Appendix 3

Timber Supply Analysis Report

TFL30 MANAGEMENT PLAN NO. 9
TIMBER SUPPLY ANALYSIS REPORT

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PREFACE

This report contains a timber supply analysis for Tree Farm Licence 30 (TFL30) and is part of the provincial Timber Supply Review process for TFL areas in British Columbia. Under Section 35(d) of the *Forest Act*, the TFL licence holder is required to submit, for the approval of British Columbia's Chief Forester, a management plan every five (5) years. The management plan must include a timber supply analysis that analyzes the short and long-term availability of timber that may be harvested from the TFL.

The purpose of the review is to provide the Chief Forester with sufficient information to enable him or her to determine an allowable annual cut (AAC) for the TFL over a five-year period as required under Section 8 of the *Forest Act*. In order for the Chief Forester to accurately and rationally make a determination, he or she must have an up-to-date assessment of the timber supply available from the TFL based on the best available information, including current land use decisions and forest management practices for the land base. This document provides the Chief Forester with this assessment.

The timber supply analysis report focuses on a single forest management scenario referred to as the **Base Case**, which reflects current management practices. Current management practices are defined by the specifications in the management plan for the TFL including guidelines for the protection of forest resources, Forest Practices Code (FPC) requirements and official land-use decisions made by Cabinet. An important part of this analysis is an assessment of how the Base Case results might be affected by uncertainties through a process called sensitivity analysis. Together, the Base Case scenario and sensitivity analyses form a solid basis for enabling the Chief Forester to make an AAC determination. In addition to having an up-to-date assessment of timber supply when setting the AAC the Chief Forester must also consider the short and long-term implications of alternative harvest levels, the existing and proposed processing facilities of the licence holder, and the social and economic objectives of the Crown.

This report is the second of three documents under the Timber Supply Review process for TFL30. The first document, entitled *TFL30 Management Plan 9 - Timber Supply Analysis Data Inputs and Assumptions Report*, was released in June of 2001 and provided detailed technical information related to the inventories, resource strategies and assumptions used to support the timber supply analysis. The last document, after the timber supply analysis report is submitted, will be prepared by government and will outline the Chief Forester's harvest level decision for TFL30 and the reasoning behind it.

EXECUTIVE SUMMARY

Tree Farm Licence 30 (TFL30) is located just northeast of Prince George in the Prince George Forest District. The TFL stretches from its western boundary near Summit Lake on Highway 97, eastward across the western foothills of the Rocky Mountains to slightly northeast of Sinclair Mills.

The total land base for TFL30 is 182,298 ha, of which 87% or 159,385 ha consist of productive forest lands. Of this productive land, 410 ha consist of non-Schedule A private lands and 90 ha fall within a Class A provincial park[1]. Of this remaining productive land, 74% or 118,725 ha are considered available for timber production and harvesting under current management practices. At present, 14.8 million cubic metres of timber is available (i.e. above minimum harvest age) for harvest across the timber harvesting land base (THLB) representing 78% of the total volume currently available. Once the THLB has been fully developed, an additional 1,946 ha of productive forest land is expected to be removed due to construction of permanent access structures leaving 73% of the TFL's total productive land base available for timber production over the long-term. Amongst reductions made to the productive land base in order to define the THLB, low volume stands occupy the largest percentage at 12% of the total productive, followed by non-forested lands consisting of brush at 7%.

The allowable annual cut (AAC) for TFL30 was last set in 1996 at 350,000 m^3/yr under Management Plan 8 (MP8). This AAC was then apportioned as follows:

- 327,288 m3 (94 %) Canfor, Schedule B Lands
- 21,312 m3 (5 %) Small Business Forest Enterprise Program (SBFEP), Schedule B Lands
- 1,400 m3 (1 %) Canfor, Schedule A Lands

As a result of the purchase of Northwood Inc. by Canadian Forest Products Ltd., the portion of the AAC attributable to Canfor was reduced by 5 % (16,364.4 m^3) and moved to the SBFEP apportionment.

Fifteen major changes from the previous analysis under MP8 are included in this timber supply review as follows:

- The *Prince George Land and Resource Management Plan* (LRMP) was completed and approved by Cabinet on January 25, 1999. Specific resource management directions for individual Resource Management Zones (RMZ) as well as general resource management directions that are applicable to all RMZs identified under the LRMP were incorporated into the analysis.
- A higher level plan (HLP) entitled, *Objectives for Recreational Sites and Trails*, was approved by the Prince George Forest District Manager on May 12th, 1997. Under the plan, management guidelines for five recreation sites located within the TFL were implemented.
- The *Forest Practices Code* (FPC) is fully implemented, including management requirements for riparian areas and full biodiversity implementation at both the landscape and stand-levels as per the *FPC Landscape Unit Planning Guidebook.*
- The results of the Scenario Planning Project (SPP) completed in June of 1999 by the McGregor Model Forest Association (MMFA) were used to evaluate various land use and forest management options on the TFL. The results from this project were used to develop the Base Case scenario under Management Plan 9 (MP9).
- A full Vegetation Resources Inventory (VRI) and Terrestrial Ecosystem Map (TEM) was completed across the entire TFL land base in March of 2000. These two inventories were then combined to represent forest cover and subsequently used to develop the growth and yield projections for natural and managed stands used under the analysis. In addition, regeneration assumptions were tied to ecological units based on TEM at the site series level.
- A Site Index Adjustment Project (SIA) was completed in February of 2000 and was used as the basis for upward adjustments to VRI site index estimates in order to obtain existing and future managed stand growth and yield projections.

[1] The Prince George LRMP identified the Giscome Portage Trail as a separate management zone (RMZ#32) and recommended protected area status within a 100m buffer on either side of the trail. Under *Bill 17-2000*, all Cabinet approved protected areas within the Province were given Class A Provincial Park status.

- Minimum harvest ages for naturally established stands were based on the *Administrative Guidelines for Priority Cutting Ages* approved for use by the Regional Manager, October 22, 1998. Minimum harvest ages for existing and future managed stands were based on the age at which 95% of the culmination of Mean Annual Increment (MAI) is achieved.
- Estimates of spruce leader weevil impacts on managed stand yields were assessed through field sampling over the summer of 2000. These impacts were accounted for by a downward adjustment of existing and future managed stand yield projections through increases to the Operational Adjustment Factor 1 (OAF1) in TIPSY.
- Through a Level 1 Interior Watershed Assessment (IWAP) completed in December of 1998, watersheds were delineated and assessed under the IWAP. Peak Flow Index (PFI) targets were assigned to each watershed through the IWAP and applied in the analysis.
- Harvest scheduling priorities were guided by the need to minimize the forested area classified as extreme to high hazard for mountain pine beetle, spruce bark beetle and balsam bark beetle over time by targeting the oldest susceptible stands in each hazard class first.
- The Tri Lakes Recreation Emphasis Area was reduced in size and removed from THLB.
- The McGregor River Management Zone was removed from the THLB.
- Visual and recreation resource inventories were updated and management practices implemented as per LRMP, FPC and Regional guidelines.
- Conversion of areas occupied by non-commercial brush species to conifer plantations is no longer assumed and therefore these areas were completely removed from the THLB.
- Timber supply forecasts were obtained using Forest Planning Studio (FPS/ATLAS) – a spatially sensitive, sequential simulation-based forest estate model. This modelling approach enabled the explicit representation of spatial constraints and permitted the mapping of resource inventory changes through time. In addition, spatially sensitive forecasting allowed for the completion of a 20 year plan that is fully rationalized to the data inputs, assumptions and resource objectives identified under MP9.

The results of this timber supply analysis suggest that an immediate 19% reduction to the current AAC of 350,000 m^3/yr is required, relative to the harvest flow policy requirement of ensuring that declines in timber supply do not exceed 12% per decade. The analysis shows that this new harvest level of 285,000 m^3/yr can be maintained for the next 10 years before harvest levels must decline by 12% per decade for three decades to 193,690 m^3/yr. Over the next 40 years, starting 41 years from now, the harvest level increases at an average rate of 9% per decade to a long-term harvest level of 508,759 m^3/yr, beginning 81 years from now. An alternative Base Case forecast demonstrates that the current AAC could be maintained over the next five years, however, this would necessitate a more rapid rate of decline from the current AAC at 15% every five years until year 20.

On average over the short-term, timber supply under MP9 is 22% below the harvest levels obtained under MP8. Over the mid-term period, 21 to 80 years from now, timber supply is on average 4% below MP8 harvest levels, ranging from 27% below MP8 levels at the start of the mid-term, to 20% above in the last period of the mid-term, 61 to 80 years from now. The THLB under MP9 was reduced by 7,525 ha or 6% relative to MP8, causing a downward pressure on timber supply across the planning horizon. In addition, significant changes to forest management practices combined with the use of spatially explicit harvest rules and targets, act to severely regulate the rate of harvest particularly over the first half of the mid-term, resulting in further downward pressures relative to MP8.

Over the long-term, the harvest level obtained under MP9 is 36% higher than the Long-Term Harvest Level (LTHL) achieved under MP8 and is realized 20 years sooner. Overall, this suggests that in the long-term, increases to managed stand site productivity estimates under MP9 significantly outweigh the additional land base removals, yield reductions for spruce leader weevil and the additional forest management requirements of the FPC and LRMP.

The short-term (next 20 years) timber supply is most negatively affected by targets for biodiversity patch sizes specified under the *Landscape Unit Planning Guidebook*. Timber supply is most severely constrained by this management requirement over the mid-term period 31 to 40 years from now, however, in order to realize the harvest flow policy of no more than a 12% per decade decline rate, this mid-term timber supply effect negatively impacts short-term harvest levels. Under a sensitivity analysis, harvest rules were removed that ensured biodiversity patches did not exceed the size targets specified in the *Landscape Unit Planning Guidebook*. The resulting harvest flow forecast, demonstrated that the current AAC could be maintained over the next 30 years before harvest levels had to decline by 10% for one decade. The potential exists for minimizing the negative timber supply effect of patch size targets through alternative harvest scheduling options and patch designs while remaining consistent with *Landscape Unit Planning Guidebook* targets; however, time limitations prevented alternative solutions from being explored under this timber supply review. A more important consideration however, revolves around a number of studies completed over the last five years investigating natural disturbance dynamics within the Prince George Forest Region. Based on the information gathered under these studies, new regional guidelines are currently being put forward by government, which suggest significant changes to the biodiversity patch size targets specified in the *Landscape Unit Planning Guidebook*. The results obtained under this sensitivity, where targets for biodiversity patches were removed, appear to be more consistent with the recommendations specified under these emerging policy changes within the Region.

Since timber supply under the Base Case is severely constrained during the first half of the mid-term due to biodiversity patch size requirements, any factors that alter the quantity or availability of volume from naturally established stands will impact short-term harvest levels. Sensitivities demonstrated that any positive or negative adjustments to natural stand yields will have a proportionate impact on short and mid-term harvest flows. Uncertainties exist, since average natural stand yield estimates obtained through field sampling under the VRI and 1996 inventory audit programs are higher by 21% and 15% respectively, when compared to the average yield obtained for the same population based upon the yield projections used in the analysis. Sensitivities revealed that a 20% increase in natural stand yield estimates would permit the current AAC to be maintained over the next 10 years and that on average, harvest flows could be increased by 21% over the next 40 years.

Uncertainty regarding reductions to the productive land base was also explored through sensitivities. Under the Base Case, natural stands not capable of achieving minimum economic yield targets were removed from the THLB, however, results of the SIA project suggest that many of these stands have marginal yields due to poor stocking conditions rather than as a result of low site productivity. A sensitivity analysis which applied the minimum economic yield criteria to managed stand yield projections rather than natural stand projections, resulted in a net increase to the THLB of 6% or 6,661 ha. The addition of these lands back into the THLB increased the current amount of available growing stock by 5% or 734,885 m^3 relative to the Base Case. However, the timber supply effect of this THLB increase revealed no significant changes relative to the Base Case forecast over the short and mid-terms. A review of the model outputs revealed that this unanticipated result was due to the fact that 78% of the additional volume was located within resource emphasis zones where harvest opportunities are severely restricted due to current harvest rules and target violations. As a result, the majority of the area could not be accessed over the short and first half of the mid-term period.

Since natural stands are on average 30 years past minimum harvest age at the present time and these stands make up 87% of the total current growing stock, any increase to natural stand minimum harvest ages would need to exceed 30 years in order to impact the availability of this volume. However, sensitivities revealed that increasing natural and managed stand minimum harvest ages by 10 years would negativity impact short-term harvest levels by 6% relative to the Base Case forecast. This is because significant timber supply shortfalls occurred both at the start and at the end of the mid-term period. As a result of the shortfalls in the first half of the mid-term, a reduction to short-term harvest levels is necessary in order to realize the maximum decline rates specified under the harvest flow policy. Shortfalls at the start of the mid-term, when harvests depend entirely on the natural stand inventory, suggest that increases to natural stand minimum harvest ages will influence the availability of this volume even though much of it has aged well beyond the minimum harvest ages specified under the Base Case. A review of the model outputs revealed that a 10 year increase in natural stand minimum harvest ages was sufficient to both alter the harvest queue relative to the Base Case, as well as limit the availability of some stands that were harvested under the Base Case. Both the harvest rules associated with targets for biodiversity patch sizes in conjunction with the adjustments to the harvest queue which cause targets for other non-timber resources to become more binding, lead to the timber supply shortfalls in the first half of the mid-term. Shortfalls in the latter half of the mid-term are attributable to the 10 year increase in managed stand harvest ages. This is because harvests increasingly depend upon the managed second growth inventory over this period, which on average, is harvested a mere four years past minimum harvest age under the Base Case.

Factors affecting managed stand minimum harvest ages include site productivity estimates, forest health agents that impact growth rates such as brush competition, insects and/or diseases and finally, forest management decisions regarding rotation age. Sensitivities revealed no short-term impact to timber supply as a result of reductions in managed stand site productivity estimates of 25% relative to the Base Case. When the impact of using the unadjusted site index estimates from VRI to obtain managed stand growth and yield projections was tested, shortfalls relative to the Base Case only occurred in the latter half of the mid-term. In addition, this result suggests that the binding effect of biodiversity patch size targets outweigh the effects of both PFI targets for watersheds and the denudation targets for visual polygons, since these height dependant constraints become more restrictive as a result of reductions to site productivity estimates. Minimum harvest age reductions related to forest health issues were indirectly incorporated into the Base Case forecast through yield reductions made to managed stand yield projections in order to account for spruce leader weevil impacts. With respect to management decisions regarding rotation age, the minimum harvest ages for managed stands were based on the age at which 95% of the culmination of MAI is achieved. As a result, the average minimum harvest age for managed stands within the THLB is 60 years and the average age at which managed stands were harvested over the long-term under the Base Case was 100 years. The average diameter at breast height, for spruce at 60 years of age, is 21 cm while at 100 years it is 28 cm. However, TFL30 consists of some of the most productive growing sites in the northern interior. As a result, the TFL is capable of producing large diameter premium quality sawlogs through management, in relatively short periods of time compared to other areas within the northern interior. Much of the volume harvested from the TFL is delivered to the Upper Fraser Sawmill which is specialized to process large diameter premium quality sawlogs. An analysis completed through this timber supply review examined the minimum harvest ages necessary to grow spruce sawlogs which meet the optimal mill requirements of an average butt diameter of 46 cm or 36 cm at breast height. The results of the analysis showed that average minimum harvest age for managed spruce stands would need to be 180 years in order to obtain these log dimensions; a difference of 120 years relative to the minimum harvest age chosen under the Base Case. Although the impact of this management option was not explored, it is almost certain that this adjustment would significantly impact short-term wood supply, since the existing stock of available volume from unmanaged natural stands would have to be harvested at a significantly reduced rate in order to realize the harvest flow objective under the Base Case.

Over the long-term, beyond 80 years from now, the harvest level is most affected by changes in estimates of site productivity since it directly affects the growth and yield of managed stands and also indirectly influences minimum harvest ages and the binding effect of resource targets dependant upon rates of height growth. As mentioned earlier, using the unadjusted site index estimates from VRI, rather than the SIA adjusted estimates, represents a 25% reduction in site index relative to the Base Case. As a result of this change, the sensitivity forecast revealed that the LTHL must decline by 32%. Sensitivities also revealed that the LTHL reacted proportionally to adjustments made to managed stand yield estimates. A 10% increase or decrease in managed stand yields resulted in a similar 10% increase or decrease in the LTHL. Finally, sensitivity tests revealed that the LTHL was responsive to changes in the THLB. When additional lands removed due to minimum economic yield criteria were returned, representing a 6% increase in the area of the THLB, the sensitivity forecast revealed a subsequent increase in the LTHL of 5%. Conversely, sensitivities revealed that the LTHL was unresponsive to a 10 year adjustment in minimum harvest age. This is because managed stands were harvested on average, 42 years past minimum harvest age under the Base Case. Therefore, in order for the LTHL to be affected, adjustments to harvest ages would need to exceed 42 years. Sensitivities also revealed that the LTHL was unresponsive to the removal of biodiversity patch size requirements.

In conclusion, based on the data inputs and assumptions used under this analysis, the results suggest that an immediate 19% reduction to the current AAC of 350,000 m^3/yr is required. It is likely that this outcome will have an economic impact on Canfor's operations and may potentially impact the surrounding communities which provide services and human resources to those operations. As a result, any alternatives to the Base Case which minimize or eliminate the need for this immediate reduction would be preferable.

Sensitivity analysis revealed that targets for biodiversity patch sizes implemented as per the *Landscape Unit Planning Guidebook* requirements, are solely responsible for this immediate reduction since their removal would enable the current AAC to be maintained for the next 30 years. It is reasonable to accept the timber supply results of this sensitivity since it does not require compromises to any other resource objectives identified for the TFL and in fact, appears to be more consistent with new regional guidelines currently being put forward by government that suggest significant changes to the current patch size targets under the *Guidebook*. In addition, the implementation of this sensitivity through the 20 year plan can be clearly articulated since the analysis was completed using a spatially explicit dataset and forest estate model. As a result, it can be clearly shown where, when and how harvests must occur in order to support this timber supply forecast. In addition, resource indicator responses over both the short and long-terms can be reported and used to measure performance relative to the resource objectives identified under the analysis.

Another critical issue in this analysis which may act to minimize the extent of the short-term timber supply reduction indicated under the Base Case relates to yield estimates for natural stands. Average natural stand yield estimates obtained through field sampling under the VRI and 1996 inventory audit programs are higher by 21% and 15% respectively, when compared to the average yield obtained for the same population based on the natural stand yield projections used in the analysis. Sensitivities revealed that a 20% increase in natural stand yield estimates would permit the current AAC to be maintained over the next 10 years and that on average, harvest flows could be increased by 21% over the next 40 years. Based on the differences between the field sample estimates from VRI and the inventory audit with the estimates obtained from the projections used under the analysis, a careful review of the yield contributed by the existing natural forest inventory should be undertaken to ensure natural stand yields are not underestimated in the analysis.

1.0 Introduction

The following sections of this report outline the timber supply analysis completed in support of MP9 for TFL30. Sections 2 and 3 of this report provide brief descriptions of the TFL area and the data inputs and assumptions used under the analysis. The analysis approach and methodology is detailed in Section 4 and the results for the Base Case are presented in Section 5. Section 6 examines the sensitivity of the Base Case results to uncertainties in the data inputs and assumptions used to support the analysis and lastly, Section 7 provides a summary and presents some conclusions which may be drawn from the analysis.

2.0 Location and Physical Description of Tree Farm Licence No. 30

TFL30 is located in the Prince George Forest District, predominantly north of the Fraser River and stretching from close to Highway 97 on the west to northeast of Sinclair Mills on the east, as shown in **Figure 1**. The boundaries of the TFL are also consistent with the McGregor Model Forest, a research initiative of the Federal Government of Canada, to develop innovations in sustainable forest management systems and techniques.

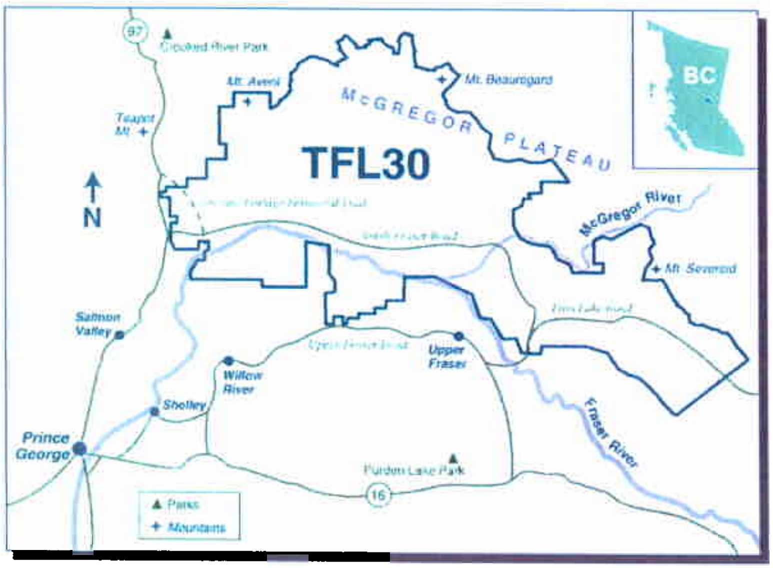


Figure 1: Location of TFL30

The TFL is located in the western foothills of the Rocky Mountains and as a result is subject to heavy snowfalls and substantial summer rainfall. Ecologically, the TFL is dominated by the very wet and wet cool variants of the Sub-Boreal Spruce (SBS) Zone occupying 80% of the total land base, followed by the wet cool variant of the Englemann Spruce Subalpine Fir (ESSF) Zone at 7% and the very wet cool variant of the Interior Cedar Hemlock (ICH) Zone at 6%. The remaining area of the TFL consists of the moist cool variant of the SBS Zone at 4%, followed by the wet cold variant of the ESSF Zone at 3%. High precipitation levels combined with deep soils have contributed to providing the TFL with some of the most productive growing sites anywhere in the northern interior of the province. As a result, a large proportion of the volume harvested to date has consisted of premium quality spruce sawlogs. Nutrient rich, wet to moist soil conditions have also resulted in 7% of the productive land base consisting of areas dominated by herbaceous and woody brush species with low to no conifer stocking.

Few stand-initiating disturbances have resulted in much of the existing naturally established forest to be greater than 100 years of age, with most of this area residing within age class 8, at an average age of 168 years. This existing natural inventory consists predominantly of spruce which makes up an estimated 53% of the current available volume, followed by sub-alpine fir (balsam) at 30% and pine at 7%. The remaining mature forest inventory consists of birch, aspen, hemlock, cottonwood and Douglas-fir. Industrial scale forest harvesting operations have occurred within the TFL since 1959. Through clear-cut harvesting practices, these operations are responsible for the majority of young forest consisting currently of managed, even-aged spruce leading plantations in age class 1, with an average age of seven years[2]. Only 15% of the total forested land base are found between age classes 2 and 5 with a relatively even amount of area in each of these age classes.

[2] Note under this analysis, all stands established prior to 1978 were considered to have established naturally without any silviculture investments.

3.0 Data Inputs and Assumptions

This section provides a summary of the data inputs and assumptions used to support this timber supply analysis. A detailed description and map folio of the inventories used, along with the specific criteria and assumptions made in order to model the resource strategies identified under MP9, is documented in the report, *TFL30 Management Plan 9 - Timber Supply Analysis Data Inputs and Assumptions Report.*

3.1 Land Base Inventory

The development and collection of land base information necessary to support this analysis commenced soon after the last AAC determination for the TFL was made in 1996 under MP8. Significant inventory projects undertaken during this time included a re-inventory of the TFL to VRI standards and an ecological inventory to TEM standards. Canfor's Forest Development Plan (FDP) mapping was used to update the VRI for disturbance and stocking to 2000 since the VRI was based on 1995 aerial photography. The regeneration assumptions for the analysis were used to determine stand composition within new openings created since 1995. In all, 29 digital resource inventories and their associated attribute files were used in the analysis to describe the TFL land base and identify areas with specific forest cover objectives, harvest rules, management activities and to define the THLB[3].

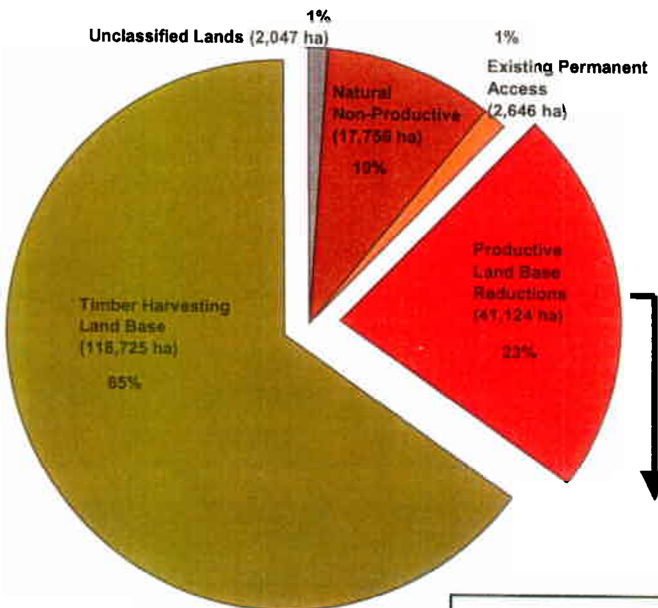


Figure 2: THLB Definition

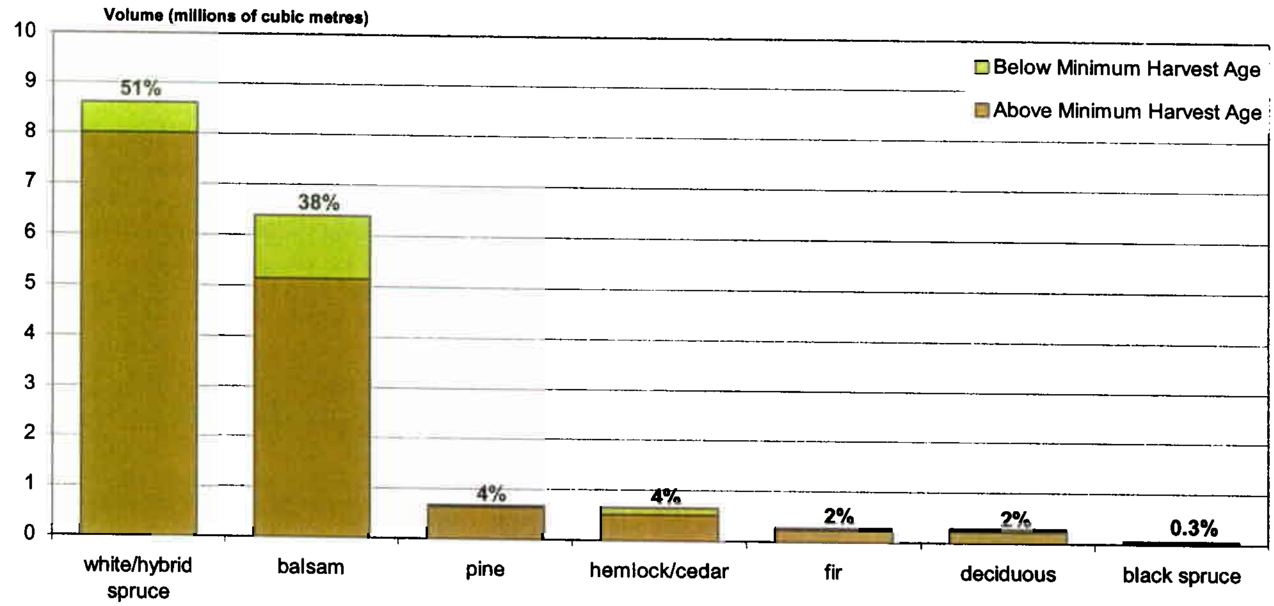
Based on the resource strategies under MP9, 20 reduction categories were identified in order to define the THLB. **Figure 2** provides a summary of the areas removed[4]. The pie chart reveals that of the total TFL land base of 182,298 ha, 1% was considered unclassified since necessary forest cover attributes were absent and 11% was considered non-productive. The productive land base is therefore 159,385 ha or 87% of the total. Productive land base reductions amounted to 23%, leaving 118,725 ha or 65% of the total land base available for timber production and harvesting. The table below provides a breakdown of the reductions made to the productive land base, sorted in descending order, based on the total productive area in each reduction category. The table reveals that low yield stands occupy the largest proportion of the productive land base at 12%, followed by the area necessary to meet Wildlife Tree Retention (WTR) requirements at 9%.

Productive Land Base Reduction Category	Total Prod. Area (ha)	Percent of Total Prod.	Net THLB Reduction (ha)	Percent of Total Prod.	Net Potential THLB Contribution (ha)	Percent of THLB
Minimum Economic Yield	18,529	11.6%	18,477	11.6%	6,661	5.6%
Wildlife Tree Retention	14,607	9.2%	3,355	2.1%	3,355	2.8%
Non-Commercial Brush	10,590	6.6%	4,591	2.9%	3,531	3.0%
Caribou High Value Habitat	8,313	5.2%	1,751	1.1%	113	0.1%
Difficult Regeneration	8,061	5.1%	4,273	2.7%	1,866	1.6%
Unstable Terrain	5,111	3.2%	2,809	1.8%	1,026	0.9%
McGregor River Management Zone	3,182	2.0%	832	0.5%	0	0.0%
Riparian Reserve Zones	2,821	1.8%	1,206	0.8%	264	0.2%
Deciduous Leading Stands	2,667	1.7%	2,071	1.3%	1,379	1.2%
Woodall Recreation Area	1,734	1.1%	100	0.1%	0	0.0%
Seebach Riparian Zone	1,196	0.8%	344	0.2%	7	0.0%
Tri-Lakes Recreation Area	675	0.4%	479	0.3%	289	0.2%
Horseshoe Recreation Area	649	0.4%	332	0.2%	0	0.0%
Private Lands (Non-Schedule A Lands)	429	0.3%	410	0.3%	313	0.3%
Giscome Portage Trail (Class A Provincial Park)	93	0.1%	90	0.1%	78	0.1%
Recreation Sites	12	0.0%	4	0.0%	2	0.0%

[3] See Section 3 of the information package for details regarding the inventories used.

The net THLB reduction column to the right, shows the productive area removed under each category according to the order in which reductions were made to account for overlaps between categories. The last column shows the potential increase to the THLB that would occur if each individual category were brought back into production. This column reveals that bringing low yield stands back into production would result in the largest increase to the THLB at 6%, followed by areas of non-commercial brush at 3%. If both of these reduction categories were returned to production concurrently, then a 10% increase to the THLB would be realized. This column also reveals that if harvesting were permitted in the Woodall Recreation Area for example, no net increase in the THLB would occur. This is because 76% of the productive area within this recreation zone also falls within caribou high habitat units, 55% is considered too difficult to regenerate, 45% consists of low yield stands and 25% consists of unstable terrain[5].

Figure 3 shows the merchantable volume currently found across the THLB by tree species[6] by availability. Of the 16.9 million cubic metres currently present, 87% is available for harvest while the remaining 13% is currently below minimum harvestable age.



	white/hybrid spruce		balsam		pine		hemlock/cedar		fir		deciduous		black spruce	
	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent
Below	605,883	7%	1,246,764	20%	38,268	6%	139,598	21%	44,011	16%	52,637	19%	4,637	9%
Above	8,006,169	93%	5,146,423	80%	628,756	94%	512,085	79%	231,188	84%	225,265	81%	45,601	91%
	8,612,052	**51%**	**6,393,187**	**38%**	**667,024**	**4%**	**651,683**	**4%**	**275,199**	**2%**	**277,902**	**2%**	**50,238**	**0.3%**

Figure 3: Current THLB merchantable volume by tree species by availability

Spruce dominates the volume profile making up 51% of the merchantable volume found across the THLB, of which 93% is currently available for harvest. Balsam is secondary, contributing 38%, followed by pine at 4%. Together, the remaining species found within the TFL make up 8% of the current volume profile.

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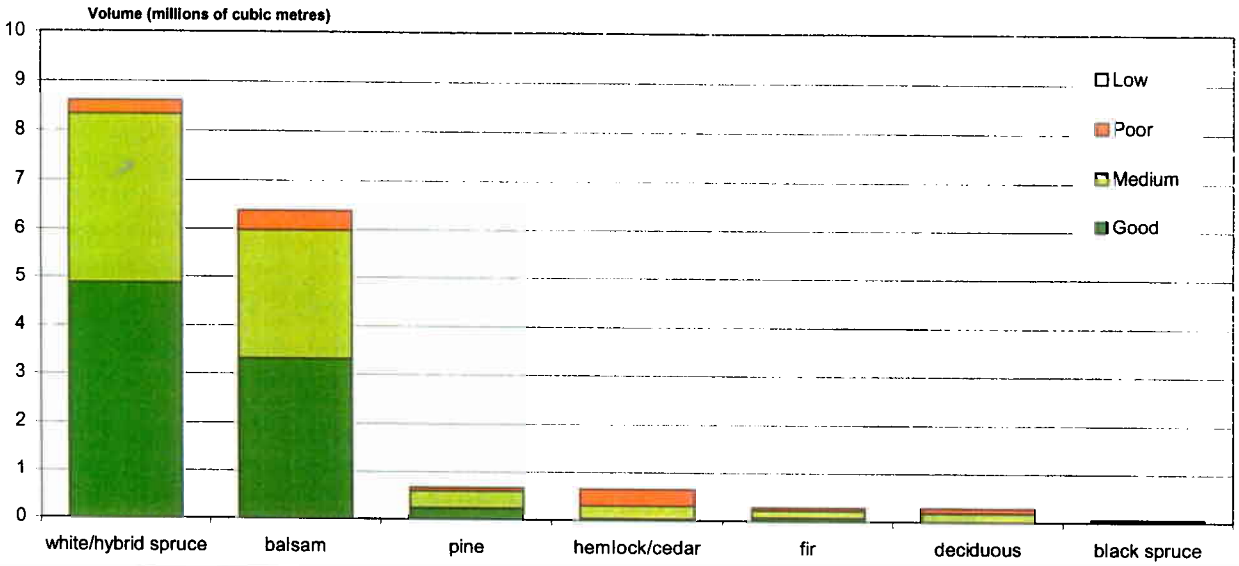
4 See Section 7 of the information package for details regarding THLB definition and Figure 33 for the location of reductions within the TFL.
5 See Table 89 of the information package for a detailed breakdown of the overlaps between reduction categories.
6 Note that the volumes reported by species were calculated by multiplying the percent composition of each species in a stand by the total current merchantable volume reported for that stand.

