0	0	0	0	0	10	0	0
487 Scenic and sightseeing transportation	0	0	0	0	0	0	0	0	0	0	0	0
488 Support activities for transportation	0	0	0	275	265	255	50	35	35	325	300	290
491 Postal service	0	0	10	255	240	245	40	35	30	295	275	285
492 Couriers and messengers	0	0	0	165	155	155	0	0	0	165	155	155
493 Warehousing and storage	0	0	0	50	50	50	0	0	0	50	50	50
511 Publishing industries	0	0	0	315	255	220	15	10	15	330	265	235
512 Industries du film et de l'enregistrement sonore	10	0	10	75	65	50	10	10	0	95	75	60
513 Broadcasting and telecommunications	0	0	0	755	715	705	10	10	10	765	725	715
514 Information services and data processing services	0	0	0	170	165	145	0	10	0	170	175	145
521 Monetary authorities - central bank	0	0	0	0	0	0	0	0	0	0	0	0
522 Credit intermediation and related activities	20	20	15	675	655	625	85	85	85	780	760	725
523 Securities, commodity contracts, and other financial investment and related a	0	0	0	285	265	240	10	0	10	295	265	250
524 Insurance carriers and related activities	10	10	10	565	525	495	15	15	15	590	550	520
526 Funds and other financial vehicles	0	0	0	0	10	10	0	0	0	0	10	10
531 Real estate	10	10	0	365	340	315	20	20	15	395	370	330
532 Rental and leasing services	0	0	0	285	260	240	10	10	10	295	270	250
533 Lessors of non-financial intangible assets (except copyrighted works)	0	0	0	0	0	0	0	0	0	0	0	0
541 Professional, scientific and technical services	30	25	25	2525	2300	2140	255	210	195	2810	2535	2360
551 Management of companies and enterprises	0	0	0	25	20	20	10	0	0	35	20	20

Both Sexes, 15 years and over - continued	Fort St. James Forest District			Prince George Forest District			Vanderhoof Forest District			Prince George TSA		
2001 Census Population 15 Years and Over by Industry - NAICS 1997, Labour Force Activity for BC Forest Districts (northern region), 20% Sample-based Data	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed	Total - Labour Force Activity	In the labour force	Employed
561 Administrative and support services	45	40	35	1570	1375	1270	130	85	80	1745	1500	1385
562 Waste management and remediation services	10	10	10	90	85	90	40	30	30	140	125	130
611 Educational services	195	170	170	3470	3250	3145	570	545	530	4235	3965	3845
621 Ambulatory health services	75	65	65	1375	1295	1255	120	115	110	1570	1475	1430
622 Hospitals (6221 to 6223)	20	20	25	1575	1475	1455	80	70	70	1675	1565	1550
623 Nursing and residential care facilities	0	0	10	785	755	685	50	45	45	835	800	740
624 Social assistance	60	55	50	1310	1155	1095	185	165	160	1555	1375	1305
711 Performing arts, spectator sports and related industries	0	0	0	215	175	130	10	10	10	225	185	140
712 Heritage institutions	0	0	0	70	65	55	10	0	0	80	65	55
713 Amusement, gambling and recreation industries	60	40	40	620	535	500	65	50	50	745	625	590
721 Accommodation services	30	15	15	660	570	495	100	100	95	790	685	605
722 Food services and drinking places	90	75	65	3390	3025	2705	230	175	145	3710	3275	2915
811 Repair and maintenance	60	60	55	1300	1220	1100	95	95	80	1455	1375	1235
812 Personal and laundry service	30	20	25	550	510	470	55	60	60	635	590	555
813 Religious, grant-making, civic and professional and similar organizations	35	20	20	610	525	475	85	75	75	730	620	570
814 Private households	10	10	0	360	260	205	45	30	20	415	300	225
911 Federal government public administration	65	65	60	960	875	850	50	50	40	1075	990	950
912 Provincial and territorial public administration	100	90	90	1135	1095	1060	110	100	80	1345	1285	1230
913 Local, municipal and regional public administration	10	0	0	725	685	650	40	35	35	775	720	685
914 Aboriginal public administration	150	130	110	100	85	80	110	100	90	360	315	280
919 International and other extra-territorial public administration	0	0	0	0	0	0	0	0	0	0	0	0

Appendix 2: Prince George TSA timber flows, by forest district, 2003-2008

Fort St James Forest District timber flows, total harvest from Crown and private.								
Scale site district	2003	2004	2005	2006	2007	2008	2003-08 avg	% by scale district
DJA	2,536,060	2,148,938	2,190,143	2,027,787	1,138,556	355,729	1,732,869	60.6%
DPG	545,123	410,040	447,611	820,602	956,256	1,270,410	741,674	25.9%
DVA	91,563	170,434	154,255	259,642	315,140	464,141	242,529	8.5%
DND	50,435	128,790	107,516	94,997	195,067	47,424	104,038	3.6%
DQU	73,968	30,425	1,988			1,620	18,000	0.6%
DHW	2,158	938	2,155		71,351	40,038	19,440	0.7%
DMK	3,966						661	0.0%
DMH	3,050	652	263				661	0.0%
DSS	184						31	0.0%
DOS	45						8	0.0%
Grand Total	3,306,554	2,890,218	2,903,932	3,203,028	2,676,370	2,179,362	2,859,911	100.0%

Fort St James Forest District percent timber flows, total harvest from Crown and private.							
	2003	2004	2005	2006	2007	2008	Average %
DJA	76.7%	74.4%	75.4%	63.3%	42.5%	16.3%	60.6%
DPG	16.5%	14.2%	15.4%	25.6%	35.7%	58.3%	25.9%
DVA	2.8%	5.9%	5.3%	8.1%	11.8%	21.3%	8.5%
DND	1.5%	4.5%	3.7%	3.0%	7.3%	2.2%	3.6%
DQU	2.2%	1.1%	0.1%	0.0%	0.0%	0.1%	0.6%
Other	0.3%	0.1%	0.1%	0.0%	2.7%	1.8%	0.7%

Prince George Forest District timber flows, total harvest from Crown and private.								
Scale site district	2003	2004	2005	2006	2007	2008	2003-08 avg	% by scale district
DPG	6,069,621	5,462,960	7,575,368	7,716,291	6,355,948	5,129,427	6,384,936	86.7%
DMK	306,372	575,443	487,490	345,131	378,788	167,659	376,814	5.1%
DQU	429,780	288,135	371,952	163,297	113,443	235,297	266,984	3.6%
DHW	80,981	223,798	113,453	24,215	17,916	630	76,832	1.0%
DPC	80,756	193,463	54,368	13			54,767	0.7%
DCC	45,716	125,346	62,091	43,679	4,242	2,581	47,276	0.6%
DMH	121,198	66,789	114,391	47,111	56,675	19,732	70,983	1.0%
DCH	1,863	46,656	43,972	9,863			17,059	0.2%
DOS	52,024	29,421	58	834	2	0	13,723	0.2%
DVA	5,990	6,781	13,847	6,623	13,234	2,257	8,122	0.1%
DJA		19,803	16,129	989		87	6,168	0.1%
DKA	22,725	3,014	373	5,707	-38	54	5,306	0.1%
DCS	2,402	505		416	354	-4	612	0.0%
DRM	35	354	705	110	142		224	0.0%
DCK	946	82		1	52		180	0.0%
DND		381	40		175		99	0.0%
DCO					49		8	0.0%
Not specified			59		131,239	96,108	37,901	0.5%
Grand Total	7,220,410	7,042,931	8,854,294	8,364,282	7,072,220	5,653,828	7,367,994	100.0%

Prince George Forest District percent timber flows, total harvest from Crown and private.							
	2003	2004	2005	2006	2007	2008	Average %
DPG	84.1%	77.6%	85.6%	92.3%	89.9%	90.7%	86.7%
DMK	4.2%	8.2%	5.5%	4.1%	5.4%	3.0%	5.1%
DQU	6.0%	4.1%	4.2%	2.0%	1.6%	4.2%	3.6%
DHW	1.1%	3.2%	1.3%	0.3%	0.3%	0.0%	1.0%
DPC	1.1%	2.7%	0.6%	0.0%	0.0%	0.0%	0.7%
DCC	0.6%	1.8%	0.7%	0.5%	0.1%	0.0%	0.6%
DMH	1.7%	0.9%	1.3%	0.6%	0.8%	0.3%	1.0%
Other	1.2%	1.5%	0.8%	0.3%	2.1%	1.7%	1.2%

