TIMBER SUPPLY ANALYSIS

SELKIRK TREE FARM LICENCE 55 (TFL 55)
MANAGEMENT PLAN NO. 4

Prepared for:

Louisiana Pacific
Malakwa, B.C.

Prepared by:

Timberline Forest Inventory Consultants Ltd.
Kelowna, B.C.

Reference: 7051011

February 2006

Timberline
Forest Inventory Consultants

Timberline
Forest Inventory Consultants

February 5, 2006

File: 7051011

Louisiana Pacific
Malakwa Division
4872 Lybarger Road
Malakwa, BC
V0E 2J0

Attention: Fernando Cocciolo, R.P.F.
Area Forest Manager

Reference: ***TFL 55 MP No. 4 Timber Supply Analysis***

Enclosed please find the Management Plan No. 4 Timber Supply Analysis for Tree Farm Licence 55.

Please call if you have any questions or comments related to the document or any other aspect of the analysis.

Yours truly,
TIMBERLINE FOREST INVENTORY CONSULTANTS LTD.

Kelly Sherman, R.P.F.
Resource Analyst

214 - 1884 Spall Road, Kelowna, BC V1Y 4R1
Tel: (250) 762-3191 ▪ Fax: (250) 762-3192
www.timberline.ca

DOCUMENT HISTORY

Revision Number	Description	Submitted Date	Submitted By:
1	Initial Draft	February 14, 2006	Kelly Sherman

EXECUTIVE SUMMARY

Timberline Forest Inventory Consultants Ltd., on behalf of Louisiana Pacific (LP) is preparing a timber supply analysis for the Management Plan (MP) No. 4. Timber supply reviews (TSR) are conducted every five years and assist the B.C. Forest Service's Chief Forester in re-determining the allowable annual cut (AAC). The determination for TFL 55 is scheduled for April 2006.

Key documents supporting the AAC determination are the *Information Package* (Appendix 1), and the timber supply analysis.

The TFL was split into two areas in 1993, with an AAC of 110,000 m^3 attributed to TFL 55. In 1996, the AAC was reduced to 100,000 m^3 and in 2001 it was further reduced to 90,000 m^3. In preparation for MP No. 4, LP conducted several key projects to improve the datasets used for this timber supply analysis, specifically:

1. Completed Phase 1 and Phase 2 vegetation resource inventory (VRI);
2. Mapped ecosystems using predictive ecosystem mapping (PEM) and completed an accuracy assessment as required for use in TSR; and
3. A site index adjustment (SIA) project was completed to improve the accuracy of the site indices for managed stands; and
4. Revised operability mapping.

This document presents the results of the timber supply analysis conducted in support of MP No. 4. A Basecase analysis was prepared using the most current data sources and management assumptions based on current practice. The retention requirements for caribou and the landscape level bodiversity requirements have been modelled as required in the *Revelstoke Higher Level Plan Order*. These inputs are documented in the *Information Package*. The MP No. 4 Basecase included several improvements in addition to the four key projects, which are:

- Natural disturbances in the non-timber harvesting land base (nonTHLB);
- Spatial adjacency is in effect for 30 years in lieu of IRM requirements; and
- Implementation of genetic gains to managed stand yields.

The Basecase initial harvest level was set at 100,000m^3 for 40 years, then stepping down to 81,000m^3 long term harvest level. This compares to the previous MP No.3 long term harvest level of 64,410m^3 as seen in the following figure.

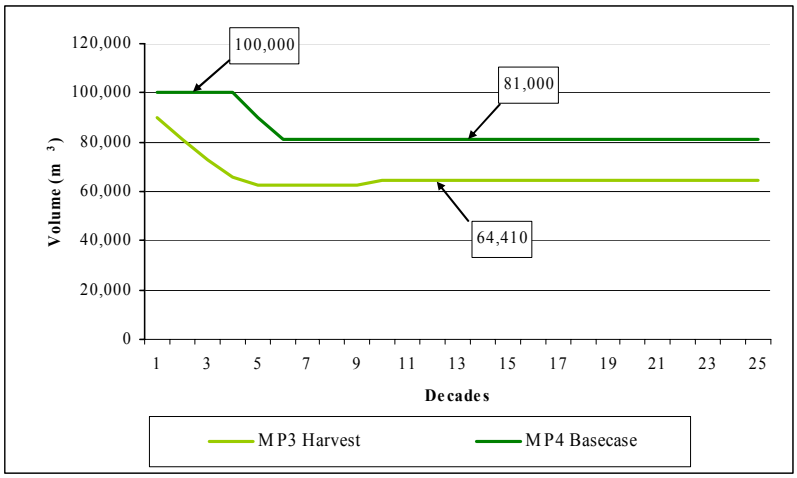

Figure 1 Basecase Harvest Level – MP No. 3 versus MP No. 4

The Basecase for this analysis shows a very robust short term timber supply that is being consumed over the first 50 years. After 50 years the first rotation is largely complete and the majority of the harvest is sourced from managed stands. Figure 2 shows the amount of timber that is available for harvest at each period.