Figure 4 shows the merchantable volume currently found across the THLB by tree species by site quality class[7].



		white/hybrid spruce		balsam		pine		hemlock/cedar		fir		deciduous		black spruce	
Site Class	Avg Site Index	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent
Good	20	4,876,357	57%	3,315,773	52%	237,849	36%	41,101	6%	68,257	25%	1,981	1%	7,451	15%
Medium	14.6	3,456,066	40%	2,660,899	42%	350,922	53%	261,569	40%	151,001	55%	175,876	63%	18,271	36%
Poor	12.2	275,594	3%	414,988	6%	67,350	10%	349,000	54%	55,940	20%	100,044	36%	20,022	40%
Low	10.5	4,036	0.047%	1,527	0.024%	10,903	2%	14	0.002%	0	0%	0	0%	4,493	9%
Totals:	**17.9**	**8,612,052**	**51%**	**6,393,187**	**38%**	**667,024**	**4%**	**651,683**	**4%**	**275,199**	**2%**	**277,902**	**2%**	**50,238**	**0.3%**

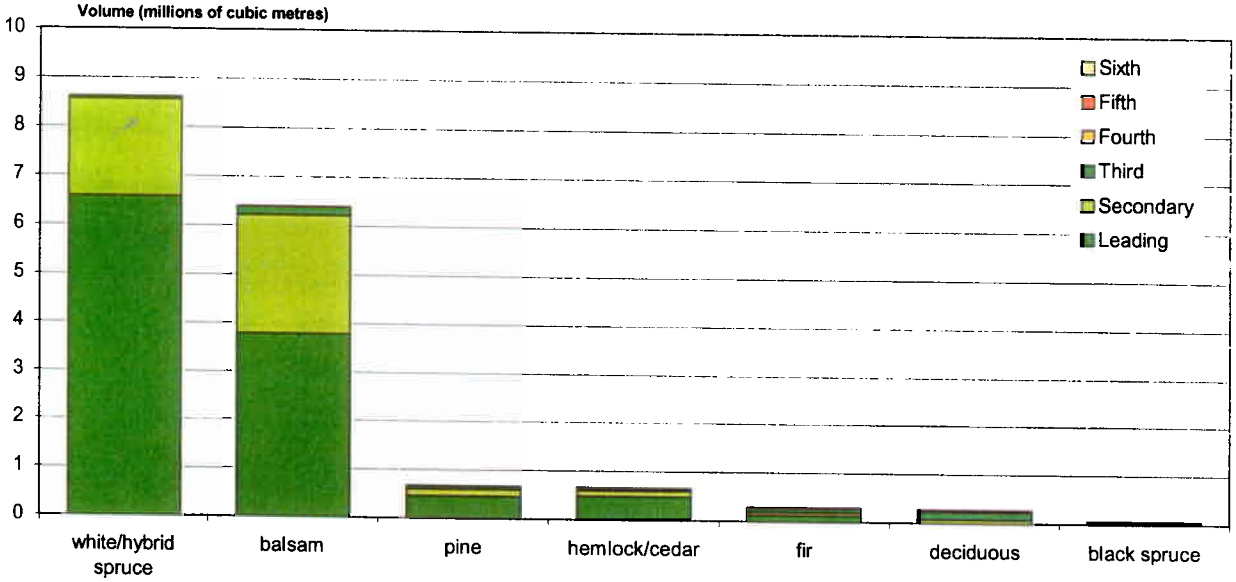
Figure 4: Current THLB merchantable volume by tree species by site class

Of the total merchantable volume currently found across the THLB, 51% is found on good growing sites with an average site index of 20 metres at a breast height age of 50 years. Of the remaining merchantable volume, 42% is found on medium quality sites, 8% on poor and less than 1% from sites considered low[8]. The majority of the current merchantable volume contributed by spruce and balsam is found on good growing sites while the opposite is true for hemlock and cedar.

Across all species, the area weighted average site index of the current THLB natural stand inventory is 17.9 metres. Based on the site index adjustments applied to managed stands, a 3.2 metre or 18% increase in average site productivity will be realized, once the current inventory of naturally established forest is converted to managed second growth[9]. At the present time, 63% of the area within the THLB consists of naturally established forest while the remaining 37% consists of managed plantations.

[7] See Table 19 of the information package for the site class breakpoints by tree species used to define site classes.
[8] Most growing sites considered low were removed from the THLB under minimum economic yield criteria. See Section 5.5.1 of the information package for the criteria used and a detailed description of the inventory for this forest type.
[9] See Section 5.12.1 for a detailed description of the site index adjustments used in the analysis, along with tabular summaries showing their impact on key growth and yield attributes across the forested land base.

Figure 5 shows the merchantable volume currently found across the THLB by tree species by stand composition order.



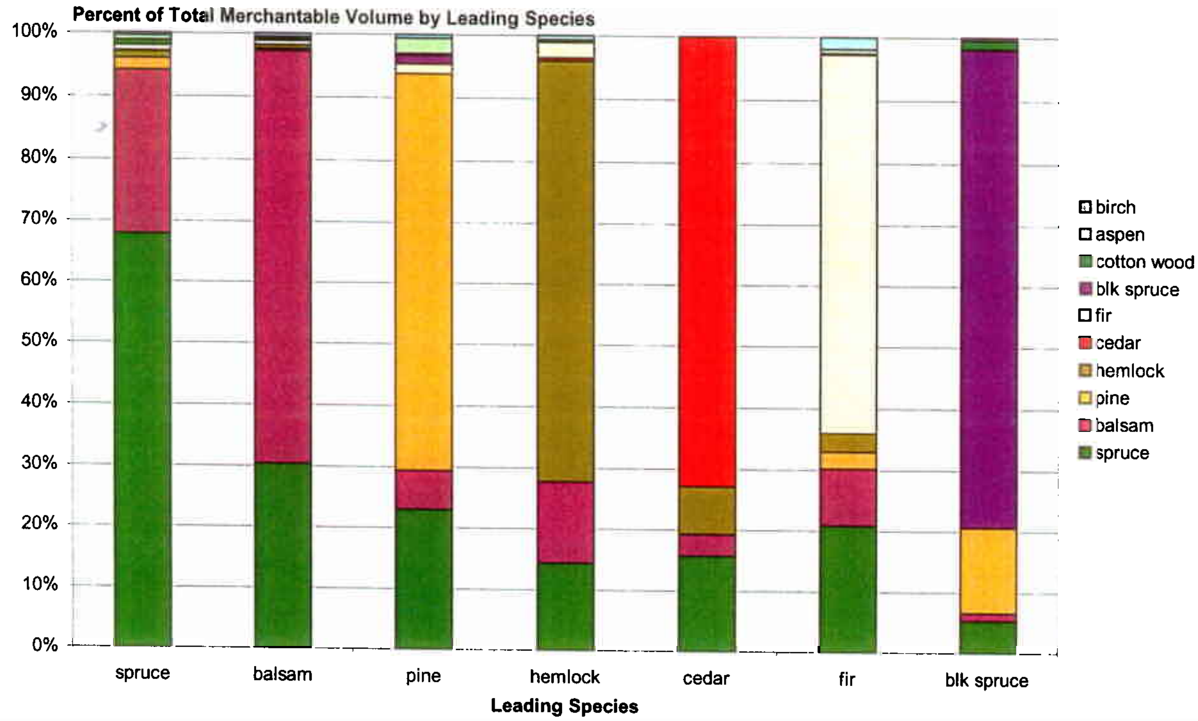
	white/hybrid spruce		balsam		pine		hemlock/cedar		fir		deciduous		black spruce	
Stand Comp. Order	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent	Volume (m^3)	Percent
Leading	6,584,801	76%	3,786,482	59%	459,813	69%	484,505	74%	130,863	47%	0	0%	34,398	68%
Secondary	1,969,943	23%	2,430,436	38%	142,763	21%	109,920	17%	59,126	21%	82,133	30%	14,955	30%
Third	53,904	1%	163,179	3%	57,508	9%	50,489	8%	71,756	26%	149,573	54%	864	2%
Fourth	3,340	0.039%	10,622	0.166%	5,590	1%	6,728	1%	11,956	4%	31,992	12%	21	0.042%
Fifth	64	0.001%	2,468	0.039%	1,351	0.202%	41	0.006%	3,698	1%	11,403	4%	0	0%
Sixth	0	0%	0	0%	0	0%	0	0%	503	0.181%	99	0.036%	0	0%
Totals:	8,612,052	51%	6,393,187	38%	667,024	4%	651,683	4%	277,902	2%	275,199	2%	50,238	0.3%

Figure 5: Current THLB merchantable volume by tree species by stand composition order

Based on the VRI, Figure 5 reveals that the majority of the current merchantable volume by species is found where each species is leading within the stand except for Douglas-fir and deciduous species consisting of cottonwood, aspen and birch.

Although, 47% of the total merchantable volume contributed by Douglas-fir is found where it is the leading species, the majority at 53%, is found where it exists as a secondary or lower stand component. Deciduous volume in a leading stand position is not present since deciduous leading stands were removed from the THLB, however, utilization of deciduous is assumed where they occur as secondary or lower stand components. As a result, 275,199 m^3 or 2% of the total merchantable volume currently present, consists of deciduous species.

Figure 6 provides a further breakdown of the information presented under Figure 5 revealing the aggregated species composition for each leading species stand type based on current merchantable volume within the THLB.



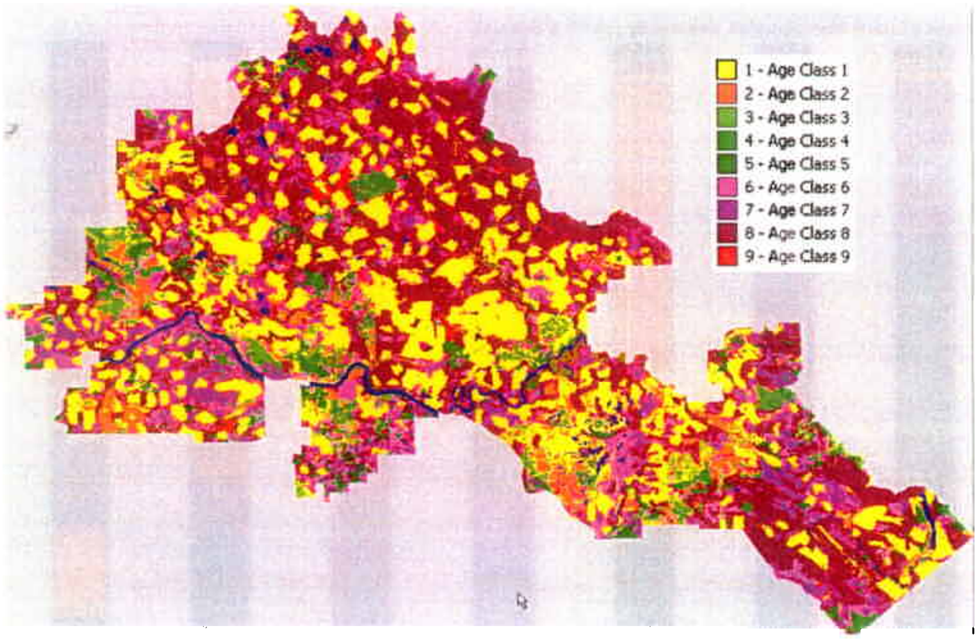
Leading Species	Pure Stands	Mixed Stands: spruce	balsam	pine	hemlock	cedar	fir	blk spruce	cotton wood	aspen	birch	Total Volume (m^3)
spruce	1%	67%	26%	2%	1%	0.148%	1%	0.052%	1%	1%	0.417%	9,661,371
balsam	1%	30%	66%	0.267%	1%	0.002%	1%	0.027%	0.386%	0.201%	1%	5,621,403
pine	6%	22%	6%	61%	0%	0%	1%	1%	0.188%	2%	1%	691,969
hemlock	3%	14%	13%	0.014%	66%	1%	2%	0%	0.428%	0.032%	1%	638,951
cedar	1%	16%	4%	0%	8%	72%	0%	0%	0%	0%	0%	59,180
fir	0.447%	21%	9%	3%	3%	0%	61%	0%	0.179%	1%	2%	213,008
blk spruce	25%	4%	1%	11%	0%	0%	0%	58%	1%	0.311%	0.008%	41,404
Totals:	**2%**	**50%**	**38%**	**4%**	**3%**	**0%**	**2%**	**0%**	**1%**	**1%**	**0%**	**16,927,286**

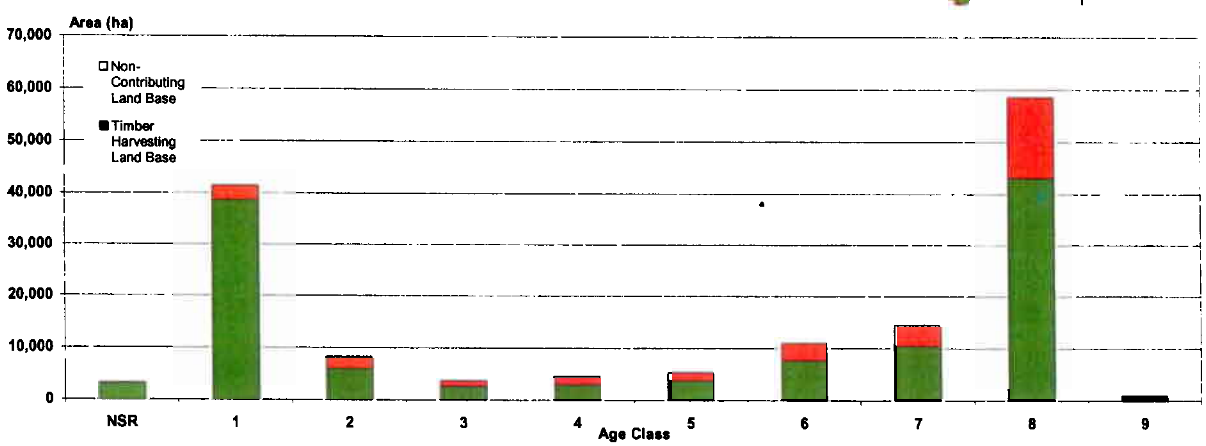
Figure 6: Current THLB merchantable volume species composition by leading species

Figure 6 reveals that of the total merchantable volume currently found within the THLB, 98% comes from mixed species stands with only 2% being contributed by pure stands. Amongst balsam, pine, cedar and Douglas-fir leading stands, spruce represents the second largest volume component while amongst spruce leading stands, balsam represents the largest secondary volume component.

Across all hemlock leading stands, spruce and balsam make up the majority of the secondary volume in relatively equal proportions while pine is the dominant species associated with black spruce leading stands.

Figure 7 shows the current age class distribution over the TFL forested land base both spatially and using graphical as well as tabular summaries.





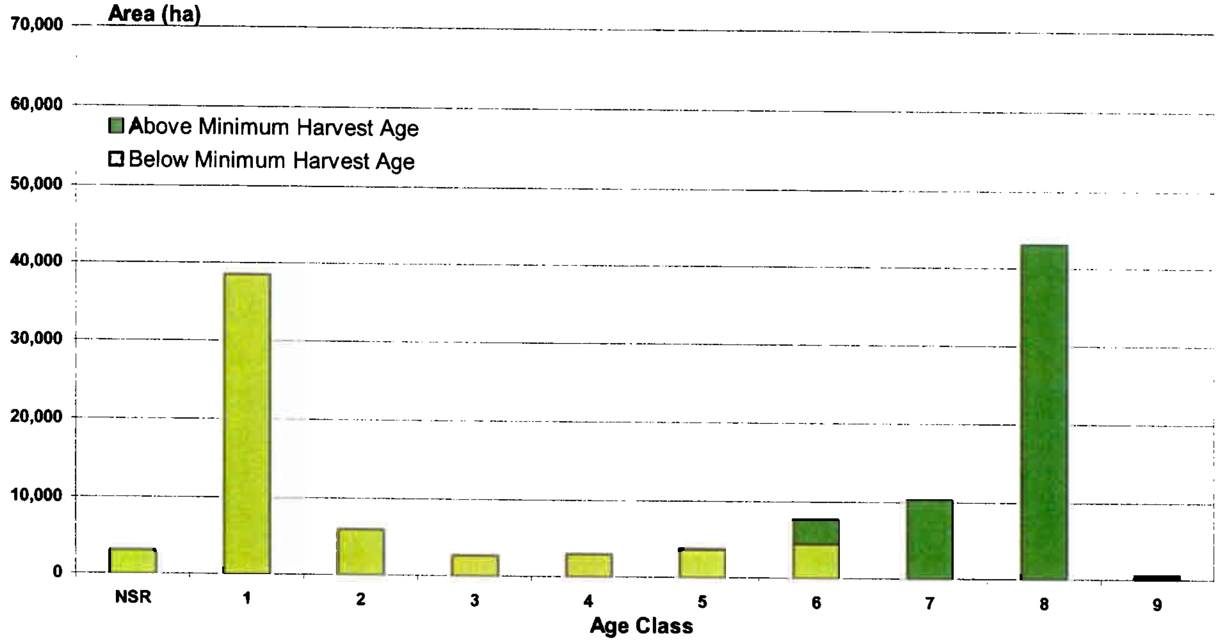
Age	Age Class	Total Forested Land Base (ha)	Area Weighted Average Age (yrs)	Per cent of Total Forested	Non-Contributing Land Base (ha)	Area Weighted Average Age (yrs)	Per cent in Age Class	Per cent of Total Non-Contributing	Timber Harvesting Land Base (ha)	Area Weighted Average Age (yrs)	Per cent in Age Class	Per cent of Timber Harvesting Land Base
0	NSR	3,284	0	2%	190	0	6%	1%	3,095	0	94%	3%
1-20	1	41,382	7	27%	2,846	6	7%	9%	38,535	7	93%	32%
21-40	2	8,188	29	5%	2,207	30	27%	7%	5,981	28	73%	5%
41-60	3	3,804	51	3%	1,110	52	29%	3%	2,694	51	71%	2%
61-80	4	4,554	72	3%	1,537	73	34%	5%	3,017	71	66%	3%
81-100	5	5,345	89	4%	1,562	88	29%	5%	3,783	90	71%	3%
101-120	6	10,925	111	7%	3,272	110	30%	10%	7,653	112	70%	6%
121-140	7	14,377	129	10%	4,038	129	28%	12%	10,339	129	72%	9%
141-250	8	58,492	168	39%	15,435	166	26%	48%	43,057	168	74%	36%
251	9	868	271	1%	297	273	34%	1%	571	270	66%	0%
		151,219	**97**	**100%**	**32,494**	**120**	**21%**	**100%**	**118,725**	**90**	**79%**	**100%**

Figure 7: Current age class distribution over the total forested land base

The current age class distribution for the TFL reveals that 39% of the total forested land base consists of stands in age class 8, 27% in age class 1, with the remaining 34% distributed amongst the other age classes.

As a result of reductions, 21% of the forested land base is located outside of the THLB and is currently distributed across all age classes with the majority residing in age class 8. Although this area does not contribute to timber supply directly, it does contribute to non-timber resource targets such as landscape and stand level biodiversity, visuals and watershed hydrology. As a result, the land base outside the THLB can affect timber supply indirectly, by regulating the amount, rate and pattern of harvest based on its forest composition and structure through time.

Figure 8 provides a breakdown of the age class distribution across the THLB by area either above or below minimum harvestable age.

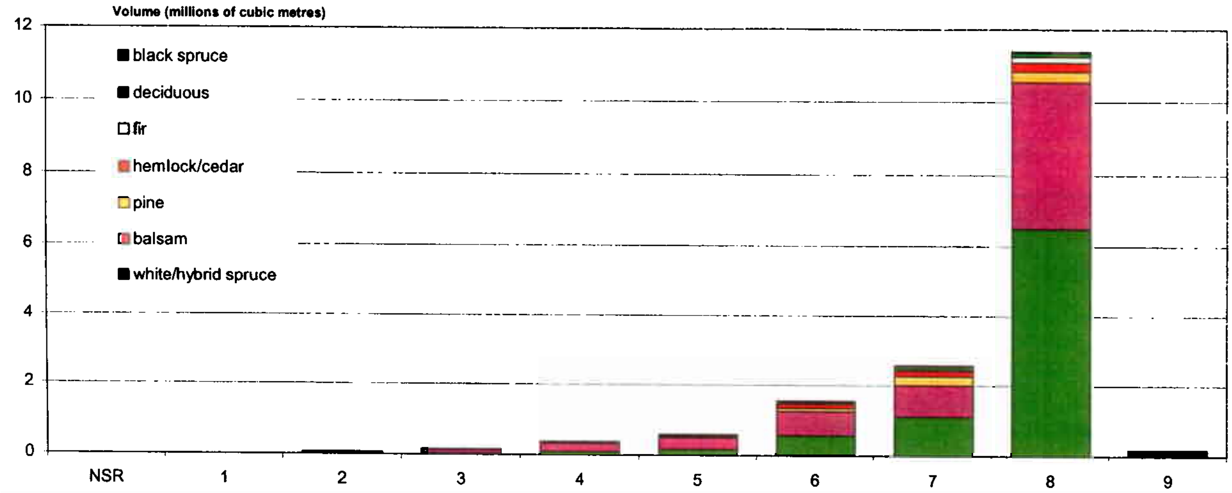


Age	Age Class	Below Minimum Harvest Age: Area Below (ha)	Percent of THLB	Current Avg. Age (yrs)	Avg. Harvest Age (yrs)	Years to Reach Harvest Age (yrs)	Above Minimum Harvest Age: Area Above (ha)	Percent of THLB	Current Average Age (yrs)	Average Harvest Age (yrs)	Years Past Harvest Age (yrs)
0	NSR	3,095	3%	0	62	62	0	0%			
1-20	1	38,536	32%	7	64	57	0	0%			
21-40	2	5,981	5%	28	62	34	0	0%			
41-60	3	2,694	2%	51	110	59	0	0%			
61-80	4	3,017	3%	71	117	46	0	0%			
81-100	5	3,689	3%	90	117	27	94	0%	93	82	11
101-120	6	4,495	4%	111	121	10	3,158	3%	112	101	12
121-140	7	0	0%				10,339	9%	129	108	20
141-250	8	0	0%				43,056	36%	168	106	62
251+	9	0	0%				571	0%	270	106	163
		61,508	**52%**	**26**	**76**	**50**	**57,217**	**48%**	**159**	**106**	**53**

Figure 8: Current age class distribution over the timber harvesting land base by timber availability

Across the THLB, 32% of the forested land base consists of stands in age class 1 and 36% in age class 8 with the remaining 32% distributed over the other age classes. Across all stands currently below minimum harvest age, on average, 50 years are required before they become old enough to harvest. As a result, over this time period, timber supply over the short and first half of the mid-term must be supported by growing stock from naturally established forests, the majority of which is currently found in age class 8.

Figure 9 shows the distribution of merchantable volume currently present over the THLB, by age class, by tree species.



Age	Age Class	white/hybrid spruce Volume (m³)	white/hybrid spruce Percent	balsam Volume (m³)	balsam Percent	pine Volume (m³)	pine Percent	hemlock/cedar Volume (m³)	hemlock/cedar Percent	fir Volume (m³)	fir Percent	deciduous Volume (m³)	deciduous Percent	black spruce Volume (m³)	black spruce Percent	Total Volume (m³)	Total Percent
0	NSR	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
1-20	1	450	25%	234	13%	1,006	56%	0	0%	118	7%	0	0%	0	0%	1,807	0.011%
21-40	2	20,005	30%	33,525	50%	8,247	12%	158	0.235%	1,505	2%	3,662	5%	2	0.003%	67,103	0.396%
41-60	3	51,218	31%	97,524	60%	379	0%	1,793	1%	3,319	2%	8,156	5%	299	0.184%	162,688	1%
61-80	4	110,439	28%	228,783	59%	21,983	6%	9,373	2%	12,836	3%	5,396	1%	650	0.167%	389,459	2%
81-100	5	179,287	30%	337,087	56%	19,307	3%	41,991	7%	8,508	1%	13,445	2%	3,363	1%	602,987	4%
101-120	6	566,340	36%	698,598	44%	92,191	6%	133,512	8%	26,131	2%	42,458	3%	12,184	1%	1,571,413	9%
121-140	7	1,124,257	44%	888,833	35%	245,533	10%	151,713	6%	60,054	2%	86,116	3%	11,027	0.429%	2,567,532	15%
141-250	8	6,498,381	57%	4,066,071	36%	278,379	2%	258,914	2%	151,113	1%	118,671	1%	22,713	0.199%	11,394,243	67%
251+	9	61,675	36%	42,532	25%	0	0%	54,229	32%	11,616	7%	0	0%	0	0%	170,052	1%
		8,612,052	51%	6,393,187	38%	667,024	4%	651,683	4%	275,199	2%	277,902	2%	50,238	0.3%	16,927,286	100%

Figure 9: Current distribution of THLB merchantable volume by age class by tree species

Figure 9 reveals that 67% the total current merchantable volume within the THLB is found within age class 8 from which most of the timber supply is dependent over the next 50 years. Within this age class, 57% of the volume consists of spruce and 36% consists of balsam.

3.2 Forest Management Strategies and Assumptions

Significant changes in land base inventories, land uses and forest management practices have occurred since the last timber supply analysis was completed in 1996 under MP8. The following table compares the timber and non-timber resource strategies and assumptions that were implemented under MP9,[10] relative to those used under the MP8 timber supply analysis.

Table 1: Summary of Base Case forest management strategies and assumptions

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Natural Non-Productive Areas (NP)	NP areas were defined as those sites incapable of growing any commercial tree species of any quality or quantity currently or into the future in their present state. NP areas were identified using TEM site series information and deducted from the area of each polygon.	NP areas were identified using the 1995 FIP attribute files based on the non-productive descriptors and basic class codes. NP areas occupying less than 100% of a polygon were accounted for through a TIPSY OAF1 yield reduction.	Based on the NP definition used under MP9, alpine forest or forested wetland types typically described as AF or NP forested under the previous FIP inventory were considered productive. Unlike FIP, TEM polygons frequently consisted of NP expressed as a percentage of the polygon's area. Under MP9, the area considered NP increased by 90% relative to MP8 from 9,469 ha to 17,993 ha.
Forested Land Base Definition	Using VRI, the forested land base was defined as the productive area currently having ≥ 10% commercial tree cover where stand age is ≥ 80 years of age or, all stands < 80 years of age except those areas classified NCBR, where crown closure is <10%.	The forested land base was identified using the 1995 FIP attribute files where projected type identity was between 1 and 3. All areas classified NSR and a portion classified NCBR were later added back to the THLB over time.	Under MP9, 151,219 ha were considered forested including all current NSR. Forested areas contributed to resource targets under MP9 included forested areas outside the THLB of 32,494 ha or 21% of the total forested.
Lands Not Managed by Canfor	Private, non-Schedule A lands and the Giscome Portage Trail buffer zone were removed from the THLB.	Identical areas removed.	Combined total area equaled 522 ha under both MP8 and MP9.
Non-Merchantable Timber Types	Two non-merchantable timber types were removed from the THLB based on VRI attribute data and VDYP yield projections: 1. naturally established stands which produce insufficient merchantable yields to warrant timber harvesting from an economic perspective. Criteria based on achievement of minimum yields by a certain age, by harvest system, by leading species[11]. 2. deciduous leading stands. Any secondary or lower deciduous volume components within existing natural stands were not deducted from VDYP yield projections.	Similar to MP9, two non-merchantable timber types (referred to as Problem Forest Types) were removed based on 1995 FIP attribute data and VDYP yield projections: 1. criteria based on achievement of 100m^3/ha by 200 years of age across all stands. 2. deciduous leading stands. Identical to MP9, any secondary or lower deciduous volume components within existing natural stands were not deducted from VDYP yield projections.	Reductions under MP9 for this category increased by 267% relative to MP8 from 5,775 ha under MP8, to 21,196 ha under MP9. The minimum yield criteria used under MP9 is attributable for this large difference since only 393 ha were removed under MP8 while 18,529 ha were removed under MP9. The area in deciduous leading forest decreased by 50% under MP9 relative to MP8 from 5,382 ha to 2,667 ha.
Utilization Levels	Utilization levels used were 12.5 cmdbh for pine leading stands and 17.5 cmdbh for all other stands.	Utilization standards were identical to MP9.	

[10] Complete details of the strategies and assumptions used in the analysis can be found in the MP9 information package - *TFL30 Management Plan 9 - Timber Supply Analysis Data Inputs and Assumptions Report.*

[11] See Table 7 of the information package for the specific criteria used.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Minimum Harvest Age	Minimum harvest ages for natural stands were based on the Prince George Region, Timber Tenure Administrative Guidelines for Priority Cutting Ages[12]. For both existing and future managed stands, minimum harvestable age was based on the age at which 95% of the culmination of MAI is achieved.	Minimum harvest ages for all natural and managed stands were based on the lower of the Prince George Region, Priority Cutting Ages at the time or the age at which culmination of MAI is achieved.	The average THLB minimum harvest age for natural stands decreased by 6% from 116 years under MP8, to 109 years under MP9. For managed stands, average minimum harvest age decreased by 42% from 103 years under MP8, to 60 years under MP9. This significant reduction in managed stand harvest ages under MP9 is attributable to the managed stand site index adjustments implemented under MP9.
Immature Plantation History	Stands established prior to 1978 or greater than 22 years of age as of 2000 were considered to have regenerated naturally without any silvicultural investments.	Stands established prior to 1965, or greater than 30 years of age as of 1995, were considered to have regenerated naturally without any silvicultural investments.	Based on the year of analysis for MP9 (2000), the threshold age at which existing stands were considered managed versus natural decreased by 37% under MP9 relative to MP8, from less than 36 years under MP8 to less than 23 years under MP9. Although the age threshold decreased under MP9, the THLB area considered managed at the start of the planning horizon increased by 27% from 34,495 ha of managed forest at time 0 under MP8, to 43,862 ha under MP9, due to harvesting and reforestation activities that have occurred since MP8 was completed.
Not Satisfactorily Restocked Areas (NSR)	Areas were classified NSR at the start of the planning horizon using up-to-date silviculture information provided by Canfor. These areas were considered restocked after the regeneration delay period of 1 year elapsed for each stand, since all but 1% of the total was considered current NSR.	Areas were classified NSR at the start of the planning horizon using the projected type identity attribute codes in the 1995 FIP inventory. Current NSR areas were considered re-stocked after 5 years and backlog NSR areas after 10 years.	The area classified backlog NSR under MP9 decreased by 99% relative to MP8, from 2,672 ha to 22 ha.
Regeneration Assumptions	Regeneration assumptions were formulated by Canfor based on TEM site series[13].	Regeneration assumptions were based on reforestation practices by natural stand analysis unit definitions.	Average establishment density under MP9 increased 64% relative to MP8, from 1,400 sph under MP8 to 2,300 sph under MP9. This is because in an effort to better reflect early managed stand dynamics; establishment densities under MP9 were set 10% above average free-growing densities by site series based on silviculture survey information. Regeneration delay periods were reduced from 3 years under MP8 to 1 year under MP9. Under both analyses, most regenerated stands were established through planting.

[12] See Table 14 of the information package for the specific ages used.
[13] See Table 18 in Appendix III of the information package for the specific silviculture regimes used.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Difficult Reforestation.	Areas with specific TEM site series were identified where successful regeneration is unlikely and no harvesting is recommended, as per the FPC Establishment to Free Growing Guidebook for the Prince George Forest Region[14]. As a result, these areas were removed from the THLB.	Areas where successful regeneration is unlikely were identified using ESA classifications based on the 1995 FIP. Area reductions of 100% were made for polygons classified Ep1 and 25% for polygons classified Ep2.	The area removed from the THLB due to regeneration concerns under MP9 increased by 20% relative to MP8, from 6,697 ha under MP8 to 8,061 ha under MP9.
Rehabilitation Activities	All areas classified NCBR were removed from the THLB since no rehabilitation activities are anticipated by Canfor over the next five years. NCBR areas were identified using VRI attributes based on specific criteria[15].	Of the total area classified NCBR, 57% was removed from the THLB based upon past rehabilitation activities completed by Northwood. NCBR areas were identified using the projected type identity attribute codes in the 1995 FIP inventory.	The area classified NCBR under MP9 decreased by 27% relative to MP8, from 14,552 ha under MP8 to 10,590 ha under MP9, however, since all NCBR was removed from the THLB under MP9, the NCBR area reduction under MP9 increased by 28% relative to MP8, from 8,302 ha under MP8 to 10,590 ha under MP9.
Silviculture Systems	A clear-cut silvicultural system will be used throughout the THLB, except within riparian management zones (RMZs) and moderate value caribou habitat zones where partial cut systems will be used[16].	A clear-cut silvicultural system was assumed for all areas except within stream and lakeside riparian management zones where a partial cut prescription of 50% volume retention was applied.	Partial cutting under MP8 was implemented by reducing the yields in partially cut areas by 50%. Under MP9, partial cut approximations available in FPS/ATLAS were used.[17]
Spruce Leader Weevil	Spruce leader weevil impacts were accounted for by downward adjustments to growth and yield projections for existing and future managed stands[18] via OAF1.	Impacts due to spruce leader weevil were not account for.	
Bark Beetle Management	Bark beetles where managed by minimizing the forest area across the THLB classified as extreme to high hazard for mountain pine beetle, spruce bark beetle and balsam bark beetle over time through priority based harvesting of the oldest areas in each beetle hazard class[19].	A beetle management zone was delineated where past harvesting has been concentrated in an effort to remove beetle damaged or destroyed timber. Forest cover requirements for the zone specifying that no more than 25% of the unit can be less than 3 metres in height at any time was waived over the first 10 years of the planning horizon.	
Fixed Scheduling	All blocks proposed for harvest over the next six years under Canfor's approved FDP were harvested by the scheduling model in the year specified by Canfor regardless of constraint violations.	No fixed scheduling was implemented.	
Harvest Scheduling Priorities	As per bark beetle management strategies.	Priority for harvest was assigned by analysis unit based on average rates of volume increment for each analysis unit. Within each analysis unit, priority was based on oldest first.	