Vanderhoof Forest District timber flows, total harvest from Crown and private.								
	2003	2004	2005	2006	2007	2008	2003-08 avg	% by scale district
DVA	2,910,486	2,623,676	2,612,748	2,508,106	2,125,613	2,329,215	2,518,307	60.2%
DPG	1,152,240	962,985	1,513,661	1,115,393	918,938	969,507	1,105,454	26.4%
DSS	310,398	383,795	371,092	274,115	37,573		229,495	5.5%
DMK	14,511	129,960	298,387	139,904	49,216		105,330	2.5%
DND	157,202	220,906	56,615	33,403	1,585	1,036	78,458	1.9%
DJA	46,735	31,164	144,827	133,948	26,748		63,904	1.5%
DCH	22,712	61,344	45,688				21,624	0.5%
DPC		4,984	49,099	4			9,014	0.2%
DQU	16,529	23,270	13,267	78	4,112	772	9,671	0.2%
DHW	9,065	2,924	734				2,121	0.1%
DMH	44,735	14,652	14,462	3,785	9,857		14,582	0.3%
DCK		30						
DOS		17						
DKA	472				95,966	66,620	27,176	0.6%
Grand Total	4,685,085	4,459,706	5,120,581	4,208,735	3,269,608	3,367,150	4,185,136	100.0%

Vanderhoof Forest District percent timber flows, total harvest from Crown and private.							
	2003	2004	2005	2006	2007	2008	Average %
DVA	62.1%	58.8%	51.0%	59.6%	65.0%	69.2%	60.2%
DPG	24.6%	21.6%	29.6%	26.5%	28.1%	28.8%	26.4%
DSS	6.6%	8.6%	7.2%	6.5%	1.1%	0.0%	5.5%
DMK	0.3%	2.9%	5.8%	3.3%	1.5%	0.0%	2.5%
DND	3.4%	5.0%	1.1%	0.8%	0.0%	0.0%	1.9%
DJA	1.0%	0.7%	2.8%	3.2%	0.8%	0.0%	1.5%
Other	2.0%	2.4%	2.4%	0.1%	3.4%	2.0%	2.0%

Appendix 3: OBAC preliminary input to the timber supply review process in the Prince George TSA

PILOT PROJECT

PRELIMINARY INPUT TO THE ALLOWABLE ANNUAL CUT DETERMINATION FOR THE PRINCE GEORGE TIMBER SUPPLY AREA (TSA)

From the

Omineca Beetle Action Coalition (OBAC)

July 2009

NOTE: The following information has been summarized or interpreted from work done during the development of sector strategies for the Omineca Region. It is provided as preliminary input, and should not be interpreted as the official position of the OBAC, its directors or member local governments.

The following general AAC relevant objectives were identified in the OBAC Future Forest Products and Fiber Use Strategy and Alternative Energy Sector Strategy. It is expected that the tourism and agriculture strategies may also have relevant objectives however they will not be complete until June 2009:

- Increase community benefits (e.g., jobs) from forest resources.
- Diversify and strengthen the sector.
- Ensure the forest is managed to meet both present and future needs and opportunities.
- Make use of available fiber, including fiber resulting from the Mountain Pine Beetle epidemic to produce bioenergy.

A number of specific more recommendations have arisen in the strategy documents and related work, and are summarized below for consideration:

1. Partitioning and/or scheduling the harvest so that:
   a) dead pine is emphasized in the short-term and other species are held for the medium-term to the extent possible;
   b) in the implementation of (a), the impacts on business certainty for tourism and other forest resources users is taken into account;
   c) notwithstanding (a), providing for access to a mix of species to support diversity in the forest products industry;
   d) the assumed shelf-life of dead pine includes utilization for non-traditional products (e.g., bioenergy);

e) the expected downward transition from the current salvage level AAC is gradual and leaves room for market fluctuations and opportunities, industry adjustment and diversification, and community transition;
f) in the medium term the industry is encouraged to utilize species that have traditionally been lower value (e.g., balsam and hardwoods);
g) subject to (a), the allowable harvest volume is distributed geographically in a manner more-or-less commensurate with the inventory of each supply block (in other words, encourage a distributed cut across the entire TSA); and
h) the rate and pattern of harvest takes into account transportation infrastructure constraints and opportunities.

2. Applying silviculture assumptions[29] that include one or more scenarios:
   a) reflecting immediate stocking /restocking of all beetle-killed stands within the operable land base;
   b) reflecting enhanced (intensive) silviculture treatments of existing juvenile stands with measures that could bring their harvest forward in time and reduce the expected mid-term fall-down;
   c) involving a significant percentage of reforestation with short rotation species; and
   d) using a portion of the forest land base for multiple crops through agroforestry practices.

3. Applying utilization assumptions[30] that include one or more scenarios:
   a) for utilization of roadside "waste" and other accessible biomass that is potentially suitable for bioenergy production and other fiber-based opportunities; and
   b) active management of some riparian areas or other constrained areas (e.g., VQAs) for multiple values, including timber.

The OBAC work also points to a number of factors that should be considered for future administration of the AAC, and could be identified at this time as work to be done in the ensuing five-year period:

1. Developing area-based approaches to administration of AAC for possible future application.
2. Ensuring multiple forest resource inventories are complete and up to date so that government and businesses can plan how to best utilize the available raw material for both conventional and non-conventional products.
3. Improved planning and more concise resource objectives at the landscape level to enable effective integration and optimization of resource uses.

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[29] It is recognized that the Chief Forester does not set silviculture policy or program funding through the AAC determination process however it is important to understand the impact on mid to long-term supply of status-quo versus more aggressive silviculture policies.

[30] It is recognized that utilization is a function of both policy and economics that are not directly within the control of the Chief Forester or the AAC determination process, however such information is important to informing policy and business decisions.

4. Evaluation of the impacts of MPB on Land and Resource Management Plans, including any required updating of values and objectives.
5. Analysis of the long-term applicability of current TSA boundaries relative to community resilience, transportation patterns, consolidation of commodity businesses, aspirations to diversify the industry, optimal use of raw materials and other possible factors.

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8.4 Risks to Landscape Level Biodiversity associated with Mid-term Timber supply analysis

Input into Prince George Timber Supply Area Mid-Term Timber Supply Technical Report

Risks to Landscape Level Biodiversity

November 2011

Omineca Region, Ministry of Forests, Lands and Natural Resource Operations

I. Introduction

A. Definition of biodiversity:

"Biological diversity (or biodiversity) is the diversity of plants, animals and other living organisms in all their forms and levels of organization, and includes the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them." (*Forest Practices Code Biodiversity Guidebook – September 1995*)

B. Methods to manage for biodiversity:

A biodiversity management approach that provides suitable habitat conditions for all native species uses habitat diversity as a surrogate to maintain biodiversity. This is based on the underlying assumption that the more that managed forests resemble the forests that were established from natural disturbances, the greater the probability that all native species and ecological processes will be maintained. Planning to maintain biodiversity occurs at a variety of levels and scales. (*Forest Practices Code Biodiversity Guidebook – September 1995*)

1. Coarse Filter or Landscape Level approach

"Developing a biodiversity strategy that is based on a variety of management strategies for individual species is neither feasible nor effective. The impact of forest management practices on many species is unknown and certain practices that benefit some species are often detrimental to others. Recommended instead is the development of an ecosystem management approach that provides suitable habitat conditions for all native species. The underlying assumption with this approach is that all native species and ecological processes are more likely to be maintained if managed forests are made to resemble those forest created by the activities of natural disturbance agents such as fire, wind insects and disease." (*Forest Practices Code Biodiversity Guidebook – September 1995*)
The coarse filter approach:
Protects ecosystem function and provides for a broad range of habitats for a broad range of species.

The *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area October 2004* is an example of a coarse filter approach to biodiversity management.

2. Fine Filter or Species Specific approach:

"The fine filter approach protects the critical habitat for species' needs. This approach is necessary where practices at the forest-level (coarse-filter practices), do not meet the needs of a particular species or a unique vegetation community." (Ministry of Forests and Range Biodiversity Training Module).

Designated Ungulate Winter Range for Mountain Caribou is an example of a fine filter or species specific approach to biodiversity management.

Red and Blue Listed Species supported by Old Forests:

Species and ecological communities that are endangered or of concern, are assigned to the Red and Blue list by the British Columbia Conservation Data Centre. As well, the Lieutenant Governor in Council may designate a species as an endangered species pursuant to section 6 of the Wildlife Act.

A number of species and ecological communities (plant associations) in the Prince George Timber Supply Area are on the Red and Blue list and some of them are supported by old forests (Table 1). Some of these species have critical habitat designations (e.g. Ungulate Winter Range for Mountain Caribou). Others species, such as fisher, wolverine and grizzly bear, do not have critical habitat designations, at this time. These species depend on coarse filter or landscape level approaches to biodiversity management. Timber supply mitigation strategies that reduce old forest requirements could put these species at further risk.

It should be noted that there are other species which are currently not listed or are yellow listed (i.e. currently secure) species which are potentially impacted by loss of old growth and / or are dependent on old growth stands with interior forest conditions.

The terms Red List and Blue List are defined below.

Red List: List of ecological communities, and indigenous species and subspecies that are extirpated, endangered or threatened in British Columbia. Red-listed species and sub-species may be legally designated as, or may be considered candidates for legal designations as Extirpated, Endangered or Threatened under the *Wildlife Act*.

Blue List: List of ecological communities, and indigenous species and subspecies of special concern (formerly vulnerable) in British Columbia.

