Appendix 6 – Timber Supply Analysis Report

BRITISH COLUMBIA

August 31, 2006

File: 12850-20/48

Don Rosen
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Canadian Forest Products Ltd.
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Chetwynd, BC V0C 1J0

Dear Don Rosen:

Re: Information Package for Tree Farm Licence (TFL) 48

Thank you for your Timber Supply Analysis Report in support of Sustainable Forest Management Plan 4 for TFL 48 (version 1.0b dated August, 2006) submitted August 8, 2006. I have reviewed the report and discussed the results with the consulting timber supply analyst responsible for preparing the report.

As the MoFR timber supply analyst responsible for reviewing this analysis report, I accept the document for use in the AAC determination for TFL 48 with no conditions.

I wish to point out that this letter does not mean that the MoFR endorses every aspect of this analysis. During the AAC determination information session, MoFR staff will advise the deputy chief forester regarding the technical validity of the analysis and the implications of its assumptions and results. The deputy chief forester will consider this advice as he develops the rationale for his determination of the AAC for TFL 48.

Sincerely,

Gordon Nienaber, R.P.F.
Timber Supply Analyst
Forest Analysis and Inventory Branch

cc: Winn Hays-Byl, MoFR - Peace District
Robert Schuetz, Industrial Forest Service
Bud Koch, MoFR - FAIB

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TREE FARM LICENCE # 48

TIMBER SUPPLY ANALYSIS REPORT
In support of
MANAGEMENT PLAN # 4

Prepared for

Canadian Forest Products Ltd.

Chetwynd Operations

August 2006

Version 1.0b

Prepared by:

Robert Schuetz, RPF

INDUSTRIAL FORESTRY SERVICE LTD.

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1. Executive Summary

A spatial timber supply analysis has been completed for TFL 48 in support of Sustainable Forest Management Plan #4. This analysis assessed both the coniferous and deciduous species within the TFL and derived a sustainable harvest level for both.

As per the direction of the Chief Forester in the AAC Rationale for Management Plan #3, Phase II vegetation resource inventory sampling of stands within the TFL has been completed. This sampling project resulted in a significant increase in the timber harvesting land base for the TFL; as well as a significant increase in the current merchantable growing stock and the estimation of unmanaged stand site productivity.

A base case scenario was identified using a coniferous timber harvesting land base (THLB) of 314,800 hectares and a deciduous THLB of 48,500 hectares. Upon this land base, natural range of variation seral targets have been applied to natural disturbance units at both the landscape level and by biogeoclimatic zone. Visual quality objectives have been maintained. Watersheds are monitored for hydrologic greenup. Riparian habitat, legislated protected areas, recreation sites, archeological sites and wildlife tree patches have been identified and preserved.

Both the coniferous and deciduous land bases have a current age class distribution that continues to be heavily skew to the mature and over-mature. For the coniferous land base, this provides a very stable platform whereby seral stage targets are met either immediately, or in the very near future.

The current AAC for TFL 48 is 580,000m^3/year. This is partitioned 525,000 to coniferous-leading species and 55,000 to deciduous-leading species. The current analysis reveals that a harvest of 642,800m^3/year can be supported by coniferous-leading stands and 94,200m^3/year by deciduous-leading stands.

Sensitivity analysis on the base case scenario, as well as on alternative management strategies, was completed. The analysis showed that the base case was sensitive to changes in visual quality objectives, old growth constraints and managed stand yield estimates. Sensitivity analysis also showed that the TFL could support a 25 to 50 percent higher short-term harvest for 10 to 30 years, and still maintain a mid-term non-declining harvest very near the base case.

Analysis on the potential impacts of a growing mountain pine beetle infestation was examined. Infestation scenarios ranging from 40 to 80 percent maximum pine mortality were simulated. The results indicated that up to 50 percent pine mortality could occur on the TFL, with minimal impact on the mid-term harvest level. Maximum mortality in excess of 50 percent had in increasingly negative effect on mid-term timber supply.

Additional analysis, giving consideration to the combined effect of managed stand yields (ie SIBEC), recommended VQOs and the focus on pine harvesting as a result of MPB mortality, revealed that a coniferous harvest of 744,000m^3/year and a deciduous harvest of 101,300m^3/year are sustainable for the long term. In consideration of this information, Canfor believes the allowable annual cut for Tree Farm License 48 should be set at 845,300m^3/year for the term of SFMP#4.

Timber Supply Analysis Report
In support of Tree Farm License 48's
Management Plan # 4

2. Introduction

In accordance with Section 35(1)(vii) of the Forest Act of British Columbia, Canadian Forest Products Ltd.'s, Chetwynd Operations (Canfor), has completed a timber supply analysis of Tree Farm License (TFL) # 48, in support of and leading to the preparation of Sustainable Forest Management Plan (SFMP) # 4.

A timber supply information package was submitted to the Ministry of Forests and Range (MOF) on February 21, 2006. After one revision and clarification on the visual inventory used in the analysis, conditional approval was received on April 25, 2006. A complete information package incorporating the issues identified in the approval letter is provided in Appendix I.

This report examines the short, medium and long-term timber supply for TFL 48. In many ways this analysis is a continuation of forest management activities and assumptions used and modeled in MP#3. In regard to forest management and timber supply modelling assumptions, important information relative to TFL#48 includes:

- A revised TFL boundary, whereby the 'Stewart Block" has been added to the TFL and parts of the TFL's Rice Property have been removed from the TFL and added to the Dawson Creek TSA.

- As a result of Phase II statistical analysis of inventory field data and corresponding volume adjustment factors, a significantly larger timber harvesting land base has been identified.

- Visually sensitive areas have been updated.

- The base case analysis utilizes natural disturbance units (although the 'Established Old Growth Order' is also examined in sensitivity analysis).

- The Dunlevy higher level plan has been incorporation into the analysis.

- The Remsoft® Planning models were used to conduct aspatial and spatial timber supply modelling.

- The potential loss in economic lodgepole pine growing stock as a result of the migration of the mountain pine beetle into TFL48 is examined.

This analysis report is divided into four principle sections.

- Section one deals with the Base Case scenario. This scenario best describes the management practices and forestry operations carried out at the present time.

- Section two investigates a large number of "what if" questions regarding various assumptions on the Base Case scenario. Although the best available information was applied to the timber supply model in the Base Case scenario, uncertainty is implicit when a computer attempts to mimic the complicated, ever-changing dynamics of a complex ecosystem. To assess the impact that variables could have on timber supply, sensitivity analysis is used to identify which variables could have significant effects on timber supply. Uncertainty in these variables could result in a large or small upward or downward movement in the timber supply picture.

- Section 3 considers alternative management strategies relative to the TFL and the impact of these strategies on timber supply. This section is focused on providing Canfor with quantitative information to assist in the direction that management practices or information acquisition should be directed on TFL 48.

- Section four summarizes the most pertinent results from the first three sections and draws some conclusions on the current and future state of the forest resource.

3. Description of Tree Farm License # 48

Tree Farm License # 48 is located in and adjacent to the Rocky Mountains in the north-east interior of British Columbia. Divided into five non-contiguous blocks, the TFL land base spans a wide range of terrain; from the flat, spruce-pine-aspen forests of the Alberta Plateau, to the Rocky Mountain foothills and the jagged peaks of the Hart Ranges in the Rocky Mountains. Map 1 identifies the location of TFL 48 within the Province and relative to the Dawson Creek Forest District.

The TFL comprises a wide range of ecosections. The Engelmann Spruce-Subalpine Fir (ESSF) predominates within the TFL. Alpine Tundra (AT), Sub-Boreal Spruce (SBS) and Boreal White and Black Spruce (BWBS) also occur in varying amounts. The principle commercial tree species are white spruce (Picea glauca), lodgepole pine (Pinus contorta var. latifolia), sub-alpine fir (i.e., balsam) (Abies lasiocarpa), trembling aspen (Populus tremuloides) and cottonwood (Populus balsamifera). Paper birch (Betula papyrifera), larch (Larix laricina) and black spruce (Picea mariana) also occur, but are seldom utilized in any significant amount.

Principle road access to the TFL is by Highway 97-North (from Prince George and Mackenzie), or via Highway 97-West from Dawson Creek. The towns of Chetwynd, Tumbler Ridge and Hudson Hope are the principle population centers within or adjacent to the TFL. From these population centers, access to the forests within the TFL is possible through an expanding network of forest service roads and operational roads. These include the Johnson Creek, Sukunka River, Hasler Creek, Wolverine River, and Murray River Forest Service Roads. The road network has been developed to access areas of spruce bark beetle attack, pine beetle attack, fire salvage and contiguous drainages of old, merchantable timber.

Logging began in and around the current area of TFL 48 as early as the 1950's. A Chetwynd-based sawmill was first constructed in 1958-59 and has undergone reconstruction and several modernization programs since that time. In 1963, Canfor Limited purchased the sawmill from the Fort St. John Lumber Company. TFL 48 was awarded to Canadian Forest Products Ltd. in December 1988. Since this time Canfor's Chetwynd Operations personnel have managed the TFL.

The annual harvest level maintained by Canfor in the Chetwynd area was initially authorized under several Forest Licenses. In 1988, Canfor exchanged the apportionment from one of these forest licenses into an apportionment under a tree farm license. The initial allowable annual cut (AAC) was set at 410,000 cubic metres on an estimated land base of 661,365 hectares. Canfor maintained this apportionment for the term of Management Plan #1. In 1994, the AAC was increased 25.4% to 514,000 cubic metres on an adjusted land base of 638,811 hectares. The term of this apportionment is coincident with the term of Management Plan # 2, (i.e., from December 31, 1996 to December 31, 2001). On September 20 2001, the AAC was again increased, this time by 11 percent to 580,000 cubic metres. Table 1 shows the current apportionment to deciduous leading stands and coniferous leading stands

The Chief Forester's decision to set the AAC at 580,000 m3 was made with the direction that during the term of Management Plan # 3, Canfor:

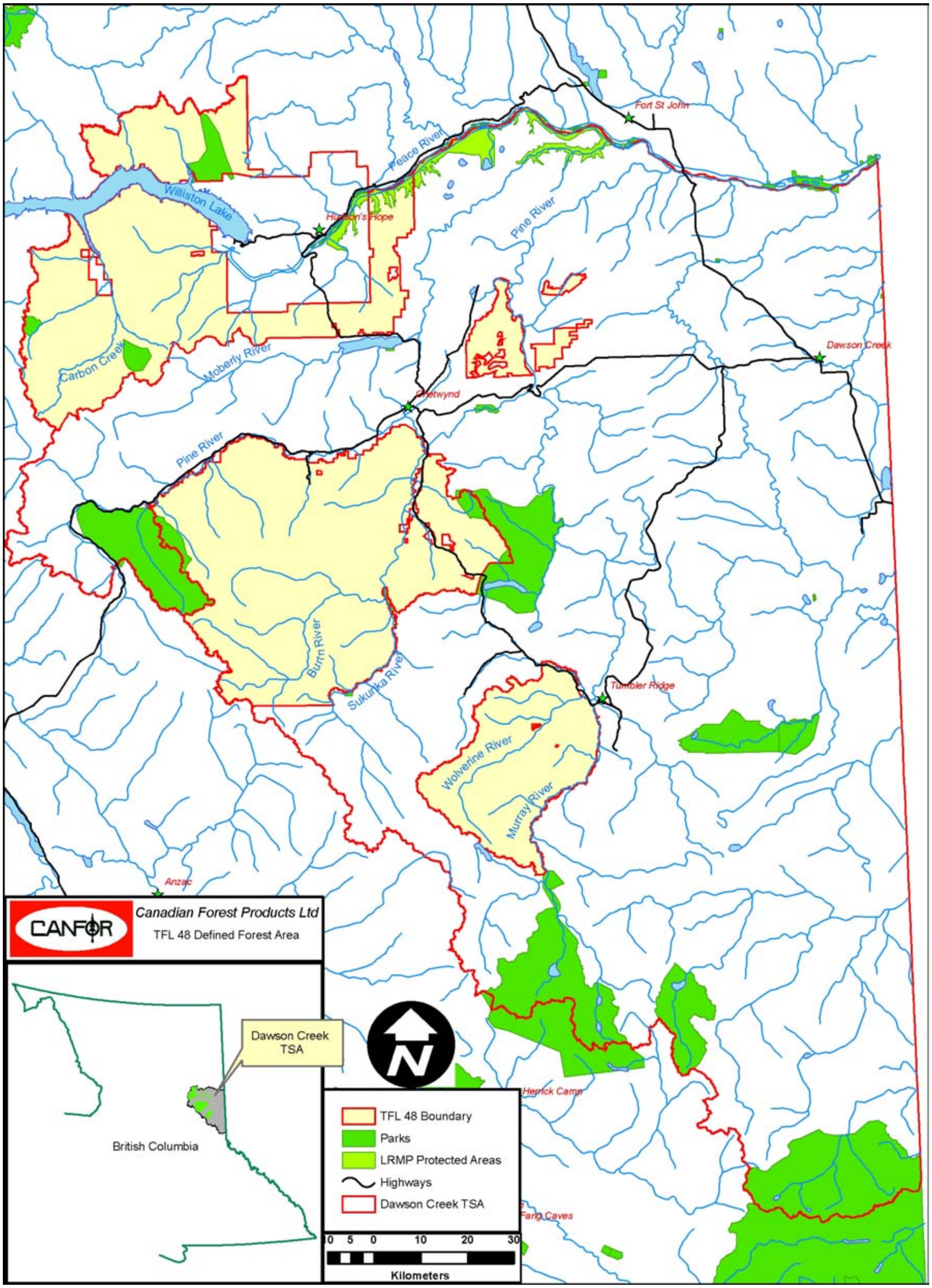
- Complete Phase II sampling of the TFL
- Ensure all polygons have an inventory label
- Monitor harvesting performance in deciduous leading stands
- Document stand conversion activities in the Rice Property
- Localize site productivity information
- Monitor the productivity of regeneration and advanced regeneration in shelterwood stands
- Document actual Wildlife tree patch retention
- Track and quantify areas denuded for energy exploration and development.
- Confirm management practices in riparian areas
- Confirm the amount of not satisfactorily restocked lands

Canfor has responded to all of these requests made by the Deputy Chief Forester in the AAC Rationale Document. This reader is directed to the Sustainable Forest Management Plan #4 document for TFL 48 for specific information.

Table 1 Current AAC Apportionment

1	Coniferous partition applicable to coniferous and deciduous trees harvested from *coniferous-leading stands.*	525,000 m3/year
2	Deciduous partition applicable to coniferous and deciduous trees harvested from *deciduous-leading stands.*	55,000 m3/year

Map 1 Location of TFL48



4. Information Preparation for the Timber Supply Analysis

A tremendous amount of effort goes into the preparation of a timber supply analysis for a TFL timber supply review. With regards to forest and other resource inventories, the following activities were completed or reworked during the past 5 years.

- Stream classifications were completed for the TFL
- The Phase II Sampling of the TFLs VRI inventory was completed and revealed that volumes and growth potential were generally underestimated when compared to previous information,
- The known visual inventory was updated and is now in line with visual inventories from the Dawson Creek TSA
- Wildlife habitat ratings have been completed for eight species across the TFL.
- Estimates of losses to future roads, trails and landings have been improved through the application of a model that produced a hypothetical road network to access the entire THLB. The THLB area lost as a result of this road network was used as a percent area conversion to non-productive applicable to existing unmanaged stands after their initial harvest.
- An inventory of existing and proposed energy and mining exploration and development activities was completed across the TFL. The net impact of these activities is minimal and is discussed further in this report.

4.1. Land Base Inventory

The inventory's for TFL 48 currently exists in a spatially explicit ARC-INFO geographic information system (GIS). This GIS contains the results of a union of all of the different inventories identified in the appended information package into one comprehensive database. The resultant inventory database was then used to spatially identify the areas that will contribute to the present and future THLB. This THLB is shown in Map 2.

As per the analysis completed for MP#3, this analysis also identifies and tracks the distribution and age of productive forest area that was excluded from the THLB. This was done to allow the forested areas that have been excluded from the THLB, to contribute to biodiversity seral-stage targets, visual quality objectives, and the maintenance of wildlife habitat.

Areas excluded from the THLB are represented in riparian reserves, operability reserves, parks, alpine forest and recreation areas. Map 2, Figure 1 and Table 2 summarize the area reductions that were made to the TFL's productive forest area for the purpose of determining the THLB. It is estimated that 64 percent of the productive forest area is eligible for timber harvesting activities either presently, or some time in the future. This proportion is divided between the coniferous THLB (56%) and the deciduous THLB (8%).

Map 2 Timber Harvesting Land Base

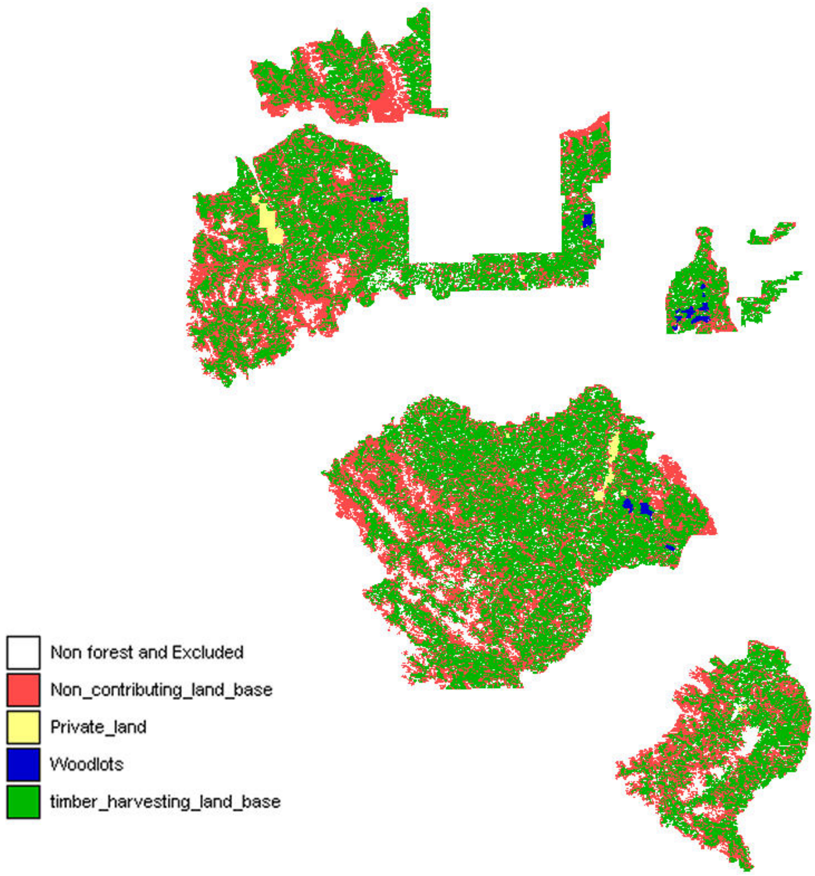
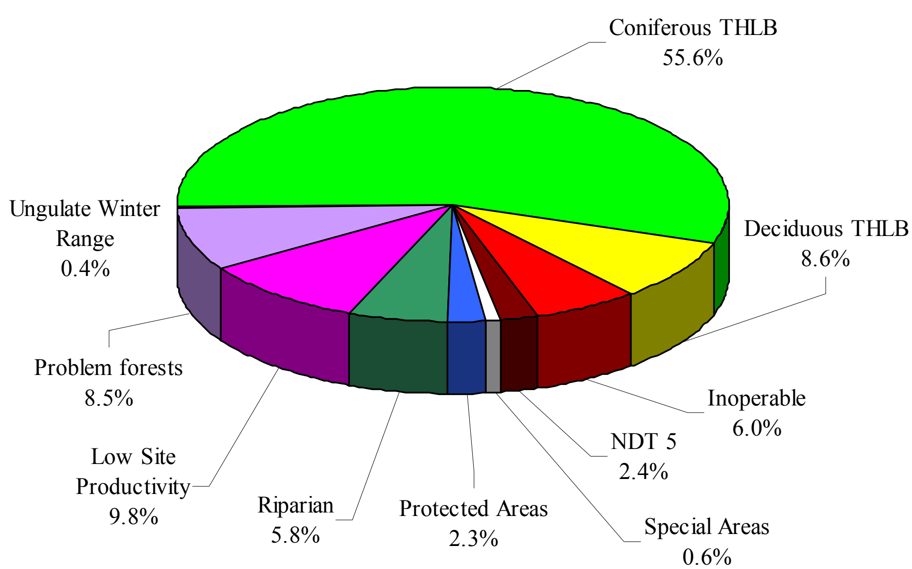


Figure 1 Distribution of the Productive Forest Area



Productive Forest Area = 566394 hectares

Table 2 Timber Harvesting Land Base Determination

Classification	Gross Area (ha)	Area (ha)	% Prod. Forest
MP 3 TFL Total Area (incl. Water)		643,511	
Changes to TFL Boundary			
Removed woodlots		794	
Removed "Rice Property" farm fields		1231	
Inclusion of the Stewart Block		1,753	
SFMP 4 TFL Total Area (incl. Water)		**643,239**	
Less: TFL Boundary sliver polygons		112	
Water	3,104	3,104	
Mine Site	2,236	2,236	
Existing Roads	5,567	3,830	
Non-Vegetated Land	971	949	
Vegetated Non-Treed (no disturbance history)	67,171	66,943	
Plus: Sukunka Falls Park	426	330	
Potentially Productive Area		**566,394**	**100.0%**
Less: Inoperable	34,038	34,038	6.0%
NDT 5	14,942	13,765	2.4%
Forested Islands	195	141	0.0%
Wildlife Habitat - Bull Trout	86	74	0.0%
Archaeological Sites	10	10	0.0%
Protected Areas (including parks)	14,853	12,849	2.3%
Recreation	1,270	418	0.1%
Buffers: Lakeshore reserves	28	25	0.0%
Stream/River riparian buffers	31,082	27,597	4.9%
Forested Wetlands	4,001	3,558	0.6%
Forested Wetland Buffers	1,882	1,760	0.3%
Low productivity sites	72,618	55,710	9.8%
Problem Forest types	62,497	48,077	8.5%
Sukunka Falls Park	426	286	0.1%
Visual preservation	723	167	0.0%
Dunlevy Ungulate Winter Range	4,480	1,983	0.4%
Rare Site Series	4,080	2,572	0.5%
Total Reductions to Productive Forest		203,029	35.8%
Net Land Base		**363,365**	**64.2%**
Split into: Coniferous THLB		314,829	86.6%
Deciduous THLB		48,536	13.4%

Commercial tree species within the TFL comprise white spruce, lodgepole pine, balsam fir, trembling aspen and cottonwood. A large proportion of these species existing in mixedwood stands comprising two or more different species. Species such as larch, white birch and black spruce also make up small amounts of problem forest types. These species may be harvested when existing within mixedwood stands, but will not be specifically targeted for harvest during the term of MP#4. Figure 2 shows the distribution of commercial species within the THLB. Map 3 shows the distribution of species across the productive forest land base. Apparent from both images is the predominance of white spruce and lodgepole pine. Deciduous species exist in the lower elevations along the eastern foothills and as trace amounts within leading-coniferous stands. In keeping with Canfor's operational objectives, deciduous stands within the ESSF have been excluded from the timber harvesting land base. Further, the deciduous volume within leading-coniferous stands (in the ESSF), have been removed from natural stand yield tables.