14 See Table 22 in the information package for the site series identified.
15 See Section 5.8.4 in the information package for details regarding the criteria used to identify NCBR based on VRI attributes.
16 See Section 5.8.6 in the information package for the prescriptions and assumptions used to implement partial cutting under the analysis.
17 See Section 4.2 of this report for further details.
18 See Section 5.9.1 in the information package for details regarding the adjustments made.
19 See Section 5.10.2 in the information package for the hazard rating criteria and harvest priorities used.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Harvest Flow Objective	To maintain the current AAC of 350,000 m^3/yr, for as long as possible, without allowing declines to exceed 12% per decade. Any increases were to be realized as soon as they became available. Harvest level over the long-term must be sustainable based on the point at which growing stock levels stabilize resulting in even annual timber flows from managed second growth stands.	To maintain an initial target harvest rate that is within 5% of the current AAC of 407,000 m^3/yr, for as long as possible, without allowing declines to exceed 10% per decade.	Reporting periods under MP8 were fixed at five years in length across the planning horizon. Although declines in the harvest rate were not to exceed 10% per decade, this objective was actually implemented through a decline of 5% per five-year period. In contrast, under MP9 reporting periods were set to one year over the first five years, then five-year periods to year 60 and then 20-year periods thereafter. The decline rate of no more than 12% per decade was implemented explicitly as specified.
Site Productivity	Estimates of site productivity were obtained using site indices reported by VRI and were used to develop growth and yield projection for natural stands. VRI site index estimates were then adjusted for spruce based on the results of the Site Index Adjustment project. These adjusted site indices were then used to develop growth and yield projections for existing and future managed stands. Ministry of Forests conversion equations were used to estimate the site index for other species based on the adjusted spruce site indices.	Site index estimates were obtained using VDYP based on reference ages and heights reported in the 1995 FIP for each forest cover polygon greater than 30 years of age. For stands less than 31 years of age, the mid-point of the site class was used to estimate site index. These estimates were then used to develop growth and yield projections for natural stands and existing managed stands. For future managed stand projections, the area weighted average site indices by existing analysis unit were used. Ministry of Forests conversion equations were used to adjust site indices where species conversion was prescribed through regeneration assumptions.	Average THLB site index for natural stands under MP9 increased by 7% relative to MP8, from 15.2m (based on the FIP inventory) under MP8, to 16.2m (based on the VRI) under MP9. Average THLB site index estimates for future managed stands under MP9 increased by 37% relative to MP8, from 15.4m (based on existing AU average site index and conversion adjustments) under MP8, to 21.1m (based on SIA adjustments) under MP9.
Growth and Yield Estimates for Natural Stands	The Variable Density Yield Prediction Model (BatchVDYP version 6.6d) was used to provide individual yield, top height and diameter estimates for all natural stands found within the TFL. Natural stand yield tables were ratio adjusted to VRI phase II ground plots using the Fraser Method.	The Variable Density Yield Prediction Model (BatchVDYP version 4.5) was used to provide yield estimates for natural stands. No adjustments were made to these VDYP yield projections.	Average THLB yield estimates at culmination age for natural stands under MP9 decreased by 12% relative to MP8, from 237 m^3/ha under MP8, to 209 m^3/ha under MP9.
Growth and Yield Estimates for Existing and Future Managed Stands	The Table Interpolation Program for Stand Yields (BatchTIPSY version 2.5r) was used to provide individual yield, top height and diameter estimates for all productive lands within the TFL.	The Table Interpolation Program for Stand Yields (WinTIPSY version 1.1) was used to provide yield estimates for managed stands.	Average THLB yield estimates at culmination age for future managed stands under MP9 increased by 20% relative to MP8, from 315 m^3/ha under MP8, to 379 m^3/ha under MP9.
Managed Stand Operational Adjustment Factors (OAFs)	An OAF1 of 7% was applied to account for variable and sub-optimal stocking conditions. OAF1 reductions to account for natural NP areas within plantations was accounted for through explicit area reductions based on TEM site series information. An standard OAF2 of 5% was applied to account for endemic losses over time.	The standard OAF1 of 15% and OAF2 of 5% were applied.	Natural NP areas occupying less than 100% of a polygon based on TEM site series, accounts for 5.2% of the land base under MP9 after reductions for unclassified lands, roads, trials, landings, and spatially explicit natural NP areas are applied. This represents an total OAF1 equivalent of 12.2%, a difference of 2.8%, relative to the OAF1 default value of 15%.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Genetic Gain	An average yield increase of 17.9% for genetic gain, was applied to spruce components within future managed stands	No genetic gain adjustments were made to growth and yield projections.	
Analysis Units	Natural and managed stand yield projections were tracked for each VRI polygon and were not aggregated into analysis units.	FIP forest cover polygon specific natural and existing managed stand yield projections were aggregated into 14 analysis units. Future managed stand yield projections were based on 23 analysis units or regenerated stand types.	
Unstable terrain	Level D terrain stability mapping, completed across the entire TFL in 1996, was used to identify those areas with soil stability concerns where harvesting should be restricted.	No explicit reductions were made to account for unstable terrain unless indirectly captured through Es and/or inoperability reductions.	Under MP9, 5,111 ha were considered to have unstable soils where harvesting was not permitted.
Inoperability	With access to aerial harvest systems, no physical barriers to harvesting was assumed.	Inoperable areas were removed from the THLB using inoperability reconnaissance mapping, assuming conventional harvesting systems.	Under MP8, 4,694 ha were classified as inoperable.
Mapped Existing and Proposed Roads and Trails and Unmapped Existing Landings	The location of mapped existing and proposed roads and trials within the TFL were provided by Canfor. Road widths by road class were used to estimate productive land reductions based on the mapping provided[20]. To account for losses to productive land due to unmapped landings, a 2% area reduction was applied to the productive area of blocks harvested throughout the TFL up to 1994. After 1994, harvesting practices utilized roadside landing systems and therefore no reductions to account for landings were assumed after this time.	The location of mapped existing roads and trials within the TFL were obtained from the 1995 FIP inventory using the non-productive descriptor and basic class codes. In addition to these, a 3.6% reduction was applied to the productive land base less than 30 years of age to account for unmapped roads, trails and landings and a 0.9% reduction across the productive land base greater than 30 years of age.	The area occupied by existing roads, trails and landings under MP9 decreased by 38% relative to MP8, from 4,633 ha under MP8, to 2,873 ha under MP9.

[20] See Table 41 in the information package for a list of the road widths by road class.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Future Roads and Trails	To account for losses to productive land due to roads and trails within treatment units currently without access, the average percent area occupied by roads and trails within the developed portions of the TFL were used to forecast future reductions. Using the logging history, existing road network and harvest system mapping, the total productive area of each existing block occupied by roads and trails was calculated and then averaged by harvest system zone. These percentages (average of 4%) were then applied to the harvestable area within each treatment unit currently without access after the unit is harvested for the first time[21].	To account for losses to productive land due to future roads, landings and trails, a 3.2% reduction was applied.	The area occupied by future roads, trails and landings under MP9 decreased by 26% relative to MP8, from 2,621 ha under MP8, to 1,946 ha under MP9. Note that landings are no longer included under MP9.
Unsalvageable Losses due to Natural Catastrophic Disturbances	Since the last AAC determination, Canfor has determined that unsalvaged losses have remained consistent with figures used under MP8 and that no changes to these figures are anticipated over the next five years.	Based on licensee records over the preceding 5 years, unsalvaged losses due to fire, insects and windthrow have amounted to 3,640 m^3/yr.	
Endemic Unsalvageable Losses	Losses to endemic mortality and decay in natural stands are inherent within VDYP yield projections. Waste and breakage was based on PSYU 325. Endemic losses due to decay, waste and breakage for managed stands were accounted for by applying a 5% OAF2 reduction to TIPSY yield projections.	Waste and breakage based on Monkman PSUY (Special Cruise 174). Endemic losses due to decay, waste and breakage for managed stands were accounted for by applying a 5% OAF2 reduction to TIPSY yield projections.	Under MP9 losses to waste and breakage in natural stands based on PSYU, amount to 11 m^3/ha or 4% of the average gross yield. This yield reduction represents a loss of 794 thousand m^3 of volume across all natural stands within the THLB. Across future managed stands, losses due to natural stand mortality, OAF1a (sub-optimal stocking) and OAF2 amount to a total of 173 m^3/ha or 32% of the average gross yield. This yield reduction represents a loss of 20.5 million m^3 of volume across all future managed stand yield projections within the THLB.
Environmentally Sensitive Areas	ESA classification mapping was no longer considered to be the best information currently available with respect to identifying areas where timber harvesting operations cannot be undertaken without unacceptably compromising the values for other non-timber resources. As a result, no reductions or special considerations were made based on ESA classifications[22].	THLB area reductions of 100% applied to Ep1, Er1 and Es1 ESA classes. Reductions of 25% applied to Ep2 and Es2 classes.	Under MP8, 12,214 ha were removed from the THLB as per the assumptions used.

[21] See Table 42 in the information package for a list of the percentages used.
[22] See Table 45 in the information package for a list of the standard and non-standard inventories considered to be better information than ESA mapping with respect to protecting non-timber resource values.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Landscape and Stand Level Biodiversity	All five landscape (OGMAs, seral stages distributions, connectivity and patch size) and stand level (WTR and species diversity) biodiversity elements implemented as per the *FPC Landscape Unit Planning Guidebook, March 1999*[23].	Not considered. A maximum 60 ha block size and 3 metre green-up adjacency rule was approximated by ensuring that no more than 25% of the Normal Forest Resource Zone may be less than 3 metres in height at any time.	Wildlife tree retention requirements resulted in a 2% reduction to the THLB or 3,355 ha under MP9. In addition, a recruitment rather than a "lock-out" approach was used to ensure seral and old growth management targets were achieved as soon as possible within assessment areas where insufficient area is currently available to satisfy targets.
Mountain Caribou Habitat	Three caribou habitat zones were delineated within the TFL, High Value, Moderate Value and Movement Corridors. No harvesting is permitted within high value caribou habitat zones and these areas are removed from the THLB. Within moderate value caribou habitat zones, all areas will be harvested using partial cut silvicultural systems where 70% of the pre-harvest merchantable volume is retained at each entry. Subsequent stand re-entries will occur once the stand has recovered its original pre-harvest merchantable volume. Within each caribou movement corridor unit, 70% of the forested area in each unit must be in a mature or older seral state at all times. Harvest units adjacent to immature stands must be maintained in a mature or older state until these areas achieve the seral age definitions for mature. In addition, harvested openings cannot exceed 10 ha in size.	Three caribou habitat zones were delineated within the TFL, High Value, Moderate Value and Movement Corridors. No harvesting is permitted within high value caribou habitat zones and these areas are removed from the THLB. Within moderate value caribou habitat zones, no more than 20% of the zone may be less than 3 metres in height at any time and at least 66% must be greater than 80 years of age. Within caribou movement corridors, no more than 20% of the zone may be less than 3 metres in height at any time and at least 20% must be greater than 120 years of age.	Under MP9, the area in caribou high value habitat increased by 35% relative to MP8, from 6,147 ha under MP8, to 8,312 ha under MP9. The area in medium habitat decreased by 33%, from 3,135 ha under MP8, to 2,098 ha under MP9. The area in corridors decreased by 42%, from 11,552 ha under MP8, to 6,628 ha under MP9.
Forest Ecosystem Network	Not considered since full implementation of landscape and stand level biodiversity requirements were considered to adequately achieve the FEN objectives under MP8.	A single contiguous FEN polygon was delineated within the TFL. Across the FEN, no more than 20% of the zone may be less than 3 metres in height at any time and at least 20% must be greater than 120 years of age.	

[23] See Section 6.2 of the information package for complete details of the criteria and assumptions used.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Riparian Management Areas (RMAs)	Consistent with the *FPC Riparian Management Area* and *Lakeshore Management Area, Prince George Forest Region Guidebooks*, RMAs were delineated around all lakes, rivers, streams and wetlands using specified buffer widths by riparian class based on a combination of 1994 riparian inventory information and default methodologies and criteria described in the *FPC Riparian Management Area Guidebook*. No harvesting was permitted within riparian reserve zones and stream class specific partial cut prescriptions were implemented in riparian management zones[24].	Riparian reserve and management zones were delineated around all lakes and streams. No harvesting was permitted within riparian reserve zones. A partial cut prescription of 50% volume retention was applied across all management zones.	Under MP9, the area across all riparian reserve zones decreased by 72%, from 10,047 ha under MP8, to 2,821 ha under MP9. The area within management zones increased by 788%, from 5,384 ha under MP8, to 47,836 ha under MP9. This is because under MP9, single line streams were identified using TRIM2 base mapping and the majority of these streams were classified as S4.
McGregor River Management Zone	No harvesting was permitted.	Across the McGregor River Management Zone, no more than 20% of the zone may be less than 3 metres in height at any time and at least 20% must be greater than 120 years of age.	The area of the McGregor River Management Zone under MP8 could not be found and may have been included within the 5,384 ha for stream and lakeside management zones. Under MP9, the area of this zone was 3,182 ha.
Seebach Riparian Zone	No harvesting was permitted.	No harvesting was permitted.	Under MP9, the area of the Seebach Riparian Zone increased by 1%, from 1,188 ha under MP8, to 1,196 ha under MP9.
Watersheds	Based on the results of an Interior Watershed Assessment (IWAP) completed in 1999, peak flow index target thresholds by watershed were applied to 27 watersheds delineated across the TFL[25].	Not considered.	
Scenic Areas with Established Visual Quality Classes	Based on a visual landscape inventory (VLI) completed in 1999, 70 visually sensitive units (VSU) with established visual quality classes (VQC) of partial retention or modification were delineated across the TFL. Maximum denudation targets by VQC, by VSU were applied as per the document, *Procedures For Factoring Visual Resources into Timber Supply Analyses, Forest Practices Branch, Ministry of Forests, March 1998 (REC – 029)*[26]. On average across all partial retention VSUs, no more than 8% of the area may be less than 6 m in height at any time. On average across all modification VSUs, no more than 20% of the area may be less than 5 m in height at any time.	Based on a landscape inventory, visual polygons with the following visual quality objectives (VQO) were delineated; retention (R), partial retention (PR), modification (M) and maximum modification (MM). No harvesting was permitted within retention VQOs. No more than 15%, 24% and 25% of each PR, M and MM polygon respectively, could be less than 5 metres in height at any time.	Under MP9, the area occupied by partial retention VSUs increased by 9% relative to MP8, from 5,925 ha under MP8, to 6,448 ha under MP9. The area occupied by modification VSUs decreased by 8%, from 7,745 ha under MP8, to 7,134 ha under MP9. Overall, the area occupied by visually sensitive areas decreased under MP9 by 10% from 15,028 ha under MP8, to 13,583 ha under MP9.

[24] See Section 6.4.1 of the information package for a detailed description of the criteria, assumptions and reduction made.
[25] See Section 6.4.4 of the information package for a detailed description of the criteria and assumptions used.
[26] See Section 6.5.1 of the information package for a detailed description of the criteria and assumptions used.

Resource Issue	MP9 Strategies and Assumptions	MP8 Strategies and Assumptions	Comments
Backcountry Recreation Emphasis Areas	No harvesting was permitted within the Tri-Lakes, Woodall and Horseshoe Recreation Areas.	No harvesting was permitted within the Horseshoe and Woodall Recreation Areas. Within the Tri-Lakes Recreation Area, no more than 10% of the zone may be less than 3 metres in height at any time.	The area occupied by all 3 backcountry recreation areas decreased by 19% relative to MP8, from 3,765 ha under MP8, to 3,058 ha under MP9.
Recreation Management Class 1	Not considered since strategies to protect recreation values within the TFL have already been addressed through site-specific prescriptions applied to identified features.	No harvesting was permitted.	The area in Recreation Management Class 1 under MP8 was 8,985 ha.
Recreation Sites	No harvesting is permitted within buffer zones around five recreation sites, identified under an approved Higher Level Plan.	Not considered. May have been included within recreation management class 1 areas.	

Based on the strategies and assumptions described in Table 1 above, the THLB was reduced by 6% under MP9, relative to MP8, from 126,250 ha under MP8, to 118,725 ha under MP9. This reduction in the size of the THLB between the two analyses represents a downward pressure on timber supply under MP9 relative to MP8. Resource issues that lead to this reduction in the size of the THLB under MP9 include; an increase in the size of the non-productive land base, an increase in the area occupied by non-merchantable forest types, no rehabilitation of areas occupied by non-commercial brush, reductions for wildlife tree retention requirements, an increase in the size of caribou high value habitat areas and finally, the removal of the McGregor River Management Zone from the THLB.

Table 2 provides a summary of the anticipated timber supply effects of changes to timber and non-timber resource strategies and assumptions by resource issue, that were implemented under MP9, relative to the strategies and assumptions used under MP8.

Table 2: Anticipated timber supply impacts of changes to Base Case resource strategies relative to MP8

Resource Issue	Pressure on Timber Supply	Planning Horizon Impact
Minimum Harvest Age	Upward	Short and Long-Term
Not Satisfactorily Restocked Areas (NSR)	Upward	Mid and Long-Term
Site Productivity	Upward	Mid and Long-Term
Growth and Yield Estimates for Existing and Future Managed Stands	Upward	Mid and Long-Term
Genetic Gain	Upward	Mid and Long-Term
Mapped Existing and Proposed Roads and Trails and Unmapped Existing Landings	Upward	Short and Long-Term
Future Roads and Trails	Upward	Long-Term
Natural Non-Productive Areas (NP)	Downward	Short and Long-Term
Non-Merchantable Timber Types	Downward	Short and Mid-Term
Difficult Reforestation	Downward	Short and Long-Term
Rehabilitation Activities	Downward	Short and Long-Term
Spruce Leader Weevil	Downward	Mid and Long-Term
Growth and Yield Estimates for Natural Stands	Downward	Short and Mid-Term
Landscape and Stand Level Biodiversity	Downward	Short and Long-Term
McGregor River Management Zone	Downward	Short and Long-Term
Watersheds	Downward	Short and Long-Term
Backcountry Recreation Emphasis Areas	Downward	Short and Long-Term
Recreation Sites	Negligible	
Lands Not Managed by Canfor	No Change	
Utilization Levels	No Change	
Unsalvageable Losses due to Natural Catastrophic Disturbances	No Change	
Seebach Riparian Zone	No Change	
Forested Land Base Definition	Uncertain	
Immature Plantation History	Uncertain	
Regeneration Assumptions	Uncertain	
Silviculture Systems	Uncertain	
Bark Beetle Management	Uncertain	
Fixed Scheduling	Uncertain	
Harvest Scheduling Priorities	Uncertain	
Managed Stand Operational Adjustment Factors (OAFs)	Uncertain	
Analysis Units	Uncertain	
Unstable terrain	Uncertain	
Inoperability	Uncertain	
Endemic Unsalvageable Losses	Uncertain	
Environmentally Sensitive Areas	Uncertain	
Mountain Caribou Habitat	Uncertain	
Forest Ecosystem Network	Uncertain	
Riparian Management Areas (RMAs)	Uncertain	
Scenic Areas with Established Visual Quality Classes	Uncertain	
Recreation Management Class 1	Uncertain	

4.0 Analysis Approach and Methodology

4.1 Approach

The timber supply analysis under MP8 utilized an aspatial, sequential simulation based modelling[27] approach in order to obtain harvest flow forecasts.

Under MP9, a spatially sensitive, sequential simulation based modelling[28] approach was used since it better facilitated preparation of the 20-year plan. In addition, a spatial modelling approach better supports performance based, adaptive management planning, because clear measurable linkages can be made between operational activities on the ground and the strategic resource objectives identified under the management plan.

4.2 Methodology

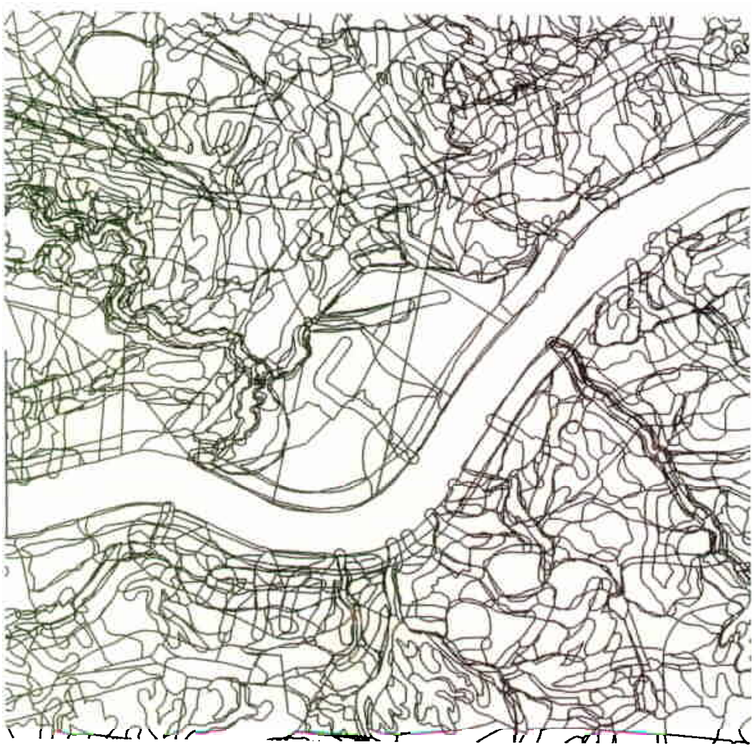


Figure 10: Example of the resultant coverage

Since the purpose of the analysis was to not only provide short and long-term forecasts of timber supply, but also to support operational planning, the spatial location of timber and non-timber related resource features had to be explicitly maintained. As a result, the spatial resource inventories collected for the analysis were combined into a single resultant coverage that was then used to represent the land base in the timber supply model. Due to the complexity of the inventories used, the resultant coverage consisted of nearly half a million discreet polygons which were explicitly tracked through time by the forest estate model. **Figure 10** reveals a small portion of the resultant coverage along the Fraser River that was used in the analysis.

A critical component necessary for the successful implementation of an operationally relevant spatial analysis is a treatment unit or block coverage, also referred to as a total chance plan. The treatment unit coverage delineates the land base into spatially discreet polygons that the model uses to schedule harvests or other forest management activities. To be operationally meaningful, these treatment units must conform to the layout and design specifications of the various logging systems that will be used to harvest timber. The treatment unit coverage developed for this analysis was computer generated using the McGregor Treatment Unit Model. The model utilizes information such as timber type, stand age and slope, to optimally delineate areas into operationally relevant blocks. The blocks generated can be aggregated together to create larger contiguous units (e.g. for biodiversity patch size modelling), but they cannot be subdivided[29]. In FPS/ATLAS, a block will not be harvested until all stands within the block are at or above minimum harvest age.

[27] The MP8 timber supply analysis was completed by Industrial Forestry Services Ltd. of Prince George using IFSYIELD.

[28] Timber supply forecasts under MP9 were obtained using Forest Planning Studio (FPS/ATLAS), Version 5, developed at the University of British Columbia.

[29] See Appendix II of the information package for details regarding the development of the treatment unit coverage used under the analysis.

Another critical component is the spatial relationship between polygons. This is accomplished through an adjacency table generated by GIS that tells the model which polygons are neighbours. As a result, spatial harvest rules can be explicitly represented and the timber supply effects of harvest distributions and patterns are more accurately assessed.

FPS/ATLAS is capable of allowing the analyst to define periods of varying time spans for any particular scenario. Since outputs from this timber supply analysis will be used directly to support operational planning, all forecasts were obtained using 33 reporting periods where each period was one year in length for the first five years, five years in length thereafter to year 60 and then 20 years in length throughout the remainder of the planning horizon. FPS/ATLAS updates all time dependant attributes (e.g. stand age) by the number of years in a reporting period prior to scheduling harvests. Therefore, an area harvested in a 20-year period for example is reported as being age 0 by the model at the end of the period. If the next period is also 20 years in length, then this area is considered 20 years of age by FPS/ATLAS at the start of the next period, prior to harvest scheduling.

In the absence of explicit growth and yield projections to predict stand response to partial cut silviculture systems, FPS/ATLAS utilizes an approach that approximates even-aged partial cut systems (e.g. large group selection) by altering the age of a partially cut polygon following harvest based on a residual growing stock (volume/ha) parameter specified for the stand by the analyst, based on the partial cut prescription required. For example, a stand 120 years of age has a yield of 400 m^3/ha. Based on the partial cut prescription for the stand, a residual growing stock level of 330 m^3/ha was specified by the analyst. Once harvested by the model, the age of the polygon is now set to the age where the residual growing stock level of 330 m^3/ha occurs on the volume curve assigned, for example 100 years, assuming the stand does not move to another growth and yield curve following treatment. When the polygon again reaches 120 years of age, it will again be harvested to 330 m^3/ha, and have its age set to 100 years. This cycle repeats itself, with a harvest of 70 m^3/ha every 20 years.

With respect to biodiversity patch size modelling, the FPS/ATLAS scheduler cannot explicitly target for patch size class thresholds. However, the model can be made to create patches by manipulating the model inputs and FPS/ATLAS is capable of patch size assessments based on outputs. To implement biodiversity patch size requirements under the Base Case forecast, zonation and various constraint parameters available within the model were used to try and create patches as per the requirements laid out in the information package.

To create medium and large patches harvest blocks were aggregated into patches outside of the model and then represented as zones inside the model with no adjacency requirements within each zone. The areas within each LU delineated into zones for medium and large patches were based on the target thresholds by size class based on THLB area. For example, 40% of the THLB within the Seebach LU was targeted to consist of zones as close to 250 ha in size as possible. Patch zones did not include special management areas such as VQOs and Caribou Connecting Corridors since constraints applied to these areas would preclude large aggregated harvest units. **Figure 11** shows the spatial distribution of biodiversity patches by size class used for the Base Case.

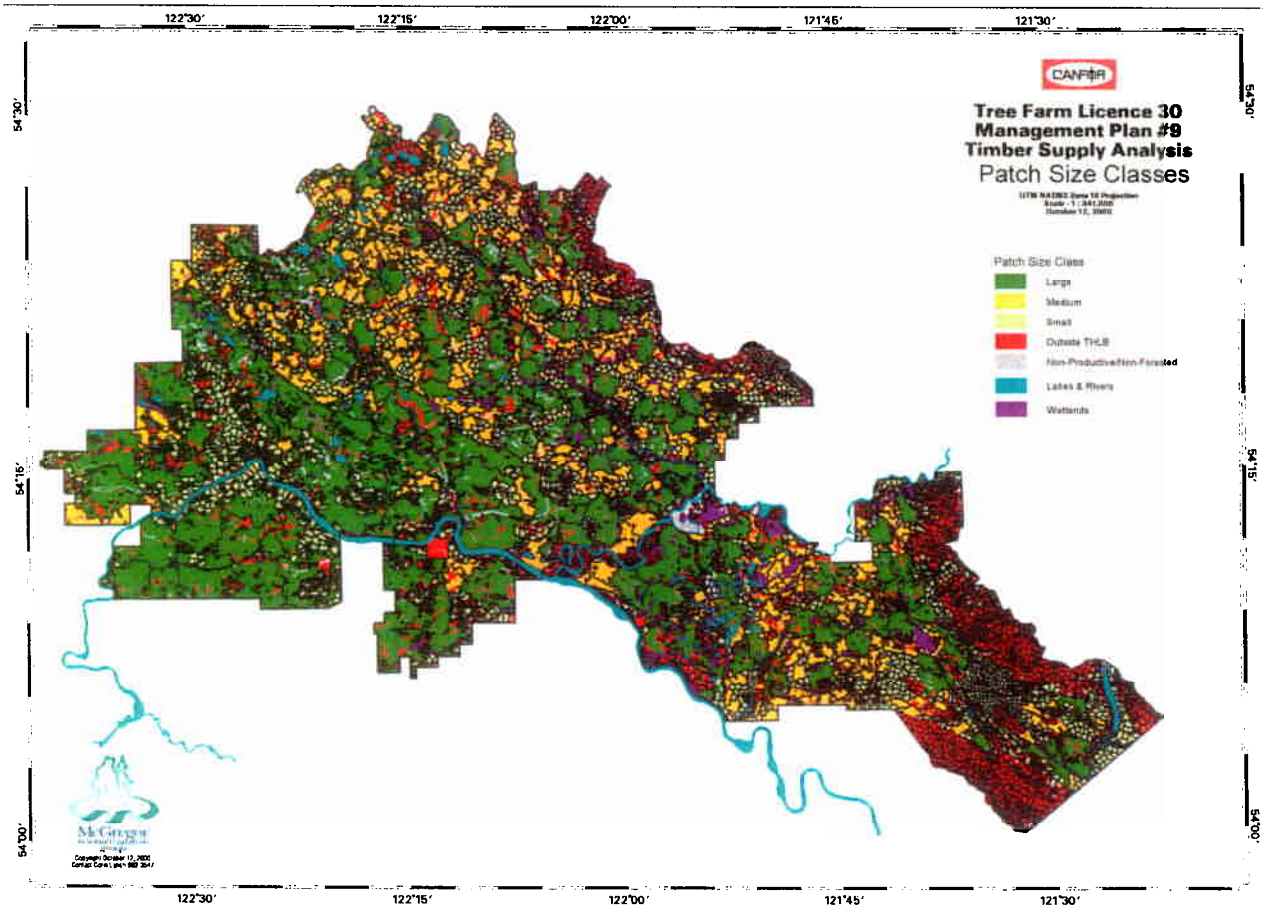


Figure 11: Base Case biodiversity patch sizes

Each patch zone was then allocated to a harvest pass. The size and distribution of patch zones resulted in four passes where adjacent patch zones were not permitted to belong to the same pass. Since only areas considered forested and <=20 years of age contribute to patch size thresholds, a 20-year cutting cycle was implemented between each pass. Therefore, all harvests within the first 20 years were restricted to Pass 1 Patch Zones. Between 21 and 40 years from now, harvests were restricted to Pass 2 zones only and so on. In addition, the 20-year cycle ensured that harvested areas would not exceed the maximum patch sizes permitted within each LU as well as allow for a reasonable proximity to be maintained between large and medium sized units. Finally, patch zones with the highest amount of currently available volume were allocated to the first pass in order to maximize flows over the short-term while at the same time, an effort was made to balanced the amount of harvest area across each pass to ensure even-flows and stable growing stock levels over the long-term.

Small patches were created using individual blocks delineated by the McGregor Treatment Unit Model. Small patches were distributed amongst medium and large patch zones as well as special management areas and were targeted to occupy between 30 to 40% of the THLB within the Seebach and Woodall LUs and between 10 and 20% of the THLB within the Averil. A 20-year adjacency constraint was applied to these areas to ensure aggregated harvests did not occur and a reasonable proximity between small patches was maintained.

Large and medium sized patch zones were given a higher priority for harvest than areas contributing small patches. **Figure 12** shows the spatial distribution of biodiversity patches by pass allocation used for the Base Case.

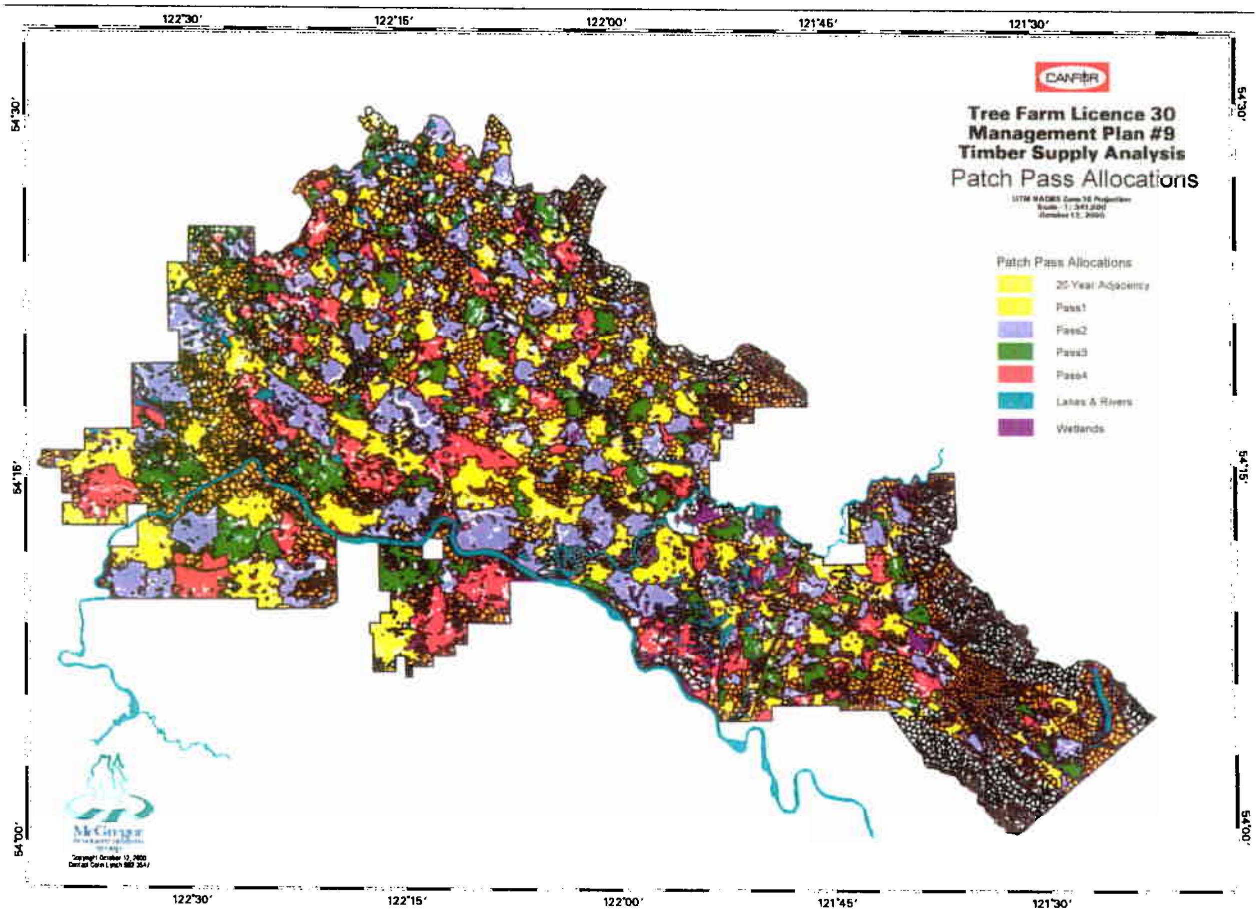


Figure 12: Base Case biodiversity patches by pass allocation

5.0 Analysis Results

This section presents the results of the timber supply analysis for TFL30 under MP9.