Table 1: Red and Blue Listed Species supported by old forest within the Prince George TSA

Species	Listing	Key Points
Mountain Caribou	Red Listed	• need to maintain old forests with arboreal lichen forage • creation of early seral conditions favours other ungulates, creating a prey-base for wolves, which in turn has predation impacts on mountain caribou populations • an increase in the amount of early seral habitat will increase risks to caribou • government commitment for protection and maintenance of mountain caribou habitat characteristics (no road building and no timber harvesting) associated with Mt Caribou Recovery Implementation Plan (MOE, 2007) • The *Conservation Framework lists mountain caribou as a high priority species (priority 1), for which habitat protection is a recommended action.
Western Red Cedar/Devil's Club/ Ostrich Fern	Red Listed Plant Association	• Western Red Cedar/Devil's Club/Ostrich Fern is only found in the ICHvk2 (Prince George District) in mature forests (more structurally complex stands usually >150 yrs & old forest (>250 yrs). • Connectivity of old forest habitat is a serious

		conservation issue, especially along the major riparian corridors where this plant community occurs • OGMAs may protect some occurrences; where possible protecting remaining occurrences through placement of spatial OGMAs is a strategic management recommendation • The *Conservation Framework lists Western Red Cedar/Devil's Club/Ostrich Fern as a high priority (priority 1), for which ecosystem protection is a recommended action.
Hybrid White Spruce/ Ostrich Fern	Red Listed Plant Association	• Hybrid White Spruce/Ostrich Fern is restricted to the SBSmh (a small subzone in the central interior). • Although widespread, this small, linear ecosystem is uncommon within a localized range. It has been seriously depleted and old and mature stands continue to decline in distribution. • Connectivity of old forest habitat in the subzone is a serious conservation issue • OGMAs may protect some occurrences; where possible protecting remaining occurrences through placement of spatial OGMAs is a strategic management recommendation • The *Conservation Framework lists Hybrid white Spruce/Ostrich Fern as a high priority (priority 1), for which ecosystem protection is a recommended action.
Northern Caribou	Federally threatened	• need to maintain old forests with arboreal and terrestrial lichen forage. Low elevation pine lichen winter ranges occur on sites between 70 and 140 yrs (lodgepole pine). High elevation winter range support arboreal lichens generally in stands > 120 yrs old (sub-alpine fir). • creation of early seral conditions favours other ungulates, creating a prey-base for wolves, which in turn has predation impacts on northern caribou populations • an increase in the amount of early seral habitat will increase risks to caribou • Northern caribou herds within Ft St James FD have been designated as Threatened by the Federal government (likely to become endangered if nothing is done to reverse the factors leading to extirpation or extinction)

		• The *Conservation Framework lists northern caribou as a high priority species for which habitat protection and restoration are recommended actions.
Fisher	Blue Listed	• Fisher habitat use is associated with mature and old forest where structural characteristics provide resting and maternal denning habitat (i.e. retention of large trees, dense canopies, and abundant levels of coarse woody debris) • Fisher need low elevation riparian systems with older forest characteristics and connectivity for functional habitat • old forest retention is required for fisher habitat conservation • The *Conservation Framework lists fisher as a high priority species for which habitat protection and restoration are recommended actions.
Wolverine	Blue Listed	• Wolverine are widely distributed (at low densities), and can occur in all biogeoclimatic zones from valley bottoms to alpine meadows, although they do spend substantial time moving through mature and old forest structural stages. In the Omineca region Lofroth (2001) reported that at least 50% of the locations of radio-tagged wolverines were in late successional stands and they had relatively little use of mid-successional stands. • The cumulative impacts of habitat alternations, forest harvesting, and forest access on wolverine populations are not well understood. Although wolverines are not widely reported to be a habitat specialist, habitat loss is thought to be a major contributing factor to population declines. The major habitat threat is the large-scale conversion of mature and old forest structural stages into early structural stage habitats. • Effective management of wolverine habitat needs to occur at the landscape spatial scale. • The *Conservation Framework lists wolverine as a high priority species, for which habitat protection is a recommended action.
Bull Trout	Blue Listed	• The maintenance of riparian forests is very important in maintaining the integrity of bull trout habitat. The forest structural stage surrounding streams may play an

		important role - generally, natural structural stages produce more large woody debris, more sediment trapping & storage, more nutrient cycling, more fish habitat structure, and more temperature regulation than younger seral stages. • OGMAs and general maintenance of mature and old forests may help maintain habitat for Bull Trout.
Grizzly Bear	Blue Listed	• Grizzly bears are wide ranging, occurring in most broad ecosystem units at various elevations. They are <u>not</u> solely dependent upon old forests, but they are supported by a variety of forest types and a variety of structural stages that in places includes old seral stages. They show site fidelity, meaning they usually return to the same seasonal food sources and areas throughout their lifetimes, which in some locations encompasses old forests. Related to forest operations, habitat fragmentation and increased access from roads are of more relevance in terms of habitat conservation then actual maintenance of old stands. • Grizzly bears experience increased mortality with increased road density and human interactions • The *Conservation Framework lists grizzly bear as a high priority species for which habitat protection and restoration are recommended actions.

Table notes: * The Conservation Framework was produced by Ministry of Environment in 2009 (Cabinet endorsed document). It is a set of science-based decision support tools to help prioritize species and ecosystems conservation work, and to determine the most appropriate and effective management actions.

- The species in the above table are only those Provincially Red or Blue listed, <u>and</u> are Identified Wildlife (species at risk or regionally important wildlife that may be adversely impacted by forest or range practices), <u>and</u> are supported by old growth.
- The primary source of "Key Points" above has been adapted from IWMS Species Accounts, and Conservation Framework summary reports (refer to Reference section)

D. Stewardship and Sustainability Backdrop

The Association of British Columbia Forest Professionals states that stewardship involves "balancing present and future values against the capacity of the land to provide for those values". These values include social and economic interests, such as a mill's fibre supply and a community's economic stability. They also include environmental values such as healthy watersheds and wildlife habitat. The extent to which all of these often competing values and interests can be provided for is a challenge that requires careful consideration. To achieve stewardship, the interests of society must be balanced against any environmental impacts so that the forest resource can be sustained across

the land and for future generations. Decisions that provide benefits in the present can only be sustainable if they allow for future options to be kept open. This ensures a resilient forest resource, healthy ecosystems, and stable communities in the long term. Land managers must use the best knowledge, science and expertise available so that they can adequately understand the implications of the issues they face. This allows for the creation of well-crafted decisions that can achieve stewardship. (Principles of Stewardship of Forests, Forest Lands, Forest Resources and Forest Ecosystems {Draft}, Association of BC Forest Professionals, June 2001).

II. Background on Prince George Timber Supply Area Landscape Biodiversity Order

A. Ecological foundation – Natural Range of Variability:

One of the most important goals of managing forests in an ecologically sustainable way is through the conservation of biological diversity (Hilbert 2003; Lindenmayer et al. 2002; Fahrig 2001; Angelstam 1997). Natural disturbance events play a critical role in forested ecosystems, as they create the patterns, shapes, sizes and structure evident at various scales over time. A widely accepted concept, embraced by many ecologists, conservation biologists and resource managers is that ecological integrity is dependent on forest management strategies that are more characteristic of natural disturbance patterns and regimes. Old forests resulting from natural disturbance contains biological legacies that include specific organisms, structures and patterns (Franklin et al. 2000).

There is a large body of literature available that substantiates the theory of managing the landscape based on the natural disturbance processes or the natural range of variability. Some of this literature includes Grumbine 1994; Bunnell 1995 & 1991; Bergeron et al. 1999; Brussard 1998; DeLong 1998; Angelstam 1998 & 1997; Landres et al. 1999; Swentnam et al. 1999; Lindenmayer and Franklin 2002; Lindenmayer 2004, 2002 & 1999; Purdon,2003; Wong et al. 2003.

In 2002, Craig DeLong, Regional Ecologist for Ministry of Forests and Range, researched and authored a paper titled *Natural Disturbance Units of the Prince George Forest Region: Guidance for Sustainable Forest Management.* The information in the 2002 document was published in 2010 as *Technical Report 059 - Land units and benchmarks for developing natural disturbance-based forest management guidance for northeastern British Columbia*.

Key excerpts of the DeLong, 2002, document are provided below:

"Within the Prince George Forest Region a number of studies have investigated particular aspects of natural disturbance (e.g., DeLong 1998, DeLong and Kessler 2000, Lewis and Lindgren 2000, Rogeau 2001). This document is meant to present updated guidance for the Prince George Forest Region based on this new information."