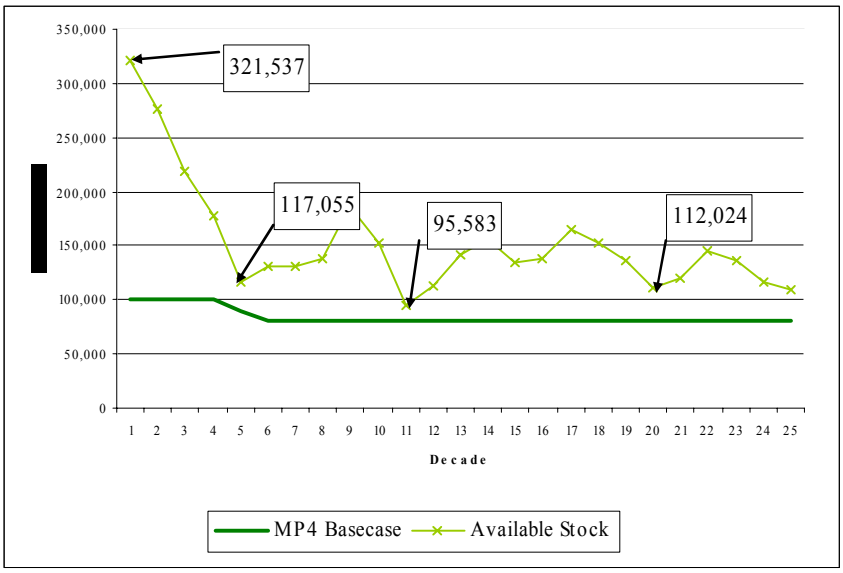

Figure 2 Basecase Harvest Level and Available Timber

A series of 24 sensitivity analyses were conducted to explore the risk associated with various sources of uncertainty in the modelling assumptions and data. These issues can be grouped into four categories, namely:

1. Landbase;
2. Operability;
3. Growth and yield; and
4. Biodiversity.

The sensitivity issues were assessed based on the degree to which they influence harvest levels positively or negatively. From the sensitivity analyses performed, the key factors affecting timber supply availability are:

- Productivity adjustments (no SIA);
- Alternate operability classification;
- Alternate retention requirements for caribou; and
- Phase 2 VRI adjustment.

The timber supply impact for each of these sensitivities is shown in Figure 3 and Table1.

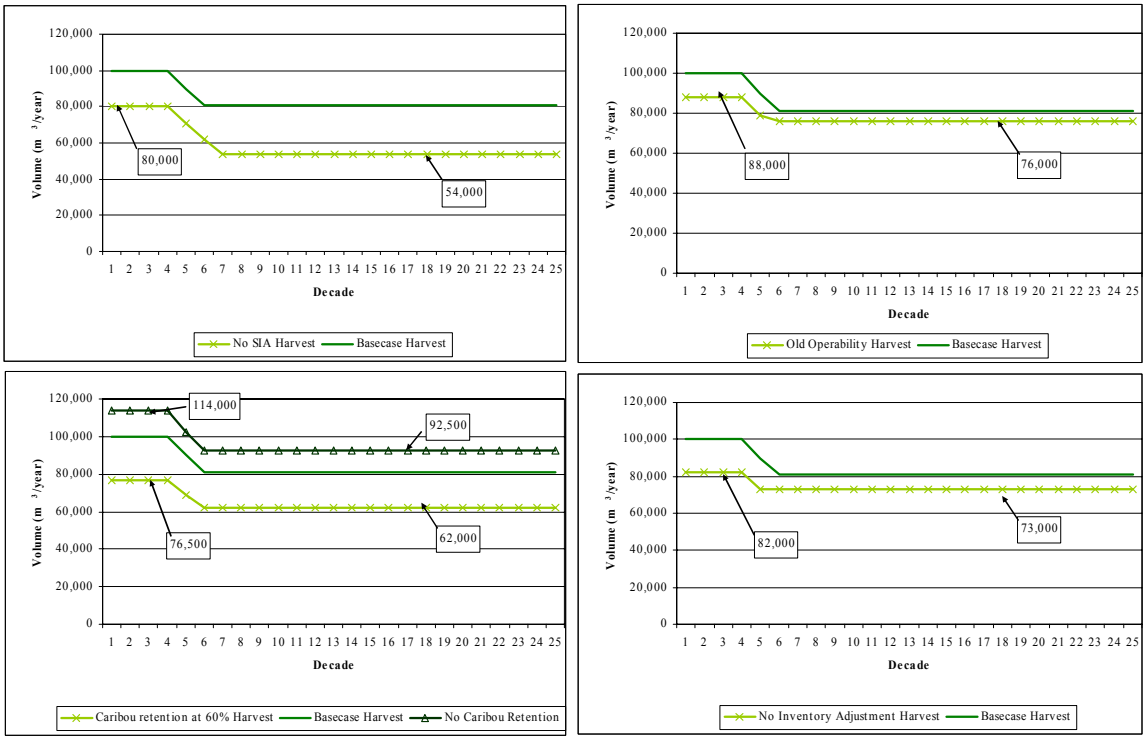

Figure 3 Timber Supply Impact of key Sensitivities

Table 1 Percentage Change in Timber Supply of Key Sensitivities

Sensitivity	Change in Timber Supply from Basecase (%)		
	Short term	Mid term	Long term
No SIA	-20%	-34%	-34%
MP3 Operability	-10%	-12%	-12%
Caribou retention at 60%	-24%	-23%	-23%
No caribou retention	14%	14%	14%
No Inventory Adjustment	-18%	-10%	-10%

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

Timberline Forest Inventory Consultants Ltd., on behalf of Louisiana Pacific (LP) has prepared a timber supply analysis for the Management Plan 4 (MP No. 4) of TFL 55. It is to be used as by the Chief Forester to help determine the Annual Allowable Cut (AAC). For TFL 55 this is scheduled for completion April 2006. Licensees are required to re-evaluate timber supply every five years.