5.1 Base Case Harvest Forecast

The Base Case harvest forecast represents the anticipated short and long-term timber supply available from the TFL based on estimates of growth and yield along with the land use decisions and forest management practices to be implemented under MP9, as summarized in Table 1. Because the planning horizon under the Base Case forecast extends hundreds of years into the future, uncertainty surrounds much of the information important in determining timber supply. This uncertainty will be discussed in Section 6.

Figure 13 shows the Base Case harvest forecast[30] obtained for TFL30 under MP9 relative to the Base Case forecast that was obtained five years earlier under MP8. In addition, the long-run sustained yield (LRSY) is shown for reference[31].

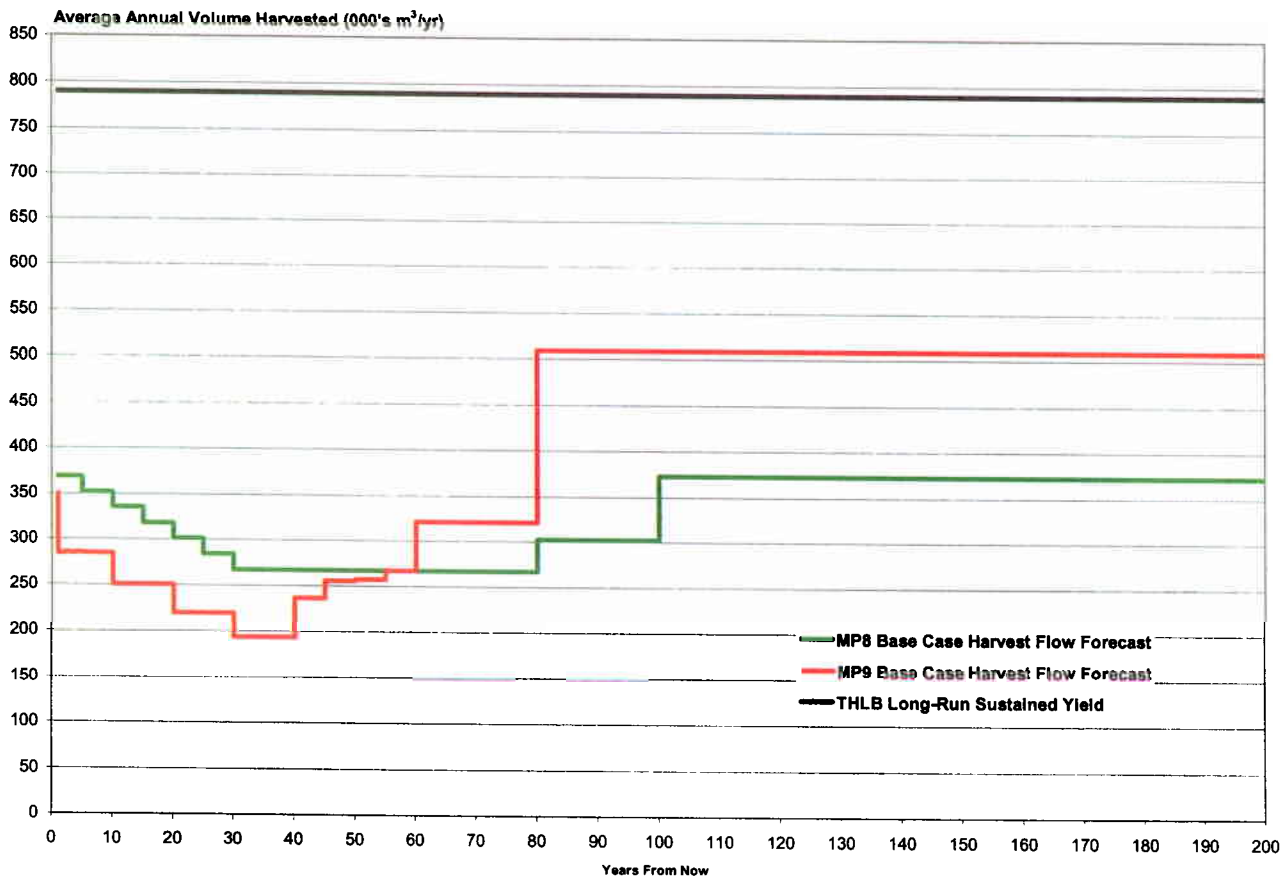


Figure 13: MP9 and MP8 Base Case harvest flow forecasts

[30] Net of unsalvaged or non-recoverable losses (NRLs) at 3,640 m^3/yr.

[31] Note that LRSY is a measure of land base productivity and is independent of forest structure, land-use decisions and forest management practices. It represents the **maximum** sustained rate of harvest which could be achieved and should not be confused with the Long-Term Harvest Level (LTHL) which represents the sustained rate of harvest achievable when forest structure (e.g. age class distribution), land-use decisions (e.g. THLB) and forest management practices (e.g. forest cover requirements) are considered. In all cases the LTHL of a land base will always be less than its LRSY.

Table 3 presents the same information as shown in Figure 13 but in tabular form.

Table 3: MP9 and MP8 Base Case harvest flow forecasts

Planning Horizon	Period Number	Years from Now	Years in Period	MP8 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to MP8	THLB Long-Run Sustained Yield (m^3/yr.)	Percent Difference in MP8 Flow Relative to LRSY	Percent Difference in MP9 Flow Relative to LRSY
	1	1	1	369,360		**350,000**		-5%	789,834	-53%	-56%
	2	2	1	369,360	0%	**284,548**	-19%	-23%	789,834	-53%	-64%
	3	3	1	369,360	0%	**285,291**	0%	-23%	789,834	-53%	-64%
Short-Term	4	4	1	369,360	0%	**284,882**	0%	-23%	789,834	-53%	-64%
	5	5	1	369,360	0%	**285,582**	0%	-23%	789,834	-53%	-64%
	6	6-10	5	352,360	-5%	**285,110**	0%	-19%	789,834	-55%	-64%
	7	11-15	5	335,360	-5%	**250,460**	-12%	-25%	789,834	-58%	-68%
	8	16-20	5	318,360	-5%	**250,460**	0%	-21%	789,834	-60%	-68%
	9	21-25	5	301,360	-5%	**219,968**	-12%	-27%	789,834	-62%	-72%
	10	26-30	5	284,360	-6%	**219,968**	0%	-23%	789,834	-64%	-72%
	11	31-35	5	267,360	-6%	**193,690**	-12%	-28%	789,834	-66%	-75%
	12	36-40	5	267,360	0%	**193,690**	0%	-28%	789,834	-66%	-75%
Mid-Term	13	41-45	5	267,360	0%	**236,170**	22%	-12%	789,834	-66%	-70%
	14	46-50	5	267,360	0%	**255,058**	8%	-5%	789,834	-66%	-68%
	15	51-55	5	267,360	0%	**257,183**	1%	-4%	789,834	-66%	-67%
	16	56-60	5	267,360	0%	**267,225**	4%	0%	789,834	-66%	-66%
	17	61-80	20	267,360	0%	**321,175**	20%	20%	789,834	-66%	-59%
	18	81-100	20	302,693	13%	**508,759**	58%	68%	789,834	-62%	-36%
	19	101-120	20	373,360	23%	**508,759**	0%	36%	789,834	-53%	-36%
	20	121-140	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	21	141-160	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	22	161-180	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	23	181-200	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	24	201-220	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
Long-Term	25	221-240	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	26	241-260	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	27	261-280	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	28	281-300	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	29	301-320	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	30	321-340	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	31	341-360	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	32	361-380	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%
	33	381-400	20	373,360	0%	**508,759**	0%	36%	789,834	-53%	-36%

Based on the MP8 timber supply analysis, the initial harvest flow objective for MP9 stated that the current AAC of 350,000 m3/yr was to be maintained for as long as possible without allowing declines to exceed 10% per decade. However, due to changes in land base inventories, estimates of growth and yield and forest management practices since the last timber supply analysis, this harvest flow objective could not be realized due to significant timber supply shortfalls occurring over the 10 year period 30 to 40 years from now. As a result of this shortfall in the first half of the mid-term, combined with provincial policy requiring that declines in timber supply across sustained yield units cannot exceed 12% per decade, an immediate reduction of 19% to 285,000 m^3/yr is required, relative to the current AAC of 350,000 m^3/yr.

Note that Period 1, Year 1 (2001 calendar year) has already elapsed. As a result, a portion of the harvest schedule for this period reflects actual deletions to the land base subject to the current AAC. Consequently, NRLs were not deducted from the flow target. In essence, scheduling in period 1 served to update the forest inventory for disturbance and stocking in order to ensure both non-timber resource indicators as well as the remainder of the harvest flow projection is consistent with the actual age class distribution across the TFL.

Based on Canfor's harvest records, 350,000 m^3 of timber was harvested in 2001, of which approximately 66% or 231,399 m^3 consisted of Category A blocks identified under Canfor's current five-year forest development plan (28 blocks in total). These blocks have been subsequently incorporated into this analysis. The remaining 34% or 118,601 m^3 of timber harvested consisted of pest management blocks which fell outside the scope of Canfor's current forest development plan. Canfor was unable to provide the spatial location of these areas within the timeframes necessary in order to incorporate them into this analysis. Therefore, to account for this additional area, the target harvest flow was set to 350,000 m^3 in period 1. Note however, that it is unlikely that the areas scheduled by FPS/ATLAS within this period match the spatial location of the actual estimated 500 ha harvested. As a result, timber and non-timber resource indicators forecast under this timber supply analysis may be subject to some error. Also note that the volume flows reported in Periods 2 to 5 consist entirely of blocks proposed for harvest under Canfor's current five-year development plan. Under Period 6, 44% of the volume flow consists of Category A blocks proposed for harvest under Canfor's current five-year development plan.

The analysis shows that this new harvest level of 285,000 m^3/yr can be maintained for the next 10 years before harvest levels must decline by 12% per decade for 3 decades to 193,690 m^3/yr. Over the next 40 years, starting 41 years from now, the harvest level increases at an average rate of 9% per decade to a long-term harvest level of 508,759 m^3/yr, beginning 81 years from now.

On average over the short-term, timber supply under MP9 is 22% below the harvest levels obtained under MP8. Over the mid-term period, 21 to 80 years from now, timber supply is on average 4% below MP8 harvest levels, ranging from 27% below MP8 levels at the start of the mid-term, to 20% above in the last period of the mid-term, 61 to 80 years from now. This suggests that the changes to resource strategies resulting in downward pressures to timber supply between MP8 and MP9 as listed in Table 2 outweigh the factors resulting in upward pressures over the short and mid-terms. Over the long-term, the harvest level obtained under MP9 is 36% higher than the long-term harvest level (LTHL) achieved under MP8 and is realized 20 years sooner. Overall, this suggests that increases to managed stand site productivity estimates under MP9 significantly outweigh the additional land base removals, yield reductions for spruce leader weevil and the additional forest management requirements of the FPC and LRMP over this time period.

If over the long-term, once the age class distribution has normalized, all future managed stands across the THLB could be harvested right at culmination age, then the second growth inventory is capable of supporting a LRSY of 789,834 m^3/yr. However, because of timber and non-timber related resource objectives, these stands cannot be harvested at culmination and as a result, the LTHL under MP9 is 36% below LRSY.

5.2 Base Case Timber Supply Dynamics

5.2.1 Composition of the Base Case Harvest Forecast

Figure 14 shows the average annual volume harvested from natural and managed stands in each period over the planning horizon.

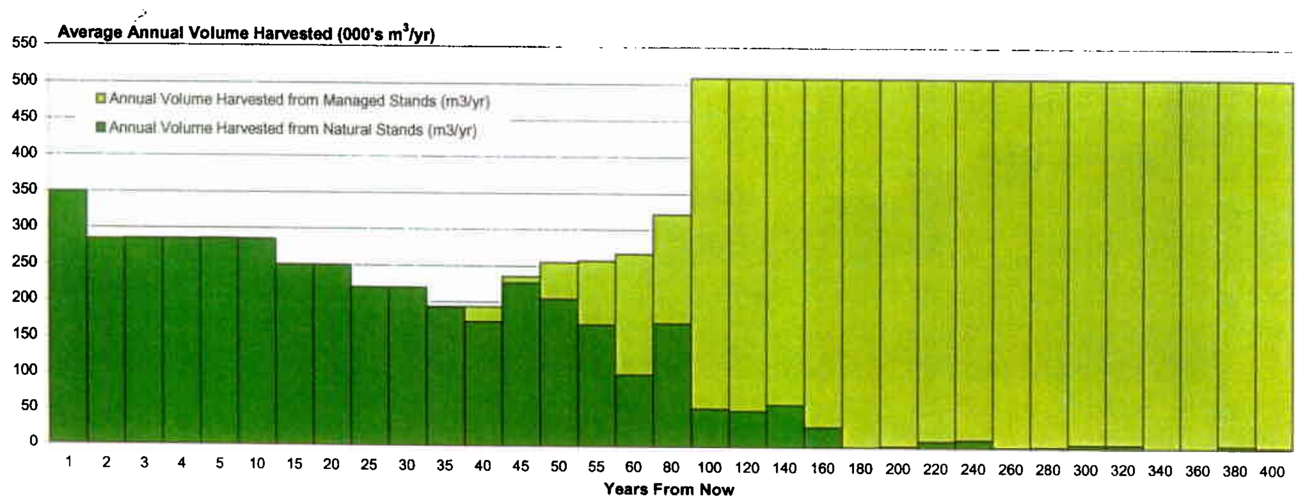


Figure 14: Contribution of natural and managed stands to timber supply

Planning Horizon	Period	Years from now	Total Annual Volume Harvested (m^3/yr)	Annual Volume Harvested from Natural Stands (m^3/yr)	Percent of Total Annual Volume Harvested	Annual Volume Harvested from Managed Stands (m^3/yr)	Percent of Total Annual Volume Harvested
Short-Term	1	1	350,000	350,000	100%	0	0%
	2	2	284,548	284,548	100%	0	0%
	3	3	285,291	285,291	100%	0	0%
	4	4	284,882	284,882	100%	0	0%
	5	5	285,582	285,582	100%	0	0%
	6	10	285,110	285,110	100%	0	0%
	7	15	250,460	250,141	100%	319	0%
	8	20	250,460	250,422	100%	38	0%
Mid-Term	9	25	219,968	219,968	100%	0	0%
	10	30	219,968	219,638	100%	330	0%
	11	35	193,690	192,443	99%	1,247	1%
	12	40	193,690	172,668	89%	21,022	11%
	13	45	236,170	227,204	96%	8,966	4%
	14	50	255,058	204,545	80%	50,513	20%
	15	55	257,183	169,467	66%	87,716	34%
	16	60	267,225	101,102	38%	166,123	62%
	17	80	321,175	171,773	53%	149,402	47%
Long-Term	18	100	508,759	54,725	11%	454,034	89%
	19	120	508,759	51,410	10%	457,349	90%
	20	140	508,759	60,158	12%	448,601	88%
	21	160	508,759	29,514	6%	479,245	94%
	22	180	508,759	1,314	0%	507,445	100%
	23	200	508,759	2,765	1%	505,994	99%
	24	220	508,759	10,438	2%	498,321	98%
	25	240	508,759	12,433	2%	496,326	98%
	26	260	508,759	1,475	0%	507,284	100%
	27	280	508,759	1,983	0%	506,776	100%
	28	300	508,759	6,173	1%	502,586	99%
	29	320	508,759	5,821	1%	502,938	99%
	30	340	508,759	651	0%	508,108	100%
	31	360	508,759	727	0%	508,032	100%
	32	380	508,759	5,121	1%	503,638	99%
	33	400	508,759	2,085	0%	506,674	100%

As anticipated, Figure 14 reveals that over the short-term 100% of the annual volume harvested under the Base Case forecast is obtained from naturally established stands. Over the mid-term, on average, 74% of the annual volume harvested is from naturally established forest with 26% from managed plantations. Managed second growth comprises the majority of the annual volume harvested 81 years from now. Over the long-term, 97% of the LTHL consists of managed second growth volume. The 3% contributed by natural stands over the long-term are harvested from areas with restrictive forest cover and adjacency requirements, such as visually sensitive units and mountain caribou connecting corridors as well as medium value caribou habitat areas where partial cuts requiring 70% volume retention is prescribed.

Figure 15 shows the average annual volume harvested by inventory age class in each period over the planning horizon.

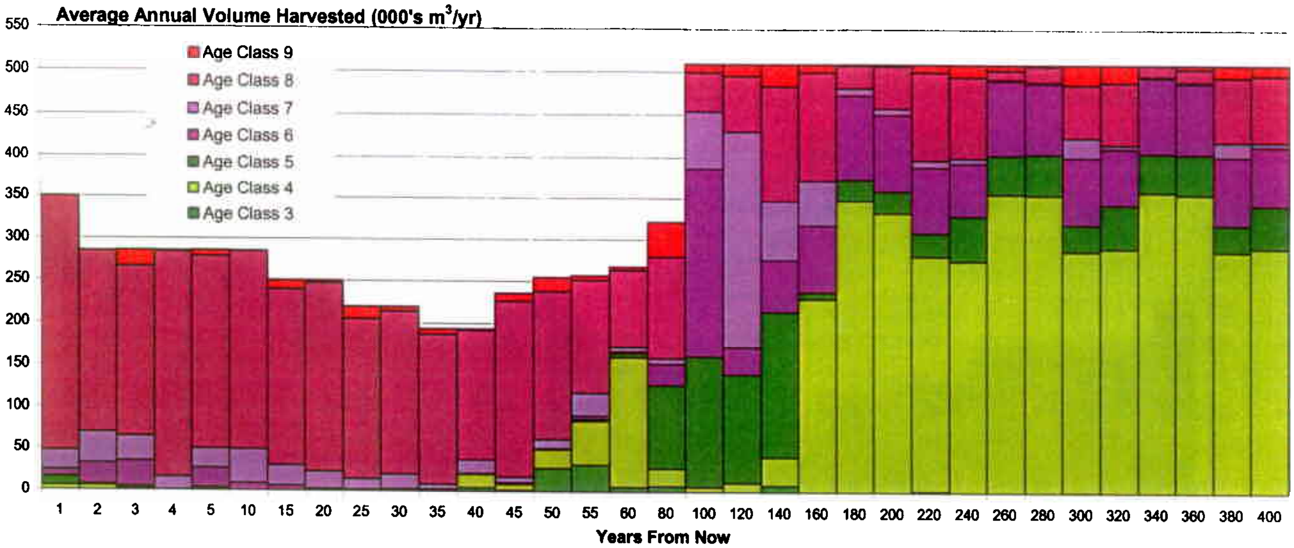


Figure 15: Annual volume harvested by age class

Planning Horizon	Period	Years from now	Percent of Total Annual Volume Harvested by Age Class						
			3 (41 to 60 yrs.)	4 (61 to 80 yrs.)	5 (81 to 100 yrs.)	6 (101 to 120 yrs.)	7 (121 to 140 yrs.)	8 (141 to 250 yrs.)	9 (>250 yrs.)
Short-Term	1	1		2%	3%	2%	7%	86%	
	2	2		2%	1%	9%	13%	75%	
	3	3			1%	11%	10%	71%	7%
	4	4					6%	94%	
	5	5			1%	8%	8%	80%	2%
	6	10				3%	14%	82%	
	7	15				2%	10%	84%	4%
	8	20				1%	8%	89%	1%
Mid-Term	9	25				1%	6%	87%	7%
	10	30				1%	8%	88%	2%
	11	35	1%			1%	3%	92%	3%
	12	40	3%	8%			8%	80%	1%
	13	45	1%	3%		1%	3%	89%	4%
	14	50	11%	9%			4%	69%	6%
	15	55	13%	21%	1%	1%	10%	52%	2%
	16	60	2%	58%	2%	1%	2%	34%	1%
	17	80	2%	7%	31%	8%	2%	37%	13%
Long-Term	18	100		1%	30%	44%	13%	9%	2%
	19	120		2%	25%	6%	51%	13%	3%
	20	140	2%	7%	34%	12%	14%	27%	5%
	21	160		45%	2%	15%	11%	25%	2%
	22	180		68%	5%	20%	2%	5%	
	23	200		65%	5%	18%	2%	10%	
	24	220		55%	5%	16%	2%	20%	2%
	25	240		54%	11%	13%	1%	18%	3%
	26	260		70%	9%	17%		2%	1%
	27	280		70%	10%	16%		4%	
	28	300		56%	6%	16%	4%	12%	5%
	29	320		57%	10%	14%	1%	14%	4%
	30	340		71%	9%	17%		3%	
	31	360		70%	10%	16%		3%	1%
	32	380		56%	6%	16%	3%	15%	3%
	33	400		57%	10%	14%	1%	15%	2%

As anticipated, Figure 15 reveals that over the short and mid-terms, the majority of the Base Case harvest forecast is supported by stands in age class 8 since 36% of the THLB is currently found in this age class. As managed stands begin to reach minimum harvest age beginning 30 years from now, the proportion of the harvest obtained from younger age classes increases through the mid-term. Over the first three periods of the long-term, the majority of the LTHL is supported by stands in age classes 5, 6 and 7 as the age class distribution begins to normalize across the THLB. By year 200 until the end of the planning horizon, on average, 62% of the LTHL is supported by stands in age class 4, followed by age class 6 at 16% and age class 8 at 11% with the remaining 13% obtained from age classes 5, 7 and 9. Note that harvests over the first 5 years of the forecast have been fixed scheduled according to Canfor's current forest development plan and as a result, harvest volumes are obtained from stands in age classes 4 to 7. In addition, the pattern of age classes harvested over the long-term starting in year 180, reflects the harvest cycle created as a result of biodiversity patch size requirements.

Figure 16 shows from which resource emphasis zones the Base Case harvest forecast was obtained in each period.

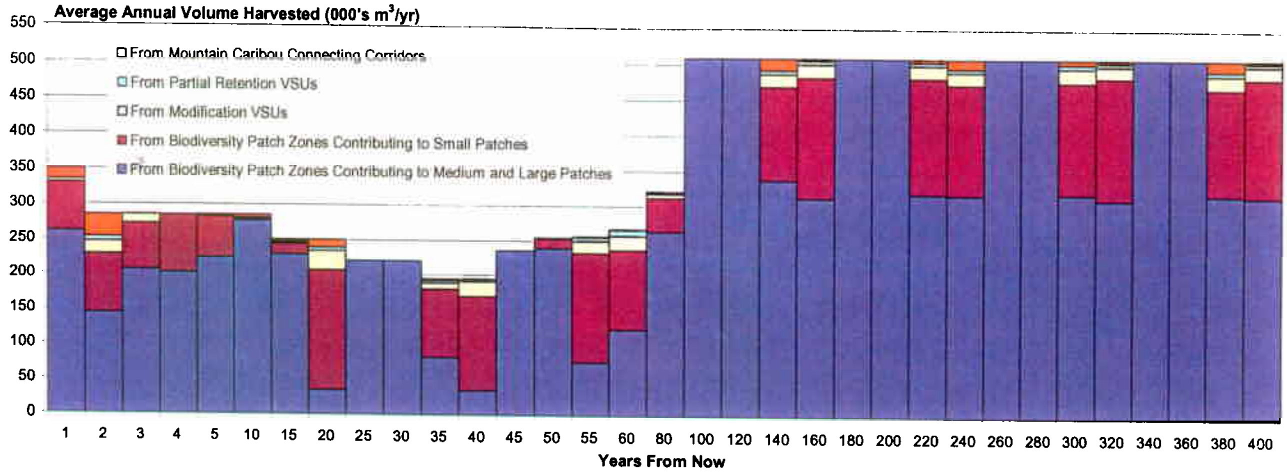


Figure 16: Harvest contribution by resource emphasis zone

Planning Horizon	Period	Years from now	Percent of Total Annual Volume Harvested: From Biodiversity Patch Zones Contributing to Medium and Large Patches	From Biodiversity Patch Zones Contributing to Small Patches	From Modification VSUs	From Partial Retention VSUs	From Mountain Caribou Connecting Corridors
Short-Term	1	1	75%	20%	1%	0%	4%
	2	2	51%	30%	6%	2%	11%
	3	3	72%	24%	4%	0%	0%
	4	4	71%	29%	0%	0%	0%
	5	5	79%	20%	1%	0%	0%
	6	10	97%	1%	0%	0%	1%
	7	15	91%	6%	1%	0%	1%
	8	20	14%	68%	12%	2%	4%
Mid-Term	9	25	100%	0%	0%	0%	0%
	10	30	100%	0%	0%	0%	0%
	11	35	42%	50%	5%	2%	1%
	12	40	18%	70%	11%	2%	0%
	13	45	100%	0%	0%	0%	0%
	14	50	94%	5%	1%	0%	0%
	15	55	30%	61%	7%	3%	0%
	16	60	46%	43%	7%	4%	0%
	17	80	82%	15%	2%	1%	0%
Long-Term	18	100	100%	0%	0%	0%	0%
	19	120	100%	0%	0%	0%	0%
	20	140	66%	26%	3%	1%	3%
	21	160	61%	33%	4%	1%	0%
	22	180	100%	0%	0%	0%	0%
	23	200	100%	0%	0%	0%	0%
	24	220	63%	32%	4%	1%	1%
	25	240	62%	31%	3%	1%	3%
	26	260	100%	0%	0%	0%	0%
	27	280	100%	0%	0%	0%	0%
	28	300	63%	31%	4%	1%	1%
	29	320	61%	34%	3%	1%	1%
	30	340	100%	0%	0%	0%	0%
	31	360	100%	0%	0%	0%	0%
	32	380	63%	29%	4%	1%	3%
	33	400	62%	33%	3%	1%	1%

Figure 16 reveals that the majority of the timber supply is obtained from biodiversity patch zones contributing to medium and large sized patches followed by areas contributing to small patches which fall outside visually sensitive areas and caribou connecting corridors.

Due to the restrictive forest cover and adjacency requirements associated with partial retention visual units and caribou corridors, only 1% of the volume harvested over the planning horizon is obtained from within these resource emphasis areas. Harvests occurring in the first two periods within caribou corridors consist of fixed scheduled blocks under Canfor's current forest development plan.

Over the long-term, Figure 16 also reveals that 100% of the LTHL is obtained from biodiversity patch zones contributing large and medium sized patches in Pass 1 and Pass 2 zones[32].

[32] See Figure 12 of this report for the spatial location of each pass.

Figure 17 shows the average annual volume harvested by tree species in each period over the planning horizon.

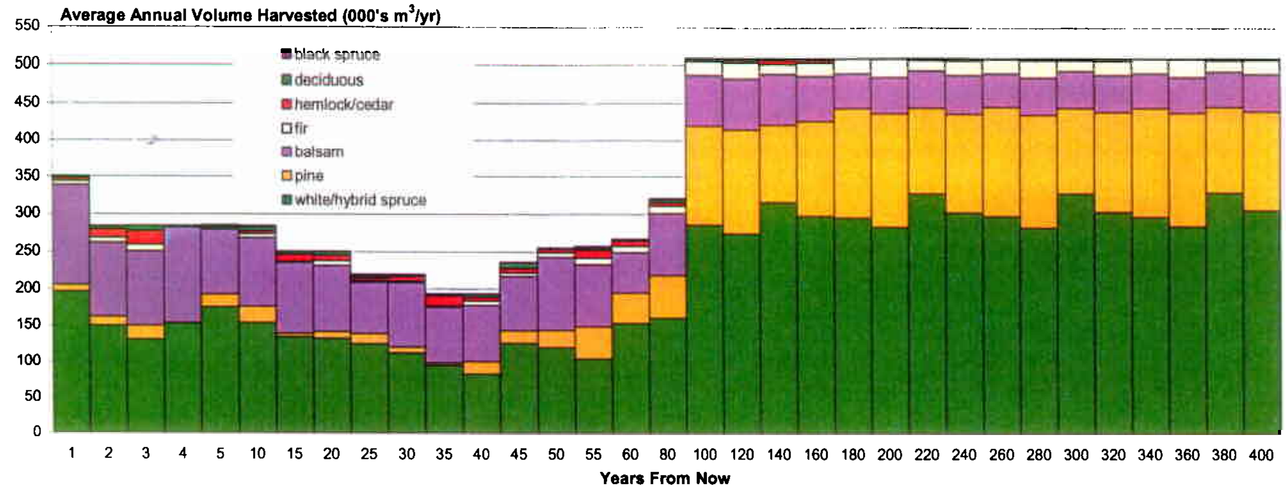


Figure 17: Harvest composition by species

Planning Horizon	Period	Years from now	Percent of Total Annual Volume Harvested by Species: white/ hybrid spruce	pine	balsam	fir	hemlock/ cedar	deciduous	black spruce
Short-Term	1	1	56%	3%	38%	2%	1%	1%	0%
	2	2	53%	4%	35%	2%	4%	1%	0%
	3	3	46%	7%	35%	3%	7%	3%	0%
	4	4	54%	0%	45%	0%	1%	0%	0%
	5	5	61%	6%	30%	1%	0%	1%	0%
	6	10	54%	8%	32%	2%	1%	2%	1%
	7	15	54%	2%	39%	1%	4%	1%	0%
	8	20	53%	4%	36%	3%	3%	2%	0%
Mid-Term	9	25	57%	6%	32%	1%	2%	1%	1%
	10	30	51%	3%	40%	1%	3%	1%	0%
	11	35	49%	2%	39%	1%	7%	1%	0%
	12	40	43%	9%	40%	3%	3%	2%	0%
	13	45	53%	7%	31%	2%	2%	3%	0%
	14	50	47%	9%	39%	2%	2%	0%	0%
	15	55	41%	17%	33%	4%	4%	1%	1%
	16	60	58%	15%	20%	3%	3%	1%	0%
	17	80	50%	18%	26%	3%	1%	1%	0%
Long-Term	18	100	56%	26%	13%	3%	0%	0%	0%
	19	120	54%	28%	13%	4%	1%	0%	0%
	20	140	62%	21%	13%	3%	1%	0%	0%
	21	160	59%	25%	12%	3%	1%	0%	0%
	22	180	58%	29%	9%	4%	0%	0%	0%
	23	200	56%	30%	9%	5%	0%	0%	0%
	24	220	64%	23%	9%	3%	0%	0%	0%
	25	240	60%	26%	10%	4%	1%	0%	0%
	26	260	59%	29%	9%	4%	0%	0%	0%
	27	280	56%	30%	9%	5%	0%	0%	0%
	28	300	64%	23%	9%	3%	0%	0%	0%
	29	320	60%	27%	9%	4%	0%	0%	0%
	30	340	58%	29%	9%	4%	0%	0%	0%
	31	360	56%	30%	9%	5%	0%	0%	0%
	32	380	65%	23%	9%	3%	0%	0%	0%
	33	400	60%	26%	9%	4%	0%	0%	0%

Figure 17 reveals that on average over the short-term, 54% of the volume harvested consists of spruce and 36% consists of balsam followed by pine at 4%, hemlock/cedar at 3%, fir at 2% and deciduous species at 1%.

Over the mid-term, 50% of the volume harvested consists of spruce and 33% consists of balsam followed by pine at 10%, with the remaining species represented in the same proportions as under the short-term.

Over the long-term, 59% of the volume harvested consists of spruce and 27% consists of pine followed by balsam at 10% and fir at 4%.

Overall, the proportion of spruce in the harvest profile remains relatively steady, decreasing by 4% over the mid-term and then increasing by 9% across the long-term. However, the proportion of pine increases substantially, from 4% over the short to mid-terms to becoming the secondary species component of the harvest profile at 27% over the long-term. The composition of the harvest profile over the short and mid-terms is consistent with the current inventory across the THLB as shown in Figure 3. Over the long-term, the harvest profile is consistent with the distribution of ecosystems across the THLB and their associated silviculture regimes[33].

[33] See Table 18 in Appendix III of the information package for the silvicultural regimes used for the analysis.

Figure 18 shows the merchantable growing stock level present at the end of each period for the THLB.