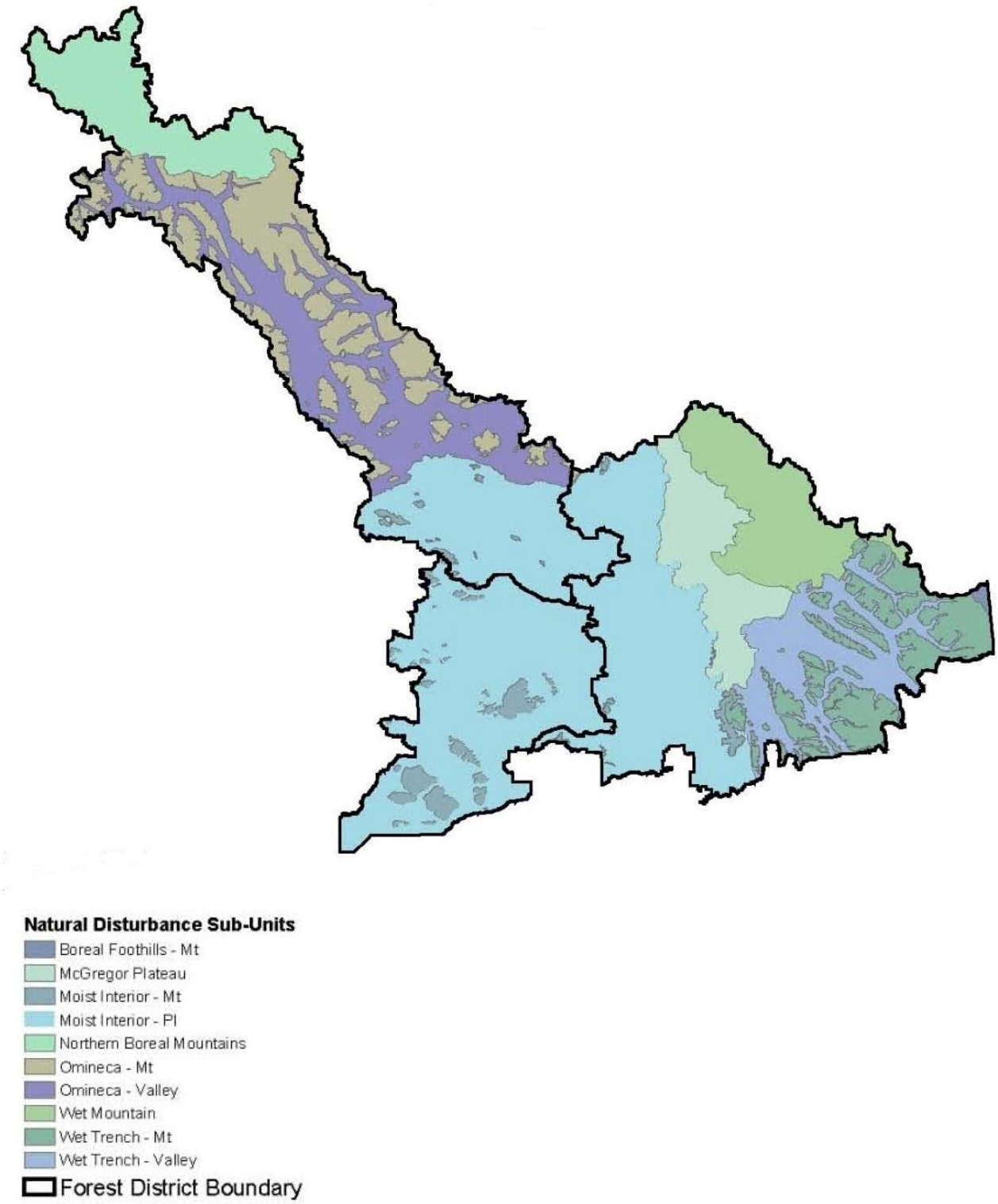
"It is recognized that forests with "old growth characteristics" such as large diameter trees, snags, complex canopy structure are what we are trying to manage for on the landscape. Old growth characteristics and age are not always well correlated but in a recent study in Robson Valley Forest District (Burton et al., unpublished report) it was found that mapped forest age class is generally well correlated with functionally important old forest characteristics. Therefore until there is an improved means of efficiently mapping old forest structure over large areas, targets recommended in this document are based on forest cover age class."

"The Natural Range of Variability for different age forests for each Natural Disturbance Unit was determined using estimated fire cycles and a simulation model. Fire cycles for each Natural Disturbance Unit were either obtained directly from the literature if local data was available or if not then from adjacent forested landscapes that were felt to have a similar disturbance history."

Table 2: Natural Range of Variability Old Forest Retention as recommended in the Natural Disturbance Unit Science (DeLong 2002 & 2011)

Forest District	Natural Disturbance Units (NDU's)	Natural Range of Variability (NRV) for Old Forest Retention – percent of forest >140 yrs
Vanderhoof	Moist Interior - Plateau	17-33
	Moist Interior - Mtn	41-61
Prince George	Wet Trench - Valley	76-84
	Wet Trench - Mtn	80-88
	Moist Interior - Plateau	17-33
	Moist Interior - Mtn	41-61
	McGregor Plateau	43-61
	Wet Mountain	84-89
Fort St. James	Moist Interior - Mtn	41-61
	Moist Interior - Plateau	17-33
	Omineca - Valley	23-40
	Omineca – Mtn.	58-69
	Northern Boreal Mountain	37-60

Map 1. Natural Disturbance Units and Sub-Units of the Prince George Timber Supply Area.



B. Managing Using Best Available Science

Best Management Practices established under the Forest and Range Practices Act requires that management be based on the best available science (BC Ministry of Forests and Range, 2008). In a memorandum dated April 29, 2002 (Appendix 1) and addressed to all District Managers in the Prince George Forest Region, the Natural Range of Variability information was formally endorsed and supported by the Regional Managers of the Ministry of Sustainable Resource Management and the Ministry of Forests, as the best information available. Other published research specifically focussing on management in the PG TSA pertaining to quality of "old Growth Forest" and associated old and natural forest attributes includes: DeLong et al. 2004; Mackillop and Holt 2004; DeLong et al. 2005; Densmore and Linnell Nemec 2006; Stevenson et al. 2006; DeLong et al. 2008; and, Heemskerk et al. 2008.

C. Process to develop the Landscape Biodiversity Order (for the Prince George Timber Supply Area)

1. The Landscape Objective Working Group

The Landscape Objectives Working Group (LOWG) was brought together in September 2002 and was a committee consisting of representatives from PG TSA timber licensees, the Ministry of Sustainable Resource Management (MSRM) and the Ministry of Forests Regional Ecologist. The goal of this group was to develop recommended objectives for landscape level biodiversity using science-based research regarding the Natural Range of Variability.

The Landscape Objective Working Group met over approximately two years, discussed and eventually agreed to a recommended set of objectives that included old forest retention requirements, old interior forest requirements and a demonstrated trend toward young forest patch size distribution. Timber supply analysis was conducted by a consultant and 13 scenarios were explored for their ability to manage for landscape biodiversity and minimize timber supply impacts. The 13th scenario was the basis for the established order. It was a negotiated outcome that attempted to balance the use of natural range of variability to manage landscape biodiversity values and the timber supply impacts. Additional information about the negotiated outcome of the Order and its perceived risks to landscape level biodiversity can be found in Section III.B Mid-term Mitigation Base Case: Prince George TSA Old Growth Order.

2. Academic and Peer Review

On November 26th, 2003, MSRM hosted a forum where the LOWG process was formally presented to academia and resource management professionals (in government and industry), fluent in the principles of biodiversity management and landscape ecology. Through the identification of strengthens and weakness in the research and process, the information gained from the session was used by the LOWG committee to revise process assumptions and rationales.

3. Process for Establishment (and Cancelling and Significantly Amending)

The *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area – October 20, 2004* was established pursuant to section 4(1) and 4(2) of the Forest Practices Code of British Columbia. It was signed-off by the Regional Director of the Ministry of Sustainable Resource

Management. For the purposes of the Forest and Range Practices Act, all forest stewardship plans submitted after the effective date of the Order must be consistent with the Order.

A formal 60 day public review and comment phase was initiated by MSRM in March, 2004 to invite comments and feedback. All comments received were reviewed and a document that outlines all comments received and how those comments were considered was prepared, made available to the Decision Maker and interested parties. During the 60 day public review period, MSRM hosted a series of Public Open Houses to facilitate the exchange of information between the LOWG participants and people interested in the recommended objectives.

During the development of the Order engagement with First Nations was pursued. Formal consultation was initiated in February of 2004. The information regarding the consultation was made available to and considered by the Decision Maker prior to establishment.

The Order and Implementation Policy can be found at:
http://archive.ilmb.gov.bc.ca/slrp/srmp/north/prince_george_tsa/pg_tsa_biodiversity_order.pdf

Establishing or significantly amending a land use objective is now regulated by the Land Use Objectives Regulation. The delegated decision maker is the Regional Executive Director of the Ministry of Forests, Lands and Natural Resource Operations.

The process for establishing or significantly amending a land use objective is outlined below.

- The decision maker must consider information that is contained in a land use plan that is endorsed by the Executive Council and that relates to the area, or is relevant to the management and use of the forest and range resources within the area.
- The decision maker must be satisfied that the establishment or significant amendment of a land use objective will provide for management and use of forest or range resources in a manner that has not otherwise been provided for under this regulation or another enactment, provide for an appropriate balance of social, economic and environmental benefits and the importance of the establishment or significant amendment of a land use objective outweighs any adverse impact on opportunities for timber harvesting or forage use within or adjacent to the area that will be affected.
- The decision maker must consider any written comment received.
- Orders must be made available for 60 days public review and comment.
- A holder of a forest stewardship plan, woodlot licence plan, range use plan or range stewardship plan must be consulted by an official of the ministry, if the establishment or significant amendment of a land use objective, would have a material adverse impact on the holder or the holder gives written notice requesting consultation.