Timber supply analysis involves three main steps:

1. Collection and preparation of information and data. This information has been documented in the *Information Package* (Appendix 1), which was reviewed by MoF Forest Analysis Branch, November, 2005;

2. Using the data in Timberline's CASH simulation model (version 6.2l) to develop harvest forecasts and complete sensitivity analyses; and

3. Interpretation and reporting of results.

Timber supply analysis uses a forest-level simulation model (CASH), which predicts the development of a forest over a 250-year planning horizon. The model uses a description of initial forest conditions, expected patterns of growth and regeneration, harvest flow criteria and other non-timber management assumptions.

LP has conducted several key projects to improve the datasets used for MP No. 4, some improvements include the following:

- Vegetation Resource Inventory (complete Phase 1 and Phase 2);
- Ecosystem based analysis units;
- Improved managed stand productivity estimate through SIA;
- Natural disturbances in the non -THLB;
- Spatial adjacency is in effect for 30 years in lieu of IRM requirements;
- Implementation of the *Revelstoke Higher Level Plan Order* for caribou and seral requirements;
- Implementation of genetic gains to managed stand yields; and
- Revised Operability Mapping.

Input assumptions and alternative scenarios were tested via multiple sensitivity analysis. In each of these, one variable was altered to see the timber supply and timber availability impacts. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results and allow better understanding and comfort with the analysis and its inputs.

This document presents the results of the timber supply analysis conducted in support of MP No. 4.

2.0 GENERAL DESCRIPTION OF LANDBASE AND TENURE

TFL 55 is located in the south-eastern corner of British Columbia and is in the Revelstoke TSA. It is part of the Columbia Forest District and is administered from the LP Malakwa Division. The total area of TFL 55 is approximately 92,706 hectares, of which approximately 40% is non-productive/non-forested. Figure 2.1 provides an overview map of the Revelstoke TSA showing TFL 55.

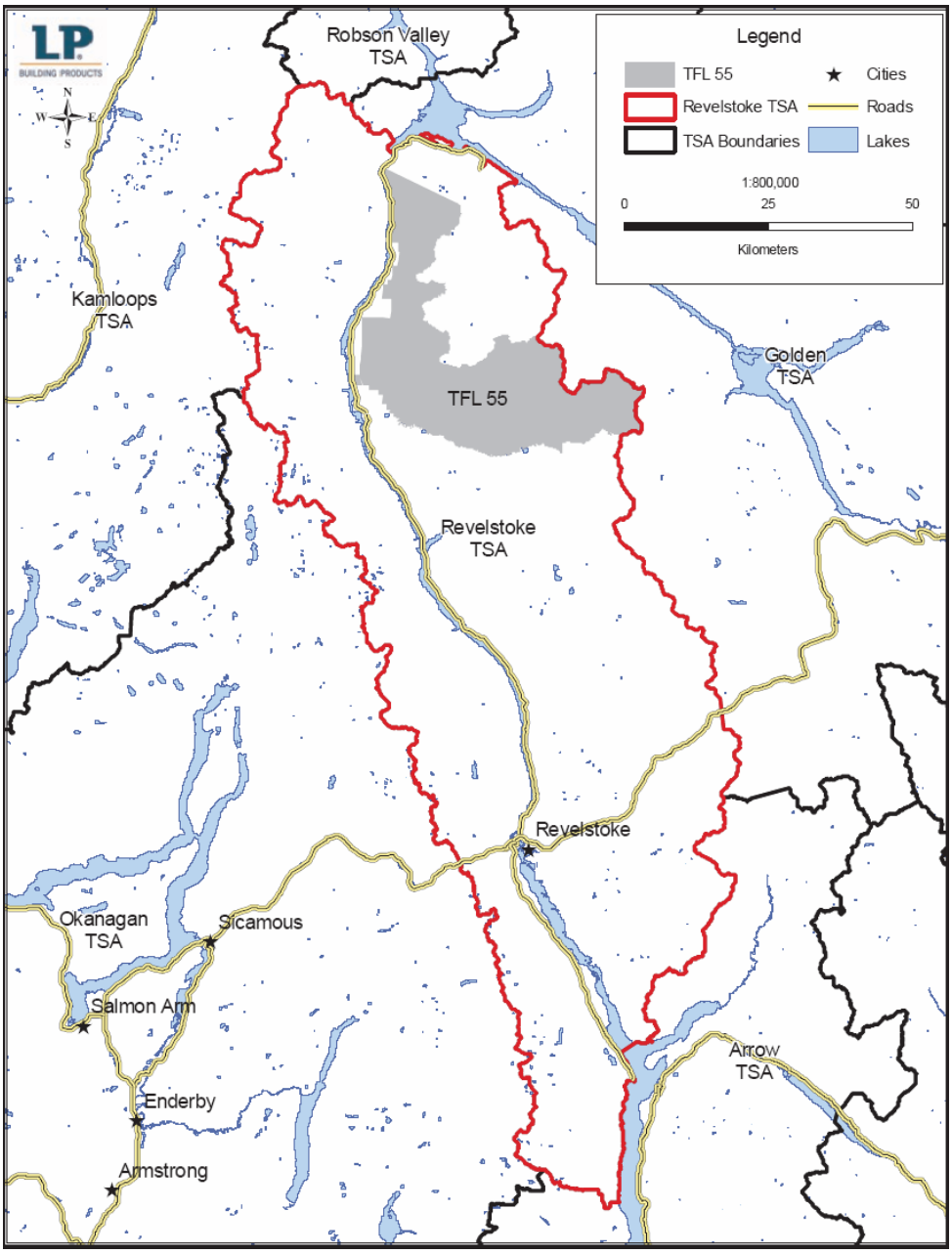

Figure 2.1 Overview of the Revelstoke TSA

3.0 TIMBER FLOW OBJECTIVES

Forest cover objectives and the biological capacity of the net THLB will dictate the harvest level. There are however, a number of alternative harvest flows possible as many management objectives must be met.