The current age class distribution of the forest inventory for the TFL is shown in Map 4 Current Age Class Distribution

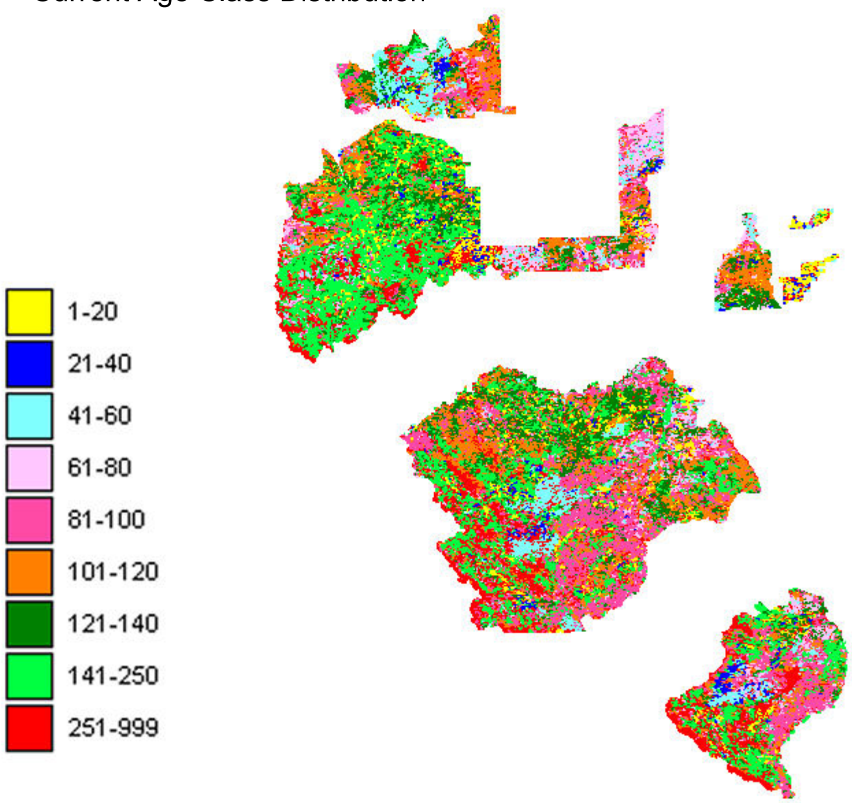


Figure 3 and Map 4. Approximately 65 percent of the conifer stands and 80 percent of the deciduous stands within the TFL's timber harvesting land base are presently above or very near the minimum harvest age and considered economically merchantable. The average age of stands within the TFL is 115 years. Forested areas excluded from harvesting have an age class distribution similar to that of the THLB.

Map 3 Species Distribution

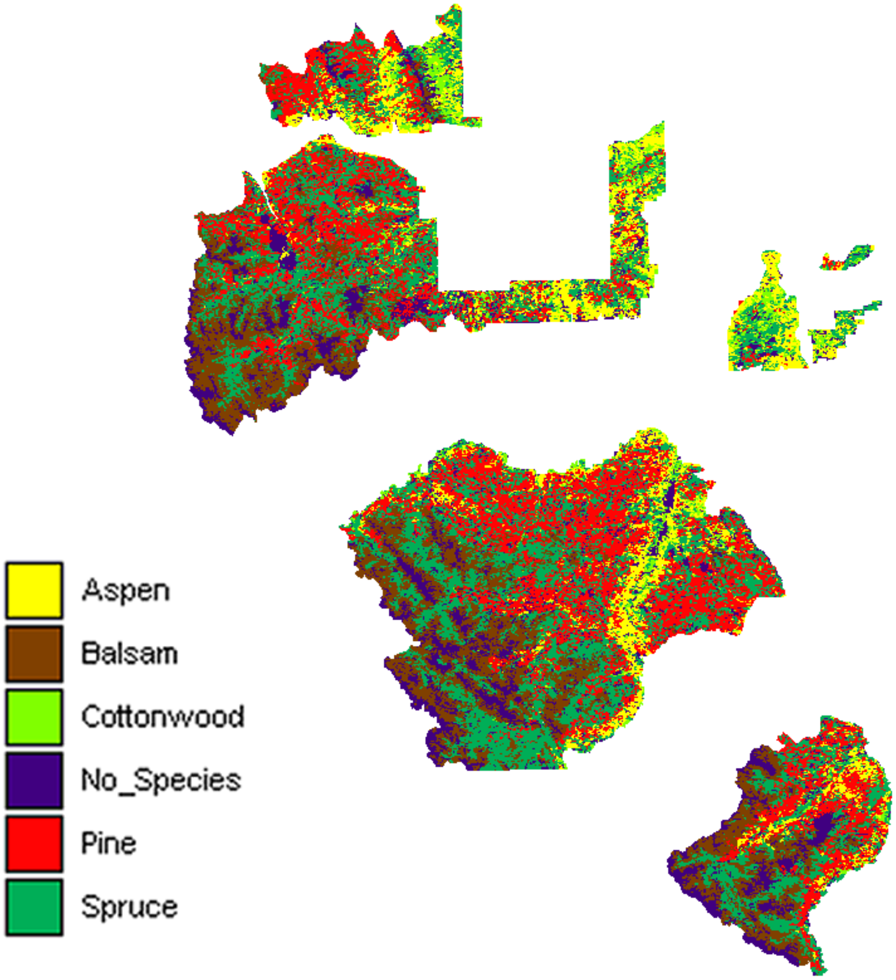
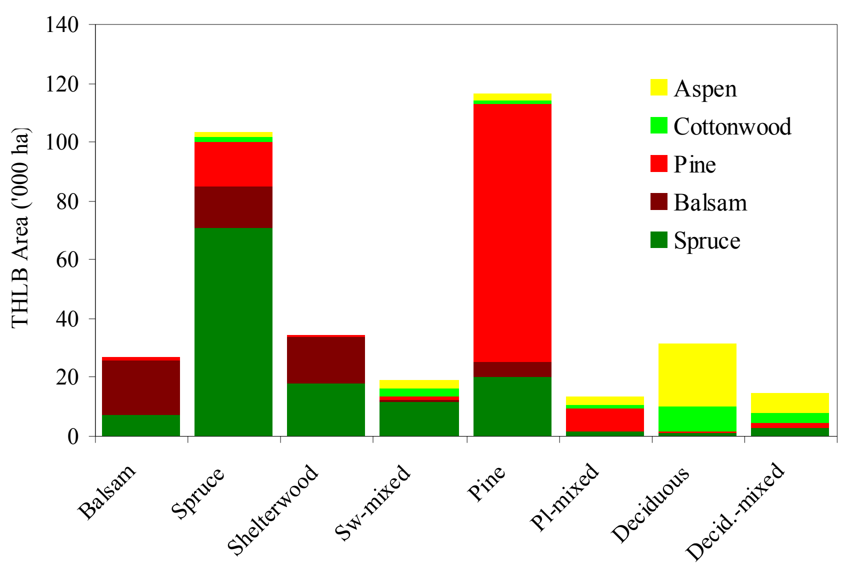


Figure 2 Species within Aggregated Timber Types



Map 4 Current Age Class Distribution

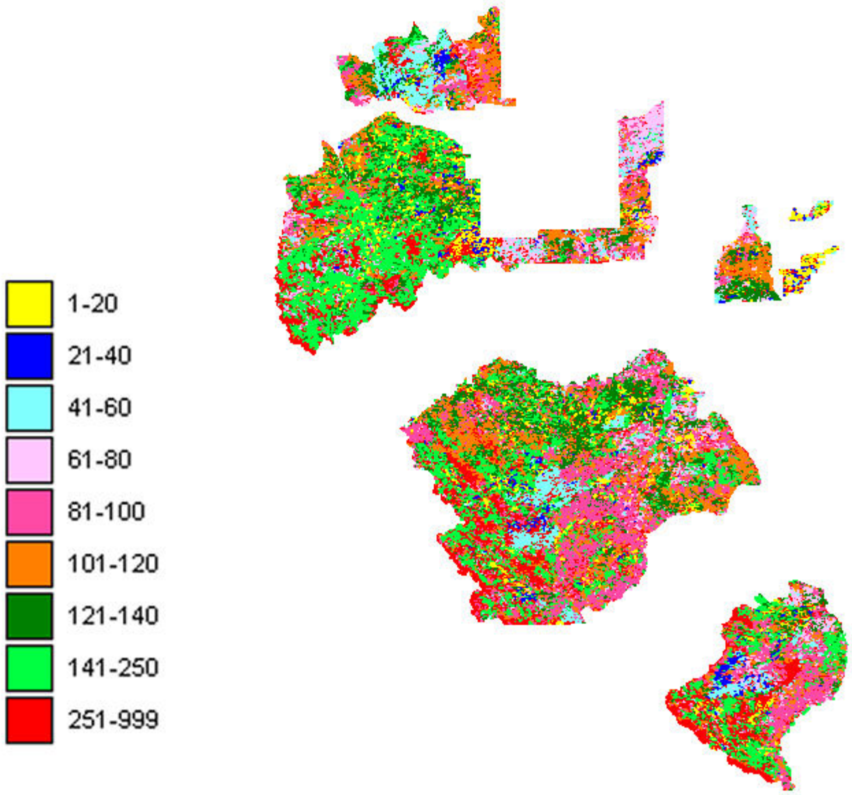
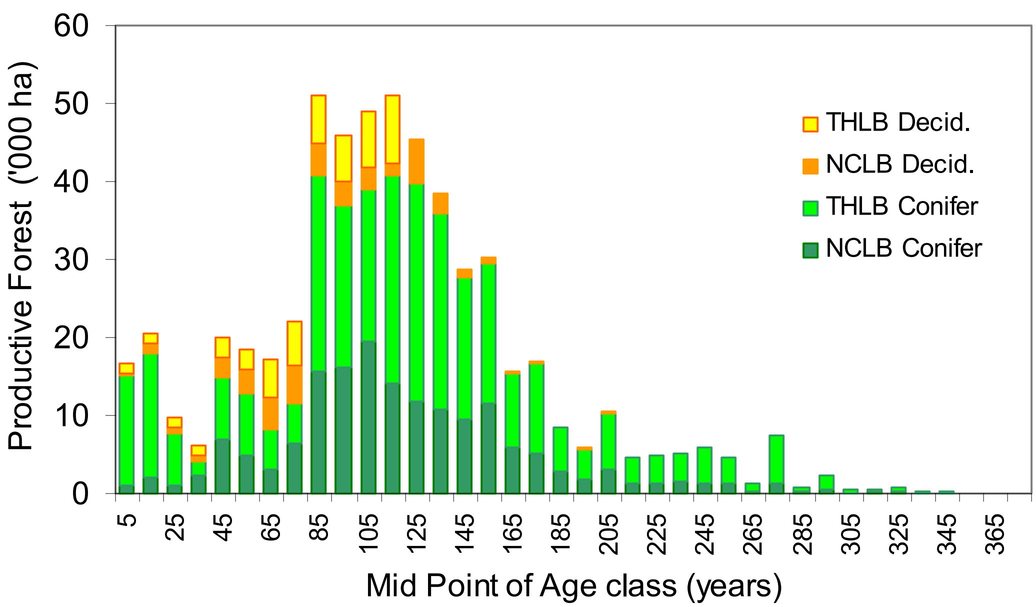


Figure 3 Current Age Distribution



4.2. Timber Growth and Yield

Timber growth and yield in this analysis refers to the change in existing stand volume over time, and the effect that current harvesting and silviculture management practices have on the future yield from managed stands and plantations.

Growth and yield tables for existing unmanaged stands within TFL 48 were calculated using the Ministry of Forests VDYP batch model. The merchantable forest inventory (or growing stock) for the TFL is simply the sum of the area of each forest stand, multiplied by the stand's estimated volume per hectare. The current analysis shows a significant increase in the merchantable growing stock for the TFL from that reported in MP#3 (i.e. from 55 to 81 million cubic metres). The increase is primarily attributable to the completion of Phase II sampling of stands across the TFL, and the corresponding statistical adjustments to the Vegetation Resource Inventory (VRI) completed by J.S Thrower and Associates in March 2005[1]. The adjustments showed:

- Mean annual increment (MAI) was found to be underestimated by 42 percent across the TFL.
- Site index was underestimated by 10 percent (average of 11.4 from Phase 1 sampling → 12.4 from Phase II sampling)
- Volume per hectare was underestimated by 34 percent.

The impact of these adjustments relative to the MP#3 analysis is a 15 percent gain in the size of the timber harvesting land base through inclusion of stands previously considered of marginal merchantability; and an overall 47 percent increase in the growing stock for the TFL, through an increase in estimated volumes and the increase in the THLB.

The growth and yield of existing and future managed stands is predicted using the MOF's Table Interpolation Prediction for Stand Yields (TIPSY) model. The conversion of area from natural unmanaged stands to managed plantations typically results in dramatically improved growth on the part of the managed plantation. This improvement occurs as a result of silviculture practices that include:

- Shorten regeneration delays,
- Site preparation,
- Planting a specified number of evenly spaced seedling that are 1 or 2 years of age,
- Monitoring plantation growth,
- Fill planting areas where seedling growth was unsuccessful,
- The performance of genetically improved stock,
- Control of competing species such as brush or grasses, and
- Thinning/spacing overstocked plantations.

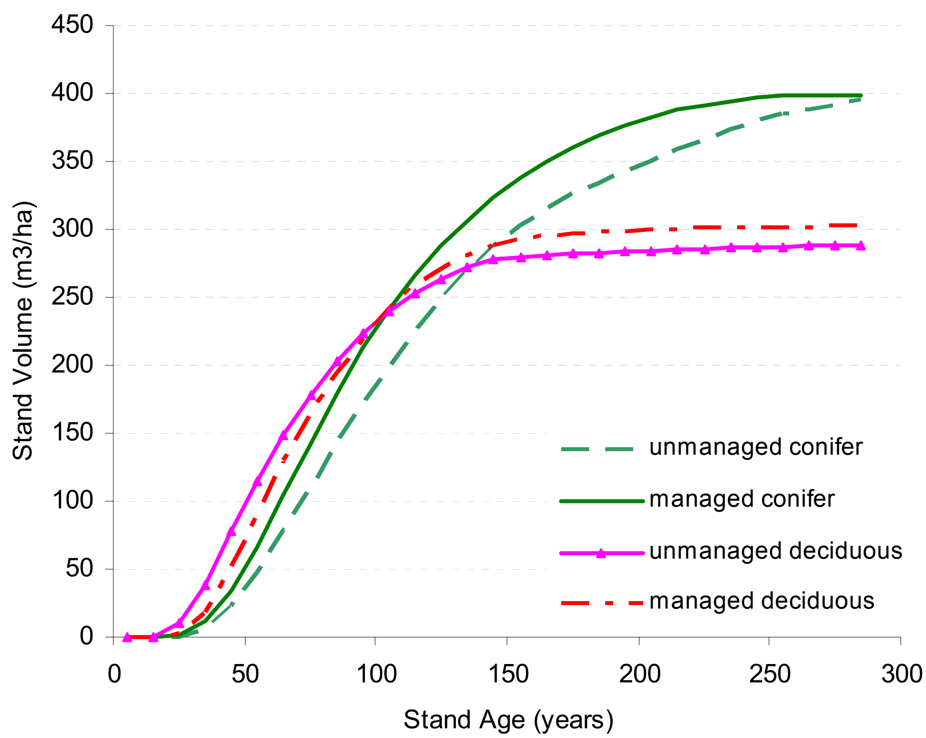
The combined impact from these activities is an increase in the volume expected from managed coniferous stands that is better than the volume achieved in unmanaged stands. Figure 4 shows the resultant area-weighted managed and unmanaged yield tables for coniferous and deciduous stands in TFL 48. The variance in deciduous yields is largely a result of weighing the unmanaged deciduous component with the smaller

[1] See Tree Farm Licence 48 Vegetation Resources Inventory Statistical Adjustment for Timber Supply Review , March 2005, J.S. Thrower and Associates Ltd., 31 pages

managed coniferous component in mixedwood stands. The short-term coniferous results however are significant. As a result of the conversion from unmanaged natural stands to managed plantations the economic rotation (culmination age) of the average stand is shortened by 20 years (e.g. from 135 to 115 for conifer stands) - though the average yield at culminations remains relatively the same. In the long term, there is very little change in the estimated yield results.

The differences in the coniferous results indicated in Figure 4 differ noticeably from the results shown on a similar graph produced for MP#3. The MP#3 graph indicated a much greater growth potential as a result of forest management. What has happened is that the Phase II sampling completed during the term of MP#3 has significantly increased the estimated volume of existing stands across the TFL. However, the corresponding site index has changed only slightly (i.e. 10%). The net result is that the gap between natural and managed stand coniferous volumes has closed significantly. Whether this is an accurate estimation of managed stand yields will be resolved in the future; though it is discussed further in Section 8.3 of this report, where we look at the impact of site index adjustments using the biogeoclimatic ecosystem classification of stands rather than age and height.

Figure 4 Differences between Natural and Managed Stand Growth



Within the existing THLB, stands may fall into one of several categories based upon their current management status. Figure 5 describes the stand attributes for the TFL in respect to historic management. Although harvesting operations have occurred within the TFL for over the past 30 years, very little area has remained in a denuded state. Not sufficiently restocked area (NSR) has declined to less than one percent of the THLB. Approximately 10 percent of the THLB is presently considered managed forest with respect to their future potential growth and yield. These are separated into pre- and post-1995 harvesting to distinguish between improved plantation management, with respect to planting densities and the availability of nursery grown seedlings. Immature natural stands exist primarily as a result of disturbances that occurred prior to 1990, such as fire, insects or other catastrophic events. These areas have been left to regenerate naturally and occur as stands with varying levels of stocking. Thrifty stands have been indicated to show the amount of area that will become merchantable over the next twenty years. At 14 percent of the TFL, a considerable portion of the THLB will soon become merchantable. Stands above the minimum harvest age comprise 51 percent of the THLB, 13 percent of which may be considered as having old growth characteristics. As we will see later in this report, the proportion of old growth within the TFL is expected to rise over time.

Map 5 Management History

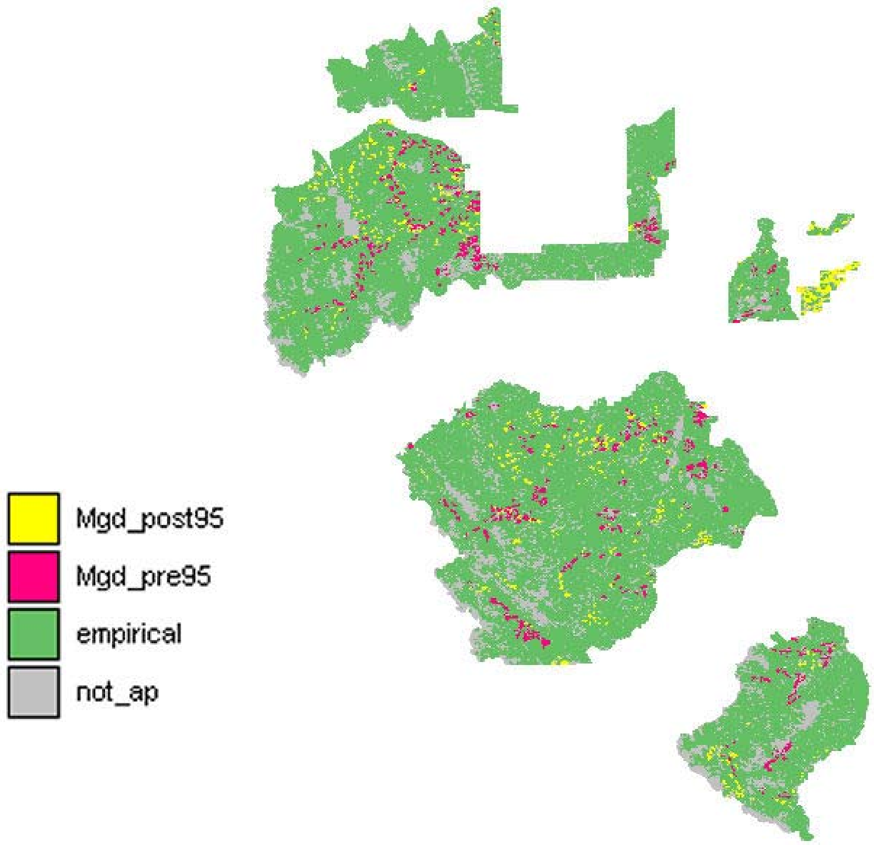
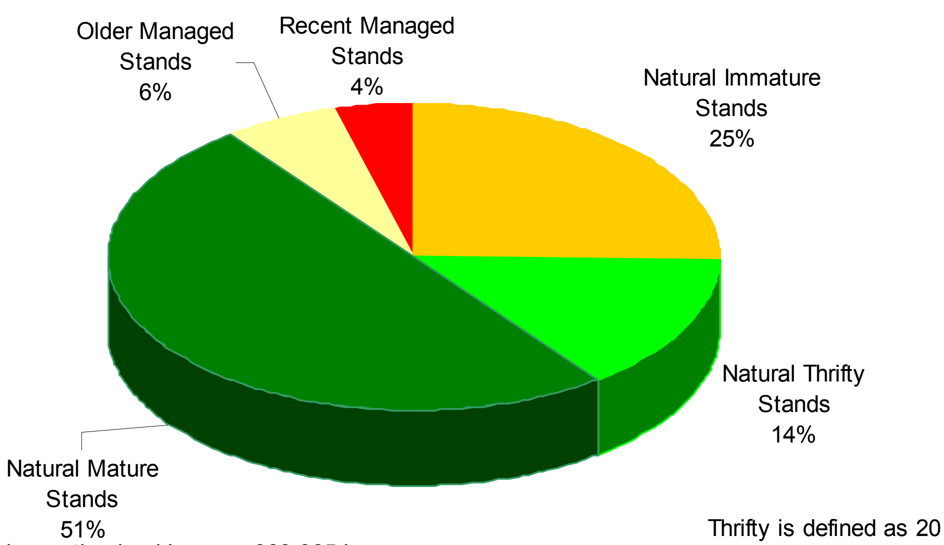


Figure 5 Management Classifications of the THLB



Timber harvesting land base = 363,365 ha

Thrifty is defined as 20 years less than mininum harvest age

4.3. Management Practices

This timber supply analysis utilized the Remsoft forest estate model "Spatial Woodstock" version 2006.1.1. The information used to model forest management practices within TFL 48 is detailed in Appendix I. The following are a few very general silviculture and harvesting practices that reflect current management on TFL 48 and were explicitly modeled in this timber supply analysis.