III. Analysis of Risks to Landscape Level Biodiversity for different Timber Supply Scenarios

A. Explanation of Risk Analysis Methodology

Two methods of providing impacts to landscape biodiversity were used:

1. environmental risk assessment using different percentages of the minimum range of natural variability, and,
2. Additional data was provided by the timber supply analyst for five of the scenarios. For Scenario 2.1, 2.2, 2.3, 3.3 and 3.4 data was provided to indicate which merged biogeoclimatic units (mBEC) would be most impacted, if future harvesting occurs consistent with the assumptions in the timber supply model.

1. Environmental risk assessment based on percent of Natural Range of Variability

To estimate levels of risk to coarse filter biodiversity, an environmental risk assessment has been developed (Holt & Sutherland 2003). The primary indicator of risk for each ecosystem was a comparison between predicted natural abundance of old forest and that from the modeling scenario, at multiple time periods.

The Natural Range of Variability research and "measures of risk" thresholds was presented by Water Land and Air protection (WLAP) to the Chief Forester during the 2002 Prince George TSA Timber Supply Review II, as a means to quantify when biodiversity is at risk. It was noted at that time "This environmental analysis uses the amount of old forest in comparison to NRV iterations as a coarse filter indicator of ecological integrity."

Based on information from several examples (Holt & Sutherland 2003; Holt & Utzig 2002; and, Angelstam 1997), acknowledging the likelihood of variability, Table 3 outlines a set of risk classes for natural range of variability.

Table 3. Categories of Risk to Biodiversity

Percent of NRV - for old forest	Risk Class
70-100	low
30-70	moderate
0-30	high

For example, if the NRV research indicated that 20% of a unit would be >140 years old in a naturally occurring forest, then the "risk to landscape biodiversity" would be low if the percent of the old forest in the Crown Forest Landbase was 14-20%; moderate if it was 6-14%; and, high if it was 0-6%.

2. Timber Supply Analysis indicating Merged BEC units at Risk

Additional data was provided by the timber supply analyst, for Scenario 2.1, 2.2, 2.3, 3.3 and 3.4. Table 5, below, assists us to understand what may happen to different geographic areas of the Prince George Timber Supply Area, if the timber supply model accurately predicts where timber

would be harvested in the future. Therefore, in addition to the general comments about high, moderate and low risks to landscape level / coarse filter biodiversity given how close we manage to the natural range of variability, we can add some detail about certain units likely to be at greater risk.

The units that are at greater risk, according to the timber supply model, are in the Prince George Forest District. Depending on the scenario there are likely 6-9 units, in approximately 2050, which will face most harvesting pressure and move further away from the NRV thresholds currently in the PG TSA Landscape Biodiversity Order and believed necessary to maintain acceptable risks to landscape level / coarse filter biodiversity values.

Maps 2 - 5 illustrate which geographic areas (merged BEC units) are indicated to be at risk in the mid-term based on 4 scenarios.

B. Risks to Landscape Level Biodiversity of Timber Supply Scenarios

The Mid Term Timber Supply analysis was run for 8 comparative scenarios. Four scenarios assessed different possible ways to manage landscape biodiversity, including no landscape biodiversity (Scenario 2.1-2.4). Four scenarios compared the impacts of managing to different percentages of NRV (Scenario 3.1-3.4 or 100%, 70%, 50% and 30% NRV).

It is very important to understand the risks to landscape level biodiversity inherent in the Mid-term Mitigation Base Case (the PG TSA Order).

Mid-term Mitigation Base Case: Prince George TSA Old Growth Order

The Mid-term Mitigation Base Case used the *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area – October 20, 2004* as the basis for biodiversity modelling assumptions.

There are five important items to note regarding the analysis of the Base Case for landscape biodiversity management implications:

1. For comparison to the NRV scenarios it is important to note that the negotiated outcome of the Order meant that 16 merged BEC units are at 100% of the minimum NRV, 23 units are at 70% of the minimum NRV, 7 units are at 60 % of the minimum NRV and 3 units are below 60% of the minimum NRV. Those that are below the 60% were deemed acceptable based on similar ecological characteristics of adjacent units. This decision was made under the professional guidance of the Regional Ecologist, Craig DeLong.

2. Also, important to note that Section D of the Order "Contributions, Interpretations and Alternatives" contains a clause:
   "D.3. Epidemic or Catastrophic Events: A representative portion of stands that have been affected by an epidemic or catastrophic event may contribute to meeting the Old Forest Retention and the Old Interior Forest objectives. Due to the current Mountain Pine Beetle epidemic, licensees and BC Timber Sales must ensure a representative portion of stands that

have not been affected by the epidemic (i.e. non-pine forest) are used to meet the Old Forest Retention and the Old Interior Forest objectives."

This clause was accounted for in the Base Case analysis by determining the amount of non-pine in the merged BEC units and allowing the model to use those percentage targets instead of the targets identified in the established Order.

3. Section D of the Order "Contributions, Interpretations and Alternatives" contains two other clauses:
   "D.4. A Portion of Younger Age Classes
   Where it can be demonstrated that equal or better conservation benefits would result, up to 20% of the Old Forest Retention and Old Interior Forest objectives may be comprised of younger age classes.
   D.5. Alternatives to the Order
   Where either the old forest retention or the old interior forest objectives cannot be achieved, with consideration of the timely and economic harvesting of timber rights, then a recruitment strategy must be submitted and complied with. ..."

   These clauses were not accounted for in the Base Case analysis.

4. When developing the Order in 2002-4, the timber supply analysis and negotiations was conducted using the minimum NRV. An example to illustrate this is the Moist Interior - Mountain Natural Disturbance Unit indicates that in a natural state the landbase would have had between 41 and 61 % of the forest in stands greater than 140 years old. Hence for this unit, it was the 41% that was used if we were assuming 100% of NRV. This was one way that timber supply impacts were mitigated when the Order was developed.

5. Although the NRV research was based on all units >140 years the old forest was defined (in the Implementation Policy for the Order) as >140 years old for all units except Moist Interior – Plateau, some SBS units in the Omineca Valley and McGregor Plateau where old was defined as 120 years old. This was another one way that timber supply impacts were mitigated when the Order was developed.

Scenario 2.1: Turn off the Prince George TSA Old Growth Order

The intent of the PG TSA Landscape Biodiversity Order was to balance the requirements of economic and environmental sustainability while considering the impacts of the mountain pine beetle.

By turning off the Prince George TSA Landscape Old Growth Order, there is a risk to the values managed through the coarse filter (i.e. "ecosystem function and the habitats for a broad range of species"). At highest and most immediate risk are those species and plant associations supported by old growth habitats and structures. Also, at high risk are certain geographic areas.

Based on the risk classes (identified in Section IV.A, above), if the landscape is allowed to be managed by turning off the Prince George TSA Landscape Old Growth Order (or 0% of the Natural Range of Variability), the relative comparison of risks to landscape level biodiversity is very high.

In some mBEC units, the old forest targets are currently attainable from the non-contributing forested land base. In these units there is less risk to biodiversity by removing the old forest targets. Many of these units have low timber values and / or are far from processing facilities. It should be noted that the contributing and non-contributing definition is mostly based on economic criteria and will change over time.

Additional biodiversity risk information is available through the data provided by the timber analyst (summary of data provided in Table 5). It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be two mBEC unit impacted to a relatively moderate level and in 2058 there may be 6 mBEC units impacted to a relatively high level. The two Interior Cedar Hemlock units in the Prince George District are included in the units likely to be impacted. Map 2 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Administration Notes: The existing Order has been in place since 2004 and was established using best available science and a 2 year process that involved government, forest industry, public review and comment which expended considered financial resources on timber supply and ecological analysis. To "turn off" the PG TSA Order would require the process outlined in Section II.C.3 to be followed and would require significant time and resources.

Scenario 2.2: Prince George TSA Old Growth Order where the definition of 'old forest age' is reduced by 20 years

The scenario to reduce the definition of old forest by 20 years, from that currently in place with the PG TSA Order, is challenging to assess for risk to biodiversity. This partially because the existing Order is applied over a very large area, in a non-spatial process, so it is difficult to assess how lowering the definition of age will impact old growth attributes. Stand age is used as a surrogate for the multitude of attributes that make up old growth. Ground-based assessments across the TSA would be required to accurately assess the impact to management of old growth attributes. It is anticipated that large snags and large live trees are the particular old growth attributes most at risk by lowering the definition of old forest.

Regarding the two methods of providing impacts to landscape biodiversity, outlined above, the relative comparison of risks to landscape level biodiversity for this scenario is challenging because the relationship to NRV is unclear.

The second method, however, provides additional risk information through the data provided by the timber analyst. It is included in Table 5 and indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be one mBEC unit impacted to a relatively low level and in 2058 there may be 6 mBEC units impacted to a relatively moderate level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. Map 3 illustrates the mBEC units, which the timber supply model indicates will be most impacted regarding risks to landscape level / coarse filter biodiversity values.