In this analysis, the proposed harvest flow reflects a balance of the following objectives:

- Maintain or increase an initial harvest level of 90,000m^3/year for as long as possible;
- Decrease the periodic harvest rate in no greater than 10% steps when declines are required to meet all objectives associated with the various resources on the landbase; and
- Achieve an even-flow long term supply over a 250-year time horizon.

4.0 LANDBASE INFORMATION

A complete description of the data sources and assumptions used as the basis for TFL 55 timber supply analysis is contained in the *Timber Supply Analysis Information Package*. This document is included in this analysis in Appendix 1.

4.1 LANDBASE CLASSIFICATION

Information on the landbase was mainly sourced from the Vegetation Resources Inventory (VRI). Land is classified based on four broad criteria:

- It is unproductive for forest management purposes;
- It is inoperable under the assumptions of the analysis;
- It is unavailable for harvest for other reasons (*eg*. wildlife habitat or recreation); or
- It is available for integrated use (including harvesting).

The results of the landbase classification are presented in Figure 4.1 and Figure 4.2.

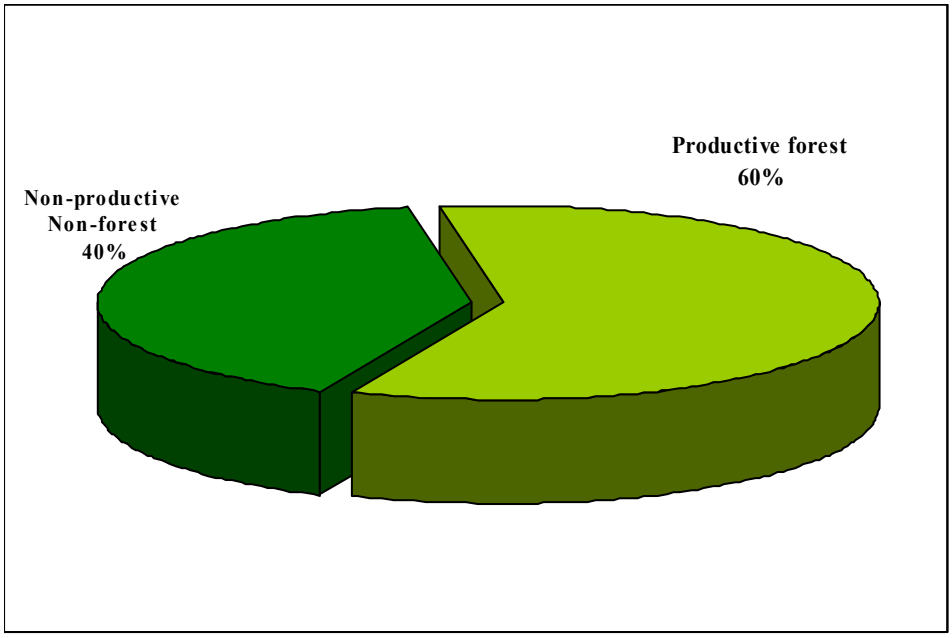

Figure 4.1 Distribution of Total TFL Area (92,706 ha)

The THLB consists of all of the productive land expected to be available for harvest over the long term. This landbase is determined by reclassifying the total productive landbase according to specified landbase classification criteria. The un-harvestable component includes exclusions such as low site removals and deciduous leading types. Figure 4.2 provides a graphic representation of the landbase reductions for TFL 55.

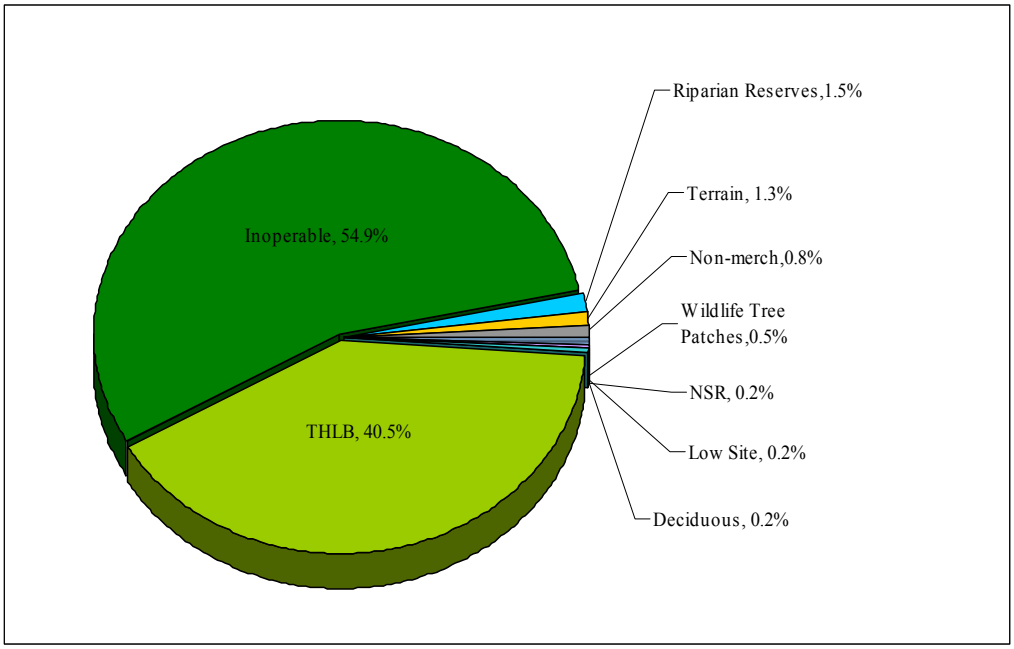

Figure 4.2 Distribution of Productive Area (55,103 ha)

4.2 FOREST INVENTORY

An ecological inventory using predictive ecosystem mapping (PEM) was recently completed which provides information on the range of biogeoclimatic ecological classification (BEC) units that occur within TFL 55. Figure 4.3 summarises the distribution of productive area by BEC zone. Note that in Figure 4.3, the sum of Productive non-THLB Area and THLB Area is Total Productive Area.