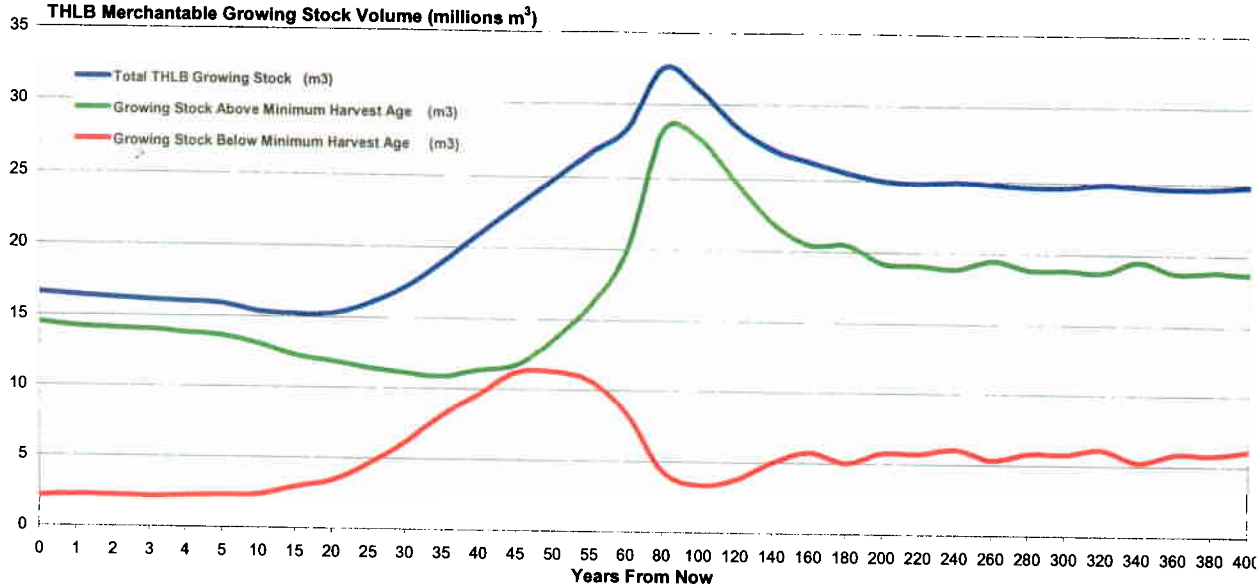


Figure 18: THLB merchantable growing stock forecast

Planning Horizon	Period	Years from now	Total THLB Growing Stock (m³)	Percent Change In Growing Stock Relative to Previous Period	Growing Stock Above Minimum Harvest Age (m³)	Percent Change In Growing Stock Relative to Previous Period	Growing Stock Below Minimum Harvest Age (m³)	Percent Change In Growing Stock Relative to Previous Period	Percent of Total THLB Growing Stock Above Minimum Harvest Age
Current	0	0	16,603,358		14,471,387		2,131,971		87%
Short-Term	1	1	16,417,745	-1%	14,203,532	-2%	2,214,213	4%	87%
	2	2	16,288,483	-1%	14,080,530	-1%	2,207,953	0%	86%
	3	3	16,168,772	-1%	14,032,686	0%	2,136,086	-3%	87%
	4	4	16,041,351	-1%	13,818,318	-2%	2,223,033	4%	86%
	5	5	15,930,890	-1%	13,635,897	-1%	2,294,993	3%	86%
	6	10	15,392,343	-3%	13,058,224	-4%	2,334,119	2%	85%
	7	15	15,212,836	-1%	12,291,284	-6%	2,921,552	25%	81%
	8	20	15,295,608	1%	11,894,932	-3%	3,400,676	16%	78%
Mid-Term	9	25	16,048,441	5%	11,414,378	-4%	4,634,063	36%	71%
	10	30	17,249,518	7%	11,091,923	-3%	6,157,595	33%	64%
	11	35	18,986,074	10%	10,872,026	-2%	8,114,048	32%	57%
	12	40	20,986,374	11%	11,359,495	4%	9,626,879	19%	54%
	13	45	22,934,104	9%	11,742,042	3%	11,192,062	16%	51%
	14	50	24,824,514	8%	13,543,506	15%	11,281,008	1%	55%
	15	55	26,654,662	7%	16,010,875	18%	10,643,787	-6%	60%
	16	60	28,316,648	6%	19,938,141	25%	8,378,507	-21%	70%
	17	80	32,548,746	15%	28,277,232	42%	4,271,514	-49%	87%
Long-Term	18	100	30,982,868	-5%	27,643,900	-2%	3,338,968	-22%	89%
	19	120	28,497,416	-8%	24,745,264	-10%	3,752,152	12%	87%
	20	140	26,953,554	-5%	21,927,660	-11%	5,025,894	34%	81%
	21	160	26,223,506	-3%	20,461,880	-7%	5,761,626	15%	78%
	22	180	25,522,068	-3%	20,509,165	0%	5,012,903	-13%	80%
	23	200	25,020,434	-2%	19,259,282	-6%	5,761,152	15%	77%
	24	220	24,866,332	-1%	19,153,487	-1%	5,712,845	-1%	77%
	25	240	24,965,664	0%	18,929,290	-1%	6,036,374	6%	76%
	26	260	24,836,838	-1%	19,523,650	3%	5,313,188	-12%	79%
	27	280	24,678,480	-1%	18,885,271	-3%	5,793,209	9%	77%
	28	300	24,682,852	0%	18,899,996	0%	5,782,856	0%	77%
	29	320	24,898,056	1%	18,778,202	-1%	6,119,854	6%	75%
	30	340	24,775,266	0%	19,530,566	4%	5,244,700	-14%	79%
	31	360	24,629,728	-1%	18,789,617	-4%	5,840,111	11%	76%
	32	380	24,644,476	0%	18,864,607	0%	5,779,869	-1%	77%
	33	400	24,831,860	1%	18,755,095	-1%	6,076,765	5%	76%

Figure 18 reveals that growing stock stabilizes after 200 years under the Base Case. In addition, the table reveals that growing stock remains stable over two full rotations under the LTHL of 508,759 m³/yr indicating that the harvest forecast is sustainable, subject to the data inputs and assumptions under the base case. In addition, Figure 18 reveals that on average, 82% of the total THLB growing stock consists of mature volume over the short-term, 69% over the mid-term and 79% over the long-term.

On average over the short-term, THLB growing stock declines by 1% per year from current levels with a total reduction of 8% over this initial 20-year period. Over the mid-term, growing stock increases by 10% per year on average, with a total increase of 103%. Across the long-term, THLB growing stock declines by 4% per year on average, 81 to 200 years from now with a total net decline of 19% after which time it stabilizes for the rest of the planning horizon. The surge in growing stock over the mid-term coincides with an accumulation of merchantable volume associated with the large area currently in age class 1, as shown in Figure 7. As this significant amount of growing stock reaches minimum harvest age, the rate at which it can be harvested is restricted due to biodiversity patch size requirements causing the growing stock level to peak 61 to 80 years from now. After this period, a rapid decline occurs as portions of the THLB are released for harvest in each subsequent 20-year period.

5.2.3 Average Annual Area, Yield and Age Harvested

Figure 19 shows the average annual area harvested from natural and managed stands in each period over the planning horizon.

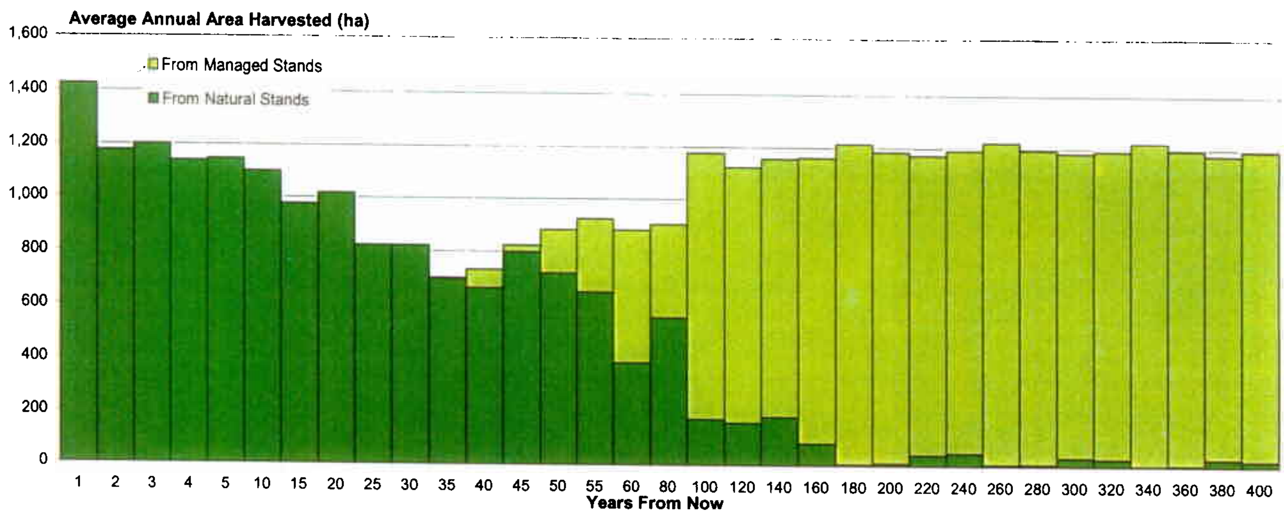


Figure 19: Average annual area harvested

Planning Horizon	Period	Years from now	Average Annual Area Harvested (ha) Total	Percent Change Relative to Previous Period	From Natural Stands	Percent of Total	From Managed Stands	Percent of Total
Short-Term	1	1	1,426		1,426	100%	0	0%
	2	2	1,176	-18%	1,176	100%	0	0%
	3	3	1,202	2%	1,202	100%	0	0%
	4	4	1,139	-5%	1,139	100%	0	0%
	5	5	1,147	1%	1,147	100%	0	0%
	6	10	1,100	-4%	1,100	100%	0	0%
	7	15	977	-11%	977	100%	0	0%
	8	20	1,017	4%	1,017	100%	0	0%
Mid-Term	9	25	822	-19%	822	100%	0	0%
	10	30	822	0%	822	100%	0	0%
	11	35	701	-15%	697	99%	4	1%
	12	40	732	4%	663	91%	69	9%
	13	45	825	13%	797	97%	27	3%
	14	50	884	7%	720	81%	164	19%
	15	55	927	5%	652	70%	274	30%
	16	60	884	-5%	389	44%	495	56%
	17	80	907	3%	558	62%	349	38%
Long-Term	18	100	1,178	30%	178	15%	1,000	85%
	19	120	1,124	-5%	163	14%	962	86%
	20	140	1,157	3%	187	16%	971	84%
	21	160	1,162	0%	84	7%	1,078	93%
	22	180	1,217	5%	7	1%	1,210	99%
	23	200	1,186	-3%	12	1%	1,174	99%
	24	220	1,173	-1%	42	4%	1,131	96%
	25	240	1,192	2%	50	4%	1,142	96%
	26	260	1,222	3%	8	1%	1,215	99%
	27	280	1,195	-2%	9	1%	1,186	99%
	28	300	1,184	-1%	35	3%	1,150	97%
	29	320	1,192	1%	30	3%	1,162	97%
	30	340	1,223	3%	5	0%	1,218	100%
	31	360	1,196	-2%	6	1%	1,190	99%
	32	380	1,178	-1%	30	3%	1,148	97%
	33	400	1,194	1%	23	2%	1,172	98%

Figure 19 reveals that on average 1,078 ha are harvested per year over the short-term. Across the mid-term, the annual area harvested declines by 21% to an average of 852 ha per year. Over the long-term on average, the area harvested increases by 39% to 1,186 ha per year. As anticipated, these trends in average annual areas harvested are relatively proportional to the average annual volumes harvested as shown in Figure 14.

Figure 20 shows the average annual yields harvested over time.

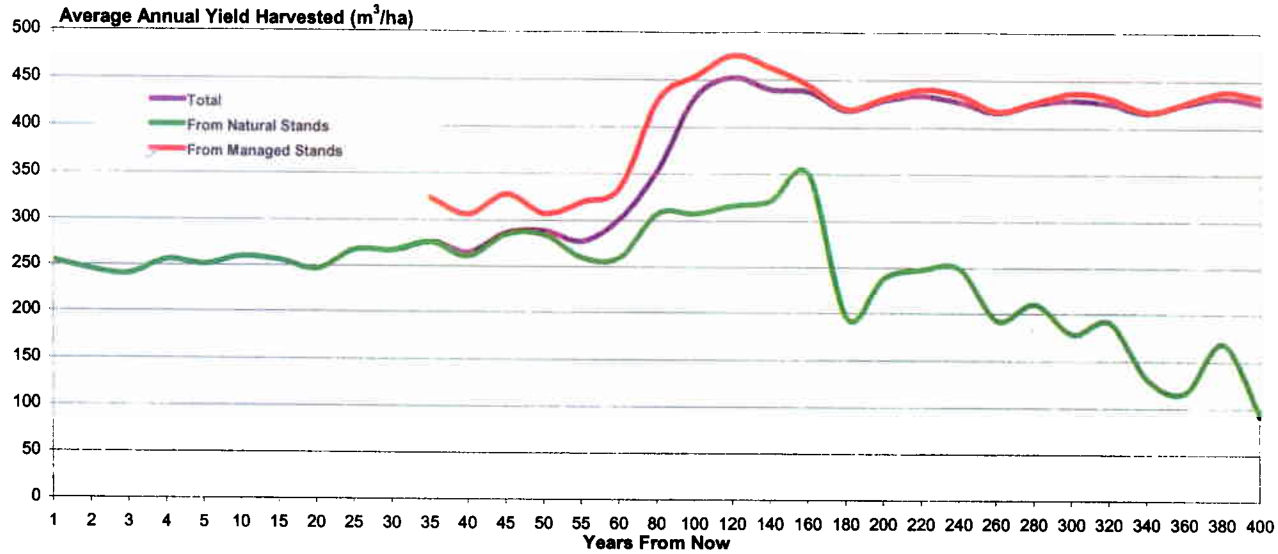


Figure 20: Average annual yield harvested

Planning Horizon	Period	Years from now	Average Annual Yield Harvested (m^3/ha) Total	Percent Change Relative to Previous Period	From Natural Stands	From Managed Stands
Short-Term	1	1	255		255	
	2	2	246	-4%	246	
	3	3	241	-2%	241	
	4	4	256	6%	256	
	5	5	251	-2%	251	
	6	10	260	3%	260	
	7	15	256	-1%	256	
	8	20	247	-4%	247	
Mid-Term	9	25	268	8%	268	
	10	30	267	0%	267	
	11	35	277	3%	276	324
	12	40	265	-4%	261	306
	13	45	286	8%	285	328
	14	50	289	1%	284	308
	15	55	278	-4%	260	320
	16	60	302	9%	260	335
	17	80	354	17%	308	429
Long-Term	18	100	432	22%	308	454
	19	120	453	5%	316	476
	20	140	440	-3%	322	463
	21	160	438	0%	350	445
	22	180	418	-4%	196	419
	23	200	429	3%	239	431
	24	220	434	1%	248	441
	25	240	427	-2%	249	435
	26	260	416	-2%	193	418
	27	280	426	2%	210	427
	28	300	430	1%	178	437
	29	320	426	-1%	191	432
	30	340	416	-2%	130	417
	31	360	426	2%	117	427
	32	380	432	1%	169	439
	33	400	426	-1%	92	433

Figure 20 reveals that on average, 253 m^3/ha are harvested per year over the short-term. Across the mid-term, the annual yield harvested increases by 20% to an average of 204 m^3/ha per year. Over the long-term, the average yield harvested increases once again by 41% relative to the mid-term, to 429 m^3/ha per year.

Typically, average yields decline towards the long-term since natural stands harvested over the short to mid-terms are well past their minimum harvestable ages allowing for volume increment to have accumulated within the stand. As this naturally established forest is depleted it is replaced with managed second growth which is typically harvested closer to its minimum harvestable age and therefore less volume increment has accumulated before the stand is harvested. However, in the case of TFL30, the opposite is true since the remaining inventory of naturally established forest although on average 30 years past minimum harvest age and comprised of highly productive growing sites, suffers in terms of yield due to low stocking from wet soil moisture conditions and heavy brush competition. As these stands are replaced with managed plantations at higher stocking levels, combined with yield projections that reflect large increases to site productivity estimates as well as the binding effect of forest management restrictions forcing them to be harvested beyond their minimum harvestable ages, the average annual yield harvested increases towards the long-term.

Figure 21 shows the area weighted average harvest age obtained under the Base Case forecast for both natural and managed stands.

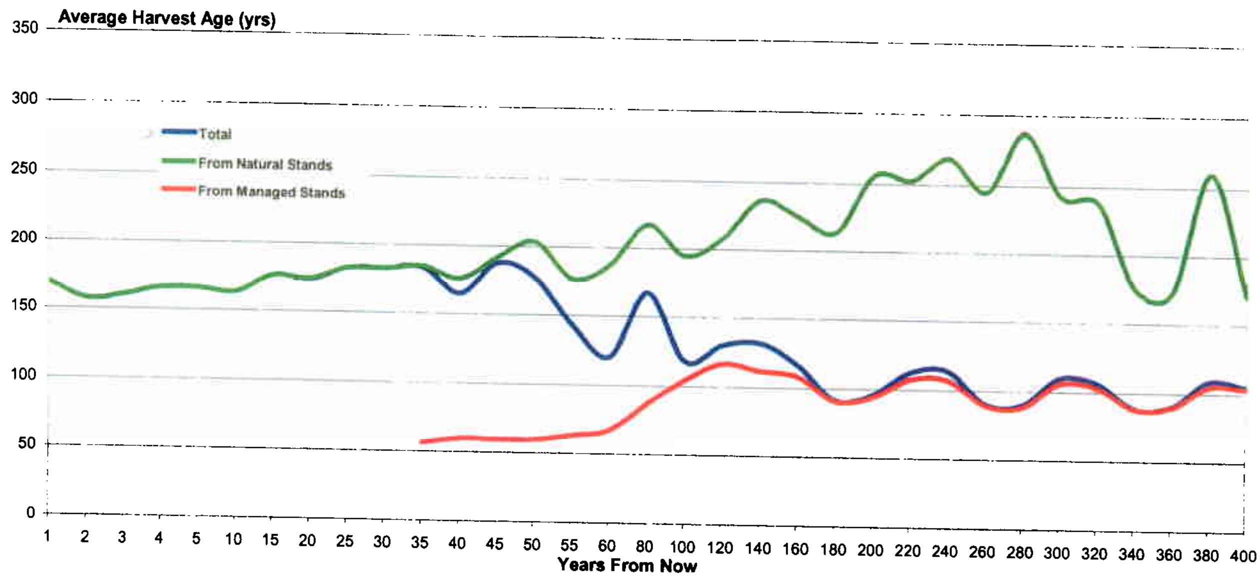


Figure 21: Average harvest age

Planning Horizon	Years from now	Average Harvest Age (yrs.)									
		Total	Pcnt. Chg. Rel. to Prev. Per.	From Natural Stands	Avg. Min. Harv. Age	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Percent Diff. Btw. Min. Harv. Age & Harv. Age	From Managed Stands	Avg. Min. Harv. Age	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Percent Diff. Btw. Min. Harv. Age & Harv. Age
Short - Term	1	169		169	108	61	56%				
	2	158	-7%	158	106	52	49%				
	3	160	2%	160	107	53	50%				
	4	166	4%	166	109	57	53%				
	5	166	0%	166	106	60	57%				
	10	164	-1%	164	105	58	55%				
	15	176	8%	176	107	69	64%				
	20	174	-1%	174	107	67	63%				
Mid-Term	25	182	5%	182	105	77	74%				
	30	182	0%	182	108	74	68%				
	35	184	1%	184	109	76	70%	57	55	2	4%
	40	165	-10%	176	110	65	59%	60	56	4	7%
	45	187	14%	192	106	85	80%	60	57	3	5%
	50	177	-6%	204	109	95	87%	60	58	2	4%
	55	143	-19%	176	110	67	61%	64	59	5	8%
	60	120	-16%	187	109	79	72%	68	63	4	7%
	80	167	39%	217	108	109	100%	87	61	26	44%
Long-Term	100	118	-30%	194	113	82	72%	104	60	44	72%
	120	130	10%	208	112	96	85%	116	60	56	94%
	140	132	1%	236	112	125	112%	111	60	51	86%
	160	116	-12%	224	114	111	98%	108	59	49	83%
	180	91	-21%	214	112	102	91%	91	58	33	57%
	200	96	5%	256	109	147	134%	94	57	37	66%
	220	113	17%	253	108	145	134%	107	60	48	80%
	240	114	1%	269	108	161	148%	107	59	48	82%
	260	91	-20%	245	109	136	124%	90	57	32	56%
	280	90	-1%	287	106	181	170%	89	57	31	55%
	300	110	21%	242	107	135	126%	106	60	46	76%
	320	106	-3%	237	107	130	122%	103	58	45	77%
	340	88	-17%	175	109	66	60%	88	58	30	52%
	360	90	2%	173	105	68	65%	90	57	33	57%
	380	109	20%	260	107	154	144%	105	60	45	76%
	400	105	-4%	170	105	66	63%	104	59	45	76%

As anticipated, Figure 21 reveals that average harvest ages for natural stands over time generally trend upward. Over the short-term, the average age at which natural stands are harvested is 166 years, then climbs 14% to 189 years and finally over the long-term, increases by another 21%, relative to the mid-term, to 228 years as remnants of the natural forest inventory is harvested. The dip in average harvest age 340 to 380 years from now coincides with 11 ha of natural forest harvested over this 40-year time period and likely consisted of stands in age class 2 or 3 at the start of the planning horizon.

Harvested volumes begin to consist of managed forest beginning 30 years from now. Over the remainder of the mid-term, managed stands are harvested on average, only seven years beyond minimum harvest age and therefore, any increase to minimum harvest age beyond seven years will likely have a negative impact on timber supply over this time period. Over the long-term, managed stands are harvested on average, 42 years past minimum harvest age where the average harvest age is 101 years and the average minimum harvestable age is 59 years. Oscillations in managed stand harvest ages over the long-term are a function of biodiversity patch size requirements, where on average, managed stands are harvested at younger ages in Pass 1 and 2 biodiversity patch zones versus Pass 3 and 4 patch zones[34].

Over both the short and mid-terms, much of the harvest delay across natural stands is simply a function of the current age of the natural forest inventory. However, over the long-term, the binding effect of harvest restrictions are solely responsible for preventing managed second growth stands from being harvested at minimum harvestable age. Biodiversity patch size requirements are likely responsible for the majority of the delays since their influence extends across all of the THLB. This is because the 20-year adjacency requirements between patches result in a four-pass cycle. This cycle will delay harvest of managed stands for at least 20 years beyond minimum harvest age since the average minimum harvest age for managed stands is 60 years and the harvest cycle amongst biodiversity patches is 80 years. Other resource requirements which regulate the rate of harvests across the THLB and therefore also contribute to harvest delays include hydrologic recovery targets by watershed and biodiversity seral stage targets for mature and old forests, visually sensitive areas with modification and partial retention objectives and travel corridors for mountain caribou which link critical habitats.

In an effort to provide further insight on the effects of resource targets on harvest age, **Table 4** (on the following page) shows the area weighted harvest ages realized under the Base Case forecast by resource emphasis zone. Note however, that resource targets overlap and therefore interact with one another. Under Table 4 the harvest ages reported for visually sensitive areas did not include harvests occurring in the zone where they overlapped with caribou corridors. Biodiversity zones contributing to targets for small patches were net of both visual areas and caribou corridors. Biodiversity zones contributing to targets for medium and large patches by design, do not overlap visually sensitive areas or caribou corridors however, resource targets for hydrologic recovery and seral stages overlap all of these areas.

[34] See Figure 12 of this report for the spatial location of each pass.

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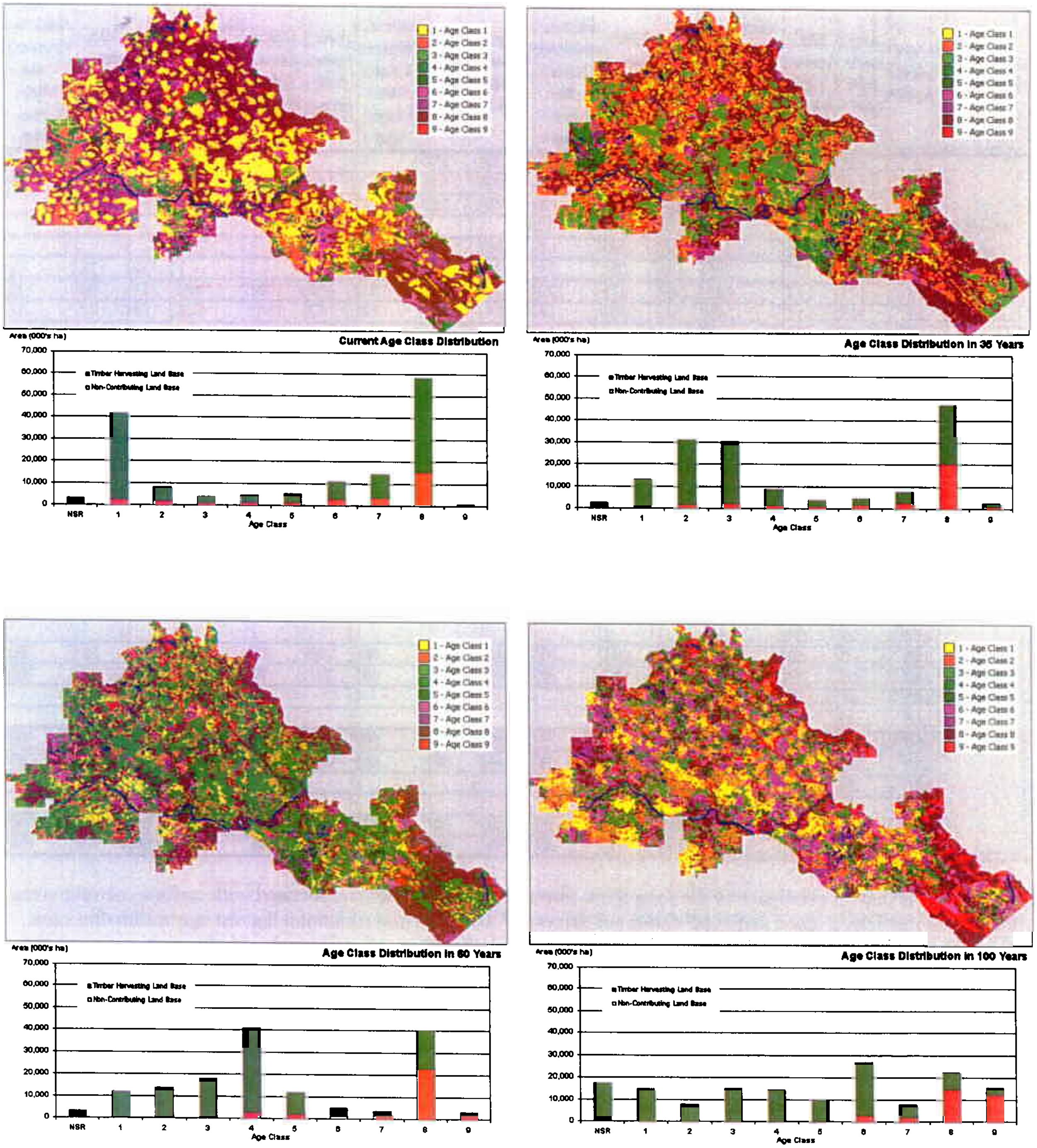
Table 4: Average harvest age by resource emphasis zone

		Biodiversity Patch Zones Contributing to Medium and Large Patches			Biodiversity Patch Zones Contributing to Small Patches			Modification VSUs			Partial Retention VSUs			Mountain Caribou Connecting Corridors		
Planning Horizon	Years from now	Avg. Harv. Age (yrs.)	Min. Harv. Age (yrs.)	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Avg. Harv. Age (yrs.)	Min. Harv. Age (yrs.)	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Avg. Harv. Age (yrs.)	Min. Harv. Age (yrs.)	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Avg. Harv. Age (yrs.)	Min. Harv. Age (yrs.)	Avg. No.Yrs. Hrvsted Past Min. Harv. Age	Avg. Harv. Age (yrs.)	Min. Harv. Age (yrs.)	Avg. No.Yrs. Hrvsted Past Min. Harv. Age
Short-Term	1	166	105	60	170	109	61	120	103	17				120	115	5
	2	154	104	50	162	108	54	123	110	13	144	108	36	164	104	60
	3	154	106	48	167	108	58	178	105	73	144	120	24			
	4	162	108	54	162	107	55									
	5	164	105	59	165	108	57	155	110	45						
	10	163	105	58	169	108	61	197	103	94				132	112	20
	15	171	107	64	226	107	120	260	107	153	254	106	148	211	106	105
	20	145	111	34	181	105	76	171	109	62	172	111	62	174	107	67
Mid-Term	25	182	105	77												
	30	182	108	74												
	35	185	109	77	182	108	74	184	110	74	189	111	78	172	109	64
	40	98	88	9	183	109	73	177	109	68	186	113	73	139	113	26
	45	187	105	83												
	50	176	100	77	185	95	90	208	110	98	152	122		104	64	40
	55	88	75	13	167	102	65	159	106	54	135	107	28	166	115	51
	60	87	71	16	146	92	54	148	98	50	161	95	66	168	109	60
	80	169	91	77	160	84	76	155	86	69	141	83	58	243	110	133
Long-Term	100	118	68	49												
	120	130	68	62												
	140	118	64	54	144	73	70	157	75	82	169	85	85	244	94	150
	160	94	59	35	154	70	84	161	72	89	184	85	99	170	75	95
	180	91	58	33												
	200	96	58	38												
	220	90	59	31	147	64	83	147	61	86	186	80	106	281	91	190
	240	90	57	33	146	66	80	146	61	86	201	76	125	246	81	165
	260	91	58	33												
	280	90	58	33												
	300	90	59	31	135	64	71	158	62	96	182	76	105	266	81	185
	320	89	57	32	130	64	66	145	60	85	199	74	125	265	84	181
	340	88	58	30												
	360	90	57	33												
	380	90	59	30	130	62	68	136	59	77	200	70	130	255	72	183
	400	90	57	33	124	64	60	155	60	95	177	69	108	260	71	189

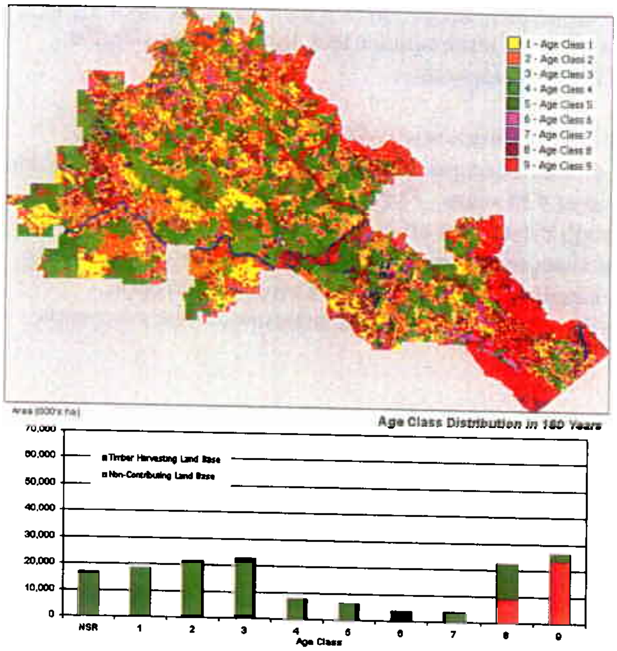
Table 4 reveals that on average over the long-term, forest cover requirements associated with caribou corridor areas are the most restrictive, since managed stands are harvested 167 years past minimum harvest age within this zone. Corridors are followed by visual areas with a partial retention objective, where second growth stands are harvested on average 110 years past minimum harvest age. As discussed earlier, biodiversity patch size requirements will delay the harvest of managed second growth stands by at least 20 years. As shown in Table 4, over the long-term, stands within biodiversity patch zones contributing large and medium sized patches are on average, harvested 37 years past minimum harvest age. This would indicate that resource targets associated with hydrologic recovery and seral also influence the timing of harvests in addition to patch size requirements.

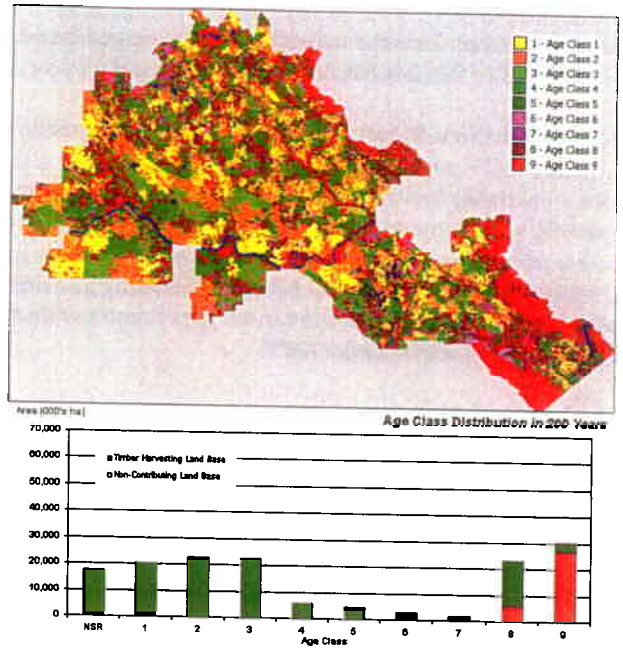
5.2.4 Age Class Distributions Over Time

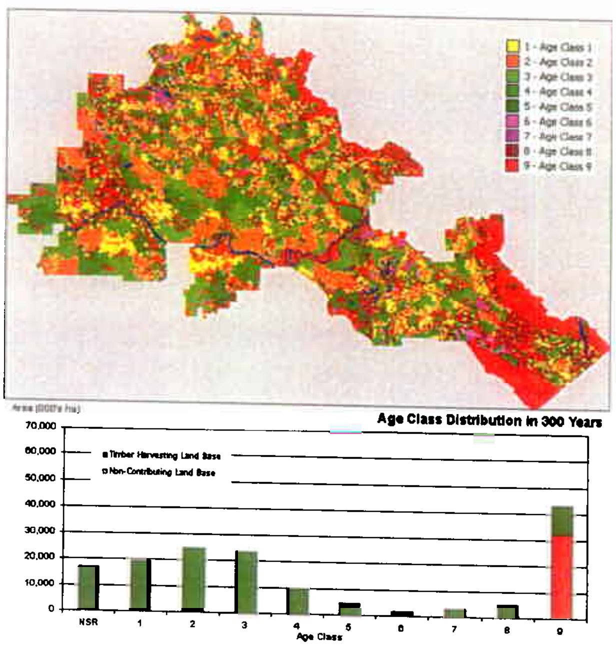
The graphs in **Figure 22** show how the distribution by inventory age classes over the total forested land base of the TFL is expected to change under the Base Case forecast and also shows the spatial distribution of these age classes through time.