Administration Notes: The definition of old is contained in the Implementation Policy that has been attached to the PG TSA Order since establishment. It is not legally binding and it is anticipated that amendment of the Implementation Policy would be administratively easier than amending the Order.

Scenario 2.3: Replace the Prince George TSA Old Growth Order with the Provincial Old Growth Order

The *Order Establishing Provincial Non-Spatial Old Growth Objectives* was established June 30, 2004. For the PG TSA, it was replaced by the PG TSA Order in October 2004. As previously documented in this report, the PG TSA Order was based on best available local science. Deviating from best available science, increases risk to maintenance of landscape biodiversity.

In addition, the Provincial Old Growth Order allowed for "landscape units with a low biodiversity emphasis, to be reduced by up to 2/3, to the extent necessary to address impacts on timber supply". To allow a drawdown of targets, in the low Biodiversity Emphasis Option units, would provide additional risk to landscape biodiversity.

Table 4: Simplistic Comparison of the Provincial Old Growth Order (June 2004) and the PG TSA Landscape Biodiversity Order (October 2004)

Provincial Old Growth Order			**PG TSA Landscape Biodiversity Objectives for Old Forest Retention**		
Biogeoclimatic Zone	**Age of Old Forest**	**Percent Old Forest Retention Range**	**Biogeoclimatic Zone**	**Age of Old Forest**	**Percent Old Forest Retention Range**
BWBS	> 140 yrs	11-16	BWBS	> 120 yrs	16
ESSF	> 250 yrs	9-28	ESSF	> 140 yrs	29-84
ICH	> 250 yrs	9-19	ICH	> 140 yrs	23-53
SBPS	> 140 yrs	7-10	SBPS	> 120 yrs	17
SBS	> 140 & 250 yrs	9-16	SBS	> 120 and 140 yrs	12-50

(source: *Background Information and Supporting Documentation for the Process Involved in Developing the Recommended Biodiversity Objectives in the PG TSA*, Prepared by: Ministry of Sustainable Resource Management, April 2004 (revised December 2005)

It should be noted that the size and number of units with the Provincial Order is significantly different. There are many more units and the units are usually much smaller. This could add to the complexity of managing to the Order and the cost of implementation and monitoring of the Order.

Additional risk information is available through the data provided by the timber analyst and is included in Table 5. It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be two mBEC unit impacted to a relatively moderate level and in 2058 there may be 9 mBEC units impacted to a relatively high level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. Map 4 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Administration Notes: To Replace the PG TSA Order with the Provincial Order would be considered cancelling the Order. To cancel the PG TSA Order would require the process outlined in Section II.C.3 to be followed and would require significant time and resources.

Scenario 2.4: Prince George TSA order with requirements based Table 1-3 of the Order (no application of Section D.3 of the Order)

The PGTSA Order included the following:
"D.3. Epidemic or Catastrophic Events
A representative portion of stands that have been affected by an epidemic or catastrophic event may contribute to meeting the Old Forest Retention and the Old Interior Forest objectives. Due to the current Mountain Pine Beetle epidemic, licensees and BC Timber Sales must ensure a representative portion of stands that have not been affected by the epidemic (i.e. non-pine forest) are used to meet the Old Forest Retention and the Old Interior Forest objectives."

The above clause is in the Order to balance the economic and ecological values available with the "non-pine" mature and old forest, especially through the mid-term period. If dead pine stands are not allowed to contribute to the old forest objectives, in a representative portion to the amount of dead pine in the mBEC units, then there will be additional impact to timber supply. There is a need to identify a method to track the areas of dead pine being used to contribute to the old forest objectives. This is an outstanding issue around the implementation of the PG TSA Order.

Administration Notes: To change the Order and remove Section D.3 (and therefore require the targets in Table 1-3 of the Order to be strictly adhered to), the PG TSA Order would need to be amended. This may or may not be considered a significant amendment and therefore, the process outlined in Section II.C.3 may or may not be required.

Scenario 3.1: 100% of minimum Natural Range of Variability

Based on the risk classes (identified in Section IV.A, above), if the landscape is managed to maintain the Natural Range of Variability to 100% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is very low. This scenario would represent a reduced risk to landscape biodiversity than is currently in place with the PG TSA Order.

Scenario 3.2: 70% of minimum Natural Range of Variability

Based on the risk classes (identified in Section IV.A, above), if the landscape is managed to maintain the Natural Range of Variability to >70% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is low. This scenario may represent a reduced risk to landscape biodiversity than is currently in place with the PG TSA Order.

Scenario 3.3: 50% of minimum Natural Range of Variability

Based on the risk classes (identified in Section IV.A, above), if the landscape is managed to maintain the Natural Range of Variability >50% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is moderate.

Additional risk information is available through the data provided by the timber analyst and is included in Table 5. It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be one mBEC unit impacted to a relatively low level and in 2058 there may be 5 mBEC units impacted to a relatively moderate level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District.

Administration Notes: To significantly amend the Order would require the process outlined in Section II.C.3 to be followed.

Scenario 3.4: 30% of minimum Natural Range of Variability

If the landscape is managed to maintain the Natural Range of Variability to >30% the relative comparison of risks to landscape level (i.e. coarse filter) biodiversity is high.

Additional risk information is available through the data provided by the timber analyst and is included in Table 5. It indicates that, if future harvesting occurs consistent with the assumptions in the timber supply model, then in 2033 there may be two mBEC unit impacted to a relatively moderate level and in 2058 there may be 7 mBEC units impacted to a relatively high level. Included in the units likely to be impacted are the two Interior Cedar Hemlock units in the Prince George District. Map 3 illustrates the mBEC units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values.

Administration Notes: To significantly amend the Order would require the process outlined in Section II.C.3 to be followed.

Table 5: Indication of the merged Biogeoclimatic (mBEC) Units that will be below current thresholds set in the PG TSA Landscape Biodiversity Order (higher risk to biodiversity), if future harvesting occurs consistent with the assumptions in the timber supply model.

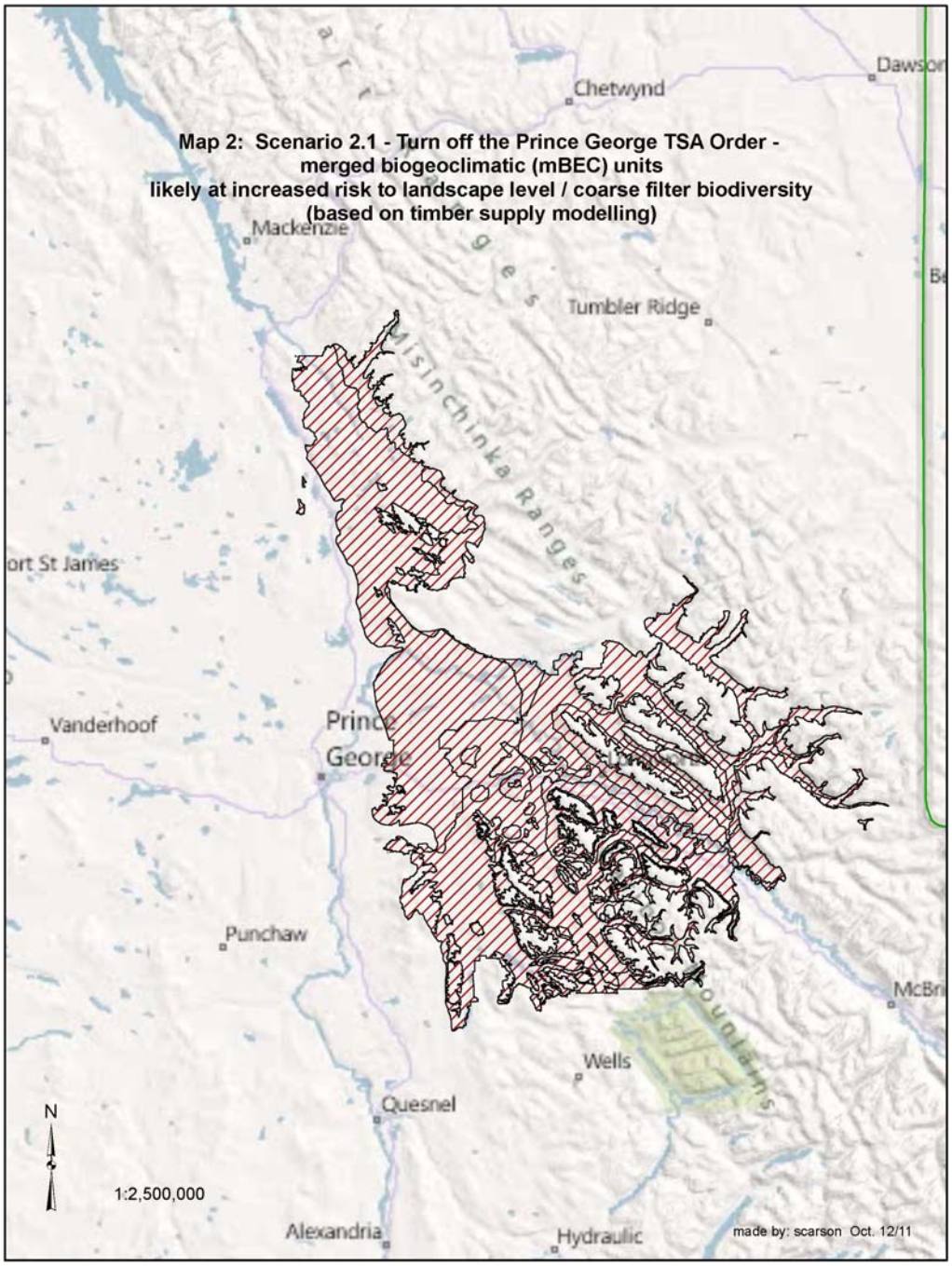
SCENARIO	2033		mBEC	2058		mBEC
	# units deficit	# ha deficit		# units deficit	# ha deficit	
Scenario 2.1 - Turn off Prince George TSA Order (using non-pine where it is noted and otherwise all species target)	2	-40,264	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1)	7	-101,859	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A16 (Wet Mtn – SBSwk1) • A21 (Wet Trench – Mtn – ESSFwk1) • A22 (Wet Trench – Valley – ICHwk3) • A23(Wet Trench – Valley – ICHvk2) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1) • A25 (Wet Trench – Valley – SBSvk)
Scenario 2.2 - Decrease the definition of old by 20 years (using non-pine where it is noted and otherwise all species target)	1	-1,920	• A4 (McGregor Plateau - SBSwk1 SBSvk)	6	-23,870	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A16 (Wet Mtn – SBSwk1) • A21 (Wet Trench – Mtn – ESSFwk1) • A22 (Wet Trench – Valley – ICHwk3) • A23(Wet Trench – Valley – ICHvk2) • A25 ((Wet Trench – Valley – SBSvk))
Scenario 2.3 - Provincial Old Growth Order	2	-39,700	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1)	9	-120,480	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A5 (Moist Interior – Mtn – ESSF) • A16 (Wet Mtn – SBSwk1) • A17 (Wet Mtn – SBSvk) • A21 (Wet Trench – Mtn – ESSFwk1) • A22 (Wet Trench – Valley – ICHwk3)