- Silviculture practices describe the post-harvesting activities utilized by Canfor to establish and maintain a free growing stand of merchantable tree species. The silviculture practices that best describe current performance include a 2-year regeneration delay, planting nursery-grown coniferous seedlings and establishing plantations with an average of 1,600 stems per hectare.

- The area contributing to the deciduous harvest has been expanded beyond the borders of the pulpwood agreement area, to be coincident with the entire TFL. Deciduous species are assumed to regenerate naturally and grow along the same yield curve predicted for unmanaged deciduous stands.

- Operating under the principle of "no net loss" in the proportion of deciduous and coniferous in the TFL, mixedwood stands were assumed to maintain their current proportion of deciduous and coniferous volume.

- Forest health and non-recoverable losses (NRL) describe the predicted average loss in volume in the TFL from fire, insects and disease. Although losses in recent years have dropped significantly, the occurrence of mountain pine beetles on the east side of the Rockies and a rapidly escalating sanitation program are cause for significant concern. The NRL's for the TFL remained unchanged from MP#2 and MP#3.

- Stand mortality was also modeled by apply a maximum lifespan to each forested stand in the TFL (i.e., conifer and deciduous). Stands achieving this maximum lifespan were assumed to die and regenerate naturally to themselves as immature stands.

- Utilization describes the minimum size of trees and logs that are removed from a stand during harvesting. Standard "close" utilization is currently described by harvesting to a 10 cm top and a 30 cm stump height. Pine and deciduous are harvested down to a minimum 12.5 cm diameter at breast height. Spruce and balsam are likewise harvested down to a minimum 17.5 cm diameter at breast height.

- Forest cover constraints and green-up heights are used to prevent harvesting from becoming overly concentrated in any one area. The TFL is managed such that no more than 33 percent of the area within the THLB is ever less than 3 metres in height.

- Visually sensitive areas are managed by limiting the visual evidence of harvesting to certain levels. Once again, forest cover constraints and extended green-up delays are used to restrict harvesting within these areas. In TFL 48 scenic areas have been identified specific to each landscape unit. Within each visually sensitive area, harvesting is restricted based upon the visual quality objective for the area. Green-up heights are increase to 5 or 6 metres depending on the visually quality objective and the average slope within the area. shows the location of existing visually sensitive areas (used in the Base Case) and recommended VQO areas (used for sensitivity analysis).

- Minimum harvest age refers to the minimum age at which a stand is eligible for harvesting. Culmination age[2] is the point at which stands are first considered eligible for harvesting. In this analysis culmination age is used as minimum age criteria for selecting eligible stands for harvest.

- Landscape level biodiversity is modeled in the timber supply analysis using the natural disturbance units provided to Canfor by the Prince George MOF Regional ecologist. Sensitivity analysis is also completed using the legislated "Old Growth Order". Biodiversity is applied to the timber supply model by defining the minimum amount of area that must be above a minimum old growth age for each NDU and each NDU and biogeoclimatic zone (BEC). Map 6 shows the distribution of natural disturbance units across the TFL. Map 8 shows the biogeoclimatic ecosystem classifications zones.

- Wildlife habitat is managed through the preservation of riparian reserves around streams, rivers, lakes and wetlands, by the maintenance of old growth stands, green-up delays on harvesting, and the maintenance of wildlife tree patches within cut blocks. Ungulate winter range habitat was addressed through the removal of potential harvestable area in the Dunlevy and through application of old 'thermal' constraints and early seral constraints in the Sukunka.

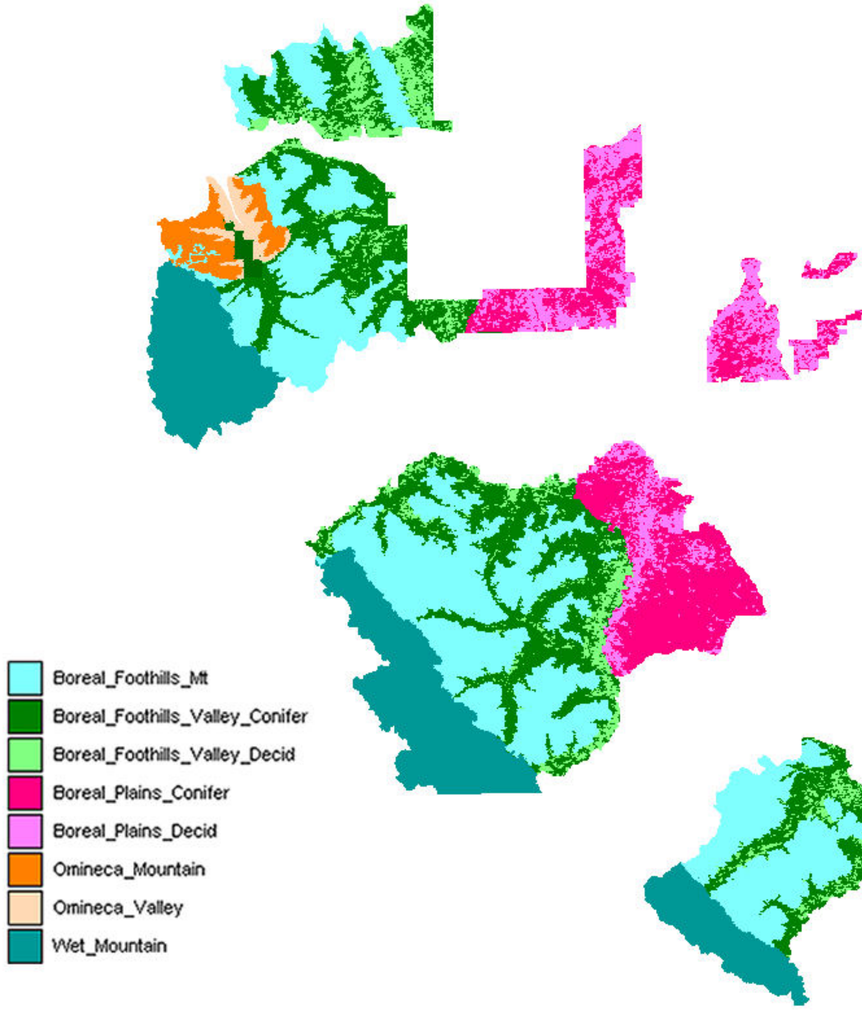
- Proposed protected areas that were identified in the Dawson Creek Land and Resource Management Plan have since been legislated into parks by the Provincial Government, with the exception of the Peace River / Boudreau Lake proposed protected area. All of these areas have been excluded from contributing to the THLB, including the proposed Peace River / Boudreau Lake area. The forested area within all of the parks within the TFL boundary contributes to achieving the biodiversity targets wherein they occur.

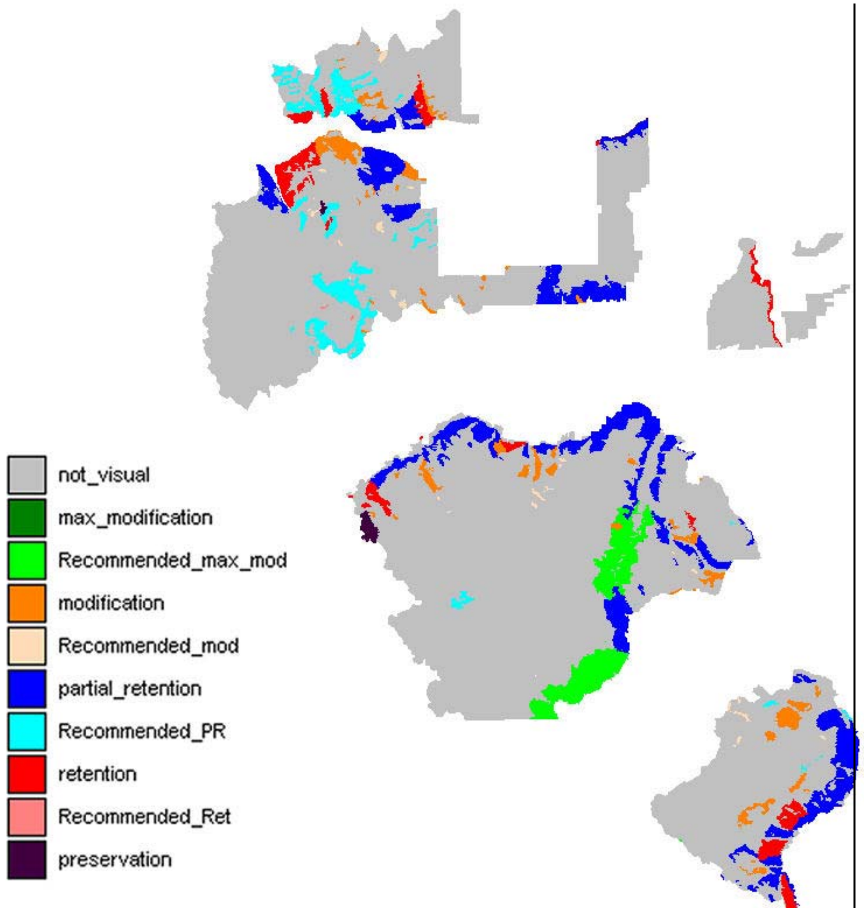
- Harvesting and access in the Dunlevy (north of the Peace arm of Williston Lake) is guided by the Dunlevy Creek Management Plan that received government endorsement in 2002. The timing and spatial quantity of area harvested each decade is modeled explicitly throughout this analysis. See Map 9 for the location of management zones within the Dunlevy.

- Watersheds were defined across much of the TFL during the term of MP#3. See Map 10. This analysis modeled the requirement that there is a limit to the maximum amount of area that could be less than a 3 metre greenup.

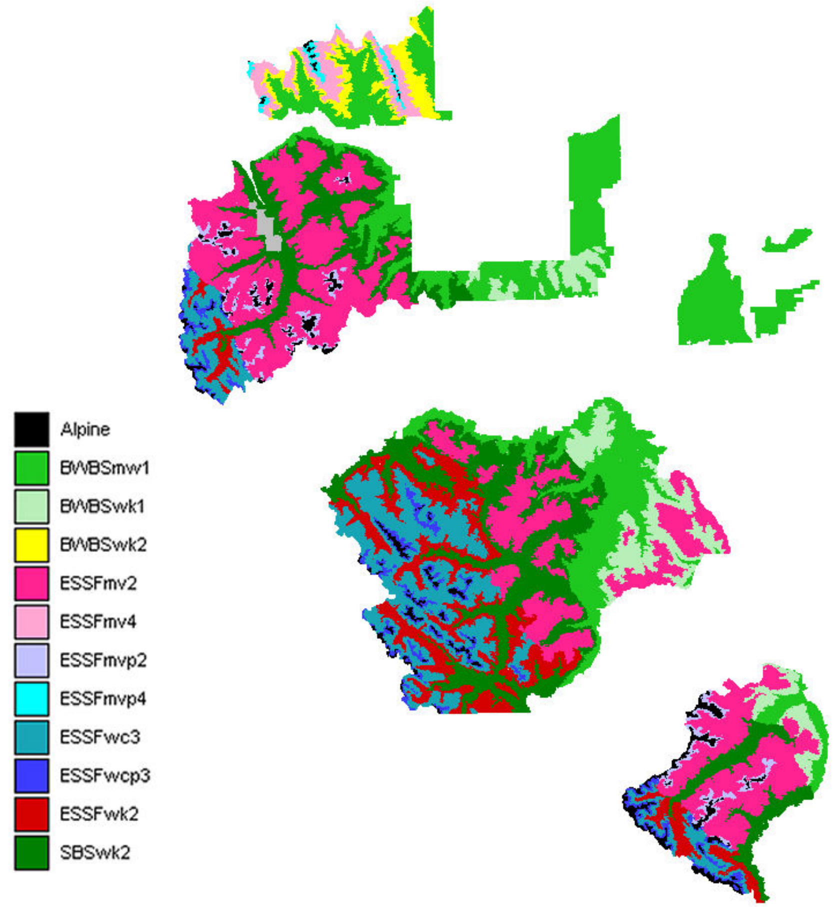
[2] Culmination age is the age at which a stand of timber achieves its highest mean annual increment (MAI) and is the optimal biological rotation age to maximize volume production from a growing site.

Map 6 Natural Disturbance Units

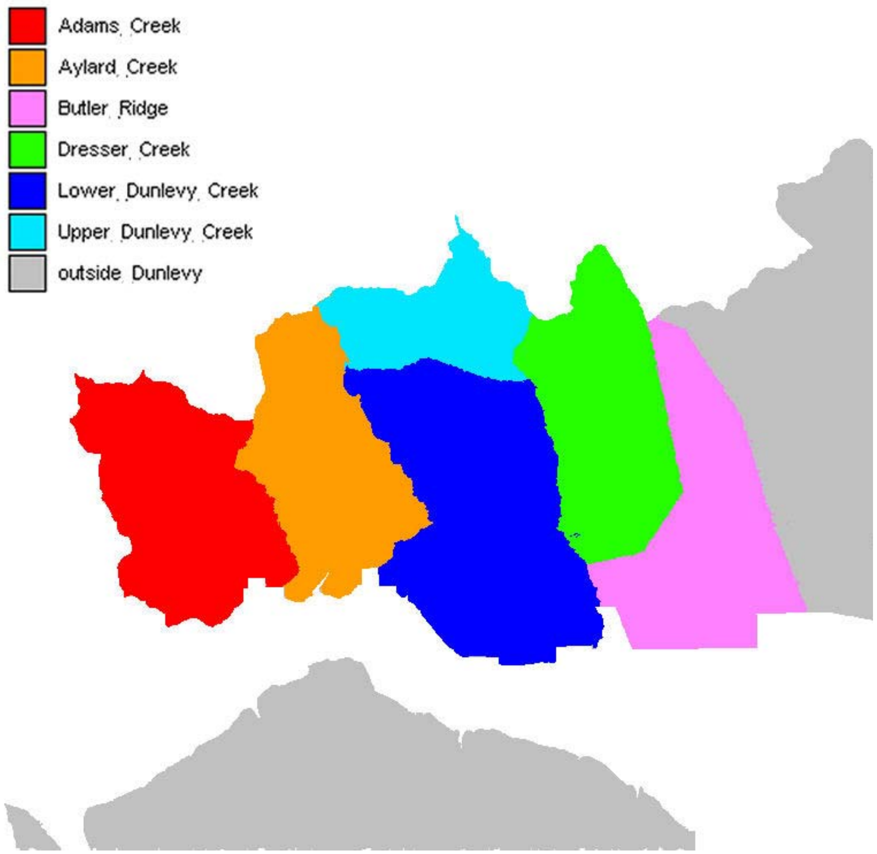




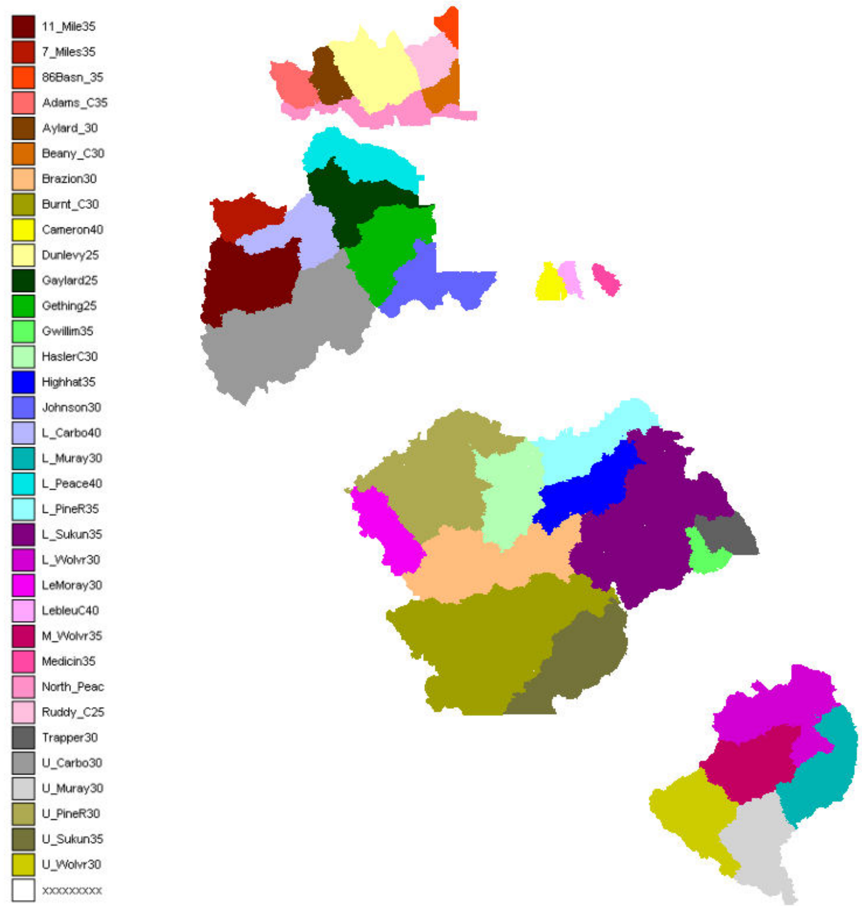
Map 7 Visually Sensitive Areas



Map 8 Biogeoclimatic Zones



Map 9 Dunlevy Management Zones



Map 10 Watersheds

4.4. Timber Supply Analysis Methods

The purpose of this analysis is to examine the short and long-term timber harvesting opportunities within TFL 48, in light of current, potential and forecasted management practices. To guide this process several steps were taken sequentially:

1. Digital forest inventory files and management zone coverages' are "loaded" into an ARC INFO® geographic information system (GIS) and are used as the base information to describe the current state of the gross forested land base.
2. An information package is then compiled that describes the "net down process", whereby the THLB is identified from within the forested land base. Basically, each forested stand must meet a certain set of predefined conditions for the stand to be eligible as a candidate for the THLB. As was revealed in Figure 1, these stands can be excluded from harvesting consideration for a wide number of reasons.
3. Each stand within the timber harvesting land base and the non contributing land base is then described in terms of its current age, volume, species, and location with respect to other resource values or management considerations.
4. Future age and volume is then predicted for each stand using unmanaged and managed stand growth and yield tables. These tables and the areas within each stand are aggregated into analysis units, to simplify the inputs into the forest estate model. Analysis units are aggregations of stands having the same general variables describing tree species, land productivity, disturbance history and current stand age.
5. Management assumptions are then defined by quantifying the rules and practices that determine the eligibility of a stand for harvesting at any given time during the planning horizon. Management assumptions can vary from the application of minimum harvest ages, to harvest priorities, to green-up and seral requirements within a target area.
6. Information regarding land based inventory, stand growth and yield, and management assumptions are then applied to a forest estate model. This model attempts to capture the essence of a real system by isolating and retaining the important elements of the system, and disregarding the rest. A conceptual model of a forest encompasses:

    - A method of describing the forest (a classification scheme),
    - A range of silviculture activities and natural events, along with a specification of how affected areas develop following these activities and events,
    - A means of measuring the impact of interventions and natural events (forest conditions, benefits and outputs),
    - A method of accounting for the passage of time

7. In this analysis the Remsoft® modelling system is used as the analysis tool. The Remsoft system combines the forest model 'Woodstock' (in linear (goal) programming mode). Remsoft's cut-block builder and harvest scheduler 'Stanley®' is also used to conduct sensitivity analysis around the validity of aspatial results. The Woodstock model is used to determine a Base Case harvest flow. Sensitivity analysis is then carried out on many modelling parameters to evaluate both the relative importance of various modelling

assumptions to the base case harvest flow, and to measure the impact of alternative management decisions.

8. Sensitivity analysis was completed to address the uncertainty surrounding a growing mountain pine beetle problem. A beetle epidemic and control model was used to calculate the non-recoverable losses that may occur over the next decade. The model was run annually using various levels of infestation and control responses. The results from this model with respect to non-recoverable pine losses were applied to the Remosft model to determine the possible mid-term harvest level resulting from various degrees of pine mortality.