<u>*Figure 22: Age class distribution over time*</u>







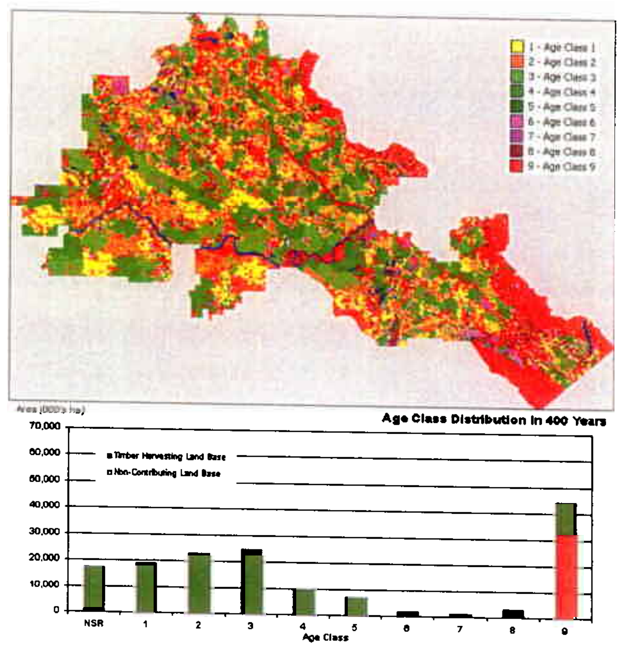


Figure 22 reveals that by year 160, the age class distribution is forecast to be relatively even in stands under 60 years of age across the THLB. By year 200, 30% of the THLB is projected to remain above age 60 with the remaining 70% relatively balanced across the four age classes between ages 0 and 60 years, which is consistent with the information presented in Figure 15. In addition, this coincides with the point at which growing stock began to stabilize as shown in Figure 18. Figure 22 also reveals that 10% of the THLB land base is maintained in age class 9 throughout the remainder of the projection beginning at year 300. Based on the information presented in Table 4 and the maps showing the spatial distribution of age classes through time, the majority of this forest is maintained due to harvest restrictions implemented within caribou corridors and visually sensitive areas. The maps also show the development of biodiversity patches through time. At year 60, leave areas between existing openings are still being harvested since the majority of the managed forest is still below minimum harvest age. By year 100, the distribution of patches has begun to emerge and by year 160 are fully apparent.

The graphs also reflect the assumption that areas outside the THLB remain relatively static in terms of forest structure and composition and simply age with time. Based on this assumption, after 300 years these areas will have all accumulated into age class 9 with an average projected age of 420 years. These areas are also clearly seen spatially as large contiguous areas of red by year 160. Although these areas do not contribute to timber supply, they do contribute to targets for non-timber resources. As a result changes in stand ages and composition within stands outside the THLB may affect harvest scheduling and timber supply within the THLB. Currently however, successional pathways for the forest types found within the TFL are not available and therefore, forest succession was not implemented under MP9.

The location and timing of large scale catastrophic disturbance events due to fire, insects, disease and windthrow are difficult to predict. As a result, incorporating assumptions related to such random events, particularly fire, into timber supply analyses may not be appropriate and would likely be misleading. This is because the magnitude, timing and location[35] of natural disturbances can all have a profound effect on forecasts of timber supply. Since this analysis is spatially sensitive, the most effective approach towards accounting for these unpredictable events would be to re-run the Base Case, after the full impact of a disturbance on forest structure has been realized. The attributes for those stands affected can be rapidly updated to reflect post-disturbance conditions and the scheduling model re-run with all other inputs remaining the same. The result will show how not only timber supply but also how forest operations must change to accommodate the new forest age class structure and the binding effects of timber and non-timber resource targets. Beyond reductions for non-recoverable losses, however, no further risk assessments related to potential impacts from catastrophic natural disturbances were conducted or implemented under this analysis.

[35] Including sudden changes within the non-contributing land base, since many non-timber resource values such as biodiversity, wildlife habitat and watershed related constraints tend to be satisfied by stands reserved from harvest.

5.4 Base Case Harvest Flow Alternatives

Since the Base Case forecast shown in Figure 13 indicates that the current AAC must immediately decline by 19%, no feasible alternatives to the Base Case exist, subject to the harvest flow objectives and resource management strategies as specified under the Base Case. **Figure 23**, however, is provided as one feasible alternative which maintains the current AAC for the next five years, but then declines by 15% per five-year period for three periods to 213,539 m^3/yr, thereby exceeding the harvest flow objective requiring that declines do not exceed 12% per decade.

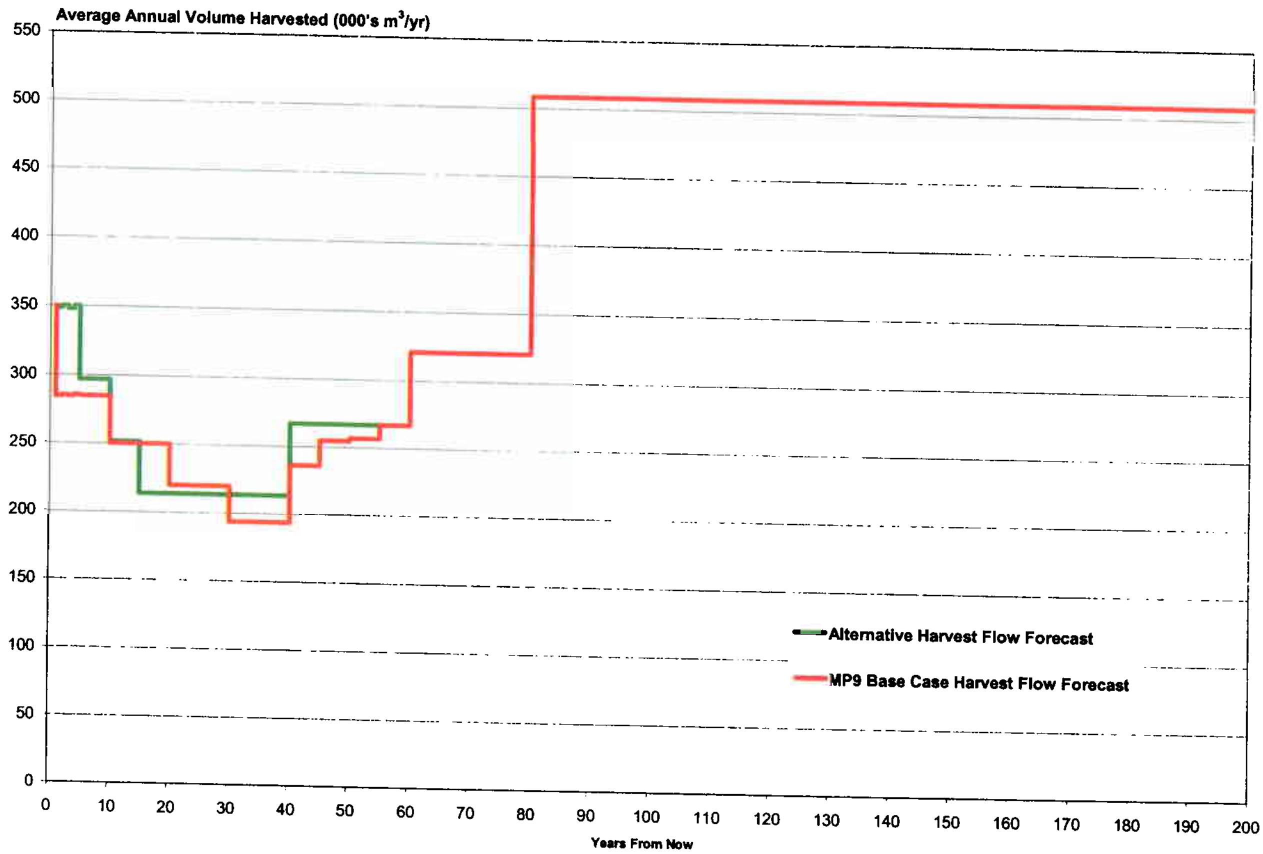


Figure 23: Alternative harvest flow forecast

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Alternative Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	349,000	0%	23%
	3	1	285,291	0%	350,000	0%	23%
	4	1	284,882	0%	348,000	-1%	22%
	5	1	285,582	0%	350,000	1%	23%
	6-10	5	285,110	0%	296,954	-15%	4%
	11-15	5	250,460	-12%	251,865	-15%	1%
	16-20	5	250,460	0%	213,539	-15%	-15%
Mid-Term	21-25	5	219,968	-12%	213,539	0%	-3%
	26-30	5	219,968	0%	213,539	0%	-3%
	31-35	5	193,690	-12%	213,539	0%	10%
	36-40	5	193,690	0%	213,539	0%	10%
	41-45	5	236,170	22%	267,225	25%	13%
	46-50	5	255,058	8%	267,225	0%	5%
	51-55	5	257,183	1%	267,225	0%	4%
	56-60	5	267,225	4%	267,225	0%	0%
	61-80	20	321,175	20%	321,175	20%	0%

The harvest level of 213,539 m^3/yr is maintained for the next 25 years and then increases by 25% to 267,225 m^3/yr for the next 20 years. Beginning in the five year period, 56 to 60 years from now, harvest flow under the alternative forecast is identical to the Base Case for the remainder of the planning horizon.

Although the alternative forecast shows that harvest levels must decline by 45% over a 15 year timeframe, it does not decline below 200,000 m^3/yr and maintains a harvest level that is 10% higher over the pinch point period in the Base Case, 31 to 40 years from now.

6.0 Sensitivity Analyses

The best available data inputs and assumptions were used to prepare the Base Case timber supply forecast for TFL30. However, uncertainties regarding these data inputs and assumptions and their potential impact on the Base Case timber supply projection must be assessed in order to ensure that an AAC decision can be fully rationalized.

The information package, prepared in advance of the timber supply forecasting, identified the sensitivities to be tested. However, due to preliminary modelling results and analysis timeframe limitations, some of these sensitivities were removed and one was added through consensus between Canfor and the Ministry of Forests. The following lists the sensitivities that were completed:

1. Increase and decrease minimum harvestable ages by 10 years.
2. Increase and decrease natural stand yield table estimates by 10% and 20%.
3. Increase and decrease managed stand yield table estimates by 10%.
4. Apply the minimum economic yield criteria to managed stand yield tables.
5. Apply managed stand yield tables without adjustments to site index.
6. Remove biodiversity patch size targets.

The sections that follow present the results of these sensitivities. Where relevant, both the unflowed[36] and flowed[37] forecasts are shown for each sensitivity.

6.1 Uncertainty in Minimum Harvestable Ages

Issues under the analysis which affect minimum harvest age include site productivity estimates, forest health agents that impact growth rates such as brush competition, insects and/or diseases and finally, forest management decisions regarding rotation age. Uncertainty regarding site productivity are further explored through removal of the site index adjustments made to managed stands in a subsequent sensitivity analysis. Minimum harvest age reductions related to forest health issues were indirectly incorporated into the Base Case forecast through yield reductions made to managed stand projections in order to account for spruce leader weevil impacts. With respect to management decisions regarding rotation age, minimum harvest ages for natural stands were set based on current regional policies. For managed stands, minimum harvest ages were based on the age at which 95% of the culmination of MAI is achieved. As a result, the average minimum harvest age for managed stands within the THLB is 60 years and the average age at which managed stands were harvested over the long-term under the Base Case was 100 years. The average diameter at breast height, for spruce at 60 years of age, is 21 cm while at 100 years it is 28 cm. However, TFL30 consists of some of the most productive growing sites in the northern interior. As a result, the TFL is capable of producing large diameter premium quality sawlogs through management, in relatively short periods of time compared to other areas within the northern interior. Much of the volume harvested from the TFL is delivered to the Upper Fraser Sawmill which is specialized to process large diameter premium quality sawlogs. An analysis completed through this timber supply review, examined the minimum harvest ages necessary to grow spruce sawlogs which meet the optimal mill requirements of an average butt diameter of 46 cm or 36 cm at breast height. The results of the analysis showed that average minimum harvest age for managed spruce stands would need to be 180 years in order to obtain these log dimensions; a difference of 120 years relative to the minimum harvest age used under the Base Case. Although the impact of this management option was not explored through sensitivity analysis, it is almost certain that this adjustment would significantly impact short-term wood supply, since the existing stock of available volume from unmanaged natural stands would have to be harvested at a significantly reduced rate in order to realize the harvest flow policy under the Base Case.

The following sensitivities assess the timber supply effects of altering minimum harvestable ages by 10 years across all natural, current managed and future managed stands.

[36] In other words, the timber supply achieved under the sensitivity when the model was run using the base case harvest flow targets.
[37] In other words, the timber supply achieved under the sensitivity when the base case harvest flow targets were adjusted to ensure consistency with the harvest flow objective used under the analysis.

6.1.1 Increase Minimum Harvestable Ages by 10 Years

Figure 24 shows the timber supply effects of increasing minimum harvestable ages by 10 years.

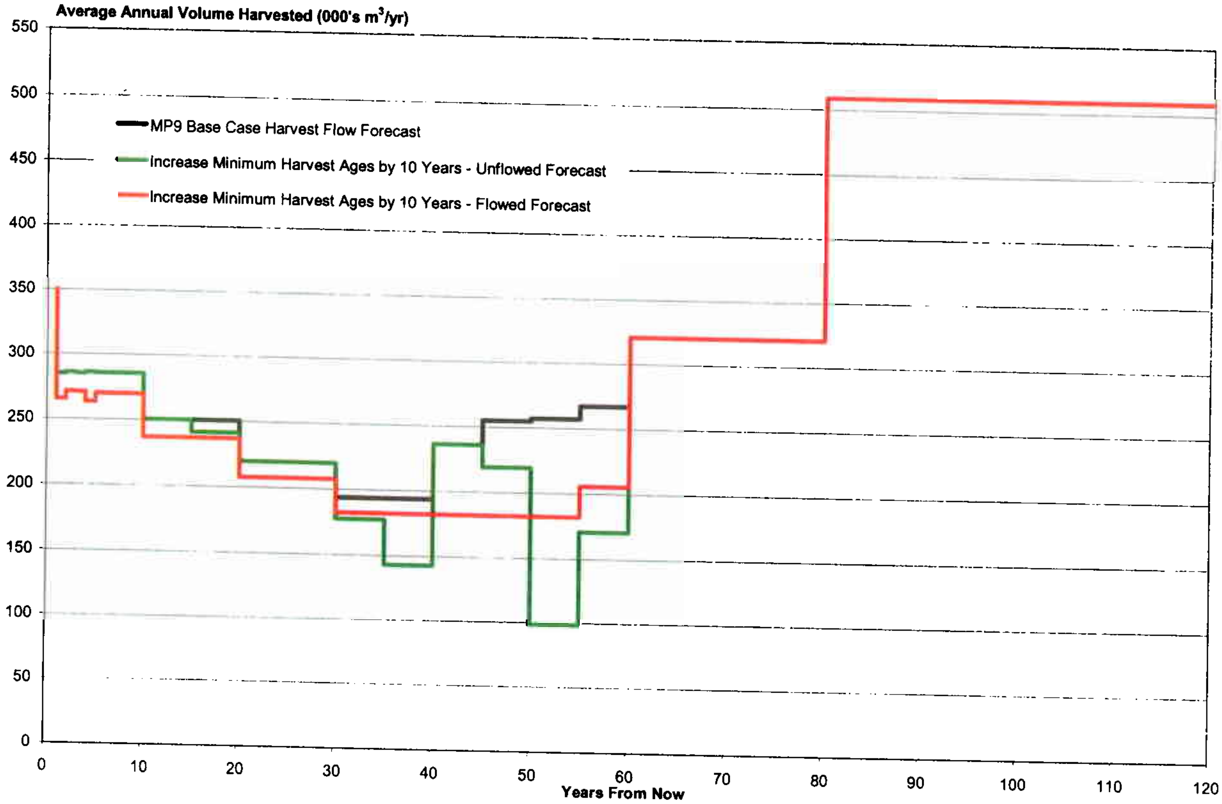


Figure 24: Increase minimum harvest ages by 10 years

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	Minimum Harvest Ages +10 Years Unflowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case	Minimum Harvest Ages +10 Years Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%	350,000		0%
	2	1	284,548	-19%	284,548	-19%	0%	265,088	-23%	-7%
	3	1	285,291	0%	285,291	0%	0%	270,921	2%	-5%
	4	1	284,882	0%	284,882	0%	0%	270,674	0%	-5%
	5	1	285,582	0%	285,582	0%	0%	263,120	-3%	-8%
	10	5	285,110	0%	285,110	0%	0%	269,360	2%	-5%
	15	5	250,460	-12%	250,460	-12%	0%	236,600	-12%	-5%
	20	5	250,460	0%	241,241	-4%	-4%	236,600	0%	-5%
Mid-Term	25	5	219,968	-12%	219,968	-9%	0%	207,771	-12%	-5%
	30	5	219,968	0%	219,968	0%	0%	207,771	0%	-5%
	35	5	193,690	-12%	177,574	-19%	-8%	182,402	-12%	-6%
	40	5	193,690	0%	142,756	-19%	-26%	182,402	0%	-6%
	45	5	236,170	22%	236,170	64%	0%	182,402	0%	-22%
	50	5	255,058	8%	219,410	-7%	-14%	182,402	0%	-28%
	55	5	257,183	1%	98,627	-54%	-61%	182,402	0%	-29%
	60	5	267,225	4%	170,959	71%	-36%	205,780	13%	-23%
	80	20	321,175	20%	321,175	88%	0%	321,175	55%	0%

Over the short-term, the unflowed forecast reveals a 4% shortfall in timber supply relative to the Base Case projection over the five-year period, 16 to 20 years from now. A shortfall in timber supply over the short and first half of the mid-term as a result of increasing minimum harvest ages was not anticipated since all of the volume harvested over this period is obtained from natural stands which are on average 30 years past minimum harvest age at the start of the planning horizon[38].

[38] In addition, as shown in Figure 15, over 80% of the volume harvested is obtained from stands currently in age class 8 over the short and first half of the mid-term. Currently these stands are on average 62 years past minimum harvest age.

Shortfalls at the start of the mid-term, suggest that increases to natural stand minimum harvest ages will influence the availability of this volume even though much of it has aged well beyond minimum harvest age. A review of the model outputs revealed that the 10 year increase in natural stand minimum harvest age was sufficient to both alter the harvest queue relative to the Base Case, as well as limit the availability of some stands in each period that were harvested under the Base Case. In addition, both the harvest rules associated with targets for biodiversity patch sizes in conjunction with the adjustments to the harvest queue had caused targets for other non-timber resources to become more binding, leading to the shortfalls in timber supply in the last period of the short term and first half of the mid-term.

A second shortfall in timber supply occurs in the latter half of the mid-term, over the three five-year periods 46 to 60 years from now, where on average, the annual volume harvested was 37% below the level achieved under the Base Case. Over this time period, timber supply increasingly relies on the managed second growth inventory as the amount of unconstrained natural forest rapidly declines in availability. Since managed stands were harvested on average four years past minimum harvest age during this period under the Base Case, the 10 year increase was sufficient to cause a considerable amount of the managed forest to be unavailable until subsequent periods.

Over the long-term, flows were identical to the Base Case since non-timber resource targets cause managed stands to be harvested on average, 42 years past their minimum harvest ages.

To realize the harvest flow objective under the analysis, the timber supply effect of increasing minimum harvest ages by 10 years, reduces timber supply by an average of 6% over the short-term relative to the Base Case forecast. Over the mid-term the timber supply reductions are 10% with no change occurring over the long-term. Over the planning horizon, the most significant timber supply impacts from increasing minimum harvest ages by 10 years are realized within the mid-term, over the 20-year period, 41 to 60 years from now, where the timber supply available is on average, 25% below what was achieved under the Base Case forecast.

6.1.2 Decrease Minimum Harvestable Ages by 10 Years

Figure 25 shows the timber supply effects of decreasing minimum harvestable ages by 10 years.

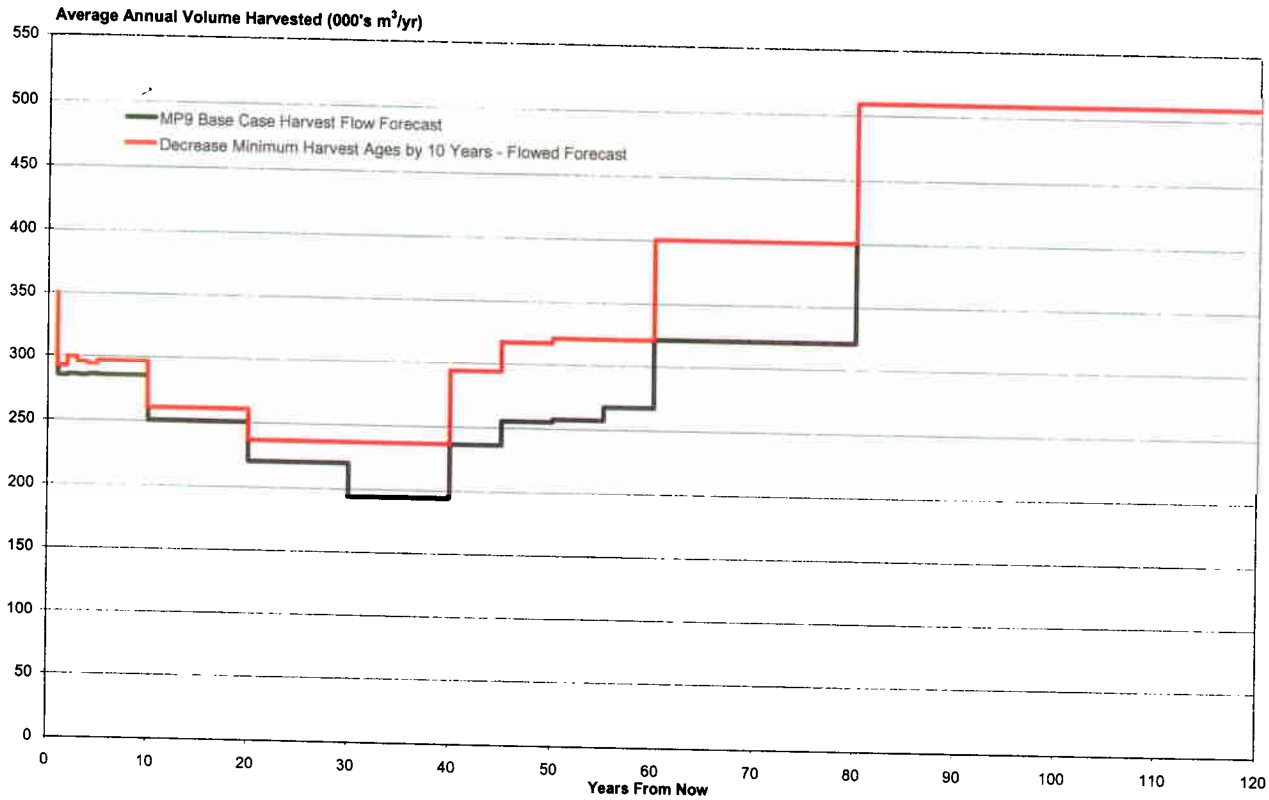


Figure 25: Decrease minimum harvest ages by 10 years

As anticipated, decreasing minimum harvest ages by 10 years significantly increases the amount of second growth available for harvest over much of mid-term. On average, the flowed forecast indicates a 20% increase in timber supply relative to the Base Case, 21 to 80 years from now. Since more second growth is available for harvest over the mid-term, less natural forest inventory must be rationed over the short-term in order to realize the harvest flow policy. As a result, an average increase of 4% is realized over the short-term relative to the Base Case. This short-term increase is only 4%, since the area from which timber may be harvested over the first 20 years is restricted to Pass 1 biodiversity patch zones and non-patched portions of the TFL. This patch requirement along with the binding effect of other resource targets continues to severely regulate the availability of timber over the short-term, regardless of the addition of managed stand volume earlier within the harvest queue.

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Minimum Harvest Ages -10 Years Flowed (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	291,915	-17%	3%
	3	1	285,291	0%	299,387	3%	5%
	4	1	284,882	0%	295,567	-1%	4%
	5	1	285,582	0%	294,119	0%	3%
	10	5	285,110	0%	296,360	1%	4%
	15	5	250,460	-12%	260,360	-12%	4%
	20	5	250,460	0%	260,360	0%	4%
Mid-Term	25	5	219,968	-12%	236,424	-9%	7%
	30	5	219,968	0%	236,424	0%	7%
	35	5	193,690	-12%	236,424	0%	22%
	40	5	193,690	0%	236,424	0%	22%
	45	5	236,170	22%	293,759	24%	24%
	50	5	255,058	8%	317,146	8%	24%
	55	5	257,183	1%	320,699	1%	25%
	60	5	267,225	4%	320,828	0%	20%
	80	20	321,175	20%	400,135	25%	25%

Over the long-term, flows were identical to the Base Case forecast since non-timber resource targets cause managed stands, on average, to be harvested 42 years past their minimum harvest ages.

6.2 Uncertainty in Natural Stand Yields

An issue potentially affecting natural stand yield table (NSYT) estimates is a variance between the area weighted average merchantable yield based on the Fraser adjusted NSYT projections used under this analysis and the average merchantable yield for the same population based on VRI Phase II ground samples.

Under the Phase II VRI inventory program, both full VRI and timber emphasis plots were established and measured throughout the TFL between 1997 and 1999. The total sample size under the VRI Phase II program was 267 plots, of which 34% consisted of full VRI clusters and 66% consisted of timber emphasis plots. The area weighted average merchantable yield for ground sampled VRI Phase II natural stands currently >=64 years of age (n=204) came to 263 m^3/ha (LCL = 244, UCL = 282 at 95% CI). The area weighted average merchantable yield based on the Fraser adjusted NSYT projections used in the analysis for the same population came to 217 m^3/ha. This reveals that the average merchantable yield obtained from the VRI ground samples is 21% higher then the average merchantable yield as projected under the MP9 analysis. This 46 m^3/ha difference in average yields when multiplied by the sum of the forested area for each stand within the population (99,157 ha) comes to 4.6 million m^3.[39]

The following sensitivities assess the timber supply effects of altering natural stand yield table estimates by 10% and 20%.

Please note that adjusting NSYTs not only effects estimates of timber supply as a result of changes to natural stand yields but also impacts the THLB since the criteria for minimum economic yield reductions are a function of natural stand yields. By adjusting NSYT estimates downward, more area is removed from the THLB thereby further increasing the downward pressure on timber supply over and above simply adjusting NSYTs downward by 10% or 20%. Conversely, adjusting these estimates upward increases the THLB relative to the THLB reported under the Base Case, thereby adding to the positive timber supply effect realized by simply adjusting NSYTs upward by 10% or 20%. Please note that the timber supply effects reported under this sensitivity did not include these adjustments to the THLB, consistent with approval from the Ministry of Forests.

[39] Please see Section 5.12.2 in the information package for further details regarding the differences between natural stand yield estimates obtained under the VRI Phase II Inventory Program, the 1996 Inventory Audit and the projections used under the MP9 analysis.

6.2.1 Decrease Natural Stand Yields by 10%

Figure 26 shows the timber supply effects of decreasing natural stand yields by 10%.

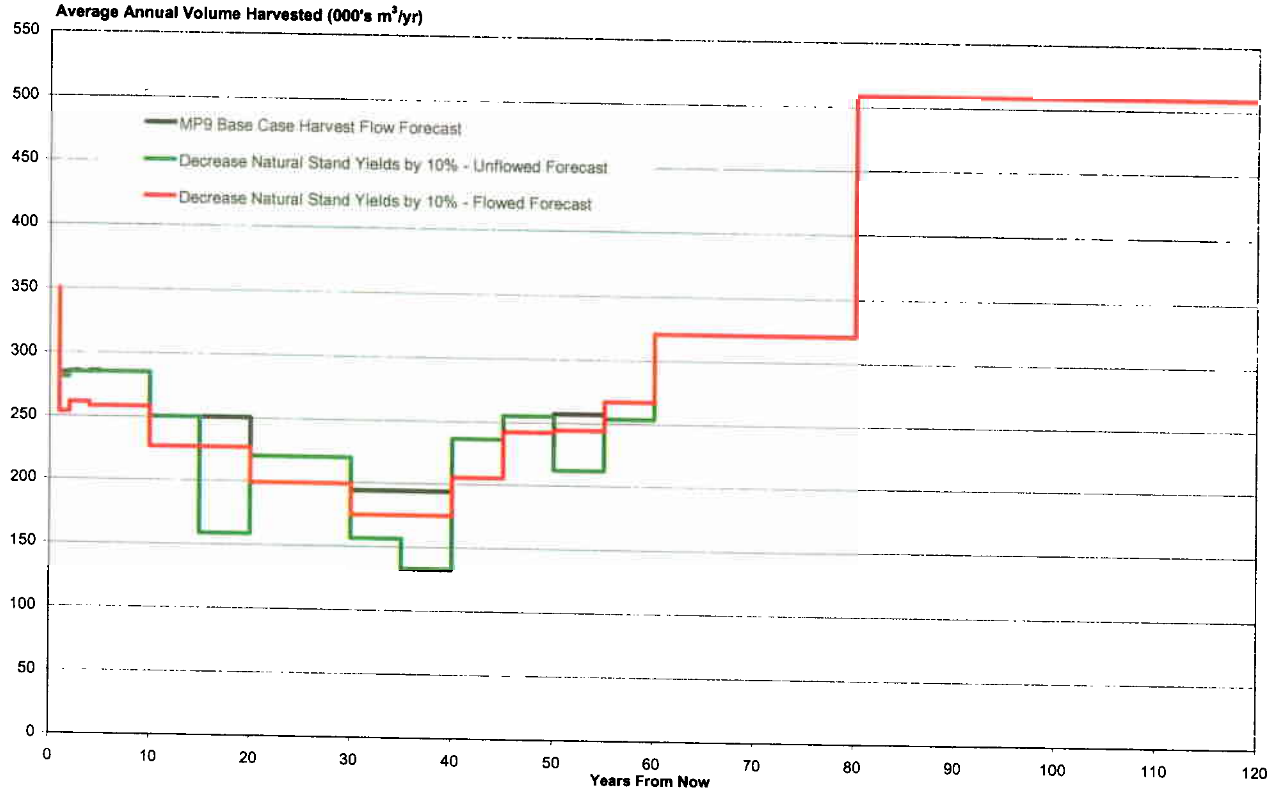


Figure 26: Decrease natural stand yields by 10%

Planning Horizon	Years from Now	Years In Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	NSYTs -10% Unflowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case	NSYTs -10% Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%	350,000		0%
	2	1	284,548	-19%	284,548	-19%	0%	253,407	-28%	-11%
	3	1	285,291	0%	285,291	0%	0%	261,421	3%	-8%
	4	1	284,882	0%	284,882	0%	0%	261,345	0%	-8%
	5	1	285,582	0%	285,582	0%	0%	258,180	-1%	-10%
	10	5	285,110	0%	285,110	0%	0%	258,360	0%	-9%
	15	5	250,460	-12%	250,460	-12%	0%	226,920	-12%	-9%
	20	5	250,460	0%	158,653	-37%	-37%	226,920	0%	-9%
Mid-Term	25	5	219,968	-12%	219,968	39%	0%	199,253	-12%	-9%
	30	5	219,968	0%	219,968	0%	0%	199,253	0%	-9%
	35	5	193,690	-12%	156,745	-29%	-19%	174,906	-12%	-10%
	40	5	193,690	0%	132,649	-15%	-32%	174,906	0%	-10%
	45	5	236,170	22%	236,170	78%	0%	205,095	17%	-13%
	50	5	255,058	8%	255,058	8%	0%	242,123	18%	-5%
	55	5	257,183	1%	212,565	-17%	-17%	244,142	1%	-5%
	60	5	267,225	4%	253,645	19%	-5%	267,225	9%	0%
	80	20	321,175	20%	321,175	27%	0%	321,175	20%	0%

Over the short-term, the unflowed forecast reveals a 37% shortfall in timber supply relative to the Base Case projection over the five year period, 16 to 20 years from now. As anticipated, since the area from which timber may be harvested over the first 20 years is restricted to Pass 1 biodiversity patch zones and non-patched portions of the TFL, the 10% reduction in available natural stand volume is realized in the last period before harvests shift from Pass 1 to Pass 2 biodiversity patch zones.

Over the mid-term, two shortfalls occurred relative to the Base Case projection. The first occurs over the two five year periods 31 to 40 years from now, where on average, the annual volume harvested was 25% below the level achieved under the Base Case. The second occurs over the two 5 year periods 51 to 60 years from now, where on average, the annual volume harvested was 11% below the level achieved under the Base Case. Within the 20-year period 21 to 40 years from now, harvests are restricted to Pass 2 biodiversity patch zones and 41 to 60 years from now to Pass 3 biodiversity patch zones. As anticipated, the 10% reduction in natural stand volumes cause shortfalls in the latter portions of each period as the amount of volume from natural stands are depleted within each pass.