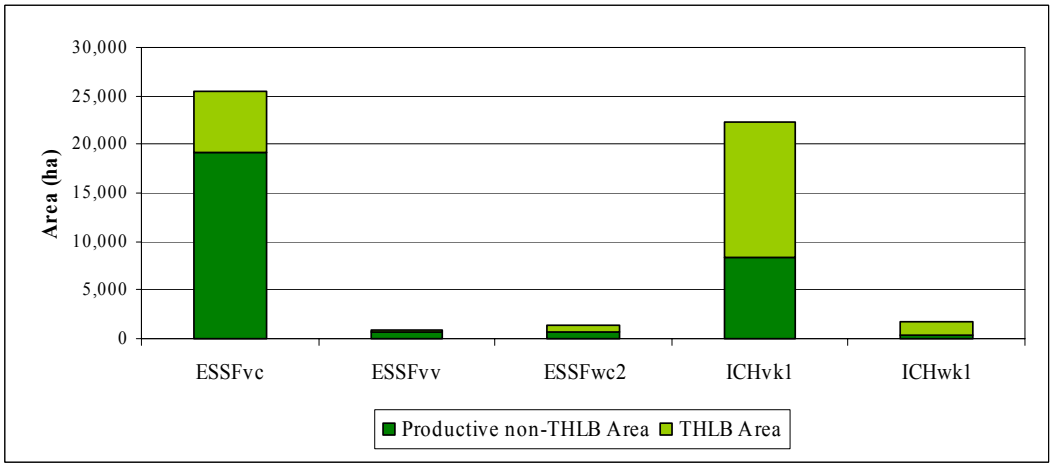

Figure 4.3 Distribution of Productive Area by BEC Zone

Forest stands are generally categorized by leading species. The distribution of THLB by leading species is shown in Figure 4.4.

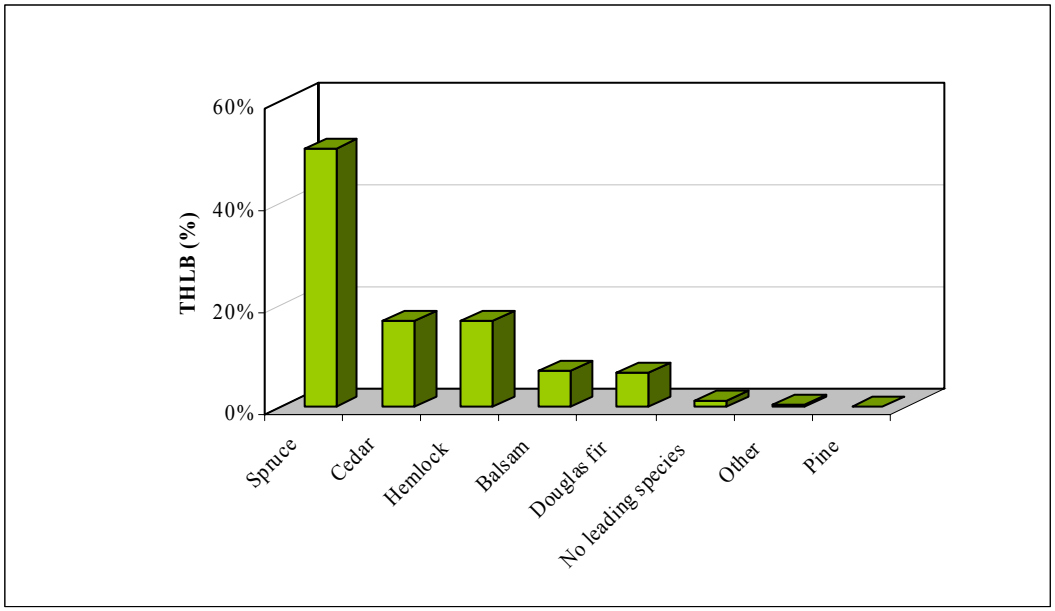

Figure 4.4 Distribution of THLB area by species

4.3 INVENTORY AGGREGATION

Stands are aggregated for many purposes as part of the modelling process for purposes such as similar growth patterns or management considerations.

4.3.1 Landscape Units

TFL 55 has two dominant landscape units: r5 and r17. The areas for these landscape units are shown in Table 4.1. In the timber supply analysis, many cover requirements must be met within the boundaries of these landscape units.

Table 4.1 Area of Landscape Units in TFL 55 (ha)

Landscape Unit	Gross Area	Productive Area	THLB Area
r5	58,281	29,602	8,834
r17	34,268	25,499	13,506

4.3.2 Resource Management Zones

The landbase has also been segregated into resource management zones (RMZs) to facilitate the application of management criteria. Each RMZ has a resource management objective (RMO) with respect to caribou, biodiversity, and grizzly bear as established in the *Revelstoke Higher Level Plan Order*. The key RMZs with a significant timber supply impact on TFL 55 are caribou management zones. The caribou zones are separated by BEC and the 1994 operability coverage. The caribou zones above the 1994 operability line have a small percentage of THLB. This is relevant because the non-THLB can contribute significantly to fulfilling the management requirements for each caribou zone. A summary of the area in each zone is shown in Table 4.2 below.