This type of analysis is similar to those completed by the BC Ministry of Forest's Analysis Branch in all of the Timber Supply Areas (TSA) of the Province. The MOF's goal in each TSA is to determine the timber supply implications of one particular timber-harvesting regime. Typically, this is the regime that best describes current operational practices, which may be carried out by a number of different forest license holders and British Columbia Timber Sales. This analysis differs from that goal by using the timber supply analysis process to assess several different timber harvesting regimes. Like the MOF, a Base Case regime is analyzed which describes current operational practice. In addition, other regimes are assessed which Canfor may then wish to pursue during the term of the next Management Plan. Such regimes might include the impact of management alternatives on an escalating mountain pine beetle epidemic; or reverting back to the Old-Growth Order for biodiversity management. This assessment of alternative regimes allows the TFL holder to quantify the harvest forecast implications of various management practices, as justification for <u>changing</u> current management practices.

5. Analysis Results

The results for the timber supply analysis for TFL 48 ,that have been completed in support of Sustainable Forest Management Plan # 4, have been divided into three sections.

Section five deals at length with the Base Case harvest forecast. As the scenario that best describes current forestry practices, this scenario also describes the sustainable harvest level if the status quo is maintained and if the information used accurately represents the current and future state of the forest.

Section six provides sensitivity analysis on the Base Case and analyzes the effect that changes in management assumptions will have on the harvest forecast. Changes in modelling assumptions are imposed to quantify the effect that these changes have relative to the Base Case harvest.

Section seven provides additional analysis that Canfor has initiated to determine the quantitative information required to assess alternative operational practices. This section provided quantitative information on the impact of a possible mountain pine beetle epidemic.

All of the scenarios described in this report used the same basic criteria in identifying the harvest forecast. These criteria are:

- All of the harvests shown in this report were calculated using a 250-year (25 decade) time line,

- The goal of each scenario was to maximize the harvest level, subject to the goals relating to:

    - Early seral objectives,
    - Old growth objectives,
    - The maintenance of a long-term stable THLB growing stock, and
    - Harvest flow objectives for coniferous and deciduous leading stands that varied between non-declining, even flow, accelerated, or a predetermined sequential step-down.

- All scenarios reported have had the non-recoverable losses removed from the harvest flow results. Non-recoverable losses were assumed to be 49,700m^3/year for coniferous-leading stands, and 6400m^3/year for deciduous-leading stands. Losses of only 5000m^3/year were applied to conifer-leading stands in the first decade in the mountain pine beetle epidemic scenarios.

- Sensitivity scenarios may have one of three effects on the Base Case harvest flow: 1) the scenario may be more constraining and result in a reduction in the harvest flow; 2) the scenario may be less constraining and have a positive impact on the sustainable harvest level; 3) they have no effect at all.

6. Base Case Harvest Forecast

Table 3 and Figure 6 describe the Base Case harvest forecast for TFL 48. The current allowable harvest level for TFL 48 is 580,000 cubic metres per year. This can be increased immediately to 737,000m^3/yr. Net of NRLs, this harvest level could be apportioned 642,800m^3/yr to coniferous-leading stands and 94,200m^3/yr to deciduous-leading stands. This non-declining harvest level is a substantial increase over the harvest level identified in the analysis completed for Management Plan #3. The principle reason for this increase is a result of the Phase II vegetation resource inventory sampling that was completed for TFL48. The Phase II sampling revealed that, for the most part, stand yields within the TFL had been significantly underestimated. Revisions to the inventory increased the estimated average volume per hectare and the estimated site productivity of stands. As a result of these two adjustments, the timber harvesting land base increased substantially. An increase in the coniferous and deciduous harvest levels were therefore an anticipated consequence of the efforts and improvements in resource information that Canfor had acquired during the term of Management Plan #3.

Also shown in Figure 6 is the level of stand mortality that has occurred during the term of the simulation. This mortality is the sum of volume-based NRLs and the application of a ceiling on the maximum age that a stand can attain to before mortality is assumed to occur. Mortality increases as the non-contributing land base ages over time and stand level mortality is assumed to occur. The results shown in Figure 6 and Table 3 are net of this mortality.

Figure 7 shows the change in the growing stock within the TFL over time. Growing stock is a measure of the total volume existing within an area at any given time. The total growing stock includes volume from young plantations, mature stands and old growth stands that exists within the THLB and the NCLB. As we see in Figure 7, harvesting operations that are occurring and forecasted to continue to occur within TFL 48 do not have a negative impact on the total growing stock within the TFL. The total growing stock is forecast to increase from 120 million cubic metres to an average of 131 million cubic metres over the next 100 years.

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Table 3 Base Case Harvest Flow

Scenario	Land Base	Net Short Term Yield (m^3/yr)
Base Case	Conifer	642,800
	Deciduous	94,200
	Total	737,000

Figure 6 Base Case Harvest Forecast

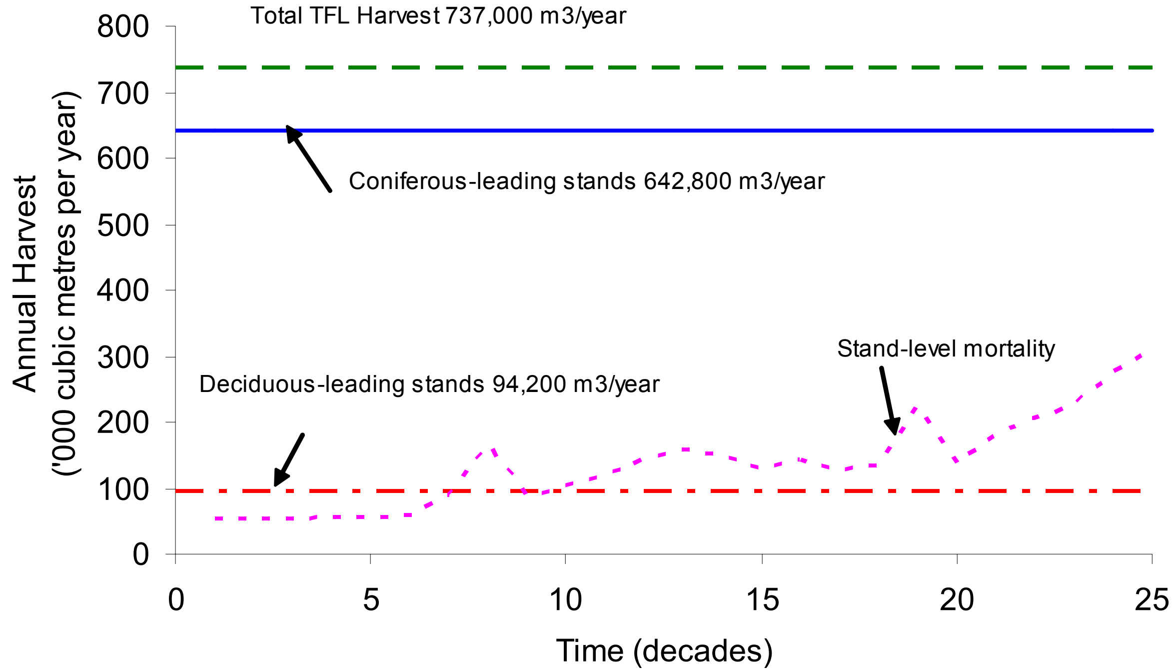
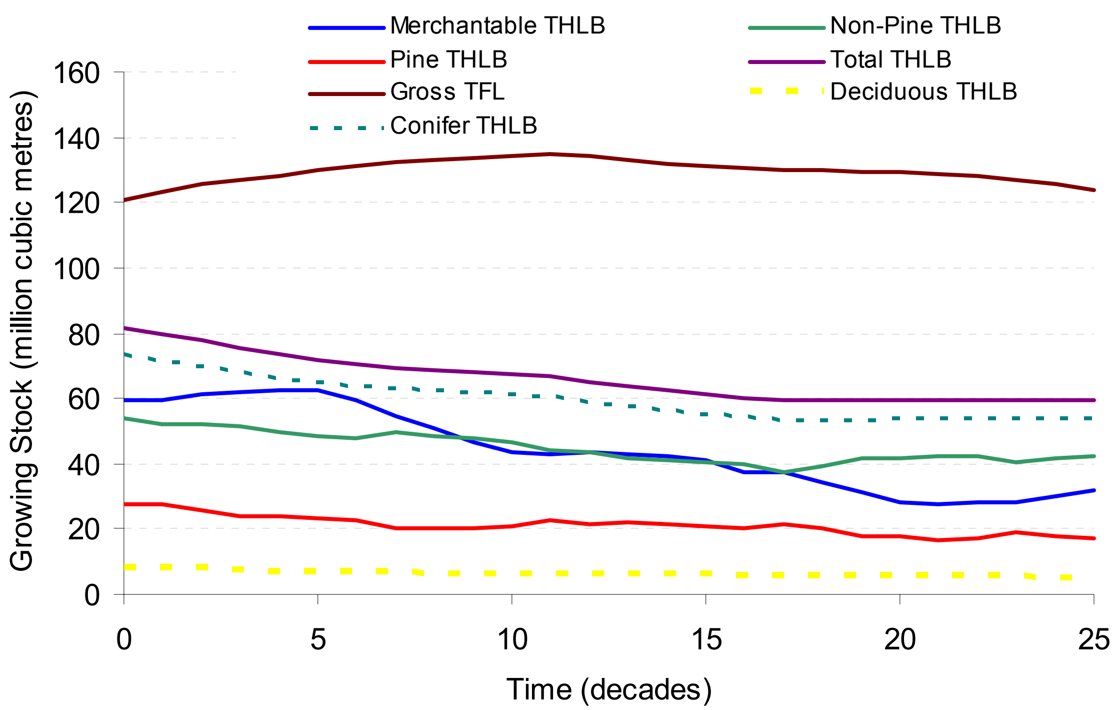


Figure 7 Changes in Growing Stock – Base Case



The growing stock representing TFL's timber harvesting land base is forecast to decline slowly from 81 million cubic metres to a steady long-term level of about 60 million cubic metres by period 17. This occurs for several reasons. One of the constraints applied to the linear programming solution to determining a sustainable harvest level is that the THLB growing stock beyond period 17 be non-declining. As we see, this constraint has been met. Period 17 was selected as the target point because the analysis completed for MP#3 identified period 18 as the point in the planning horizon when the harvest flow was most constrained[1]. By reducing the constraint one period, we account for the five-year interval since the completion of the last analysis, and ensure that the timber supply is sustainable beyond the 25-decade planning horizon. We see from the application of this constraint it has repercussions on the level of stand mortality witnessed in Figure 6, whereby the amount of volume lost due to old stands dying increases significantly after period 17.

The area between the total growing stock and the THLB growing stock is the volume existing in coniferous and deciduous forests that do not contribute to the THLB. This volume increases over the next 100 years and then remains fairly constant. This is primarily a result of stands within the NCLB aging and becoming old growth. As the old growth hits a maximum age, they are assumed to die and regenerated back to unmanaged stands.

The difference in area between the merchantable THLB growing stock and the total THLB growing stock in Figure 7 is the amount of volume in stands that are under the current minimum harvest age (i.e., immature stands). Since the majority of the TFL is presently above the minimum cutting age, the majority of the TFL might be considered to be mature or old growth forest. The harvesting activities that would result from the Base Case harvest flow will shift the distribution of area and volume into younger age classes.

There are approximately 8 million cubic metres of volume in deciduous-leading stands. Apparent from the size of the deciduous THLB and the volume of wood that deciduous stands contain, this is a relatively minor component of the tree farm.

Figure 8 shows the average volume harvested over time. The graph shows that over the next 100 years, the average volume removed from mature coniferous stands should equate to 335 cubic metres per hectare. Likewise, the deciduous land base is forecast to provide approximately 250 m^3 per hectare over the next 100 years.

[1] See Section 6.0 Page 20 TFL48 Analysis in support of MP#3

Figure 8 Average Stand Volume harvested

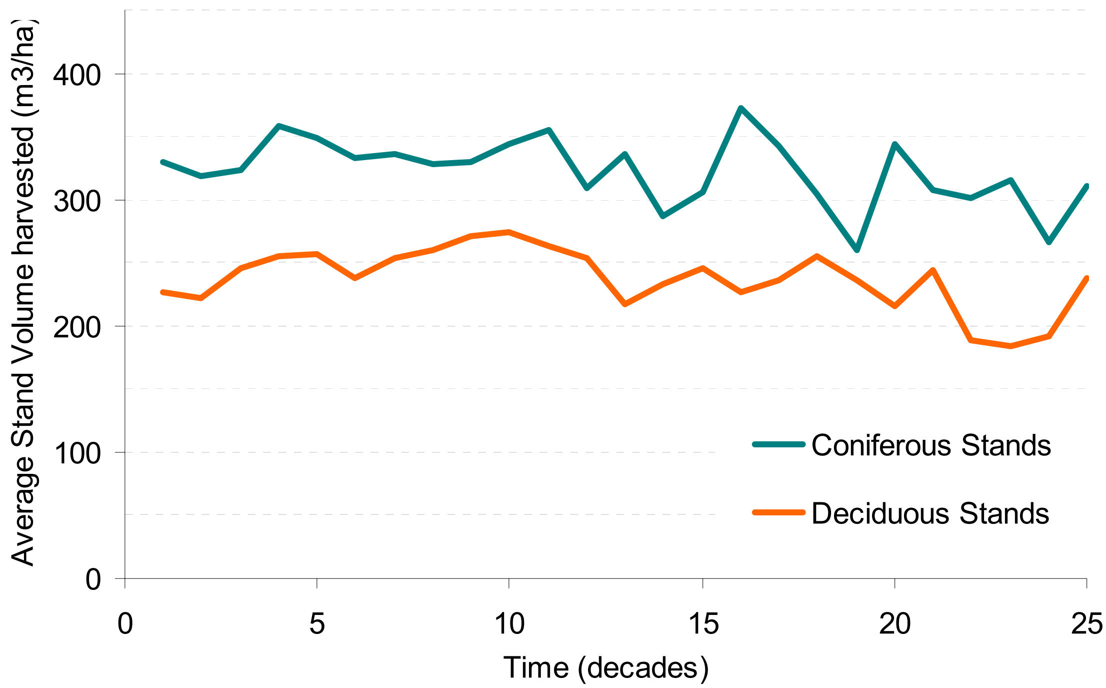
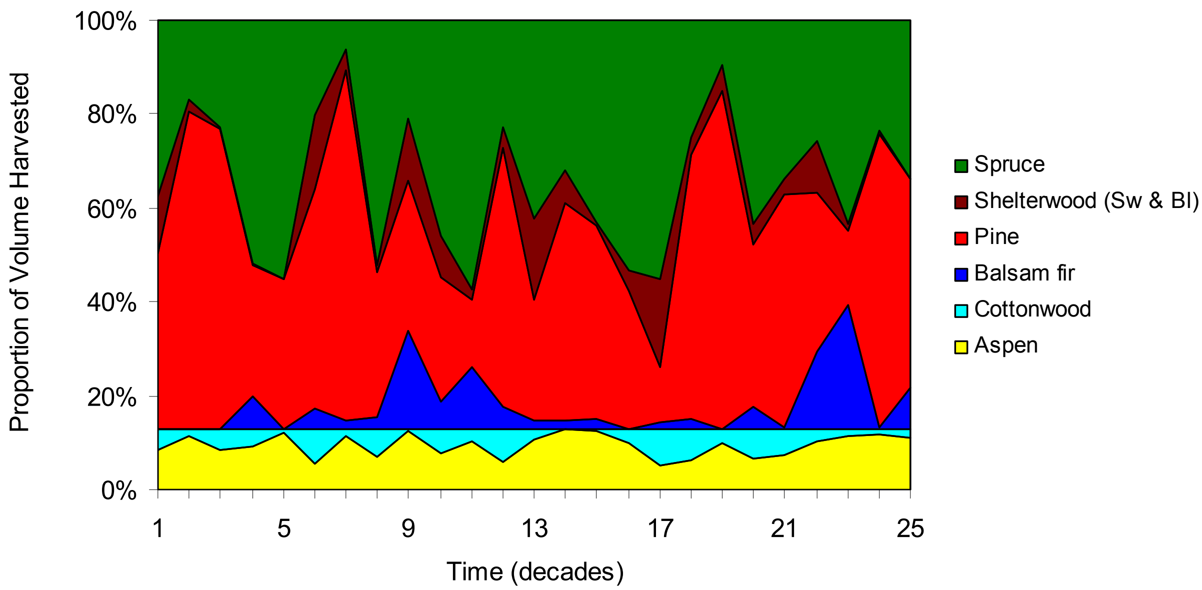


Figure 9 Leading Species Harvested over time



Over the term of the planning horizon, the volume per hectare from harvested coniferous stands remains relatively constant. Although a shift will occur from harvesting old growth conifer stands to younger plantations, the change in volume/hectare is not substantial. This is supported by the information provided in Figure 4, where we saw that the difference between unmanaged stand growth and managed stand yields are relatively small. It is important to note that although the Phase II sampling had an impact on improving the yield estimates for unmanaged stands, the site productivity (Site index) for most of these stands was still based upon VDYP estimates using stand age and height. A system that determined site productivity based upon biogeoclimatic information and site series will result in a different answer.

Figure 9 shows the change in the proportion of leading species harvested over the planning horizon. Using a linear programming optimization model, the goal is to select stands for harvesting in a manner that maximizes the harvest level, subject to many early and late seral constraints. Throughout the planning period, the proportion of harvest from leading deciduous stands remains constant at about 13 percent. The proportion of harvest from balsam-leading stands is relatively low in the initial periods of the simulation. Largely because forest cover constraints are considerably higher in mountainous areas where balsam stands predominate. In the first decade, the quantity of harvest from pine and spruce-leading stands are about equal at 37 percent each. Shelterwood stands, (e.g. balsam-fir and spruce) fill the remainder at 12 percent. In the next two decades we see a large shift in the pine harvest (i.e. to about 65%). The shift occurs for two reasons: the model recognizes that areas having a predominance of pine volume also have less stringent old-forest constraints - as a result of shorter fire-return intervals; second, the rotation age of pine stands is substantially shorter then spruce or balsam, therefore by targeting older pine stands the model is able to establish these areas on comparatively faster growing plantations.

Figure 10 shows the change in area harvested over time. Over the next 30 years, approximately 2,150 hectares of leading-coniferous stands and 440 hectares of leading-deciduous stands are required to support the Base Case harvest level on an annual basis. The amount of area harvested is relatively constraint for the first 100 years as the majority of the harvest comes from older unmanaged stands with a relatively constant average volume per hectare. After 100 years, increasing amounts of the harvest comes from managed stands of varying ages, resulting in wider fluctuations in the annual amount of area harvested. The product of the area harvested in Figure 10 and the average volume harvested in Figure 8, is the non-declining base case harvest level.

Figure 10 Area Harvested per year

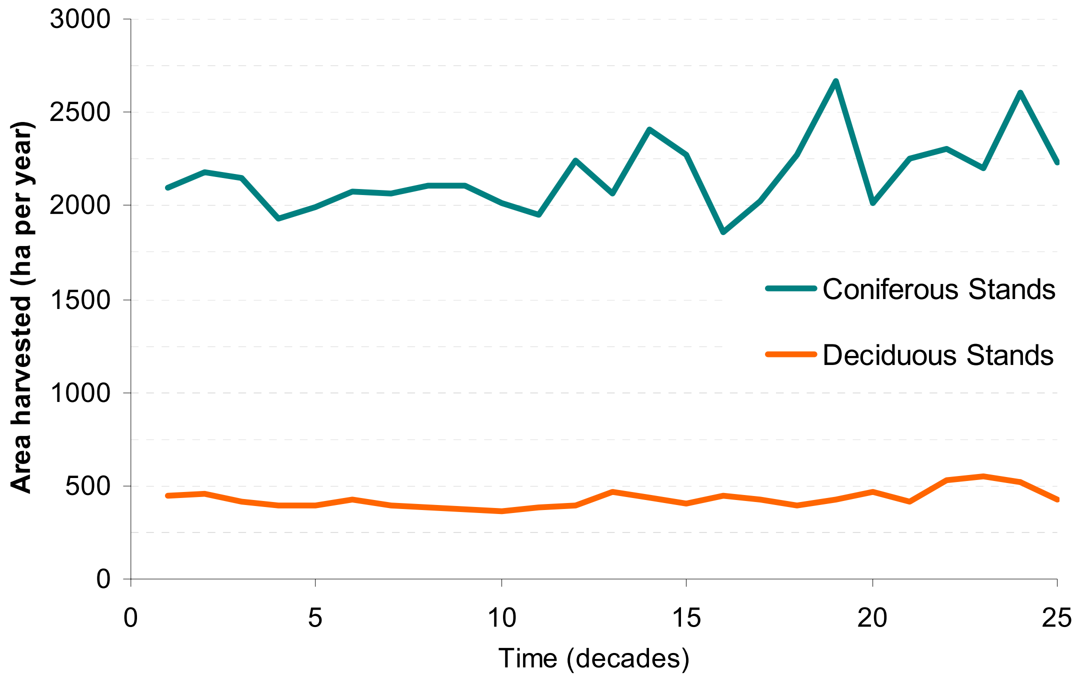


Figure 11 Shifts from Unmanaged to Managed Stand Harvesting

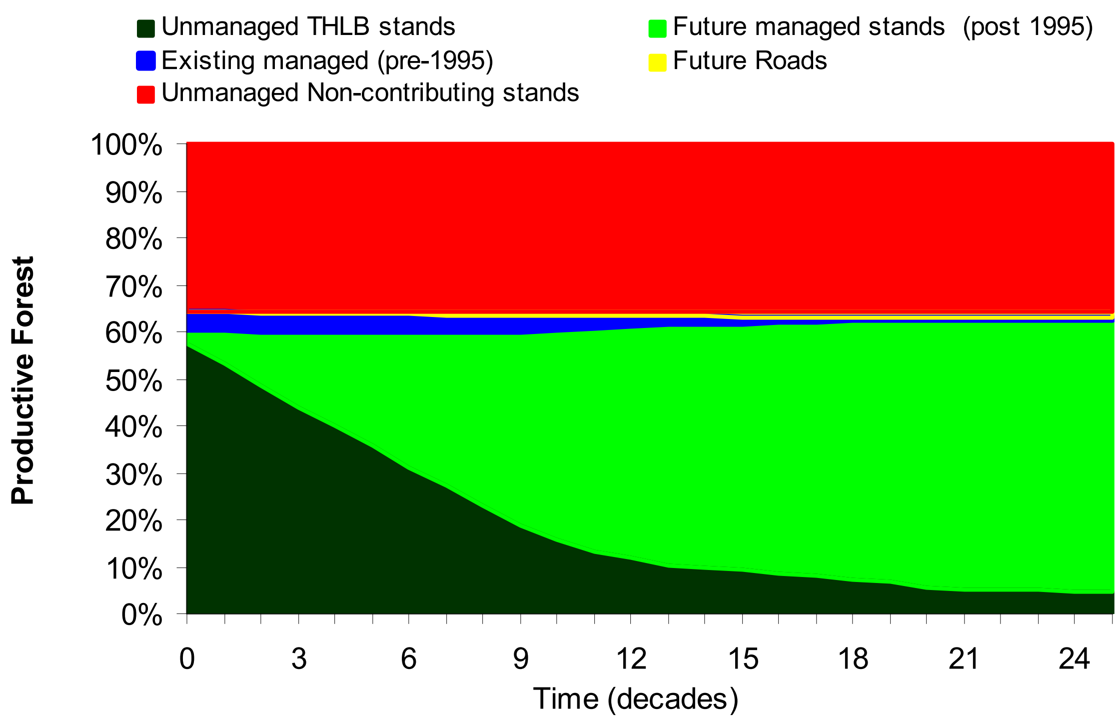


Figure 11 shows the gradual change over time in the management classification of the TFL. Throughout the planning horizon, the amount of area in the non-contributing land base (NCLB) is assumed to remain static at about 36 percent. Existing roads have been excluded from the productive forest area; however the construction of future roads will result in the gradual loss of an additional 5000 hectares over the next 100 years.