Since 97% of the volume harvested over the long-term consists of managed second growth forest, no shortfalls in timber supply are realized relative to the Base Case.

To realize the harvest flow policy under the analysis, the timber supply effect of decreasing natural stand yields by 10%, reduces timber supply by an average of 9% over the short-term relative to the Base Case forecast. Over the mid-term the timber supply reduction is 1% on average, ranging from 9% in year 25 to 0% in the last period 80 years from now.

6.2.2 Decrease Natural Stand Yields by 20%

Figure 27 shows the timber supply effects of decreasing natural stand yields by 20%.

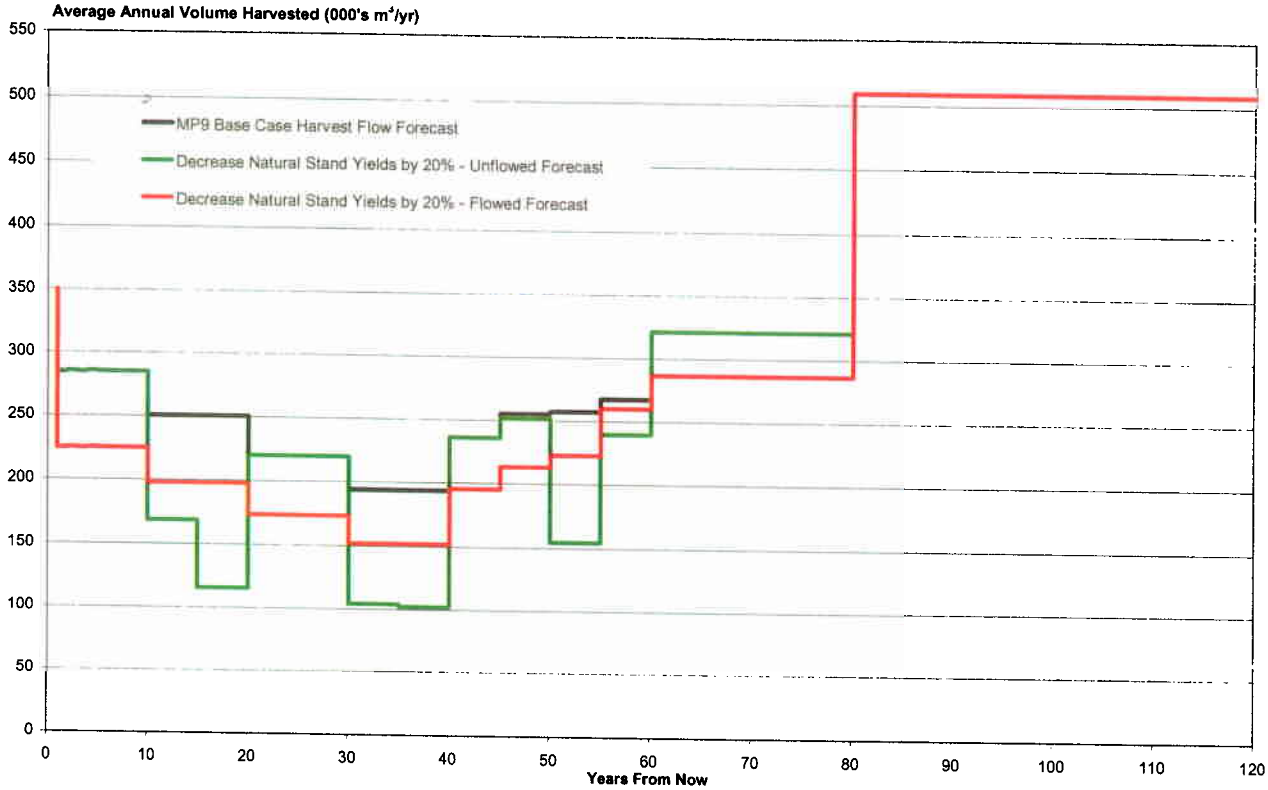


Figure 27: Decrease natural stand yields by 20%

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	NSYTs -20% Unflowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case	NSYTs -20% Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%	350,000		0%
	2	1	284,548	-19%	284,548	-19%	0%	224,605	-36%	-21%
	3	1	285,291	0%	285,291	0%	0%	225,193	0%	-21%
	4	1	284,882	0%	284,882	0%	0%	224,869	0%	-21%
	5	1	285,582	0%	285,582	0%	0%	225,424	0%	-21%
	10	5	285,110	0%	285,110	0%	0%	225,050	0%	-21%
	15	5	250,460	-12%	168,755	-41%	-33%	197,607	-12%	-21%
	20	5	250,460	0%	115,969	-31%	-54%	197,607	0%	-21%
Mid-Term	25	5	219,968	-12%	219,968	90%	0%	173,458	-12%	-21%
	30	5	219,968	0%	219,968	0%	0%	173,458	0%	-21%
	35	5	193,690	-12%	104,215	-53%	-46%	152,206	-12%	-21%
	40	5	193,690	0%	102,274	-2%	-47%	152,206	0%	-21%
	45	5	236,170	22%	236,170	131%	0%	195,399	28%	-17%
	50	5	255,058	8%	251,352	6%	-1%	213,700	9%	-16%
	55	5	257,183	1%	154,827	-38%	-40%	222,828	4%	-13%
	60	5	267,225	4%	239,688	55%	-10%	259,979	17%	-3%
	80	20	321,175	20%	321,175	34%	0%	286,507	10%	-11%

The dynamics affecting timber supply under a 20% reduction to natural stand yield estimates is identical with the results presented when a 10% reduction was applied, except that the magnitude of the impacts are more severe and relatively proportional to the percentage by which natural stand yields were reduced.

To realize the harvest flow policy under the analysis, the timber supply effect of decreasing natural stand yield estimates by 20%, reduces timber supply by an average of 21% over the short-term relative to the Base Case forecast. Over the mid-term the timber supply reduction is 15% on average, ranging from 21% in year 25 to 11% in year 80.

6.2.3 Increase Natural Stand Yields by 10%

Figure 28 shows the timber supply effects of increasing natural stand yields by 10%.

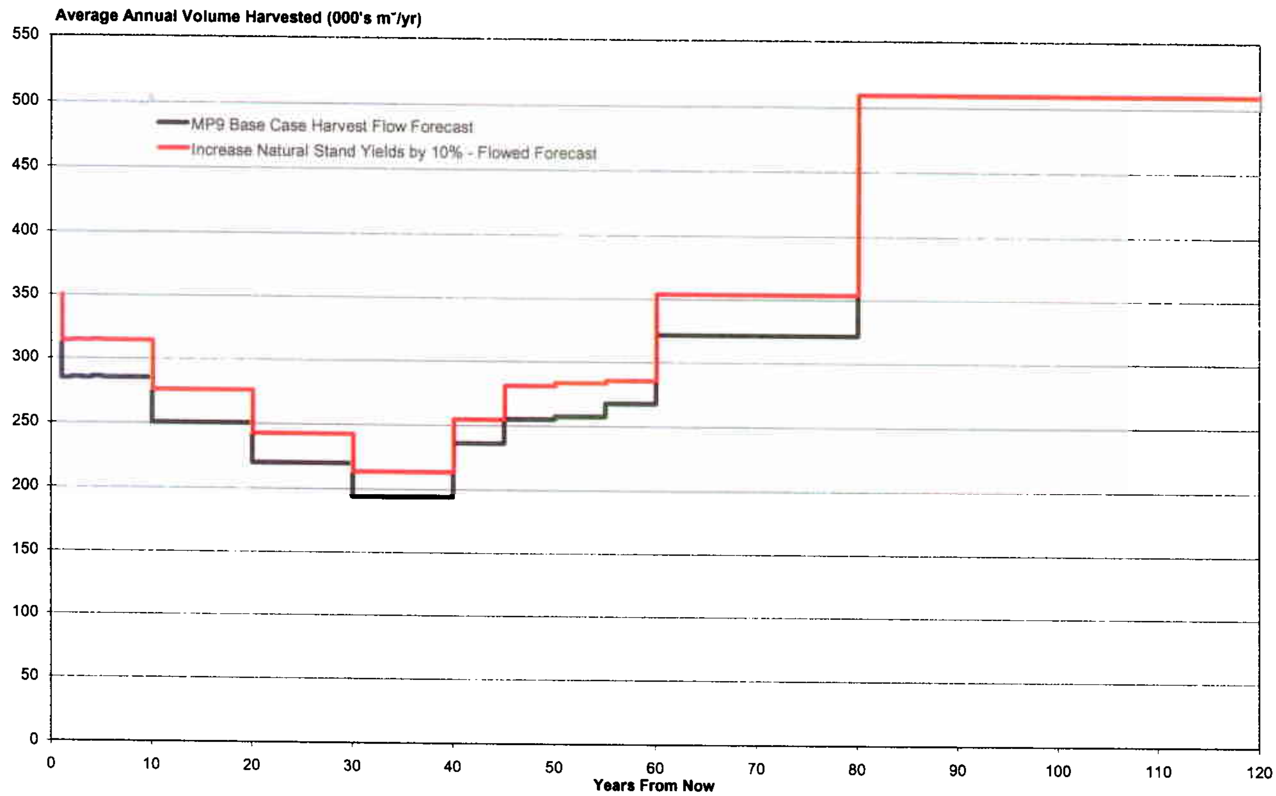


Figure 28: Increase natural stand yields by 10%

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	NSYTs +10% Flowed (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	313,367	-10%	10%
	3	1	285,291	0%	314,184	0%	10%
	4	1	284,882	0%	313,734	0%	10%
	5	1	285,582	0%	314,504	0%	10%
	10	5	285,110	0%	313,985	0%	10%
	15	5	250,460	-12%	275,870	-12%	10%
	20	5	250,460	0%	275,870	0%	10%
Mid-Term	25	5	219,968	-12%	242,329	-12%	10%
	30	5	219,968	0%	242,329	0%	10%
	35	5	193,690	-12%	213,423	-12%	10%
	40	5	193,690	0%	213,423	0%	10%
	45	5	236,170	22%	254,406	19%	8%
	50	5	255,058	8%	280,928	10%	10%
	55	5	257,183	1%	283,265	1%	10%
	60	5	267,225	4%	285,357	1%	7%
	80	20	321,175	20%	353,657	24%	10%

As anticipated, Figure 28 reveals that across the short-term, the effect on timber supply of increasing natural stand yield estimates by 10%, results in a 10% increase in timber supply. Across the mid-term, an average timber supply increase of 9% is realized.

6.2.4 Increase Natural Stand Yields by 20%

Figure 29 shows the timber supply effects of increasing natural stand yields by 20%.

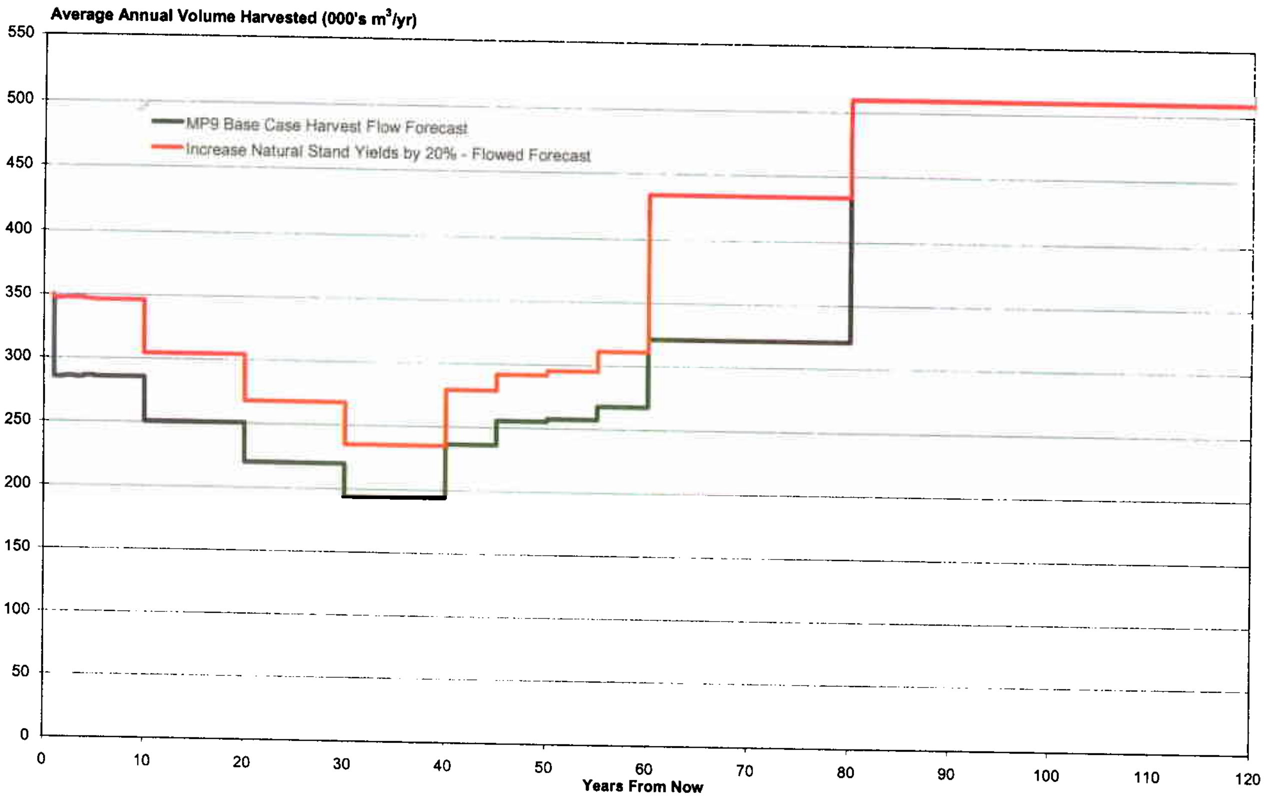


Figure 29: Increase natural stand yields by 20%

Figure 29 reveals that if natural stand yields were increased by 20%, then the harvest level could be maintained within less than 1% of the current AAC for the next 10 years, consistent with the Base Case harvest flow objective.

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	NSYTs +20% Flowed (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	347,191	-1%	22%
	3	1	285,291	0%	347,321	0%	22%
	4	1	284,882	0%	347,832	0%	22%
	5	1	285,582	0%	346,882	0%	21%
	10	5	285,110	0%	346,360	0%	21%
	15	5	250,460	-12%	304,360	-12%	22%
	20	5	250,460	0%	304,360	0%	22%
Mid-Term	25	5	219,968	-12%	267,400	-12%	22%
	30	5	219,968	0%	267,400	0%	22%
	35	5	193,690	-12%	234,875	-12%	21%
	40	5	193,690	0%	234,875	0%	21%
	45	5	236,170	22%	278,372	19%	18%
	50	5	255,058	8%	291,342	5%	14%
	55	5	257,183	1%	294,601	1%	15%
	60	5	267,225	4%	310,992	6%	16%
	80	20	321,175	20%	433,615	39%	35%

As anticipated over the short-term, the flowed forecast reveals an average increase in timber supply of 21% relative to the Base Case projection over the same time period. The average annual volume harvested under the sensitivity forecast as a result of the increase in natural stand yields is 346,781 m^3/yr. Over the mid-term, the flowed forecast reveals an average increase in timber supply of 24% relative to the Base Case projection over the same time period. Since 97% of the volume harvested over the long-term consists of managed second growth forest, no timber supply increases are realized relative to the Base Case.

As mentioned at the beginning of this section, ground based sampling under both the VRI Phase II program (n=267) and the 1996 Inventory Audit (n=50) reported that average merchantable yields across stands currently >=64 years of age throughout the TFL were 263 m^3/ha and 249 m^3/ha respectively. This suggests that the yield estimates used under the analysis may be underestimated by 15 to 21% relative to the average merchantable yield of 217 m^3/ha obtained from the VDYP projections. The fact that natural stand yield estimates may be underestimated is further supported by the fact that the average yield estimate under the analysis is 2% below the 95% lower confidence limit of the inventory audit and 11% below the 95% lower confidence limit of the VRI Phase II samples. In addition, this sensitivity did not account for the THLB increase that would also be realized as a result of increasing natural stand yields subject to the criteria applied under the minimum economic yield reductions. Since an increase in average natural stand yields would result in an increase to the THLB, it is anticipated that the timber supply effect would be greater yet, relative to the results reported currently under this sensitivity. Note also that since the area of the THLB was not adjusted, the harvest queue (i.e. stands harvested on the ground) under both the Base Case and this sensitivity are identical with the only difference being that under the sensitivity forecast, the same hectare of land provides more volume than under the Base Case.

Based on the results of this sensitivity, which demonstrates that increases in natural stand yields affect the amount of timber available for harvest in each period over both the short and mid-terms, it is imperative that natural stand yield estimates currently being used in the analysis be verified to determine if in fact they are underestimating yield across unmanaged naturally established stands within the TFL.

6.3 Uncertainty in Managed Stand Yields

Issues under the analysis which affect managed stand yields include estimates of site productivity, operational adjustment factors (OAF), regeneration assumptions and forest health agents that impact growth rates such as brush competition, insects and/or diseases. Uncertainty regarding site productivity estimates are further explored through removal of the site index adjustments made to managed stands in a subsequent sensitivity analysis. OAF1 only included reductions to account for sub-optimal stocking conditions in operational plantations. Natural non-productive areas occupying less than 100% of the area of a forest cover polygon were accounted for through explicit area reductions based on TEM site series information. Regeneration assumptions were also tied to site series provided by TEM. Finally, reductions to managed stand yield projections to account for spruce leader weevil impacts were applied through OAF1 adjustments.

6.3.1 Decrease Managed Stand Yields by 10%

Figure 30 shows the timber supply effects of decreasing managed stand yields by 10%.

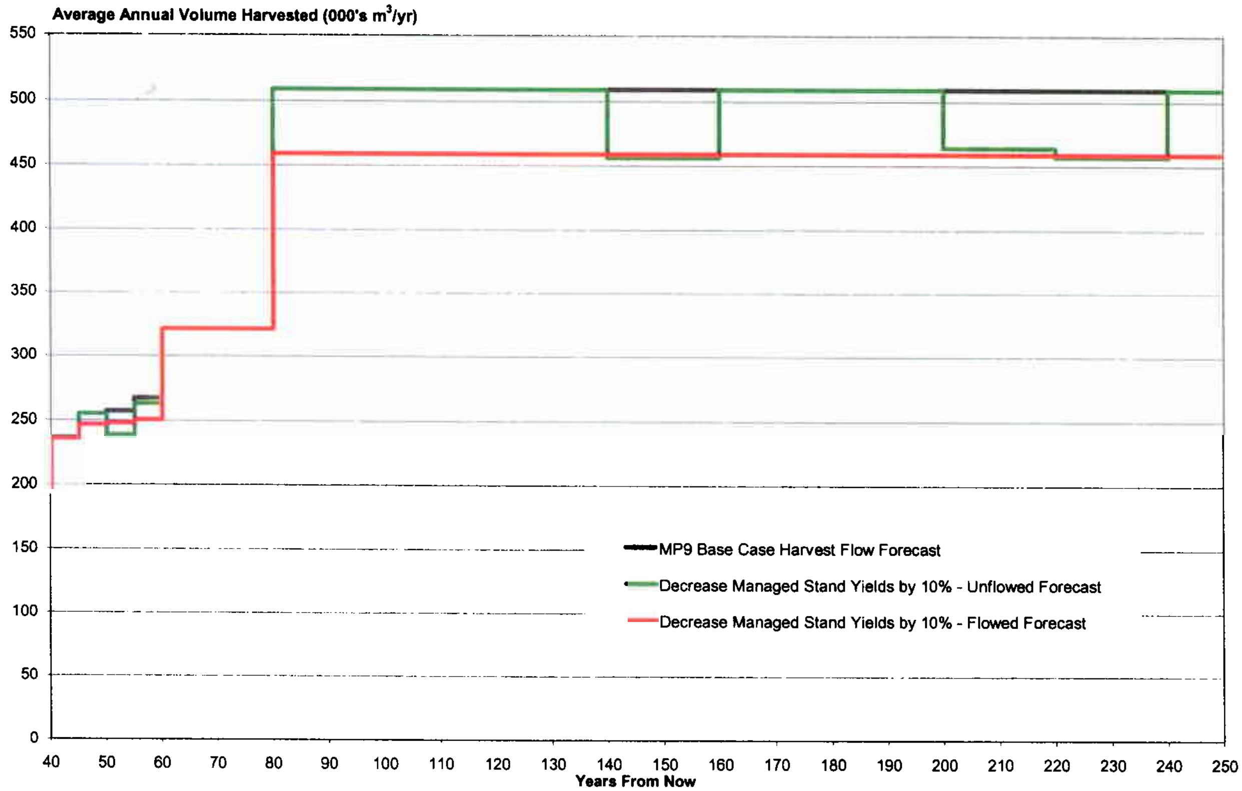


Figure 30: Decrease managed stand yields by 10%

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	MSYTs -10% Unflowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case	MSYTs -10% Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case
Mid-Term	25	5	219,968	-12%	219,968	-12%	0%	219,968	-12%	0%
	30	5	219,968	0%	219,968	0%	0%	219,968	0%	0%
	35	5	193,690	-12%	193,690	-12%	0%	193,690	-12%	0%
	40	5	193,690	0%	193,690	0%	0%	193,690	0%	0%
	45	5	236,170	22%	236,170	22%	0%	235,685	22%	0%
	50	5	255,058	8%	255,058	8%	0%	246,760	5%	-3%
	55	5	257,183	1%	238,730	-6%	-7%	247,817	0%	-4%
	60	5	267,225	4%	263,054	10%	-2%	250,420	1%	-6%
	80	20	321,175	20%	321,175	22%	0%	321,175	28%	0%
Long-Term	100	20	508,759	58%	508,759	58%	0%	459,073	43%	-10%
	120	20	508,759	0%	508,759	0%	0%	459,073	0%	-10%
	140	20	508,759	0%	508,759	0%	0%	459,073	0%	-10%
	160	20	508,759	0%	456,421	-10%	-10%	459,073	0%	-10%
	180	20	508,759	0%	508,759	11%	0%	459,073	0%	-10%
	200	20	508,759	0%	508,759	0%	0%	459,073	0%	-10%
	220	20	508,759	0%	464,147	-9%	-9%	459,073	0%	-10%
	240	20	508,759	0%	457,456	-1%	-10%	459,073	0%	-10%
	260	20	508,759	0%	508,759	11%	0%	459,073	0%	-10%
	280	20	508,759	0%	508,759	0%	0%	459,073	0%	-10%
	300	20	508,759	0%	467,554	-8%	-8%	459,073	0%	-10%
	320	20	508,759	0%	434,463	-7%	-15%	459,073	0%	-10%
	340	20	508,759	0%	508,759	17%	0%	459,073	0%	-10%
	360	20	508,759	0%	508,759	0%	0%	459,073	0%	-10%
	380	20	508,759	0%	469,709	-8%	-8%	459,073	0%	-10%
	400	20	508,759	0%	445,471	-5%	-12%	459,073	0%	-10%

Over the short-term, the unflowed forecast revealed no shortfalls in timber supply relative to the Base Case projection since 100% of the volume harvested comes from unmanaged natural stands.

Over the mid-term, a shortfall occurs over the two five-year periods 51 to 60 years from now, where on average, the annual volume harvested was 4% below the level achieved under the Base Case. This shortfall coincides with harvests occurring over the last 10 years within Pass 3 Biodiversity Patch Zones. On average, 30% of the volume harvested within

Pass 3 Biodiversity Patch Zones over this time period came from managed second growth stands under the Base Case forecast.

Over the long-term, shortfalls occurred when harvests were restricted to Pass 2, 3 and 4 Biodiversity Patch Zones with the largest shortfalls occurring when harvests are restricted to Pass 4 Biodiversity Patch Zones. This pattern indicates that there is an uneven distribution of second growth growing stock volume amongst Biodiversity Patch Zones, with surplus volumes available in Pass 1 and 2 Zones and deficit growing stock volumes in Pass 3 and 4. This means the LTHL is bound by the distribution and design of Pass 3 and 4 biodiversity patch zones and suggests that there may be opportunities for minimizing the negative timber supply effect of patch size targets through alternative harvest scheduling options and patch designs while remaining consistent with *Landscape Unit Planning Guidebook* targets. However time limitations prevented alternative solutions from being explored under this timber supply review.

To realize the harvest flow policy under the analysis, the timber supply effect of decreasing managed stand yield estimates by 10%, reduces timber supply by an average of 4% over the mid-term period 46-60 years from now relative to the Base Case forecast. As anticipated, over the long-term the timber supply reduction is 10% relative to the Base Case.

6.3.2 Increase Managed Stand Yields by 10%

Figure 31 shows the timber supply effects of increasing managed stand yields by 10%.

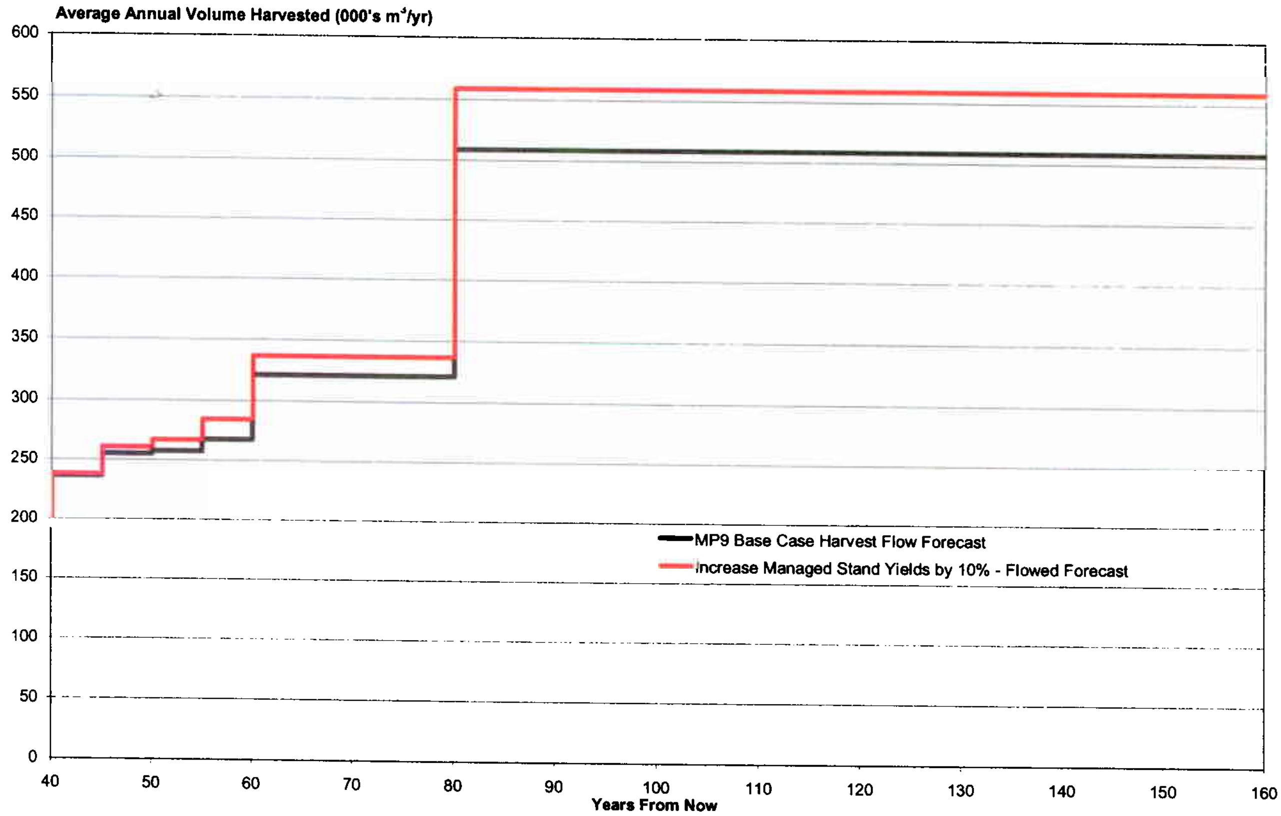


Figure 31: Increase managed stand yields by 10%

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	MSYTs +10% Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Mid-Term	25	5	219,968	-12%	219,968	-12%	0%
	30	5	219,968	0%	220,002	0%	0%
	35	5	193,690	-12%	193,817	-12%	0%
	40	5	193,690	0%	193,817	0%	0%
	45	5	236,170	22%	237,483	23%	1%
	50	5	255,058	8%	260,474	10%	2%
	55	5	257,183	1%	266,305	2%	4%
	60	5	267,225	4%	284,173	7%	6%
	80	20	321,175	20%	336,432	18%	5%
Long-Term	100	20	508,759	58%	558,445	66%	10%
	120	20	508,759	0%	558,445	0%	10%
	140	20	508,759	0%	558,445	0%	10%
	160	20	508,759	0%	558,445	0%	10%
	180	20	508,759	0%	558,445	0%	10%
	200	20	508,759	0%	558,445	0%	10%
	220	20	508,759	0%	558,445	0%	10%
	240	20	508,759	0%	558,445	0%	10%
	260	20	508,759	0%	558,445	0%	10%
	280	20	508,759	0%	558,445	0%	10%
	300	20	508,759	0%	558,445	0%	10%
	320	20	508,759	0%	558,445	0%	10%
	340	20	508,759	0%	558,445	0%	10%
	360	20	508,759	0%	558,445	0%	10%
	380	20	508,759	0%	558,445	0%	10%
	400	20	508,759	0%	558,445	0%	10%

As anticipated, the timber supply effect of increasing managed stand yield estimates by 10% results in a gradual increase in timber supply over the mid-term period, 41 to 80 years from now, relative to the Base Case, as harvest levels begin to rely more heavily on managed second growth.

Over the long-term, a 10% increase in managed stand yields results in a proportional 10% increase to LTHL.

6.4 Uncertainty in Site Productivity Estimates

The following sensitivity assesses the timber supply effect of using managed stand growth and yield projections obtained from VRI estimates of site index rather than the Base Case site index estimates from the Site Index Adjustment Project (SIA).

The information package for MP9 revealed that on average, SIA estimates of site index for managed stands would result in a 33% or 5m increase relative to VRI site index estimates for existing natural stands. The timber supply effect of these site index adjustments for managed stands under MP9 resulted in a 36% increase in the LTHL relative to the LTHL obtained under MP8. In addition, the LTHL under MP9 was realized 20 years sooner than under MP8.

Site index is the key parameter in both VDYP and TIPSY having the greatest impact on growth and yield projections obtained from both of these models. As a result, stand yield and height projections from both models respond significantly to even small changes in site index. At the forest level, any changes to estimates of site productivity impact minimum harvest ages where they are based on the growth rates of individual stands (e.g. culmination of MAI) as well as influence the binding effect of non-timber resource targets where targets are based on rates of stand height growth (e.g. green-up adjacency, effective green-up, hydrologic recovery). The impact on managed stand growth and yield attributes between the unadjusted SIs used in this sensitivity relative to the SIA adjusted SIs used in the Base Case reveals an area weighted average:

1. 38% increase in minimum harvest age or 23 years from 60 years under the Base Case to 83 years under this sensitivity.

2. decline in yield at culmination of 12% from 369 m3/ha under the Base Case to 325 m3/ha under this sensitivity.

3. decline in culmination MAI of 32% from 5.26 m3/ha/yr under the Base Case to 3.60 m3/ha/yr under this sensitivity.

4. increase of 58% or 11 years in order for managed stands to reach visually effective green-up height from 19 years under the Base Case to 30 years under this sensitivity.

5. increase of 36% or 9 years in order for managed stands to reach heights necessary for full hydrologic recovery from 25 years under the Base Case to 34 years under the sensitivity.

6.4.1 Apply Managed Stand Yield Projections based on Unadjusted Site Indices

Figure 32 shows the timber supply effects of using managed stand yield projections developed without adjustments to site index.