Table 4.2 Summary of Area by Caribou Zone

BEC zone	Operability	Ageclass	Area in Zone (ha)	
			Total Area	THLB Area
ESSF	Above	>= 8	5,542	285
ICH	Above	>= 8	2,533	918
ESSF	Below	>= 8, 9	5,561	5,201
ICH	Below	>= 8, 9	7,955	7,599

4.3.3 Analysis Units

For MP No. 4 the BEC system (using PEM) was used to group stands into ecologically-based groups. The inventory has been assembled and aggregated into analysis units on the basis of BEC variant, site series and leading species. For a more complete description of analysis unit classification and area see the attached *Information Package* (Appendix 1).

4.4 GROWTH AND YIELD

Forest growth and yield refers to the prediction of the growth and development of individual stands over time. Stand growth in terms of height, diameter and volume is tracked over time through the use of yield projection tables. Preparation of the yield tables fall into the following two categories:

- Natural stands; and
- Managed stands.

4.4.1 Natural Stands

All stands over the age of 30 years were classified as natural stands. Natural stand yield tables (NSYTs) for the timber supply analysis were developed using the batch version of the Ministry of Forests (MoF) program *VDYP* (Version 6.6d).

4.4.2 Managed Stands

All stands less than or equal to age 30 were classified as managed stands. Managed stand yield tables (MSYTs) were modeled using *BatchTIPSY* (Version 3.0a). These stands have been managed since establishment and include both natural and artificially regenerated sites. Separate MSTYs were developed for existing and future managed stands. Genetic gain factors were included in these future MSTYs but not in the existing managed.

4.4.3 Productivity

The rate at which a stand grows is a factor of the site productivity and is measured using site index. Site index for natural stands was derived from the VRI. Site index for managed stands was estimated using Site Index Adjustment (SIA) productivity estimates. Figure 4.5 shows the distribution of productive area by broad site productivity classification using SIA. The Basecase uses SIA for existing managed and future managed stands.

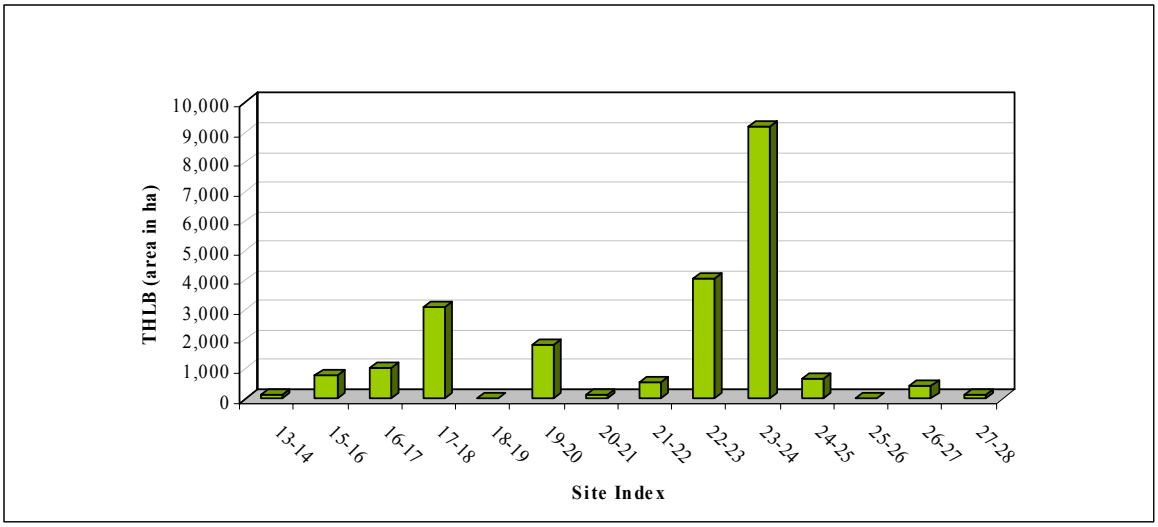

Figure 4.5 Distribution of THLB by Site Index Class using SIA

5.0 TIMBER SUPPLY ANALYSIS METHODS

Timberline's proprietary simulation model CASH6 (**C**ritical **A**nalysis by **S**imulation of **H**arvesting), Version 6.2l was used to develop spatial harvest schedules in the TFL 55 timber supply analysis.

This model uses an aspatial and spatial geographic approach to landbase and inventory definition in order to adhere as closely as possible to the intent of forest cover requirements on harvesting. CASH6 can simulate the imposition of overlapping forest cover objectives on timber harvesting and resultant forest development. These objectives are addressed by placing restrictions on the distribution of age classes, defining maximum or minimum limits on the amount of area in young and old age classes found in specified components of the forest. For the purposes of this analysis objectives are of two types:

1. Disturbance (green-up)
The disturbance category is defined as the total area below a specified green-up height or age. This disturbed area is to be maintained below a specified maximum percent. The effect is to ensure that at no time will harvesting cause the disturbed area to exceed this maximum percent. This category is typically used to model adjacency, visual, wildlife or hydrological green-up requirements in resource emphasis areas, and early seral stage requirements at the landscape unit level.