						• A23(Wet Trench – Valley – ICHvk2) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1) • A25 ((Wet Trench – Valley – SBSvk))

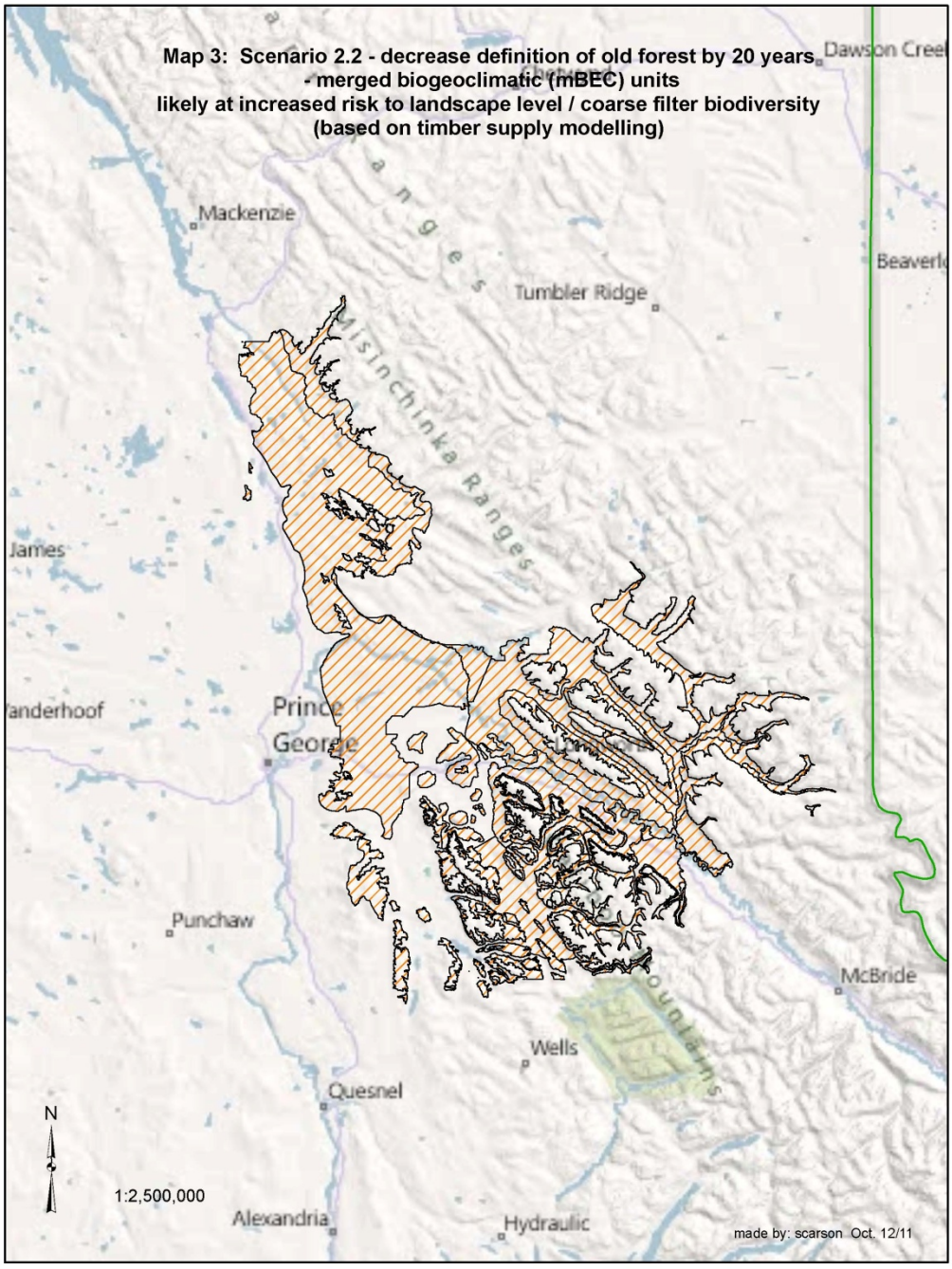
SCENARIO	2033		mBEC	2058		
Scenario 3.3 - 50% of the minimum Natural Range of Variability (using non-pine where it is noted and otherwise all species target)	1	-4,007	• A4 (McGregor Plateau - SBSwk1 SBSvk)	5	-36,802	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A21 (Wet Trench – Mtn – ESSFwk1) • A22 (Wet Trench – Valley – ICHwk3) • A23(Wet Trench – Valley – ICHvk2) • A25 (Wet Trench – Valley – SBSvk)
Scenario 3.4 - 30% of the minimum Natural Range of Variability (using non-pine where it is noted and otherwise all species target)	2	-23,480	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1)	7	-106,130	• A4 (McGregor Plateau - SBSwk1 SBSvk) • A17 (Wet Mtn – SBSvk) • A21 (Wet Trench – Mtn – ESSFwk1) • A22 (Wet Trench – Valley – ICHwk3) • A23(Wet Trench – Valley – ICHvk2) • A24 (Wet Trench - Valley - SBSwk1, SBSmw, SBSmk1) • A25 (Wet Trench – Valley – SBSvk)

Note: relative risk assumptions: 1,000 – 10,000 hectares = low; 10,000 – 50,000 hectares = moderate; >50,000 hectares = high