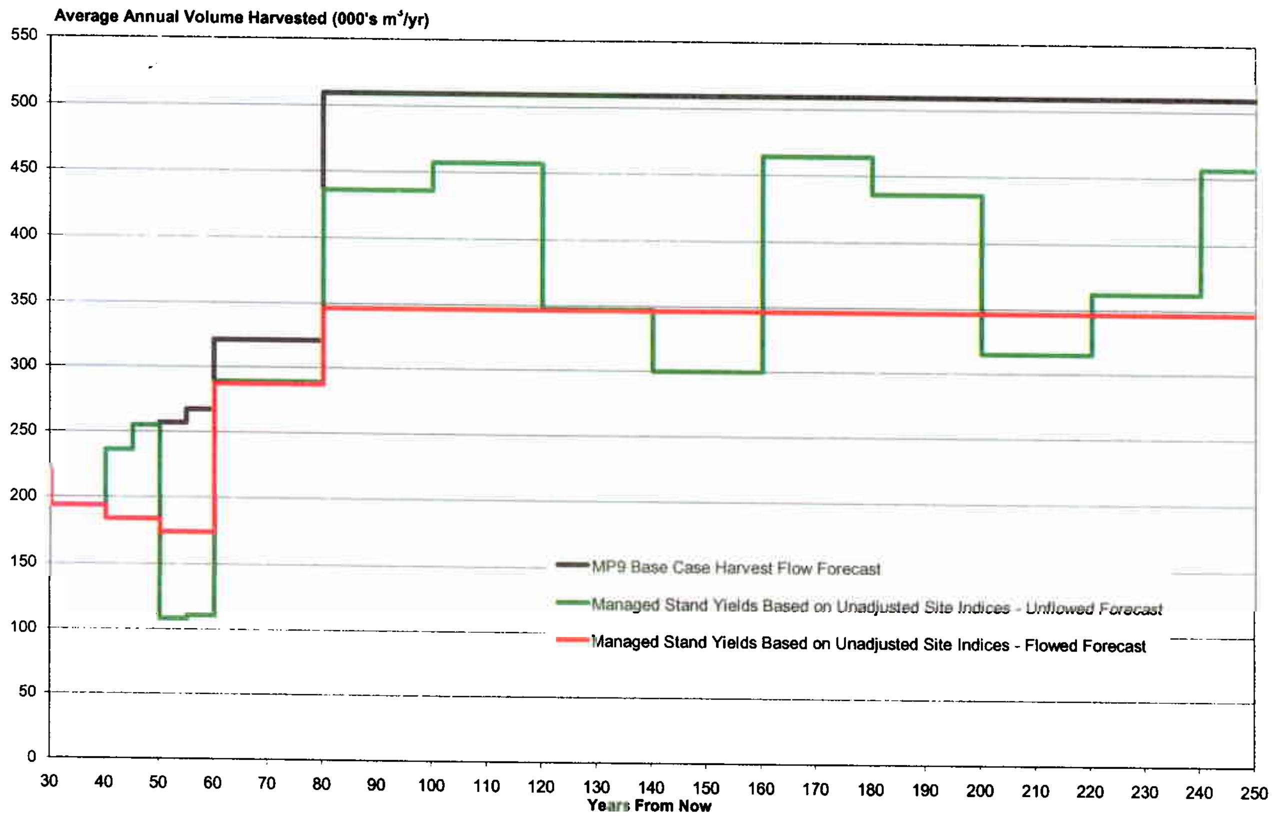


Figure 32: Apply unadjusted site indices to managed stand yields

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m^3/yr.)	Percent Change In Flow Relative to Previous Period	SI Unadj. MSYTs Unflowed (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case	SI Unadj. MSYTs Flowed (m^3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Mid-Term	25	5	219,968	-12%	219,968	-12%	0%	219,968	-12%	0%
	30	5	219,968	0%	219,968	0%	0%	219,968	0%	0%
	35	5	193,690	-12%	193,690	-12%	0%	193,690	-12%	0%
	40	5	193,690	0%	193,690	0%	0%	193,690	0%	0%
	45	5	236,170	22%	236,170	22%	0%	183,824	-5%	-22%
	50	5	255,058	8%	255,058	8%	0%	183,824	0%	-28%
	55	5	257,183	1%	108,443	-57%	-58%	174,450	-5%	-32%
	60	5	267,225	4%	110,867	2%	-59%	174,450	0%	-35%
	80	20	321,175	20%	288,892	161%	-10%	287,055	65%	-11%
Long-Term	100	20	508,759	58%	436,056	51%	-14%	346,360	21%	-32%
	120	20	508,759	0%	457,552	5%	-10%	346,360	0%	-32%
	140	20	508,759	0%	346,773	-24%	-32%	346,360	0%	-32%
	160	20	508,759	0%	299,621	-14%	-41%	346,360	0%	-32%
	180	20	508,759	0%	464,521	55%	-9%	346,360	0%	-32%
	200	20	508,759	0%	436,004	-6%	-14%	346,360	0%	-32%
	220	20	508,759	0%	314,959	-28%	-38%	346,360	0%	-32%
	240	20	508,759	0%	361,793	15%	-29%	346,360	0%	-32%
	260	20	508,759	0%	456,266	26%	-10%	346,360	0%	-32%
	280	20	508,759	0%	439,614	-4%	-14%	346,360	0%	-32%
	300	20	508,759	0%	318,794	-27%	-37%	346,360	0%	-32%
	320	20	508,759	0%	281,055	-12%	-45%	346,360	0%	-32%
	340	20	508,759	0%	477,236	70%	-6%	346,360	0%	-32%
	360	20	508,759	0%	428,176	-10%	-16%	346,360	0%	-32%
	380	20	508,759	0%	322,238	-25%	-37%	346,360	0%	-32%
	400	20	508,759	0%	356,512	11%	-30%	346,360	0%	-32%

The unflowed forecast under the sensitivity revealed that Base Case harvest flow targets can be maintained over the first 50 years of the planning horizon. Over the mid-term period 51 to 60 years from now however, a timber supply shortfall of 58% occurred followed by a 10% shortfall 61 to 80 years from now. As anticipated, the LTHL achieved under the Base Case cannot be realized if estimates of site productivity for managed stands are reduced.

To realize the harvest flow objective under the analysis, the timber supply effect of using unadjusted estimates of site index reveals no impacts to timber supply over the first 40 years of the planning horizon. Over the latter half of the mid-term, 41 to 80 years from now, timber supply must decrease by an average of 20% relative to the Base Case flow over this same period and the LTHL must decline by 32%.

This sensitivity forecast suggests therefore that over the short and first half of the mid-term, the harvest rules used to realize targets for biodiversity patches regulate the rate of harvest far more than the height dependant targets associated with watershed and visual resource objectives. Since a decrease in site productivity results in both a reduction in stand yields as well as an increase in minimum harvest ages, the shortfalls in timber supply over the latter half of the mid-term coincide with the periods in which Base Case harvest levels depend predominantly on managed second growth volumes. Over the long-term, the 32% reduction in the LTHL relative to the Base Case is consistent with the reduction in average MAIs as a result of the changes to site productivity estimates.

6.5 Uncertainty in Land Base Available for Timber Harvesting

One issue causing uncertainty regarding the size of the THLB, revolves around the minimum economic yield criteria used to identify stands that currently contribute yields which were considered too low to warrant harvest from an economic perspective. Since the minimum economic yield reduction criteria contain both an age as well as yield component, then in essence, the reduction criteria identifies stands with low site productivity estimates. Therefore, the rationale for performing this sensitivity is based on the results of the Site Index Adjustment (SIA) Project which showed that significant site index increases can be realized by converting existing natural stands to managed second growth. In Section 5.5.1.1 of the Information Package, it was shown that if all natural stands removed from the THLB as a result of the Minimum Economic Yield Reduction Criteria, were converted to managed second growth, site productivity estimates would increase by 43% from 12.3 m to 17.5 m. Currently, the area weighted average merchantable yield across all of these low volume stands is 115 m3/ha. If these stands were harvested and converted to managed second growth, the average merchantable yield at culmination would increase by 160%, from 134 m3/ha to 349 m3/ha. This information suggests that most low volume naturally established stands within the TFL are growing on highly productive sites, however, the growth and survival rates of naturally established trees were very low, likely due to severe brush competition as well as wet soil moisture conditions during establishment. By applying the minimum economic yield criteria to the TIPSY managed stand growth and yield projections rather than the VDYP projections for natural stands, which were based on VRI site index estimates, the THLB will increase since the inherent site productivity of these growing sites can be fully captured through stand management activates such as density control ensuring full site occupancy and through brushing and weeding treatments.

6.5.1 Apply Minimum Economic Yield Criteria to Managed Stand Yield Tables

Figure 33 shows the timber supply effects of applying the minimum economic yield criteria to managed stand yield tables rather than natural stand yield tables.

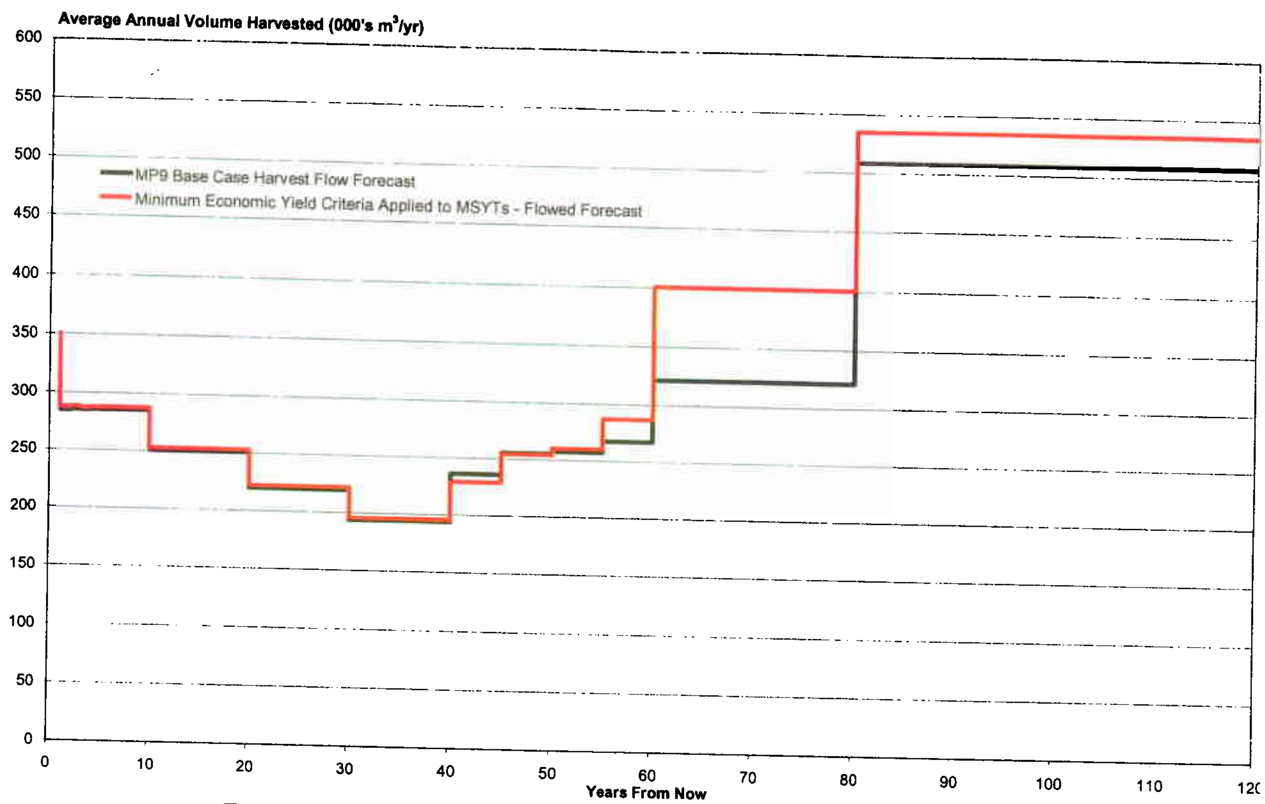


Figure 33: Apply minimum economic yield criteria to managed stand yields

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	Min. Eco. Criteria on MSYTs Flowed (m3/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference in Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	287,615	-18%	1%
	3	1	285,291	0%	287,921	0%	1%
	4	1	284,882	0%	287,122	0%	1%
	5	1	285,582	0%	287,306	0%	1%
	10	5	285,110	0%	287,571	0%	1%
	15	5	250,460	-12%	252,626	-12%	1%
	20	5	250,460	0%	252,626	0%	1%
Mid-Term	25	5	219,968	-12%	221,874	-12%	1%
	30	5	219,968	0%	221,874	0%	1%
	35	5	193,690	-12%	195,372	-12%	1%
	40	5	193,690	0%	195,372	0%	1%
	45	5	236,170	22%	229,112	17%	-3%
	50	5	255,058	8%	254,339	11%	0%
	55	5	257,183	1%	260,018	2%	1%
	60	5	267,225	4%	286,493	10%	7%
	80	20	321,175	20%	400,791	40%	25%
Long-Term	100	20	508,759	58%	534,734	33%	5%
	120	20	508,759	0%	534,734	0%	5%
	140	20	508,759	0%	534,734	0%	5%
	160	20	508,759	0%	534,734	0%	5%
	180	20	508,759	0%	534,734	0%	5%
	200	20	508,759	0%	534,734	0%	5%
	220	20	508,759	0%	534,734	0%	5%
	240	20	508,759	0%	534,734	0%	5%
	260	20	508,759	0%	534,734	0%	5%
	280	20	508,759	0%	534,734	0%	5%
	300	20	508,759	0%	534,734	0%	5%
	320	20	508,759	0%	534,734	0%	5%
	340	20	508,759	0%	534,734	0%	5%
	360	20	508,759	0%	534,734	0%	5%
	380	20	508,759	0%	534,734	0%	5%
	400	20	508,759	0%	534,734	0%	5%

When the criteria were applied to MSYTs, the total productive area removed from the THLB as a result fell by 83% or 15,323 ha from 18,529 ha to 3,206 ha. Comparing the reductions between the Base Case and this sensitivity, of the 18,529 ha removed under the Base Case, only 15% of the area was also removed when the criteria was applied to managed stand projections. Only an additional 368 ha of low productivity forest was identified through the sensitivity which was not captured under the Base Case reduction. This suggests that site productivity estimates based on existing naturally established trees over most of these sites significantly underestimate the true growth potential which may be achieved through stand management. However, when other overlapping reductions are accounted for, the net increase to the THLB was only 6% or 6,661 ha from 118,725 ha to 125,386 ha. This is because, of the 18,529 ha of low yield forest removed under the Base Case, 64% is overlapped by other reduction criteria. Of these, the most significant include reductions for non-commercial brush which occupy 32% of low yield sites followed by areas with significant regeneration problems at 18%, Caribou High Value Habitat Zones at 17% and finally areas with unstable terrain at 10%.

This 6,661 ha of low volume forest when added back into the THLB, increases the amount of currently available (i.e. above minimum harvest age) merchantable volume by 5% or 734,855 m3 relative to the Base Case at an average yield of 110 m^3/ha. Over the short-term, the timber supply effect of this THLB increase relative to the Base Case was only 1% even though available growing stock increased by 5%. Modelling runs performed with ATLAS in order to obtain the flowed forecast under the sensitivity revealed that increasing the target harvest levels by 5% caused a slight shortfall 16-20 years from now and significant shortfalls 31 to 40 years from now coinciding with the pinch point under the Base Case forecast. This suggests that although additional growing stock is made available through the addition of forested lands back into the THLB, the volume available is bound by constraints over the short-term relative to the desired harvest flow policy set for the analysis.

Of the 734,855 m3 of additional available volume under the sensitivity, 78% is found within visual areas and caribou corridors, 10% in Pass 1 Biodiversity Patch Zones, 2% in Pass 2, 4% in Pass 3 and finally 6% in Pass 4. Forest cover and adjacency requirements across visual areas and caribou corridors are very restrictive. In addition, current forest cover violations and adjacency requirements due to legacy harvests within these zones prevent harvests from occurring over 51% of the THLB in visual polygons and over 25% of the THLB in caribou corridors across the short and first half of the mid-term. As a result, much of this additional volume is bound within these resource emphasis zones. Based on the sensitivity flow forecast, much of this additional volume becomes available over the 20 year period 61 to 80 years from now, where the average annual harvest obtained was 25% higher than the Base Case harvest over this same period.

As anticipated, over the long-term, the timber supply effect of increasing the THLB by 6% as a result of applying the minimum economic yield criteria to managed stand projections, resulted in a 5% increase in the LTHL relative to the Base Case.

6.6 Uncertainty in Resource Management Practices

Recent proposed changes to biodiversity requirements as outlined within the FPC Landscape Unit Planning Guidebook based on new information regarding natural disturbance dynamics and maintenance of biological diversity are being put forward by the Ministry of Forests. These proposed changes are contained within a draft document prepared by *Craig Delong*, Landscape Ecologist with the Ministry of Forests, Prince George Forest Region. Some key differences being suggested in the draft report are:

1. to assess biodiversity targets using broader Natural Disturbance Units (NDUs) rather than combinations of Biogeoclimatic Subzone Variants, Landscape Units and Natural Disturbance Types (NDTs) currently specified under the LU Planning Guidebook.

2. to replace the provincial biodiversity targets for seral stages, patch sizes and natural stand replacement intervals suggested in the LU Planning Guidebook with more localized targets for the Prince George Forest Region.

3. to include targets related to whole stand replacement disturbances vs. gap replacement dynamics by NDU.

Based on the NDU classification used in the draft report, most of TFL30 is located within the Wet Mountain NDU. Recommended patch size targets for this NDU require that 10% of the area in age class 1 be maintained in patches greater than 1,000 ha in size, 60% between 100 and 1,000 ha, 10% between 50 and 100 ha and finally 20% less than 50 ha. Consistent with patch size targets specified in the LU Planning Guidebook, the harvest flow forecast under the Base Case ensured that patches could not exceed 250 ha within the Seebach and Woodall Landscape Units and 1,000 ha within the Averil Landscape Unit.

Note that under this sensitivity, only the targets for biodiversity patch sizes were removed. Targets for all other timber and non-timber resource values implemented under the Base Case were not altered any way. Patch size targets were removed by eliminating the harvest rules which forced the model to schedule harvests only within specific Biodiversity Patch Zones in 20 year intervals.

6.6.1 Remove Targets for Biodiversity Patch Sizes

Figure 34 shows the timber supply effects of removing targets for biodiversity patches.

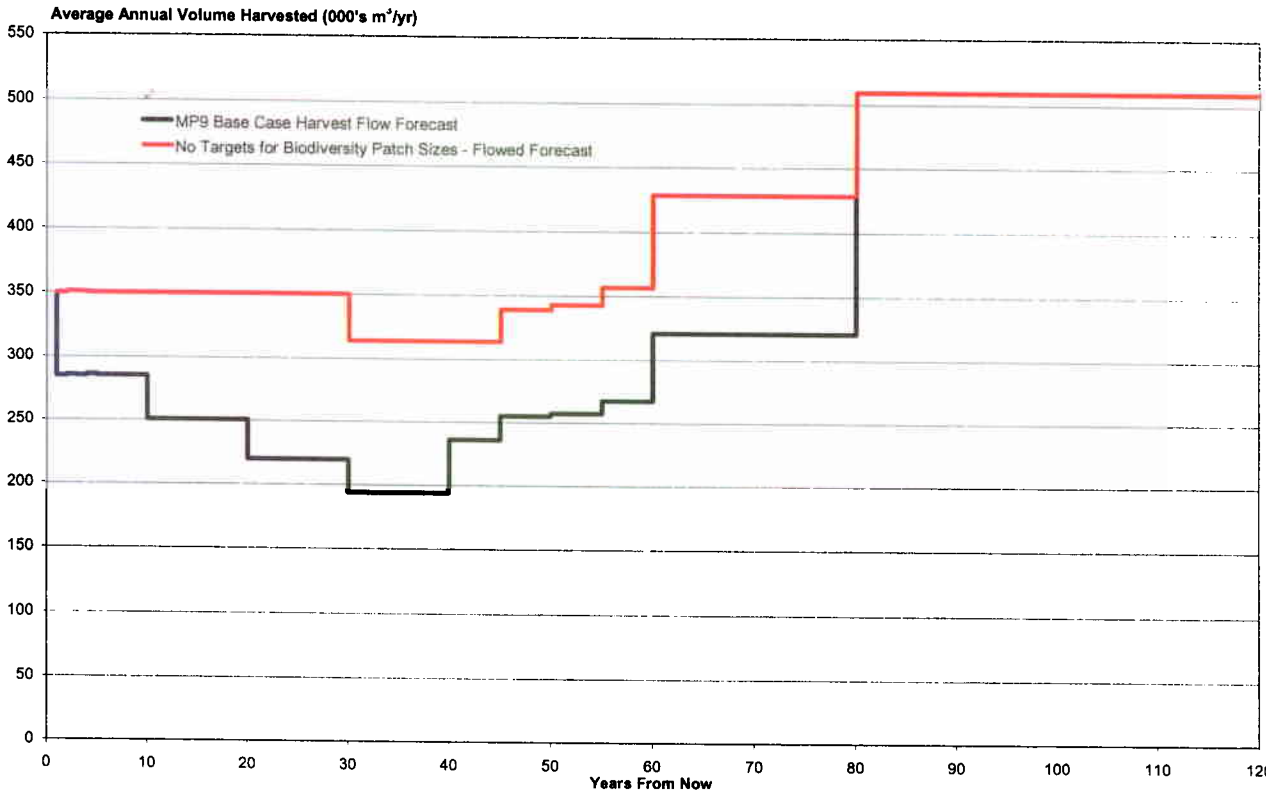


Figure 34: No targets for biodiversity patch sizes

Planning Horizon	Years from Now	Years in Period	MP9 Base Case Harvest Flow Forecast (m³/yr.)	Percent Change In Flow Relative to Previous Period	No Patch Size Targets Flowed (m³/yr.)	Percent Change In Flow Relative to Previous Period	Percent Difference In Flow Relative to Base Case
Short-Term	1	1	350,000		350,000		0%
	2	1	284,548	-19%	349,442	0%	23%
	3	1	285,291	0%	350,615	0%	23%
	4	1	284,882	0%	350,381	0%	23%
	5	1	285,582	0%	350,000	0%	23%
	10	5	285,110	0%	350,000	0%	23%
	15	5	250,460	-12%	350,000	0%	40%
	20	5	250,460	0%	350,000	0%	40%
Mid-Term	25	5	219,968	-12%	350,000	0%	59%
	30	5	219,968	0%	350,000	0%	59%
	35	5	193,690	-12%	313,711	-10%	62%
	40	5	193,690	0%	313,711	0%	62%
	45	5	236,170	22%	313,711	0%	33%
	50	5	255,058	8%	339,099	8%	33%
	55	5	257,183	1%	342,526	1%	33%
	60	5	267,225	4%	356,373	4%	33%
	80	20	321,175	20%	428,375	20%	33%

By removing the *FPC Landscape Unit Planning Guidebook* targets for biodiversity patch sizes, the rate at which the existing stock of natural forest could be harvested increased substantially without compromising targets for other resource values. In addition, this change enabled the harvest of managed second growth stands to occur closer to their minimum harvest ages over the mid-term. As a result, the harvest forecast under this sensitivity reveals that the current AAC of 350,000 m3/yr can be maintained for the next 30 years before annual harvest levels need to decline by 10% to 313,711 m3/yr over the fifteen year period, 31 to 45 years from now. The timber supply effect of removing patch size targets increases timber supply by an average of 32% over the short-term relative to the Base Case forecast.

Over the mid-term, timber supply increased by an average of 42%, while no change in flow was realized over the long-term.

Figure 35 provides a spatial comparison between the age class/patch size distributions realized when patch size targets were enforced under the Base Case and when they were removed under this sensitivity.

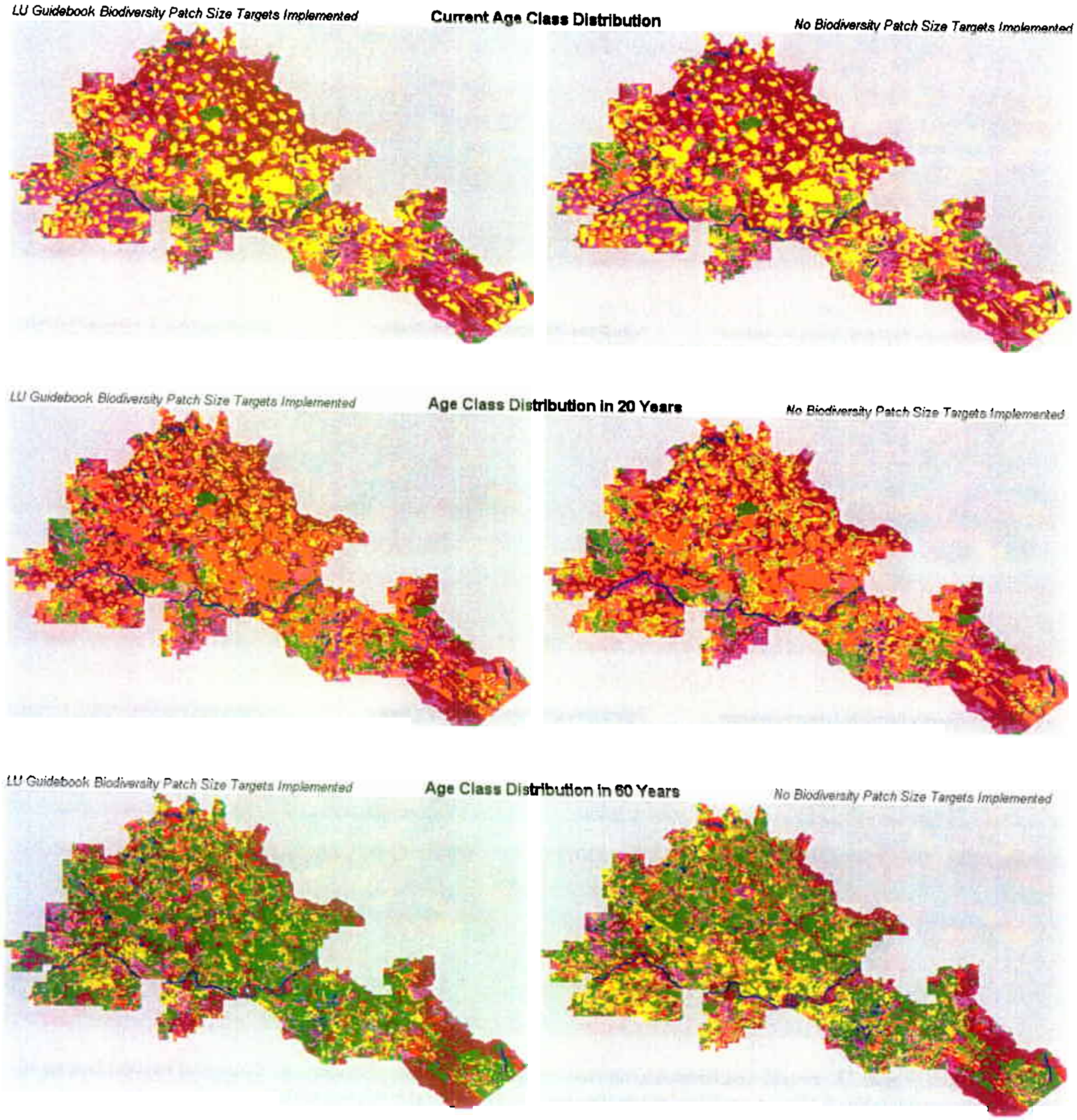
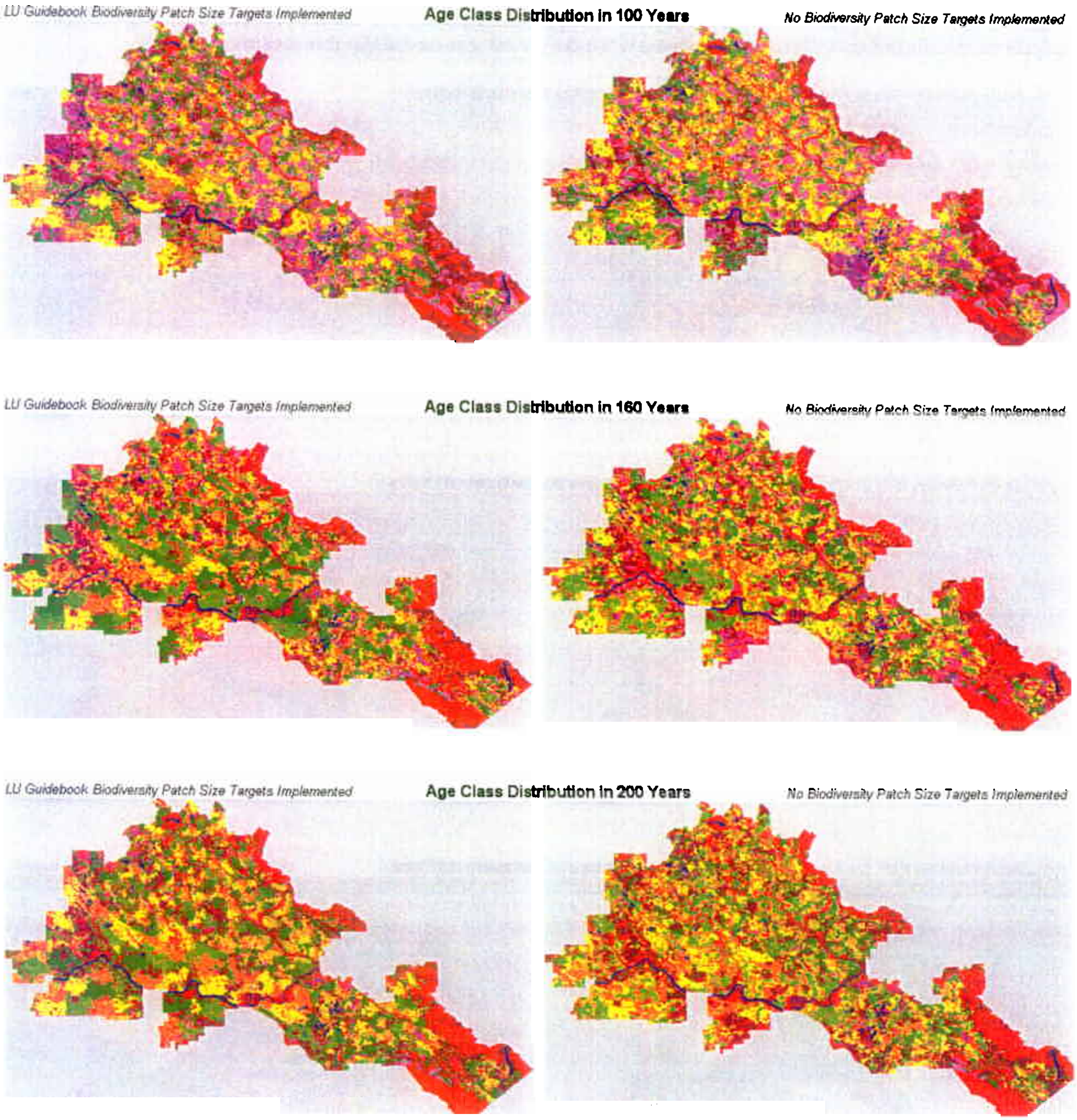


Figure 35: Spatial comparison of age class distributions through time with and without patch size targets



As anticipated, Figure 35 reveals that between the two scenarios, the size, distribution, shape and harvest timing of patches are considerably different with larger patches being created under the sensitivity.

7.0 Summary and Conclusions

The results of this timber supply analysis suggest that an immediate 19% reduction to the current AAC of 350,000 m^3/yr is required, relative to the harvest flow policy requirement of ensuring that declines in timber supply do not exceed 12% per decade. The analysis shows that this new harvest level of 285,000 m^3/yr can be maintained for the next 10 years before harvest levels must decline by 12% per decade for three decades to 193,690 m^3/yr. Over the next 40 years, starting 41 years from now, the harvest level increases at an average rate of 9% per decade to a long-term harvest level of 508,759 m^3/yr, beginning 81 years from now.

An alternative Base Case forecast demonstrates that the current AAC could be maintained over the next five years, however, this would necessitate a more rapid rate of decline from the current AAC at 15% every five years until year 20.

Uncertainty exists about several factors important in defining timber supply. A series of sensitivity analyses showed that these uncertainties affect timber supply to varying degrees. **Table 5** provides a summary of the information presented in Section 6.6, showing the average timber supply effect of each sensitivity tested relative to the Base Case forecast. The table is sorted in descending order by short-term timber supply impact

Table 5: Summary of timber supply effects by sensitivity by planning horizon

Sensitivity	Planning Horizion		
	Short-Term	Mid-Term	Long-Term
Remove Targets for Biodiversity Patch Sizes	32%	42%	0%
Increase Natural Stand Yields by 20%	21%	24%	0%
Increase Natural Stand Yields by 10%	10%	9%	0%
Decrease Minimum Harvestable Ages by 10 Years	4%	20%	0%
Apply Minimum Economic Yield Criteria to Managed Stand Yield Tables	1%	9%	5%
Increase Managed Stand Yields by 10%	0%	3%	10%
Decrease Managed Stand Yields by 10%	0%	-1%	-10%
Apply Managed Stand Yield Projections based on Unadjusted Site Indicies	0%	-13%	-32%
Increase Minimum Harvestable Ages by 10 Years	-6%	-10%	0%
Decrease Natural Stand Yields by 10%	-9%	-1%	0%
Decrease Natural Stand Yields by 20%	-21%	-15%	0%

Table 5 reveals that removing biodiversity patch size targets produces the most significant positive timber supply effects relative to the Base Case over both the short and mid-terms. Table 5 also reveals that any positive or negative adjustments to natural stand yields will have a proportionate impact on short-term harvest flows.

Over the long-term, Table 5 reveals that increasing managed stand yields by 10% produces the most significant positive timber supply effect relative to the Base Case. Conversely, applying managed stand yield projections developed using unadjusted site indices produces the most significant negative timber supply effect relative to the Base Case over both the mid and long-terms.

In conclusion, based on the data inputs and assumptions used under this analysis, the results suggest that an immediate 19% reduction to the current AAC of 350,000 m^3/yr is required. It is likely that this outcome will have an economic impact on Canfor's operations and may potentially impact the surrounding communities which provide services and human resources to the operation. As a result, any alternatives to the Base Case which minimize or eliminate the need for this immediate reduction would be preferable.

Sensitivity analysis revealed that targets for biodiversity patch sizes implemented as per *Landscape Unit Planning Guidebook* requirements, are solely responsible for this reduction since removing them would enable the current AAC to be maintained for the next 30 years. It is reasonable to accept the timber supply results of this sensitivity since it does not require compromises to any other resource objectives identified for the TFL and in fact, appears to be more consistent with new regional guidelines currently being put forward by government that suggest significant changes to the current patch size targets under the guidebook. In addition, the implementation of this sensitivity through the 20-year plan can be clearly articulated since the analysis was completed using a spatially explicit dataset and forest estate model. As a result, it can be clearly shown where, when and how harvests must occur in order to support this timber supply forecast. In addition, resource indicator responses over both the short and long-terms can be reported and used to measure performance relative to the resource objectives identified under the analysis.

Another critical issue which may act to minimize the extent of the short-term timber supply reduction indicated under the Base Case relates to yield estimates for natural stands. Average natural stand yield estimates obtained through field sampling under the VRI and 1996 inventory audit programs are higher by 21% and 15% respectively, when compared to the average yield obtained for the same population based on the natural stand yield projections used in the analysis. Sensitivities revealed that a 20% increase in natural stand yields would permit the current AAC to be maintained over the next 10 years and that on average, harvest flows could be increased by 21% over the next 40 years. As a result, a high priority should be placed on ensuring that estimates of yield for natural stands in the analysis do in fact reflect the actual natural stand inventory of the TFL.