2. Retention (old growth)
The retention category is defined as the total area above a specified age. This retention area is to be maintained above a specified minimum percent. The effect is to ensure that at no time will harvesting cause the retention area to drop below this minimum percent. This category is typically used to model thermal cover and/or old growth requirements in wildlife management resource emphasis areas, and mature and old growth seral stage requirements at the landscape unit level.

The model projects the development of a forest, allowing the analyst to impose different harvesting/silviculture strategies on its development, in order to determine the impact of each strategy on long term resource management objectives. CASH6 was used to determine harvest schedules that incorporate all integrated resource management considerations including spatial feasibility factors, for example, silviculture block green-up.

In these analyses, timber availability is forecasted in decadal time steps (periods). The main output from each analysis is a projection of the amount of future growing stock, given a set of growth and yield assumptions, and planned levels of harvest and silviculture activities. Growing stock is characterized in terms of operable volume (total volume on the timber harvesting landbase), merchantable volume (operable volume above minimum harvest age), and available volume (maximum merchantable volume that could be harvested in a given decade without violating forest cover constraints).

A 250-year time horizon was employed in these analyses, to ensure that short and medium term harvest targets do not compromise long term growing stock stability. Also, modelled harvest levels included allowances for non-recoverable losses (NRLs). Harvest figures reported here exclude this amount unless otherwise stated.

Unless otherwise stated in the timber supply forecasts that follow, the decadal rate of decline was limited to 10%, and the mid term harvest level was not permitted to drop below a level reflecting the basic productive capacity of the landbase. The long term steady harvest level will always be slightly below the theoretical long term level, attainable only if all stands are harvested at the age when mean annual increment (MAI) maximizes.

5.1 INTERPRETING TIMBER AVAILABILITY

Harvest flow has been the traditional indicator used to evaluate timber supply impacts of various management scenarios however this may not reveal the complete timber supply picture. Another useful indicator is timber availability which is the total volume of merchantable timber that could be harvested in any given period without violating any forest cover requirements. In general, the periods with the least amount of timber available control the resulting harvest flow.

When comparing management scenarios using timber availability profiles the same harvest request is used in both scenarios. In doing so, the differences in the timber availability profiles can be entirely attributed to differences in the management assumptions and not clouded by differences in the modelled harvest. Generally this harvest flow request is the Basecase harvest flow unless otherwise specified.

6.0 TIMBER SUPPLY ANALYSIS

This section presents the Basecase harvest flow profile established through analysis of timber supply. In addition, sensitivity analyses that address the issues identified as having significant uncertainty associated with them are also presented. Six sensitivity issues were tested as listed in Table 6.1.

Table 6.1 Sensitivity Analysis Outline

Issue	Sensitivity Test	Section
Landbase	Timber harvesting landbase +5%	7.1
	Timber harvesting landbase -5%	7.1
Growth and Yield	Old operability	7.2
	Natural stand yields +10%	7.3
	Natural stand yields -10%	7.3
	Managed stand yields + 10%	7.4
	Managed stand yields -10%	7.4
	Minimum harvest ages +10 years	7.5
	Minimum harvest ages -10 years	7.5
	Regeneration delays +5 years	7.6
	Turn off genetic gains	7.7
	No SIA	7.8
	Managed Stand SI +1 meter	7.9
	Managed Stand SI -1 meter	7.9
	VRI Inventory Adjustment	7.10
Resource Management	Turn off adjacency and turn on IRM	7.11
	Green-up Heights +1 meter	7.12
	Green-up Heights -1 meter	7.12
	Caribou retention at 60%	7.13
	No caribou retention	7.14
	Hemlock Merchantability at 60%	7.15
Biodiversity	Landscape Level Biodiversity	7.16
	Turn of disturbances in non-THLB	7.17
Harvest Rules	Relative Oldest First	7.18
	Maximize Volume Harvested	7.18
	Prioritize Douglas-fir and Cedar Harvest	7.19
Alternative harvest levels	Maximum Non declining Yield	7.20
	Maximum 10 year Harvest	7.20
	90,000m^3 as Long as Possible	7.20

6.1 BASECASE

The Basecase analysis was prepared using CASH6. The analysis reflects current management performance and will incorporate the following:

- Vegetation Resource Inventory (complete Phase 1 and Phase 2);
- Revised operability;
- Ecosystem based analysis units;

- Improved managed stand productivity estimate through SIA;
- Natural disturbances in the non -THLB;
- Spatial adjacency is in effect for 30 years in lieu of IRM requirements;
- Implementation of the *Revelstoke Higher Level Plan Order* for Caribou and Seral requirements; and
- Implementation of genetic gains to managed stand yields.

Results are dependent on the harvest flow criteria established for the analysis. For the purposes of this analysis, the following harvest flow objectives were established:

- An initial harvest level of 100,000 cubic meters per year;
- Decrease the periodic harvest rate in acceptable steps (<=10%) when declines are required to meet all objectives associated with the various resources on the landbase;
- Achieve an even-flow long term supply over a 250-year time horizon.

The results of the Basecase and its respective attendant timber flows projected for the 250-year time horizon are presented in Table 6.2 and Figure 6.1. All harvest level figures are net of NRLs (1,500m^3/year).