Currently, approximately 93 percent of the productive forest area is considered unmanaged, four percent of the area exists in older managed stands (i.e. having pre-1995 logging history) and slightly less than four percent in post 1995 "future" managed stands where silviculture activities have been increasingly more intensive after harvesting. Harvesting will continue to occur within the TFL. As a result the amount of managed forest area will increase. However, in 80 years, 59 percent of the productive forest land base will still remain unmanaged. In 200 years, there will still be a small portion of the TFL in unmanaged THLB stands. These are the visually sensitive areas (having retention and partial retention VQOs) that, due to forest cover constraints, are managed on a very long rotation.

Figure 12 shows the change in the average age of stands that are either harvested, or die, during next 25 decades. The average age of conifer-leading and deciduous-leading stands harvested throughout the simulation period remains relatively constant. For conifer-leading stands the ages harvested range from 80 years to 460 years, though they average throughout the simulation period between 150 and 200 years old stands. Deciduous leading stands experience a similar harvest age pattern, wherein the average age is between 100 and 150 years.

Figure 12 also shows the average age of stand mortality within the TFL. Mortality is addressed in the forest estate model in three ways. (1) Within all forest stands, mortality occurs as certain trees out-compete others, resulting in a decline in the total stems per hectare. This is offset by a rapid increase and then gradual decrease in the volume per hectare of a stand. The yield tables used in the forest estate model implicitly account for this individual tree-level mortality. (2) Stand level mortality was address through the application of a ceiling on the maximum age that a stand can achieve and still remain merchantable, or in the case of the non-contributing land base, continue to support forest cover constraints. (3) The final adjustment for stand mortality is through a volume reduction applied to the total harvest level. All of the harvest flows indicated in this report are net of this volume. A non recoverable loss of 49,700 cubic metres per year was applied to conifer-leading stands, and 6,400 cubic metres annually to deciduous leading stands. The level of mortality identified in Figure 12 is a function of the second method of mortality accounting identified above. Initially most of the mortality occurs in deciduous-leading stands, the majority of which are over-mature. Later, increasing amounts of mortality occur in coniferous stands in both the THLB and the NCLB.

Figure 12 Average Age of the Stand Harvested

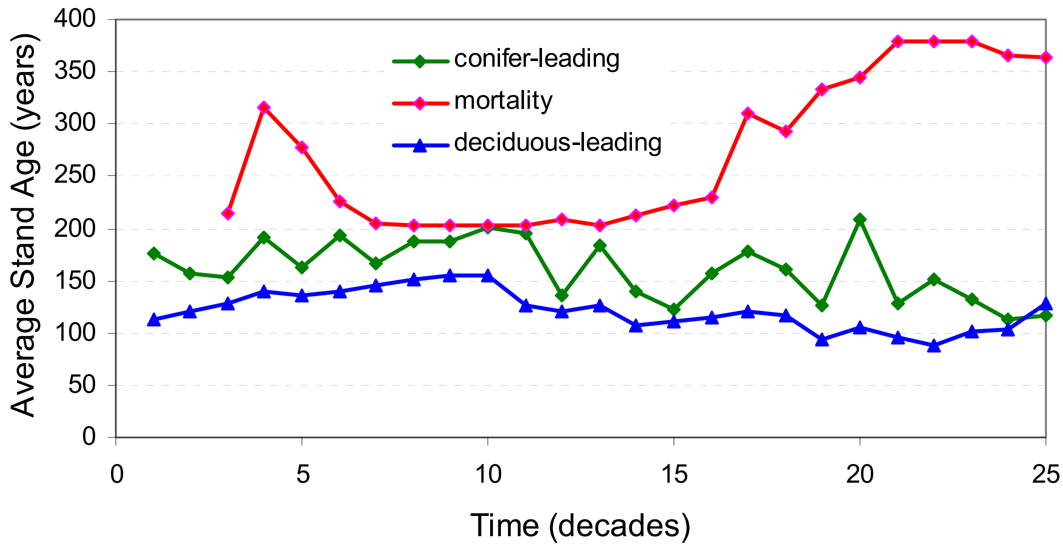


Figure 13 through to Figure 18 show the present and projected change in the age class structure of the coniferous and deciduous forest land bases, at select point in time. If 100 years is a reasonable measure of stand maturity, then 63 percent of the current productive forest land base is mature or over-mature. In 50 years, this will increase to 66%, before declining slowly over the next 200 years to about 50 percent of the productive land base.

The change in the coniferous age class distribution is typical of the shift from a largely uneven age class distribution of stands less then the minimum cutting age, to a somewhat normal distribution. This distribution however does not hold true for all stands within the timber harvesting land base. Stands that are constrained in visually sensitive areas (i.e., preservation, retention and partial retention) get progressively older, resulting in a distribution of old stands with ages well beyond 200 years.

The deciduous land base has a similar age class distribution though existing within a smaller life span. We witness deciduous stands within the THLB aging and being harvested (by the model) when they are well beyond 100 years of age. The minimum cutting age for deciduous stands was based upon their economic culmination age. However, deciduous stands (aspen in particular) that age well beyond 100 years are often of questionable economic value. Perhaps a merchantability cap of 100-120 years would have been appropriate, however, the lack of demand for deciduous stems within the TFL over the past 10 years make this a speculative assumption. Currently about 66 percent of the deciduous-leading stands within the TFL are older than 60 years.

Figure 13 Current Age Class Distribution

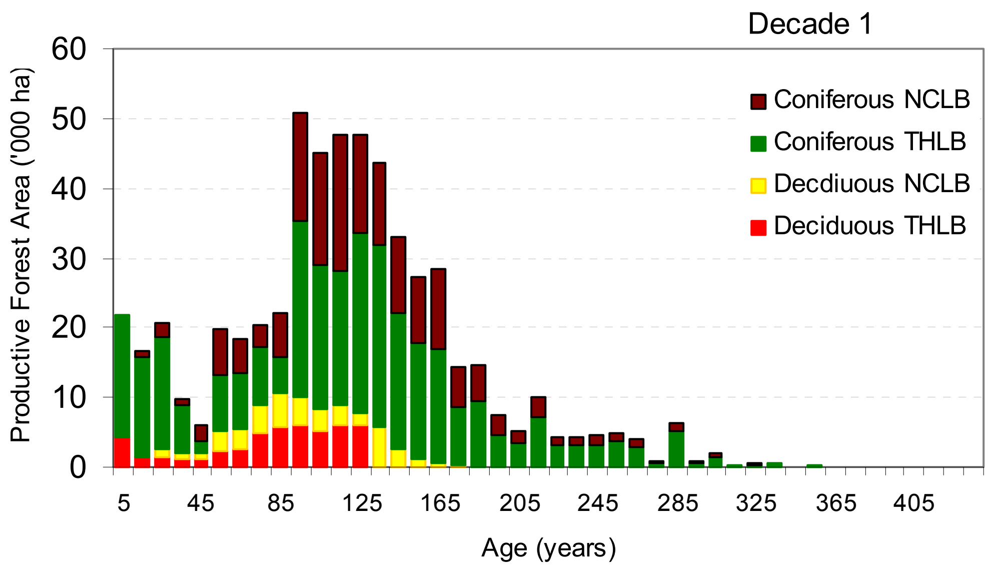


Figure 14 Decade 5 Age Class Distribution

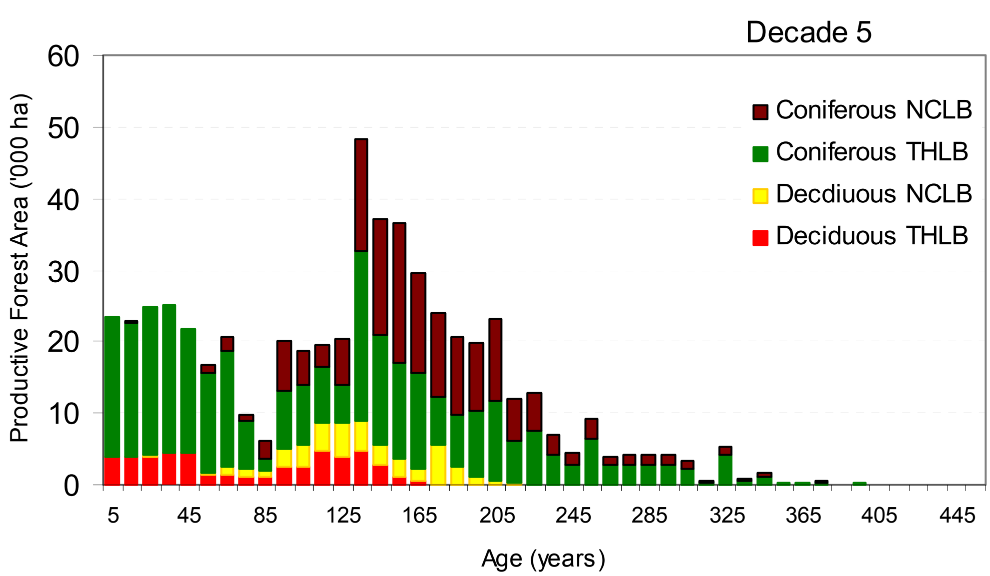


Figure 15 Decade 10 Age Class Distribution

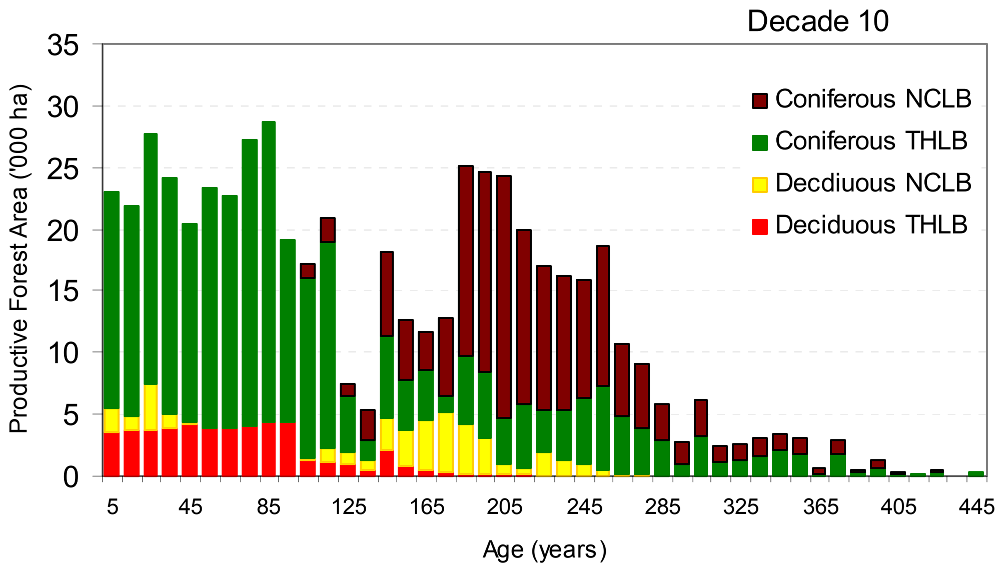


Figure 16 Decade 15 Age Class Distribution

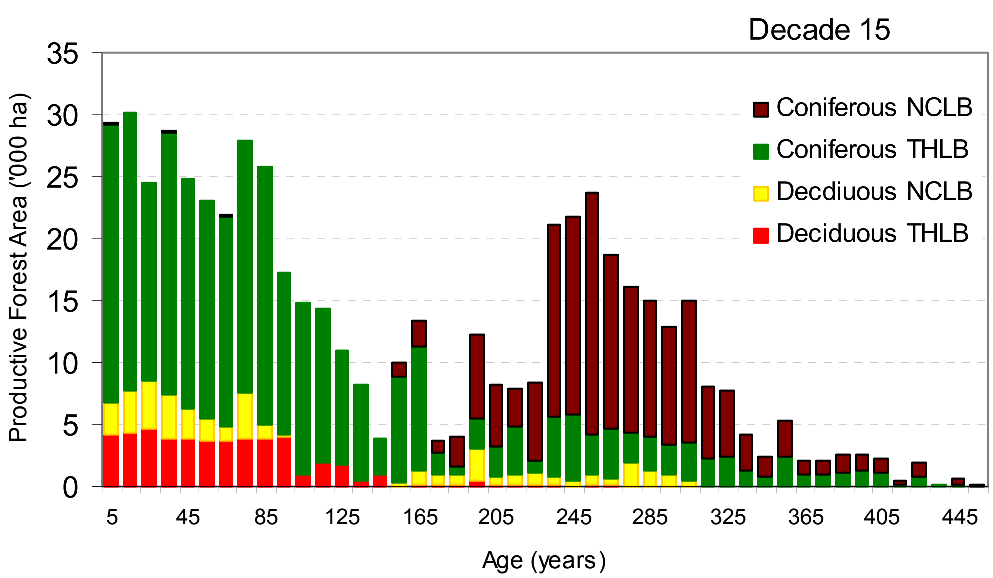


Figure 17 Decade 20 Age Class Distribution

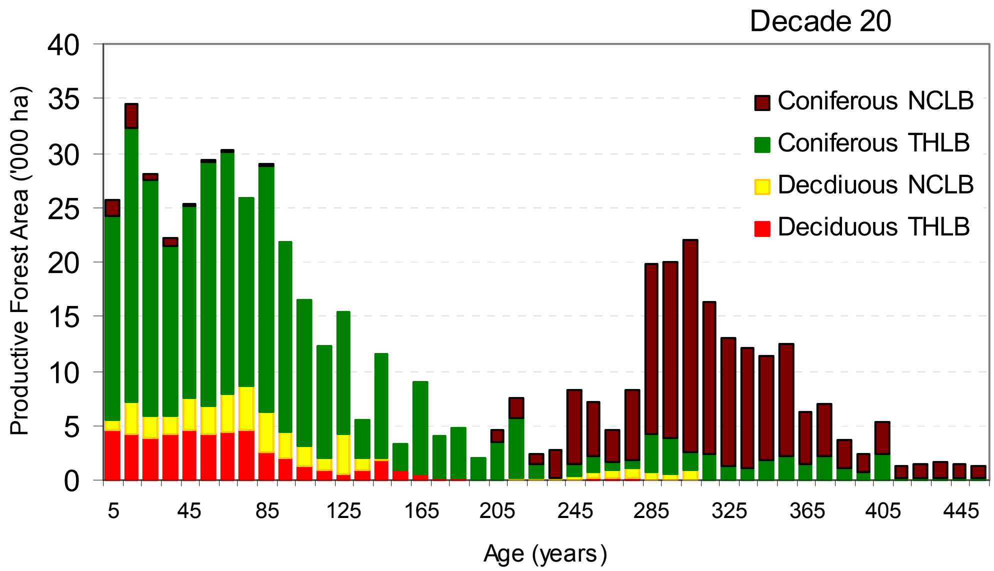
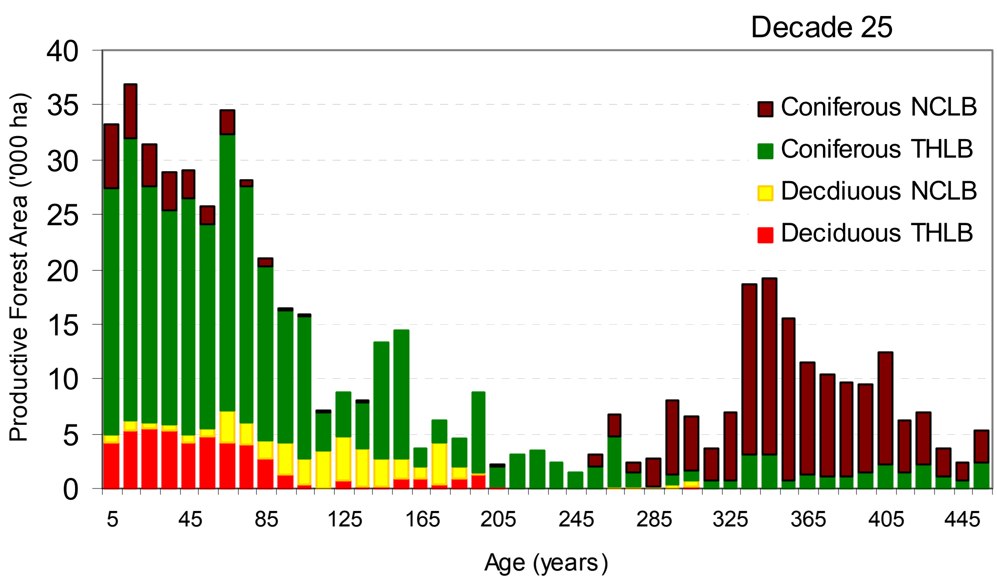


Figure 18 Decade 25 Age Class Distribution



7. Sensitivity Analysis on the Base Case

Sensitivity analysis on the Base Case harvest results were completed to assess the magnitude of impact of uncertainties in modelling assumptions (such as inventory, yield and management practices) on the harvest flow. The scenarios modeled here follow standard Ministry of Forest's protocol whereby only one Base Case assumption is addressed per scenario, to quantitatively measure the impact of the assumption on the Base Case harvest level.

7.1. Accelerated Harvest Levels

The Base Case harvest level utilized a harvest rule that forced the model to derive a non-declining harvest flow for both the coniferous and deciduous land bases. Two sensitivity analyses were conducted to measure the impact of an accelerated harvest level that maximized the harvest for 10 years, and then for 30 years. In each case the accelerated harvest would be followed by a maximum decline of ten percent per decade to a non-declining mid- and long-term harvest level.

Capitalizing on the surplus of mature and over-mature stands within the timber harvesting land base, an immediate coniferous harvest level of 969,900 m^3/year (51% above the base case) is supportable for one decade before declining to a mid-term level of 619,200 m^3/year (3.7 percent below the Base Case). A similar result can be experienced in the deciduous land base, whereby the short-term harvest level can be increased 52 percent to 143,500 m^3/year before taking three sequential 10 percent drops to a non-declining harvest flow of 92,000m^3/year - which is 2.4 percent below the deciduous Base Case.

An alternative accelerated scenario was to maximize the short term harvest flow 30 years, before dropping to a non-declining yield. The results of this scenario reveal that a coniferous AAC of 789,100m^3/year is possible (23% above the Base Case) with a subsequent drop to 629,700 m^3/year (2% below Base Case). Similarly, the deciduous AAC could be set at 116,800m^3/year and then decline to 93,000m^3/year having the same relative impact in comparison to the deciduous Base Case.

The results of these scenarios are shown in Figure 19 and Figure 20 and quantified in Table 4.