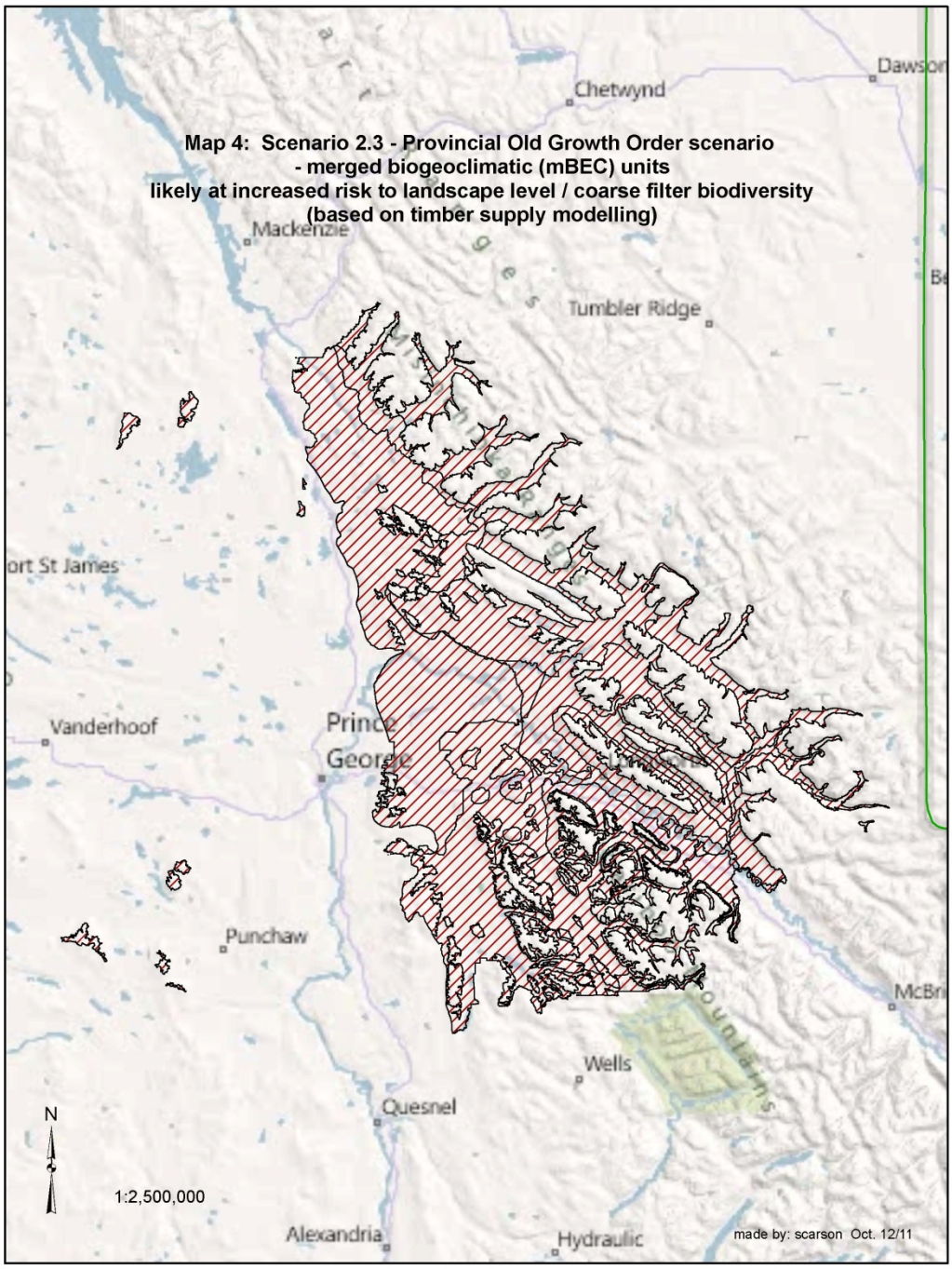
Map 2: Scenario 2.1 - Turn off Prince George TSA Order (using non-pine where it is noted and otherwise all species target) – 2058. Merged Biogeoclimatic units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values



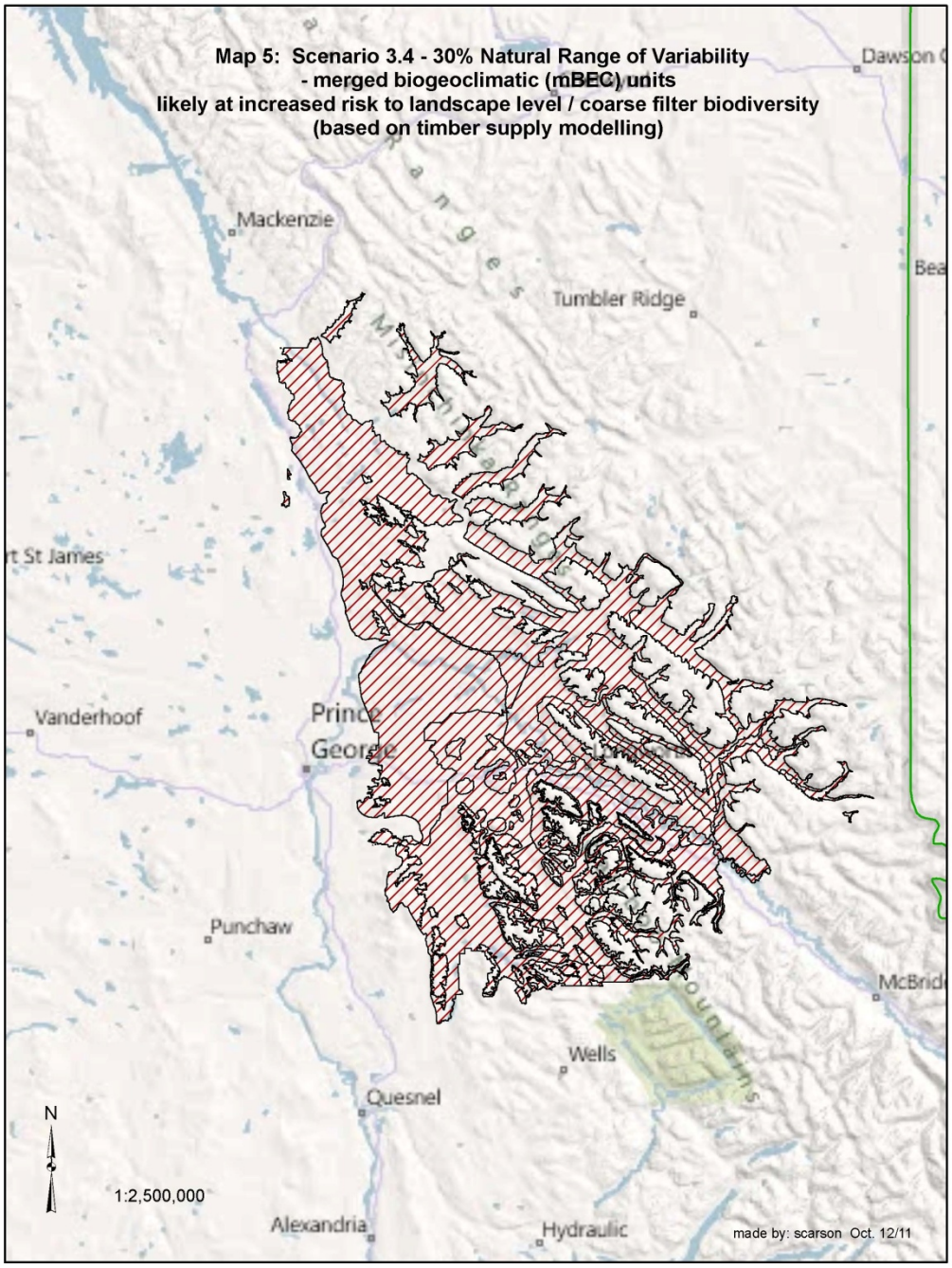
Map 3: Scenario 2.2 - Decrease the definition of old by 20 years (using non-pine where it is noted and otherwise all species target) – 2058. Merged Biogeoclimatic units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values



Map 4: Scenario 2.3 - Provincial Old Growth Order – 2058. Merged Biogeoclimatic units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values



Map 5: Scenario 3.4 - 30% of the minimum Natural Range of Variability (using non-pine where it is noted and otherwise all species target) – 2058. Merged Biogeoclimatic units, which the timber supply model indicates will be, most impacted regarding risks to landscape level / coarse filter biodiversity values



Appendix 1

BRITISH COLUMBIA Ministry of Forests Prince George Region MEMORANDUM

File: 17080-01

April 29, 2002

To: All District Managers
Prince George Forest Region

Re: Natural Disturbance Unit Guidance and Planning

We support the use of the guidance provided in the document "Natural Disturbance Units of the Prince George Forest Region" as best available information when preparing operational or landscape level plans. The information contained in this document is a synthesis of the most current scientific information on forest management based on the "natural range of variability concept". This concept is widely accepted as the basis for sound ecological sustainable forest management. We believe adopting this document as best available information is consistent with direction provided by government. In the New Era document, one of the commitments is to "Adopt a scientifically based, principled approach to environmental management that ensures sustainability, accountability and responsibility." In support of this commitment, one of the guiding principles supported in the Ministry of Sustainable Resource Management Service Plan 2002/03 – 2004/05 (February 21, 2002) is "Science-Based Decision-Making – Use the best available knowledge and technology to support consistent decision-making". We also believe that adopting this guidance will support licensee forest certification initiatives.

In the future, MSRM will be guided by the NDU information in establishing legal biodiversity objectives through MSRM-sponsored planning processes in partnership with forest licensees and others. In the interim, the NDU information is presented to practitioners to encourage a cooperative effort among licensees to consider this information when planning operational activities. In particular we encourage ministry and licensee personnel to work co-operatively to:

- identify large patches of old forest that can be identified as permanent or temporary reserves;
- identify areas of young natural forest and develop a salvage strategy that enables some amount of naturally disturbed area to persist;
- plan openings to achieve a more natural patch size distribution;
- critically evaluate silvicultural strategies that result in stand characteristics (e.g., species composition, stands structure) that are inconsistent with the natural baseline; and

- develop a co-ordinated system of indicator reporting (e.g., old forest, amount of young natural forest, patch size of old forest, patch size of young forest).

Ray L. Schultz, R.P.F.
Regional Manager
Prince George Forest Region

T.P. (Phil) Zacharatos, R.P.F.
Regional Director
Ministry of Sustainable
Resource Management, Omineca Peace

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