Table 4 Accelerated Harvest Flows

Scenario	Short term (m^3/year)		Mid and long term (m^3/year)		Short-term % change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous	Coniferous	Deciduous
10 year accelerated	969,900	143,500	619,200	92,000	50.9%	52.3%
30-year accelerated	789,100	116,800	629,700	93,000	22.8%	23.4%

Figure 19 Accelerated Harvest for 10-years

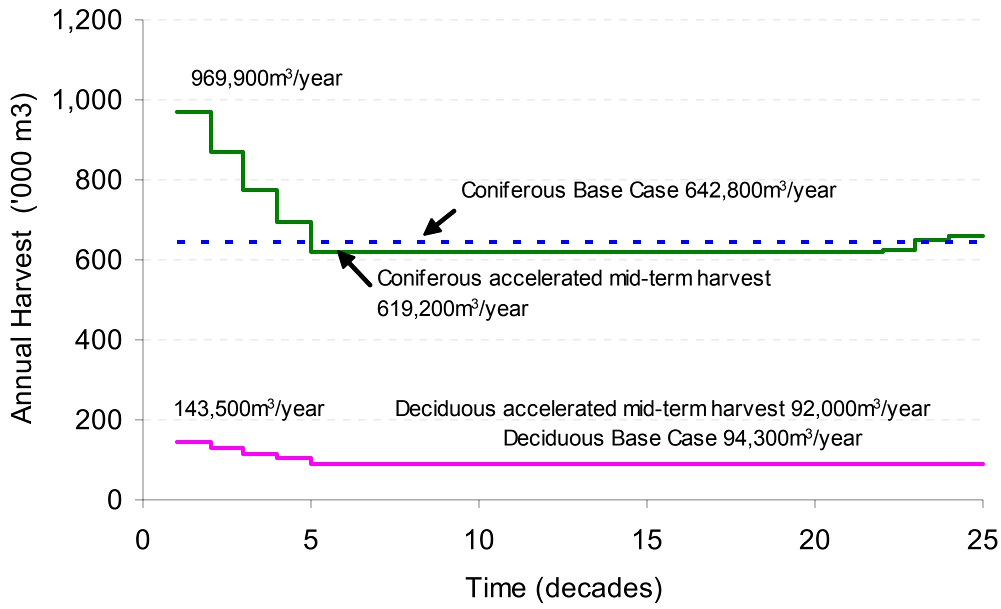
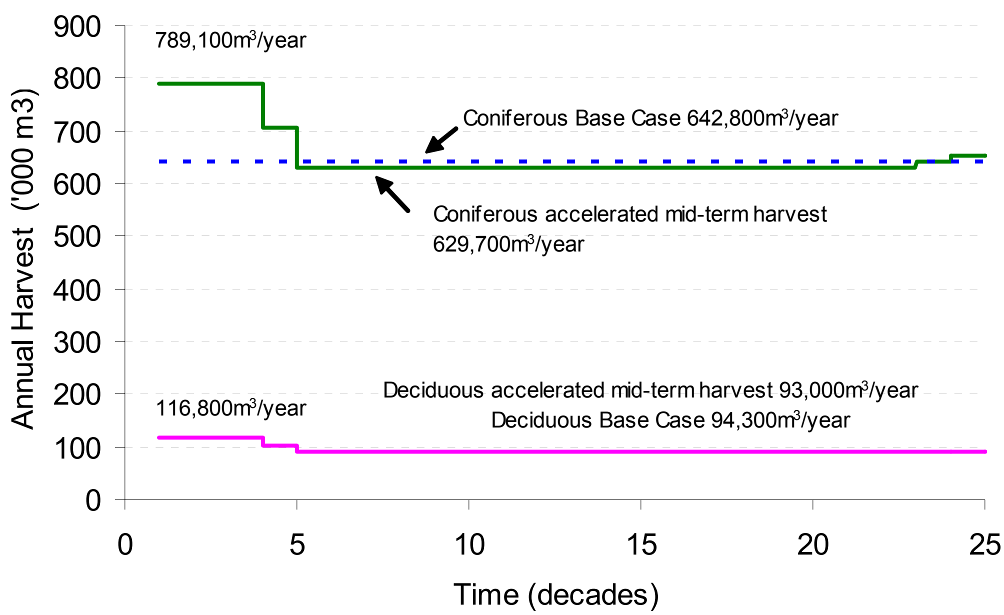


Figure 20 Accelerated Harvest for 30-years



7.2. Sensitivity of changes to the size of the TFL

Changes to the size of tree farms may come about in two ways: (1) a re-evaluation of what stands might contribute to the timber harvesting land base – which thereby keeps the gross area constant; or (2) through the addition or deletion of area to the gross TFL boundary. The first type of change is subjective and would need to be based upon management performance. The second would be either a political action or an economic investment into private land. Since we cannot speculate with any level of reasonable certainty on what the future will bring, a generic size adjustment was applied to all stands within the TFL. The adjustment involved increasing all stands by five percent for one scenario, and then decreasing the size of all stands by five percent for a second scenario. As the stand types and geographic attributes for each adjustment were kept the same as in the Base Case, forest constraint objectives were also increased or decreased by five percent as was appropriate.

Table 5 and Figure 21 show the results of these two scenarios. Increasing the size of the TFL provides only a marginal increase in the harvest flow, since much of the area added is assumed to exist in areas that are already heavily constrained due to the short-term impact of some forest cover constraints. Therefore, the benefit is only experienced for those parts of the TFL where immediate harvesting can occur.

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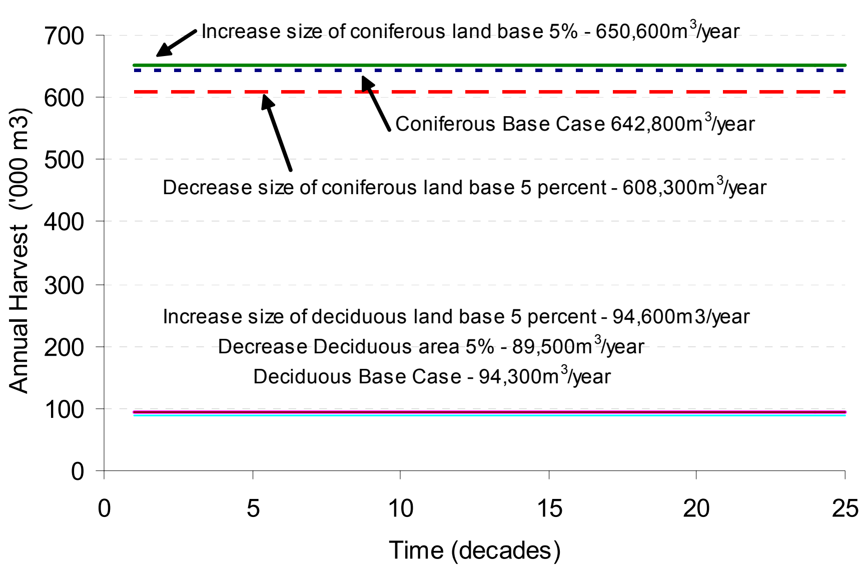
Table 5 Adjust TFL Size

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Increase TFL Area 5%	650,600	94,900	1.2%	0.7%
Decrease TFL area 5%	608,300	89,500	-5.4%	-5.0%

Figure 21 Adjust TFL Size



7.3. Sensitivity of changes to empirical and managed stand yield tables

The Base Case harvest flow utilizes four sets of yield tables by analysis unit. These are:

1. unmanaged stand yield tables,
2. managed stand tables for areas harvested pre-1995
3. managed stands harvested post-1995
4. managed stands harvested post-1995 with genetically improved spruce

The volume estimates associated with empirical (unmanaged) stands have increased substantially over the term of Management Plan #3 as a result of the completion of Phase II sampling for TFL48. A set of scenarios assesses the relative impact of additional ten percent increases, and decreases of empirical and managed stand yield tables, as compared to the Base Case harvest flow.

The results of these scenarios are shown in Table 6, Figure 22 and Figure 23. The results from these four scenarios reveal that the Base Case harvest flow is more sensitivity to adjustments in managed stand yield estimates then to empirical yield estimates.

Table 6 Changes to stand yield tables

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Increase empirical stand yields 10%	660,400	97,200	2.7%	3.2%
Decrease empirical stand yields 10%	616,700	91,500	-4.1%	-2.9%
Increase managed stand yields 10%	686,700	101,700	6.8%	8.0%
Decrease managed stand yields 10%	590,900	87,100	-8.1%	-7.5%

Figure 22 Adjust empirical yield tables

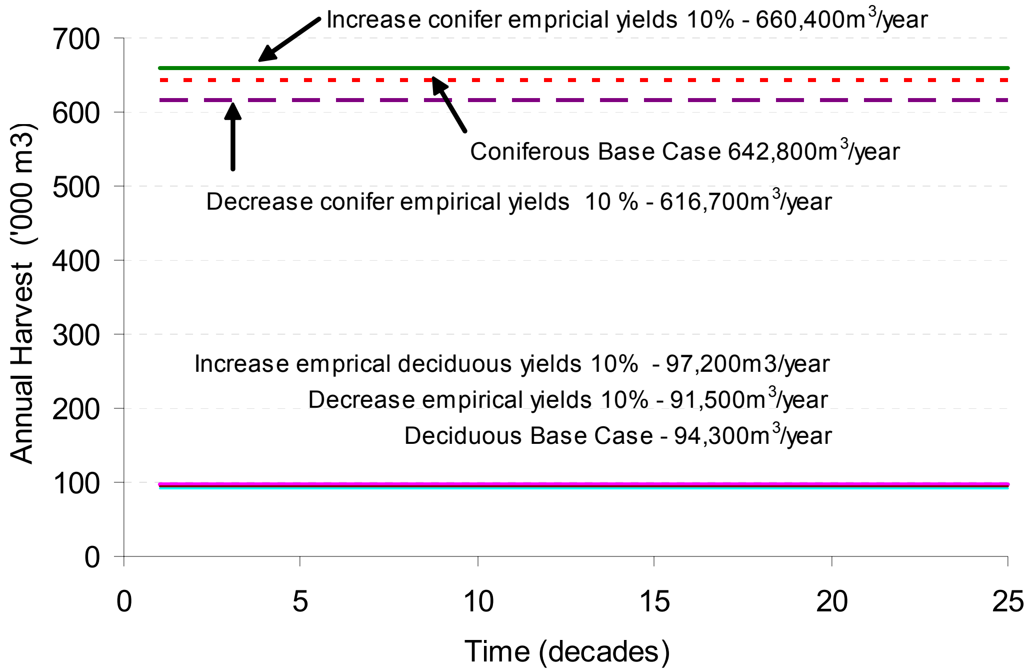
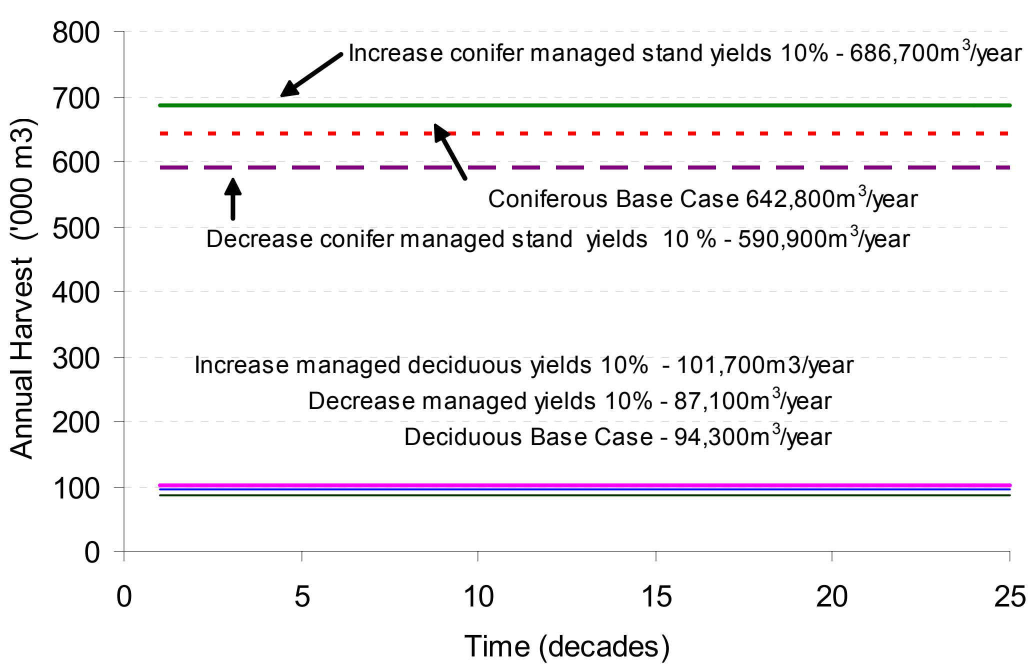


Figure 23 Adjust managed stand yield tables



7.4. Sensitivity of the minimum cutting age

The minimum cutting age applied to this base case analysis utilized the economic rotation period of each analysis unit. In other words, the culmination age of each analysis unit was calculated by identifying the point in the life of a stand when the change in mean annual increment was the highest. Two sensitivity scenarios were run to determine how sensitive the Base Case harvest flow was to changes in the minimum cutting age. The results of this sensitivity analysis are shown in Table 7 and Figure 24. The results indicated by these two scenarios shows that the Base Case is not very sensitive to changes in the minimum cutting age of stands.

Table 7 Change in the minimum cutting age

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Decrease minimum cutting age 10 years	655,100	95,300	1.9%	1.1%
Increase minimum cutting age 10 years	626,800	92,500	-2.5%	-1.8%

Figure 24 Changes in the minimum cutting age

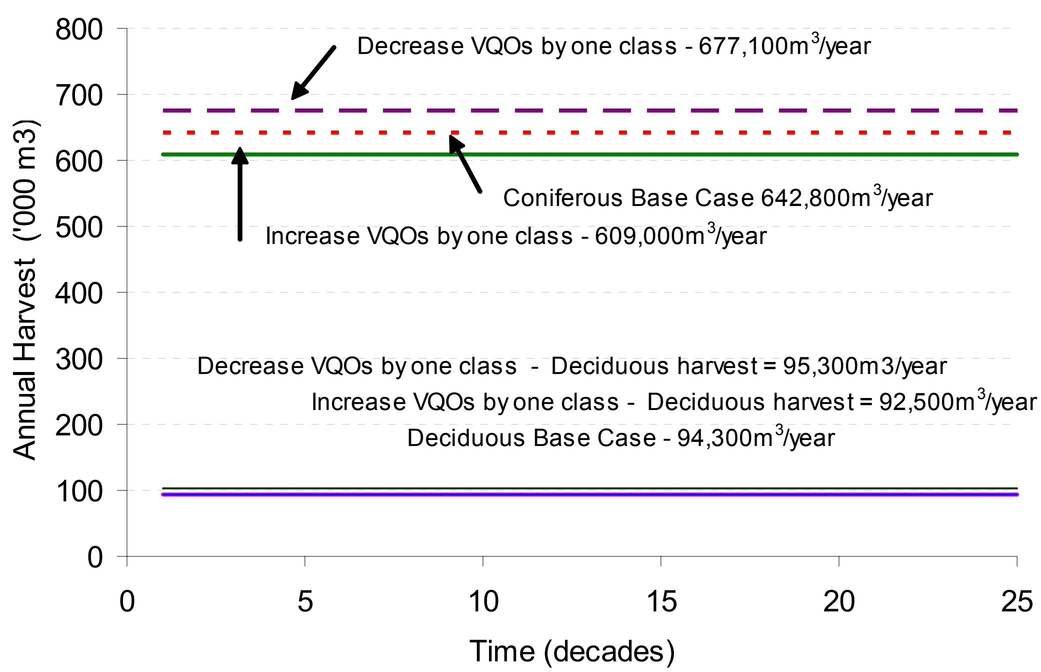
7.5. Sensitivity of changes to visual quality objectives

The scenic areas modeled in the Base Case scenario utilize the visual line work that is presently established for TFL 48. This line work utilizes the consolidated visual inventories for the Dawson Creek TSA and TFL 48. Each visually sensitive polygon is assigned a visual quality objective. The objectives place a constraint upon each area such that no more than a pre-determined amount of forest land may be less than a 5 metre greenup height. For example, an area having retention VQO may have no more than 1.6 percent of the area less than 5 metres. To assess the sensitivity of the Base Case harvest flow to the visual quality objectives, each scenic area had their VQO adjusted up, and then down one class. A move up meant that retention VQO areas were now considered partial retention, and the constraint was reduced from no more than 1.6 percent area less then 5 metres to no more than 9.9 percent less than 5 metres. A similar adjustment was made to preservation, partial retention and modification VQOs. The impacts of these changes are shown in Table 8 and Figure 25. The results reveal that the established VQOs within TFL 48 place a significant constraint on the coniferous harvest level. The deciduous harvest is sensitive to a relaxing of the VQOs, however increasing the constraints has relatively no impact.

Table 8 Sensitivity of established VQOs

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Increase VQO one class	609,000	93,800	-5.3%	-0.4%
Decrease VQOs one class	677,100	102,000	5.3%	8.3%

Figure 25 Sensitivity of established VQOs



7.6. Sensitivity of changes to the green-up delay

Greenup delay in an a-spatial model is used to ensure that the distribution of harvesting across the TFL does not become overly concentrated within one area. Greenup delay is applied to the timber harvesting land base portion of each landscape unit. Furthermore it is applied to ensure hydrologic recovery occurs within each watershed. Table 9 shows that neither increasing nor decreasing the greenup delay had an impact on the Base Case harvest flow.

Table 9 Sensitivity of greenup delay

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Increase greenup delay 10 years	642,800	94,500	-0.01%	0.29%
Decrease greenup delay 10 years	642,900	94,200	0.02%	0.29%

7.7. Sensitivity of old seral forest cover constraints

The Old-Growth Order for BC is identified in the landscape unit planning guidebook and describes the proportion of old growth timber that should be reserved within each landscape unit and biogeoclimatic zone. The old growth order was not used in the Base Case harvest flow, rather the old seral constraints as identified by the Prince George Regional ecologist were used and applied to areas identified as natural disturbance units (NDU). While the NDUs are geographically larger than landscape units, the old seral constraints are generally more stringent. Rather than eight NDU constraints applied to large areas of the TFL, the old growth order applies 40 old seral constraints to the TFL. The results of the application of old-growth order constraints on the TFL, as well as the removal of all old-growth and NDU constraints are shown in Table 10 and Figure 26.

The results shown here reveal that the old-growth order constraints allows us to increase the non-declining coniferous harvest level for the TFL by 10 percent, but it has almost no impact on the deciduous harvest flow. Furthermore, removal of all old-growth constraints results in only a slightly better harvest flow than the application of the old-growth order itself. In both scenarios, there is very little impact on the deciduous harvest flow.

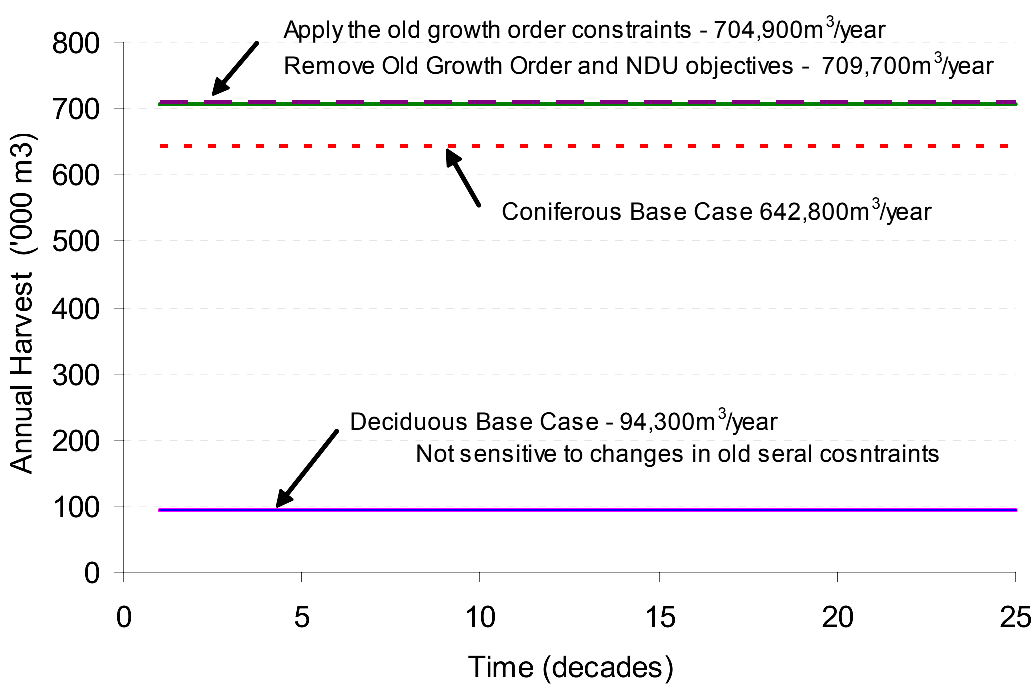
The reason for these results is due to the contribution of the non-contributing land base to old-growth. In the deciduous land base, old growth targets for the Base Case and for the Old Growth Order scenario are sufficiently low that the objectives are met within the existing age class distribution. Where they are not met immediately, they will be achieved in the next 1-3 decades as deciduous stands continue to age. A similar occurrence exists for the coniferous land base. Though considerably more focused geographically by landscape unit and biogeoclimatic zone, Old Growth Order constraints are largely met by the NCLB in the next three to 10 decades. On the other hand, constraints applied by NDU in the Omineca Mountain and Wet Mountain NDUs are never met through the NCLB alone.

Table 10 and Figure 26 also quantify the impact of removing all early seral and old growth constraints. While harvest flow constraints are still imposed through the application of minimum harvest ages, non-declining harvest levels and a future non-declining growing stock, this scenario places some parameters around the impact of these seral age constraints. This scenario reveals that the net coniferous harvest could be increased to 741,300m^3/year (a 15 percent increase), indicating that the conifer land base is quite sensitive to early and later seral constraints. The deciduous harvest level also increases to 102, 400m^3/year (an 8% increase). Proportionally less due to the shorter rotation ages, reduced green up periods and lower old-growth constraints.

Table 10 Old growth order constraints

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Old Growth Order (LU/BEC targets)	704,900	94,000	9.7%	-0.2%
No Old Growth constraints	709,700	94,100	10.4%	-0.1%
Remove all constraints (Visual and old growth)	741,300	102,400	15.3%	8.7%

Figure 26 Sensitivity of old growth order constraints



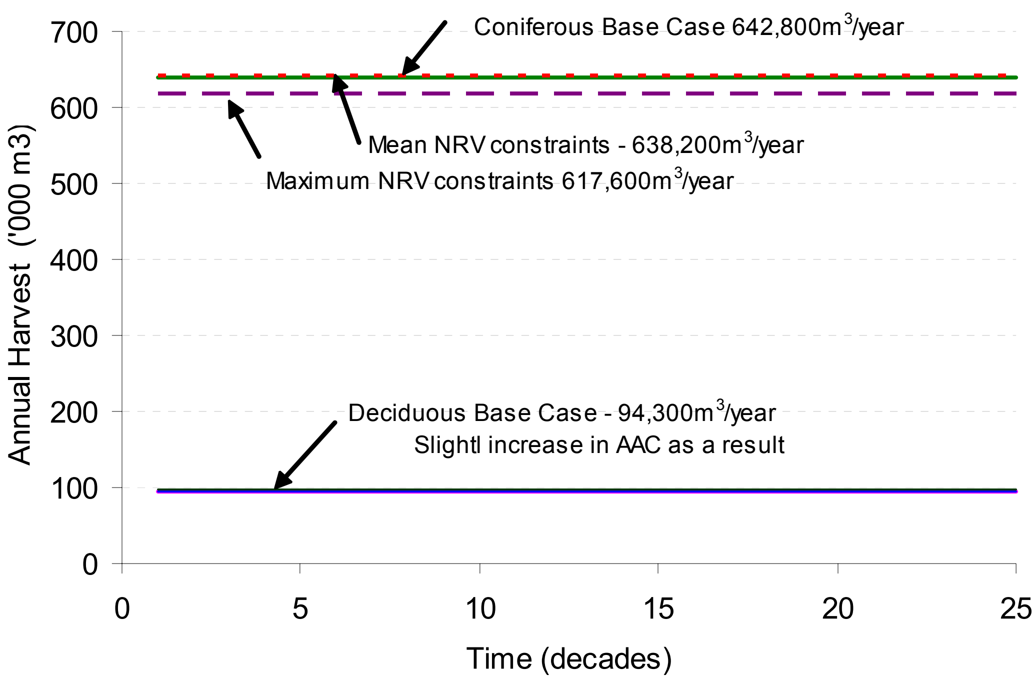
7.8. Sensitivity of varying the NDU constraints

The range of natural variation (NRV) applied to each natural disturbance unit in the Base Case is the minimum NRV identified by the Prince George MOF regional ecologist. Two scenarios were identified that tested the impact of applying the mean and the maximum NRV constraint on the Base Case harvest flow. The results of these two scenarios are shown in Table 11 and Figure 27. Although 19 percent more area is required as old growth in the application of mean NRV constraints, the majority of this area is eventually met through the non-contributing land base. However, application of maximum NRV constraints poses a heavier burden on the availability of fibre in the THLB. The constraint reduces the coniferous and deciduous harvest flows by approximately 4 percent, relative to the Base Case.

Table 11 Sensitivity of the Natural Range of Variation

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Mean NRV	638,200	95,000	-0.7%	0.9%
Maximum NRV	617,600	98,300	-3.9%	4.3%

Figure 27 Sensitivity of the Natural Range of Variation



8. Analysis of Alternative Management Assumptions

The scenarios identified in Section 7 of this report look at the relative impact of various modelling assumptions on the Base Case harvest flow. This section is not so different, but for the fact that the changes imposed on the base case assumptions are applied to examine the impact of alternative management strategies on the sustainable harvest level for the TFL. There are three principle strategies we examine in this section.

1. The impact of including recommended VQOs on the harvest flow
2. The impact of woodlots and mine sites on the harvest flow
3. The impact of SIBEC
4. The impact of spatial harvest flow constraints
5. The impact of the mountain pine beetle on the harvest flow

Details on the assumptions used for the first two categories are discussed in the Information Package that is appended to this report. Information regarding the mountain pine beetle is highly subjective and discussed both in the information package and herein.

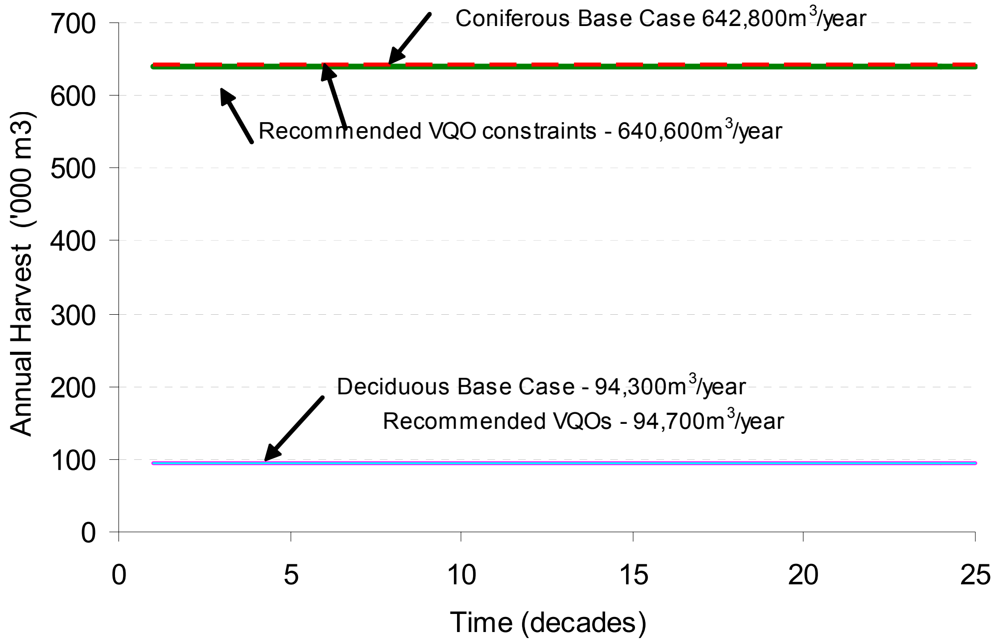
8.1. Impact of Recommended VQOs

The Base Case analysis applied constraints to the known established visually sensitive areas within the TFL. This scenario examined the impact of including recommended VQO areas into the known visual landscape inventory. Both the established and recommended VQO areas are shown in Map 7. The impact of adding recommended VQOs to the analysis is shown by Table 12 Figure 28.

Table 12 Impact of Recommended VQOs

	Harvest (m^3/year)		% change from Base Case	
Scenario	**Coniferous**	**Deciduous**	**Coniferous**	**Deciduous**
Recommended VQOs	640,600	94,700	-0.3%	0.5%

Figure 28 Impact of Recommended VQOs



Adding recommended VQOs does not have a substantial impact on the harvest flow for the TFL. A review of Table 52 in the information package provides a clue as to why. Recommended VQOs increases the area predominately in retention and partial retention VQOs in the Gething, Carbon and Dunlevy landscape units. The productive forest area within recommended partial retention VQOs exceeds 15,000 hectares. However, the THLB within these areas is only 1800 hectares. All of the partial retention constraints in Dunlevy and Gething landscape units is achieved through the occurrence of stands in the NCLB. The Carbon landscape unit is only slightly worst off then when adjacency is modelled on the THLB, versus the application of early seral constraints on the productive forest areas (THLB + NCLB).

The harvest flow for the deciduous land base shows a very slight (almost negligible) increase as a result of the application of the recommended VQO constraints. This occurs as a result of higher restrictions on the coniferous land base enabling greater availability for the deciduous land base.

8.2. Impact of woodlots and mine-sites

Existing woodlots have been removed from the productive forest land base for the TFL. Both existing and proposed mines sites have also been removed from the productive forest land base. The removal of proposed mines sites in the net down logic was inadvertent. However, as the productive forest area affected by these proposed mines sites is only 0.08 percent of the TFL's total forest area (i.e. 479 ha), the effort to redo the net-down and all of the corresponding tables in the information package was forgone.

Three scenarios were investigated to quantify the inclusion of area back into the TFL.

1) An analysis was rerun that included 479 forested hectares of proposed mine sites into the THLB.
2) A second analysis included 1,042 hectares representing woodlots that were removed during the term of Management Plan 3, but the AAC apportionment table accompanying the MP approval letter dated Sept 20, 2001 did not reflect the removal. These 1,042 hectares are assumed to increase the THLB by 1040 hectares.
3) A third scenario added-back woodlots removed from the previous scenario 2 as well as new woodlots or top ups to existing woodlots removed during the term of MP3. The scenario involved 1,839 ha of which 1,816 are assumed would have contributed to the THLB.

The results of these three scenarios, in relation to the Base Case, are shown in Table 13. In relation to the Base Case harvest flow, and in consideration of the uncertainty associated with various other modelling assumptions, the relative impact of these scenarios on the Base Case harvest level is negligible.

Table 13 Impact of proposed mine sites and woodlots

	Harvest (m^3/year)		% change from Base Case		change in THLB area (ha)	change in conifer yield (m3/yr)
Scenario	**Coniferous**	**Deciduous**	**Coniferous**	**Deciduous**		
Proposed Mine sites	643,705	94,265	0.14%	0.07%	+ 479	+ 970
Woodlot Scenario 1	645,500	94,500	0.42%	0.32%	+ 1,040	+ 2,700
Woodlot Scenario 2	647,100	94,650	0.67%	0.48%	+ 1,816	+ 4,300

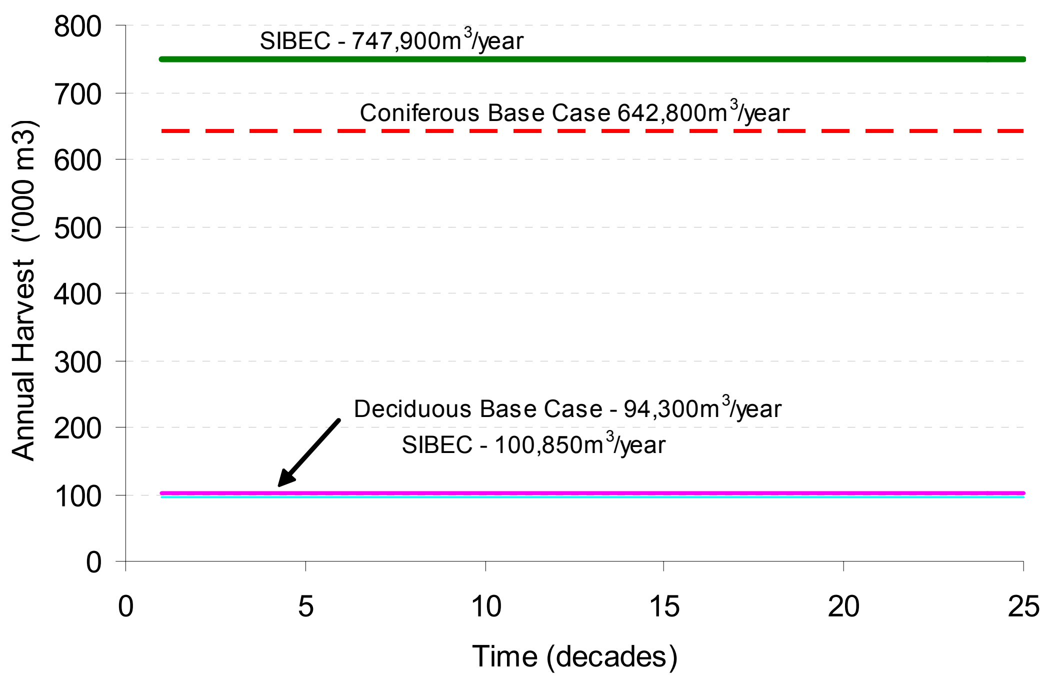
8.3. Impact of site index adjustments by biogeoclimatic zone (SIBEC)

A sensitivity analysis was completed that investigated the impact of site index adjustments to future managed stands. This was accomplished by using site series, tree species and biogeoclimatic zone to estimate site index through the MOF publication Site Index Estimates by Site Series for Coniferous Tree Species in BC – May 2006. The information package appended to this report identifies the weighted average site index by analysis unit as a result of this guidebook. The results of this analysis revealed that both the coniferous and deciduous non-declining harvest levels could be increased to 747,900 m^3/year and 100,850m^3/year respectively. This is a 16 percent increase for coniferous stands and a seven percent increase for deciduous stands (See Figure 29 and Table 14).

Table 14 Impact of SIBEC

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
SIBEC	747,900	100,850	16.35%	7.06%

Figure 29 Impacts of SIBEC



8.4. Impact of the Mountain pine beetle

The mountain pine beetle (MPB) is a growing forest heath concern in TFL48. In the last two years, a significant infestation has migrated from the west, spilling over into both the Dawson Creek TSA and TFL 48. Several scenarios were developed to estimate the impact of alternative levels of pine mortality as a result of the MPB.

In the past few years, there have been many timber supply analyses completed across BC, to estimate the impact of the MPB on short and mid-term timber supplies. Though all of them provide some insight into the short and mid-term timber supply situation, they are each plagued with the same critical uncertainties that are very important to produce an accurate mid-term timber supply picture. These uncertainties are:

- The shelf-life of dead pine with respect to nominal lumber production.
- The rate, intensity and future spread of the MPB.
- The impact of pine mortality on the existing and future stand volumes with consideration to existing ingress and future regeneration.
- New uses for dead pine timber.
- The level of immature pine mortality.
- Future social and political conservation requirements when faced with both large areas denuded of trees and residual non-recoverable losses.

The assumptions regarding the forgoing bullets are either unknown or strongly suspect, hence how an analyst deals with these uncertainties when constructing a forest estate modelling exercise will have a significant impact on the mid-term timber supply result. To address some of this uncertainty, many scenarios were run, each offering a slightly different view of the short term timber supply picture.

To model the MPB epidemic two models were used. The first is an a-spatial beetle epidemic and control model developed by IFS[2] in 1986 for the Chilcotin epidemic, and used sporadically over the past five years to address MPB infestations in other areas of the interior. Run using annual periods, the inputs to the model include:

- At risk area
- Pine volume by diameter class (17.5cm+ and 12.5cm+)
- Estimation of maximum mortality
- Proportion of pine stocking
- AAC directed to clear cutting, selective cutting, single tree pile and burn
- Shelf life
- Maximum dead volume that the mill can accept

There are many outputs from this model; however the one most pertinent to this exercise is the determination of non-recoverable pine losses as a result of varying the levels of harvest and the assumed maximum mortality. The NRLs determined using the IFS Beetle model were identified for leading pine stands or leading spruce stands having a

[2] The model is an adaptation OF THE Reed-Frost model: See Cole, Walter E., Gene D Amman and C.E. Jensen 1985 Mountain Pine beetle dynamics in lodgepole pine forests. Part II Modelling of mountain pine beetle populations. USDA For. Serv. Gen Tech. Report INT-188

significant pine component. Pine stands that were killed ('harvested') by the MPB were assumed to regenerate to an unmanaged stand. Pine mortality in leading spruce stands resulted in the pine component being removed from the spruce yield tables. All scenarios had forest cover constraints applied throughout the simulation time period. When the total pine NRLs were determined, this was applied to the Remsoft model and modeled using 10-year periods.

Table 15 shows the inputs and the non-recoverable loss results for a select number of scenarios using the IFS beetle model. The NRL results from this table were then entered into the forest estate model and produced the harvest flows indicated in Table 16, Figure 30 and Figure 31. The harvest rules applied to the long-term forest estate model for beetle scenarios 1-3 were:

1) A non-declining conifer harvest,
2) An even flow deciduous harvest,
3) 385,200 m^3/year directed to pine harvesting (representing 60% of the base case harvest level)
4) Traditional volume NRLs in decade 1 were reduced from 49,700 to 5000m^3/year

The harvest rules applied to beetle scenarios 4-7 were:

1) Total conifer harvest in the first decade = 884,300m^3/year, of which 615,510 was directed to pine; These values were arbitrarily chosen as a level of volume that Canfor might be able to process using existing manufacturing capacity in Chetwynd.
2) An even-flow conifer harvest from periods 2 to 5;
3) A non-declining conifer harvest from periods 5-25;
4) Even-flow deciduous harvest.
5) Traditional volume NRLs in decade 1 were reduced from 49,700 to 5,000m^3/year

Table 15 Annual Beetle model inputs and resultant NRLs

Beetle Scenario	Pine at Risk (m^3)	Maximum Mortality (%)	Shelf-life (years)	Total Conifer Harvest level (m^3/year)	Harvest Directed at pine (m^3/year)	Single-tree Pile and burn (m^3/year & duration in years)	Total Resultant NRLs (m^3)
Beetle 1	26,800,000	40	5	642,800	385,200	9,000 & 4	732,000
Beetle 2	26,800,000	50	5	642,800	385,200	9,000 & 4	2,640,000
Beetle 3	26,800,000	80	5	642,800	385,200	9,000 & 4	9,364,000
Beetle 4	26,800,000	40	5	879,300	615,510	9,000 & 4	151,129
Beetle 5	26,800,000	50	5	879,300	615,510	9,000 & 4	1,514,000
Beetle 6	26,800,000	70	5	879,300	615,510	9,000 & 4	5,892,000
Beetle 7	26,800,000	80	5	879,300	615,510	9,000 & 4	8,159,000

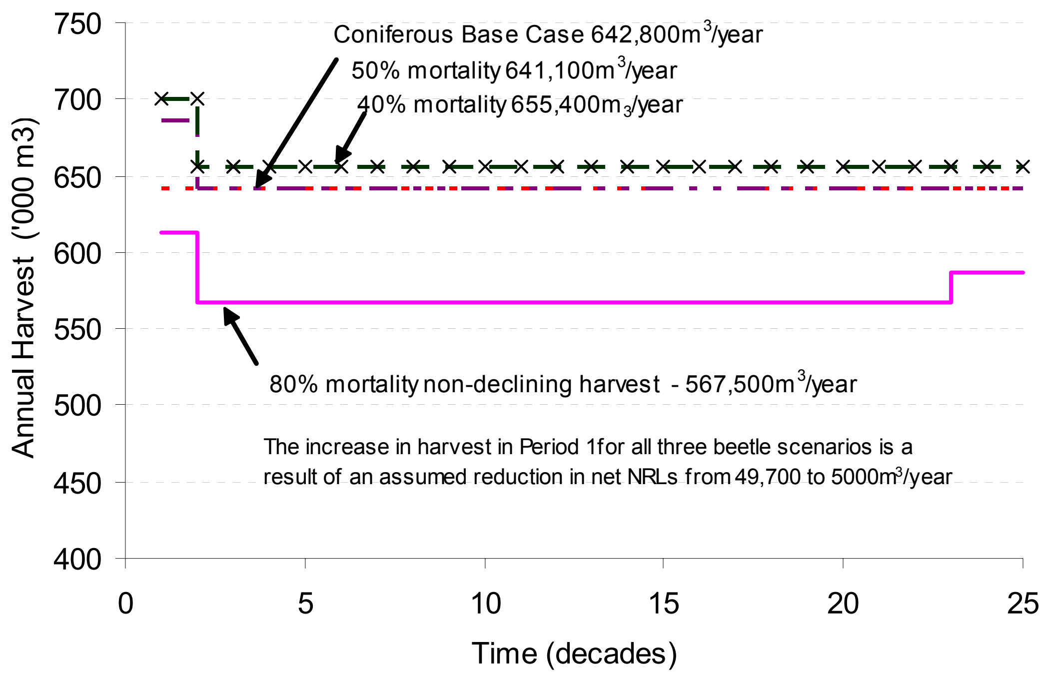
Note: pine at risk constitutes 23.1 million m^3 of pine in pine-leading stands and 3.7 million m^3 of pine in spruce-leading stands.

Table 16 Mid and long-term impacts of MBP Mortality

Scenario	Maximum mortality (%)	Short- term Harvest (decade 1) (net m³/year)	Short-term % change from Base Case	Mid-term (decades 2-5) (net m³/year)	Mid-term % change from Base Case	Long-term (decade 10) (net m³/year)	Long-term % change from Base Case
Base Case	0	642,800	0.0%	642,000	0.0%	642,000	0.0%
Beetle 1	40	612,250	-4.6%	567,551	-11.6%	567,551	-11.6%
Beetle 2	50	685,814	6.8%	641,114	-0.1%	641,114	-0.1%
Beetle 3	80	700,109	9.1%	655,409	2.1%	655,409	2.1%
Beetle 4	40	879,300	37.0%	571,474	-11.0%	571,474	-11.0%
Beetle 5	50	879,300	37.0%	645,374	0.5%	645,374	0.5%
Beetle 6	70	879,300	37.0%	653,061	1.7%	653,061	1.7%
Beetle 7	80	879,300	37.0%	601,661	-6.3%	601,661	-6.3%

Note: the net harvest level in the short term has been reduced by 5000 m^3/year instead of 49,700m^3/year to reflect the fact the most NRLs are being accounted for in the simulation. Thereafter, NRLs are applied at 49700m^3/year for coniferous stand.

Figure 30 Non-declining harvest flows in response to beetle scenarios



There are countless combinations of alternative modelling assumptions that could be included in this analysis. For example, just changing the shelf-life incrementally in Beetle Scenario 7 (i.e., wherein maximum pine mortality was assumed to be 80 percent and Canfor conducts a pine harvest of 624,510 m^3/year) resulted in a change in the NRLs as indicated by Figure 32 – from a high of 10 million m^3 to a low of 6.7 million m^3. We cannot predict what will happen with any degree of confidence, and only the next few years will determine what the most appropriate assumptions should have been. That said, the beetle scenarios examined provide insight to one very interesting point. Pine mortality of up to 50 percent will act like much like an accelerated harvest. The model responds by harvesting a disproportion amount of pine in the short-term, causing the mid-term harvest level is slightly higher then the Base Case scenario. This is possible because the Base Case was derived using a preconceived harvest rule that demands that the coniferous and deciduous harvests be non-declining. In light of the amount of mature and old-growth forests within the TFL, this rule is not the most economically or productively advantageous to the TFL manager. Though not shown in Section 7.1 (accelerated harvest levels) similar results were witnessed when smaller accelerated harvest levels were targeted for shorter time periods and a more dramatic step-down process.

In the long-term (e.g. after 100 years), the harvest flow should match the Base Case. That it did not is a result of requiring a stable THLB growing stock after period 17 to influence the harvest earlier in the simulation period.

Figure 31 Accelerated harvesting in response to beetle scenarios

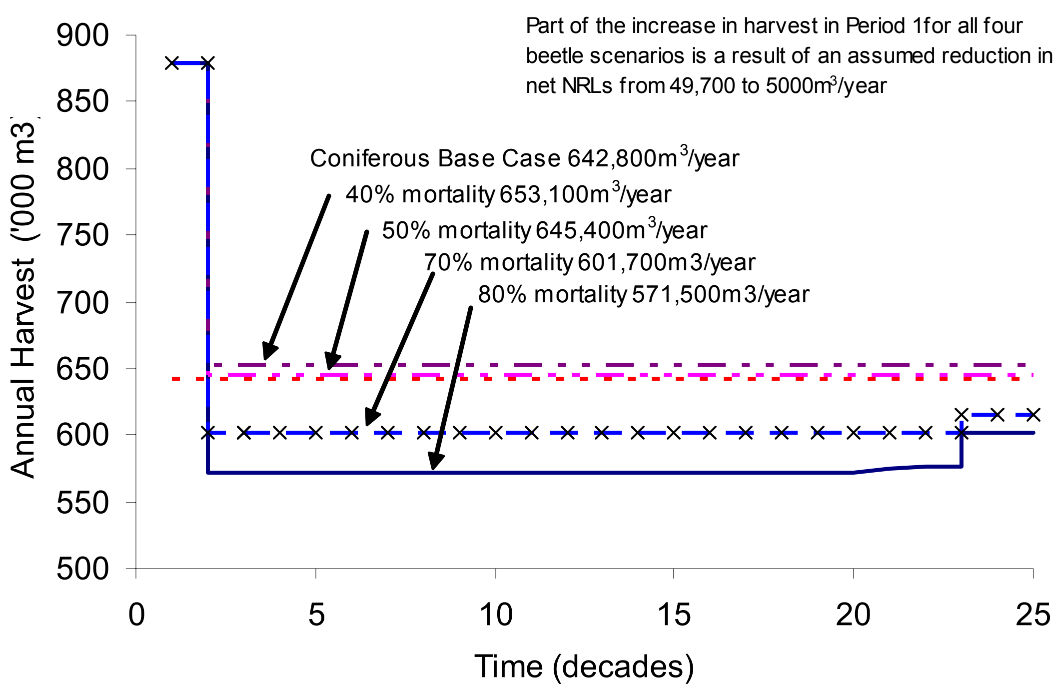
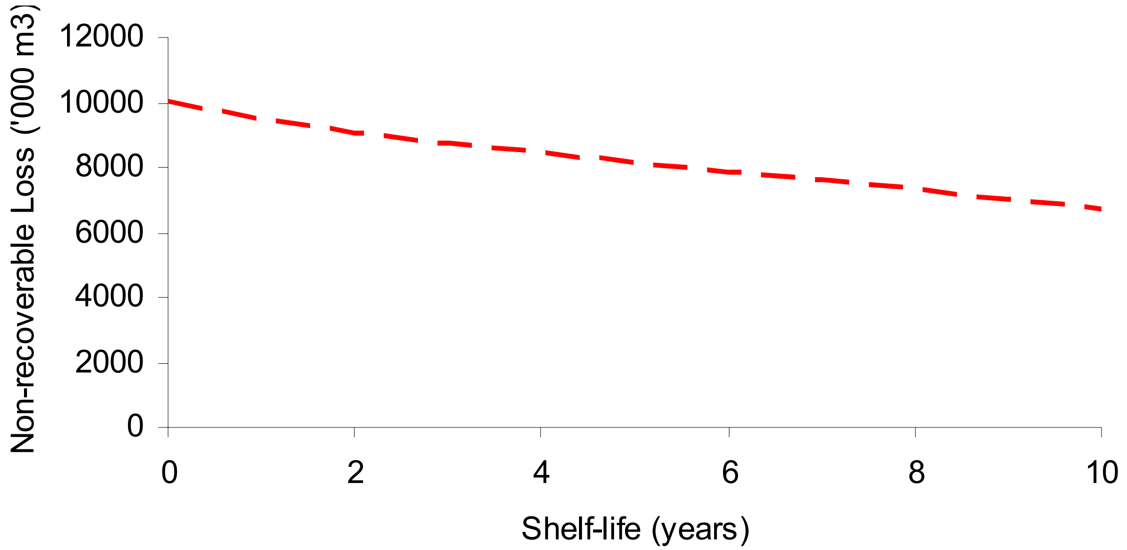


Figure 32 Sensitivity of Shelf Life



8.5. Preferred Management Scenario

A final scenario was constructed that Canfor believed would best address the management environment for TFL 48 going into Management Plan #4. This scenario involved both an a-spatial analysis of certain management initiatives, and then the construction of a hypothetical 20-year harvest plan in support of this harvest flow. The management scenario involved:

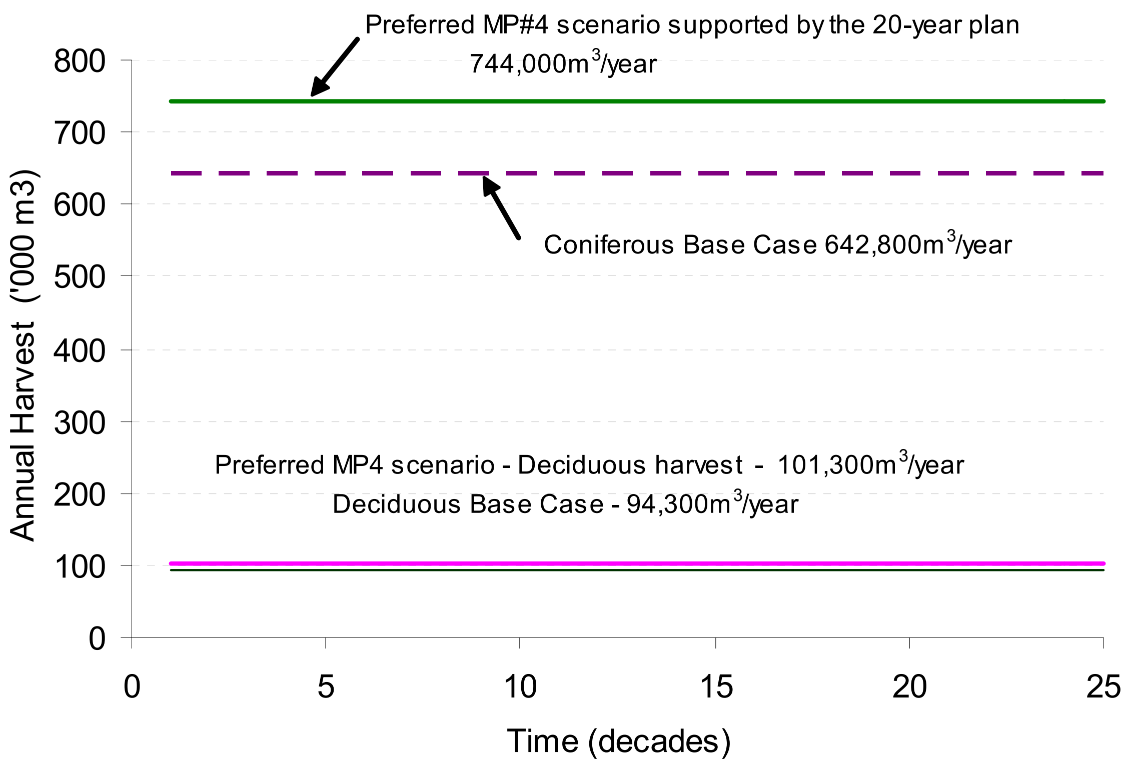
- Application of the SIBEC estimates for future managed stand yield tables.
- Application of recommended visual quality objectives.
- Target a minimum of 70 percent of the coniferous harvest in the first decade to pine volume.

The results of this scenario are shown in Table 17 and Figure 33. The hypothetical harvest plan of cut-blocks scheduled for four 5-year periods is provided in the Twenty Year Plan in support of Management Plan #4. Map 11 shows a projected age class distribution 20 years into the future should this preferred management scenario be accepted by the Ministry of Forests.

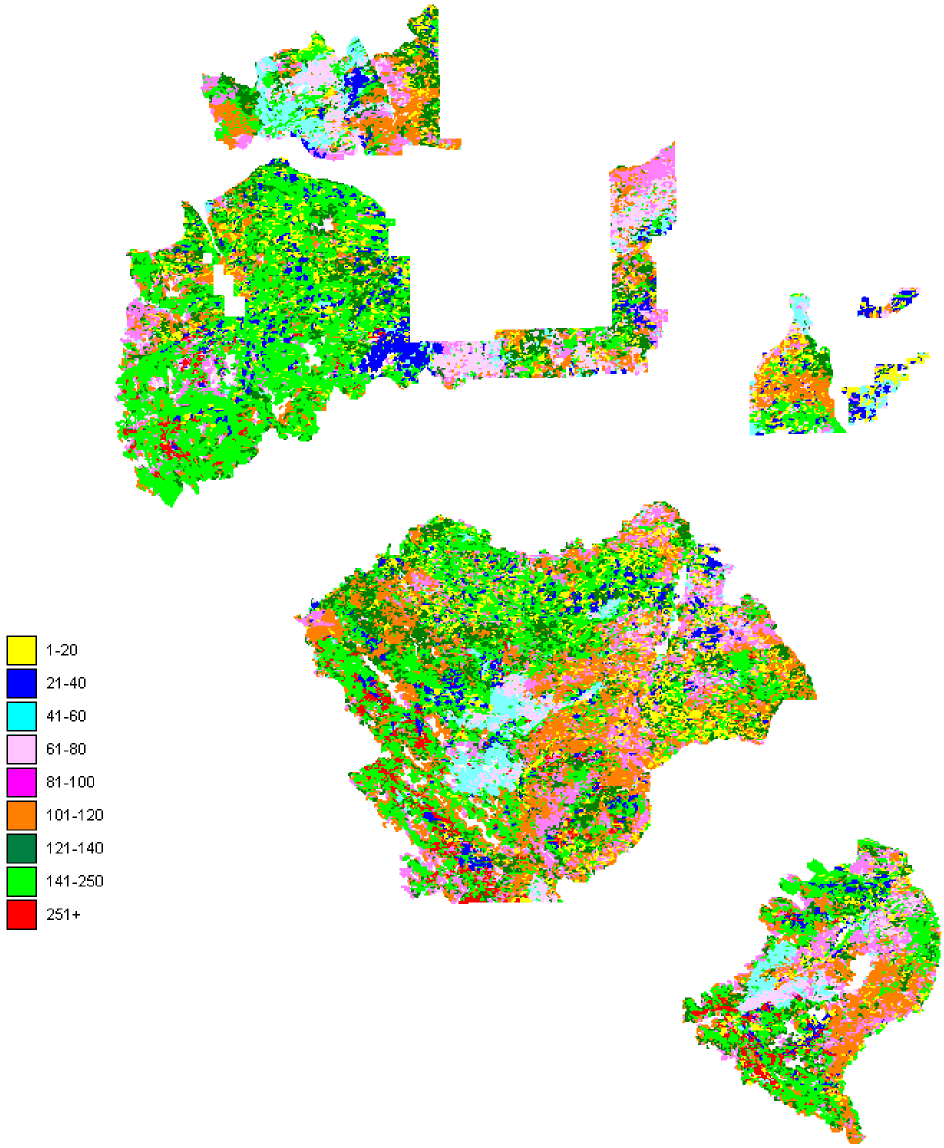
Table 17 Scenario supporting the spatial 20-year plan

Scenario	Harvest (m^3/year)		% change from Base Case	
	Coniferous	Deciduous	Coniferous	Deciduous
Preferred Management Plan #4 supporting the 20-year plan	744,000	101,300	15.7%	7.6%

Figure 33 Scenario supported by the 20-year plan



Map 11 Age Class Distribution after 20-years – Preferred Management Scenario



8.6. Summary

The following two tables provide a summary of the Base Case and sensitivity scenario results for the deciduous and coniferous land bases.

Table 18 Coniferous Harvest Flow Results

Scenario		Initial Harvest Level			Mid--term Harvest Level		
#	Description	Volume (m3/year)	Duration (years)	% change From Base Case	Volume (m3/year)	Duration (years)	% change From Base Case
1	Coniferous Base Case	642,800	250	0.00%	642,800	250	0.00%
2	Maximum 10 year accelerated	969,900	10	50.89%	619,200	50 to 250	-3.67%
3	Maximum 30-year accelerated	789,100	30	22.76%	629,700	50 to 250	-2.04%
4	Increase TFL size by 5%	650,600	250	1.21%	No change		
5	Decrease TFL size by 5%	608,300	250	-5.37%	No change		
6	Increase empirical stand yields 10%	660,400	250	2.74%	No change		
7	Decrease empirical stand yields 10%	616,700	250	-4.06%	No change		
8	Increase managed stand yields 10%	686,700	250	6.83%	No change		
9	Decrease managed stand yield 10%	590,900	250	-8.07%	No change		
10	Increase minimum cutting age 10 yrs	655,100	250	1.91%	No change		
11	Decrease minimum cutting age 10 yrs	626,800	250	-2.49%	No change		
12	Increase VQO constraints one class	609,000	250	-5.26%	No change		
13	Decrease VQO constraints one class	677,100	250	5.34%	No change		
14	Increase greenup delay 10 years	642,800	250	0.00%	No change		
15	Decrease greenup delay 10 years	642,900	250	0.02%	No change		
16	Old Growth Order (LU/BEC targets)	704,900	250	9.66%	No change		
17	No Old Growth constraints	709,700	250	10.41%	No change		
17b	No constraints at all	741,300	250	15.32%	No change		
18	Mean NRV	638,200	250	-0.72%	No change		
19	Maximum NRV	617,600	250	-3.92%	No change		
20	Recommended VQOs	640,600	250	-0.34%	No change		
21	Proposed Mine sites	643,705	250	0.14%	No change		
22	Woodlot Scenario 1	645,500	250	0.42%	No change		
23	Woodlot Scenario 2	647,100	250	0.67%	No change		
24	SIBEC Managed stand yield tables	747,875	250	16.35%	No change		
B1	40% MPB mortality - NDY	700,100	10	8.91%	655,400	50 to 200	1.96%
B2	50% MPB mortality - NDY	685,800	10	6.69%	641,100	50 to 200	-0.26%
B3	80% MPB mortality - NDY	612,250	10	-4.75%	567,550	50 to 200	-11.71%
B4	40% MPB mortality - accelerated	879,300	10	36.79%	653,000	50 to 200	1.59%
B5	50% MPB mortality - accelerated	879,300	10	36.79%	645,400	50 to 200	0.40%
B6	70% MPB mortality - accelerated	879,300	10	36.79%	601,700	50 to 200	-6.39%
B7	80% MPB mortality - accelerated	879,300	10	36.79%	571,500	50 to 200	-11.09%
25	20-year plan scenario	744,000	250	15.76%		No change	

Table 19 Deciduous Harvest Flow Summary

Scenario		Initial Harvest Level			Mid-term Harvest Level		
#	Description	Volume (m3/year)	Duration (decades)	% change From Base Case	Volume (m3/year)	Duration (decades)	% change From Base Case
1	Deciduous Base Case	94,200	250	0.0%	94,200	25	0
2	Maximum 10 year accelerated	143,500	10	52.3%	91,960	50 to 250	-2.4%
3	Maximum 30-year accelerated	116,800	30	24.0%	93,000	50 to 250	-1.3%
4	Increase TFL size by 5%	94,900	250	0.7%	No change		
5	Decrease TFL size by 5%	89,500	250	-5.0%	No change		
6	Increase empirical stand yields 10%	97,200	250	3.2%	No change		
7	Decrease empirical stand yields 10%	91,500	250	-2.9%	No change		
8	Increase managed stand yields 10%	101,700	250	8.0%	No change		
9	Decrease managed stand yield 10%	87,100	250	-7.5%	No change		
10	Increase minimum cutting age 10 yrs	92,500	250	-1.8%	No change		
11	Decrease minimum cutting age 10 yrs	95,300	250	1.2%	No change		
12	Increase VQO constraints one class	93,800	250	-0.4%	No change		
13	Decrease VQO constraints one class	102,000	250	8.3%	No change		
14	Increase greenup delay 10 years	94,500	250	0.3%	No change		
15	Decrease greenup delay 10 years	94,500	250	0.3%	No change		
16	Old Growth Order (LU/BEC targets)	94,000	250	-0.2%	No change		
17	No Old Growth constraints	94,100	250	-0.1%	No change		
17b	No constraints at all	102,430	250	8.7%	No change		
18	Mean NRV	95,000	250	0.8%	No change		
19	Maximum NRV	98,300	250	4.4%	No change		
20	Recommended VQOs	94,700	250	0.5%	No change		
21	Proposed Mine sites	94,265	250	0.1%	No change		
22	Woodlot Scenario 1	94,500	250	0.3%	No change		
23	Woodlot Scenario 2	94,650	250	0.5%	No change		
24	SIBEC Managed stand yield tables	100,900	250	7.1%	No change		
B1	40% MPB mortality - NDY	93,400	250	-0.8%	No change		
B2	50% MPB mortality - NDY	94,300	250	0.1%	No change		
B3	80% MPB mortality - NDY	95,850	250	1.8%	No change		
B4	40% MPB mortality - accelerated	94,200	250	0.0%	No change		
B5	50% MPB mortality - accelerated	95,000	250	0.8%	No change		
B6	70% MPB mortality - accelerated	96,000	250	1.9%	No change		
B7	80% MPB mortality - accelerated	96,400	250	2.3%	No change		
25	20-year plan scenario	101,324	250	7.6%	No change		

9. Conclusion

The Phase II VRI sampling that was completed by Canfor for TFL 48 during the term of management plan #3 has had a very significant impact on what is the sustainable harvest level for the tree farm. The revisions to the inventory information for the TFL have resulted in an improvement in knowledge about the productivity of existing empirical stands. This knowledge has led to a reduction in the amount of area that was previously considered problem forest types or low site, and a corresponding increase in the timber harvesting land base.

This analysis report provides a case that the current AAC apportioned to TFL 48 (i.e. 580,000m^3/year) can be increased 27 percent to the sustainable harvest level of 737,000m^3/year. This AAC would be apportioned 642,800 cubic metres to coniferous leading stands and 94,200 cubic metres to deciduous leading stands. Furthermore, the AAC for the TFL could be increased to 845,300m^3/year (i.e. 744,000m^3 for conifer and 101,300m^3 for deciduous) as indicated by the preferred management scenario. At this level, pending confirmation that SIBEC site quality estimates are reasonable, the harvest level is sustainable, should be sufficiently high-enough (at least in the short-term) to deal with pine mortality from the MPB epidemic, and is at a level that Canfor can effectively process, given the current manufacturing capacity within the Chetwynd sawmill.

Sensitivity analysis shows that upwards and downwards pressures on the harvest flow exist.

Principle downward pressures on the coniferous harvest flow include:

- Uncertainty about the spatial constraints with respect to harvesting within the Dunlevy special management areas.
- Uncertainty about the ability to schedule harvests (eg cutting age) at the optimal economic timing in order to maximize long-term productivity.
- Uncertainty about future land base withdrawals for woodlots, mines and petroleum extraction.
- Recommended VQOs
- Pine mortality from the MPB in excess of 50% of the merchantable pine growing stock

The major upwards pressures on the coniferous harvest flow include:

- Future improvements to stand productivity information through SIBEC and localized SIBEC sampling.
- The short-term opportunity cost of pine mortality if the MPB epidemic is not controlled.
- The ability to support a very significant accelerated harvest with minimal impact on the mid-term harvest forecast.

Downward pressures on the deciduous harvest flow include:

- Uncertainty about the economic lifespan (age) of deciduous stands with respect to utilization.
- Uncertainty about the seral succession of deciduous-mixed wood stands to coniferous-mixedwood.
- Lack of performance on the part of Canfor, LP, Tembec in the utilization of deciduous within the TFL.

- Uncertainty about future land base withdrawls for woodlots, mines and petroleum extraction.

Upward pressures on the deciduous harvest flow include:

- An expansion of the deciduous land base beyond the traditional borders of the Pulpwood Areas.
- The ability to support a significant accelerated harvest level that declines to within two percent of the non-declining level.

10. Discussion

Over the past 20 years, since Canfor obtained the license to harvest within the Chetwynd tree farm, we have witnessed a steady increase in the sustainable harvest forecast for the TFL - from a 1988 initial harvest estimation of 410,000m^3/year, to the current coniferous non-declining harvest flow of 642,800 m^3/year, an increase of 56 percent. There is little doubt that future improvement in inventory productivity information will continue the trend. Whether it be SIBEC, reductions in operational adjustment factors, reduced non-recoverable losses, or improvements in the availability of genetically improved stock types.

That the TFL is at risk to a mountain pine beetle epidemic is evident from current BC-Alberta dialogue, and from the efforts taken over the past two years within the Dawson Creek TSA and TFL48 to control the migration of beetle populations from the west. However, estimations on the intensity of the spread of the beetle across the TFL are just that. Canfor is extremely fortunate to have tenure over a tree farm that has a diversity of merchantable tree species much of which exists in mixed-wood stands. The combination of mixed-forests, isolated mountain valleys, and susceptibility of greater weather extremes may prove to be a blessing. To the extent that the beetle may kill up to 50 percent of the pine, the growing stock within the TFL is resilient enough to maintain the mid-term harvest at near the Base Case harvest level. At the extreme, should the beetle kill 80 percent of the pine volume at risk, then improvements in site productivity will likely off-set any significant mid-term fall-down.

At this point in time, speculation on the severity of a beetle epidemic likely does not justify significant capital expenditure that may be necessary to expand milling capacity of Canfor's Chetwynd sawmill. However, this does not preclude that additional analysis or review of the AAC may be warranted before the term of Management Plan #4 has expired, should the epidemic grow to infestation levels experienced in the B.C. central interior. The non-declining Preferred Management scenario harvest level indicated in this analysis report provides significant opportunity for Canfor to focus additional efforts towards the control of beetle populations and the salvage of dead pine.

A significant short and mid-term threat to the forest health of the TFL will be the continued maintenance of surplus over-mature fibre. This threat extends not just to the pine, but the spruce, balsam and deciduous stands as well. Harvesting at, or even above the Base Case level will maintain this old-growth well into the future. This is, in part, an artifact of managing a THLB that constitutes only 64 percent of the productive forest area. A move to determine a maximum sustainable harvest level for the TFL (through better understanding of site productivity and natural disturbance cycles) is vital to the long-term viability of the tree farm as a predictable source of fibre supply.