Table 6.2 Net harvest levels- Basecase

Decade	Annual Harvest (m^3)	
	MP NO. 3 Harvest	MP NO. 4 Basecase
1	90,000	100,000
2	81,000	100,000
3	72,900	100,000
4	65,610	100,000
5	62,460	90,000
6	62,460	81,000
7	62,460	81,000
8	62,460	81,000
9	62,460	81,000
10	64,410	81,000
11	64,410	81,000
12	64,410	81,000
13	64,410	81,000
14	64,410	81,000
15	64,410	81,000
16	64,410	81,000
17	64,410	81,000
18	64,410	81,000
19	64,410	81,000
20	64,410	81,000
21	64,410	81,000
22	64,410	81,000
23	64,410	81,000
24	64,410	81,000
25	64,410	81,000

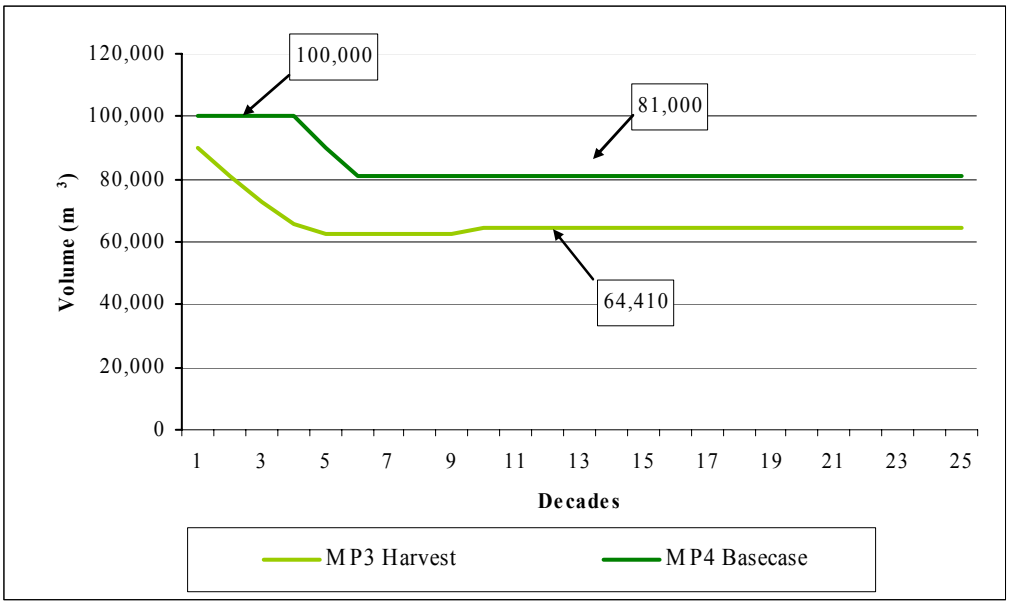

Figure 6.1 Net harvest levels- Basecase

The initial harvest level is set at 100,000 cubic meters per year, and is maintained for four decades before dropping to 81,000m^3. This is approximately 63% of the theoretical long term level (129,375m^3) based on maximizing MAI (LRSY).

Differences between the long term and theoretical levels result from three factors:

- Allowance for NRLs of 1500m^3/year;
- Allowance for wildlife tree patches; and
- Conflicting forest cover and harvest scheduling objectives.

Figure 6.2 displays the 250-year growing stock (inventory) profile associated with the Basecase. Availability values shown on the graph have not had NRLs removed. There are three major pinch-points shown in the Basecase; period 5 at 117,055m^3/year, period 11 at 95,583m^3/year and period 20 at 112,024m^3/year.

Short and mid-term harvest levels are largely dictated by the availability of harvestable regenerating stands. Short and mid-term timber supplies are significantly affected by any changes to inventory information, growth and yield expectations, silviculture treatment scenarios or forest cover requirements.

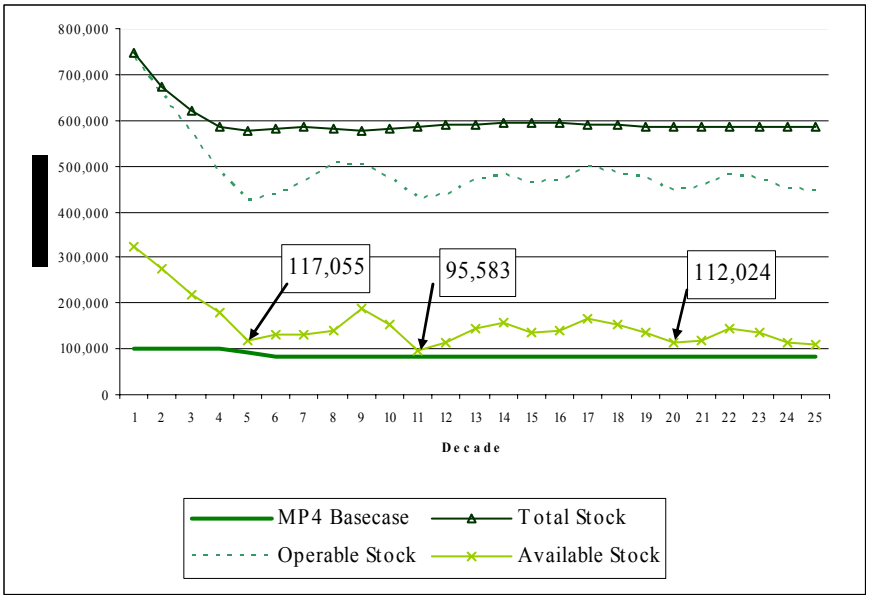

Figure 6.2 Growing Stock Profile- Basecase

6.1.1 Harvest Trends

Figure 6.3 shows the sources of timber for the gross harvest over the entire 250-year time horizon. For the first 50 years most of the harvest comes from the existing mature forest. In decade 6, there is a swift transition from the harvesting natural stands to harvesting managed, or second growth forest. This is initially in existing managed and moves in the space of 30 - 40 years to future managed. From 60 years onwards there are minimal amounts of natural timber harvested with just a small volume in decades 12 and 14.

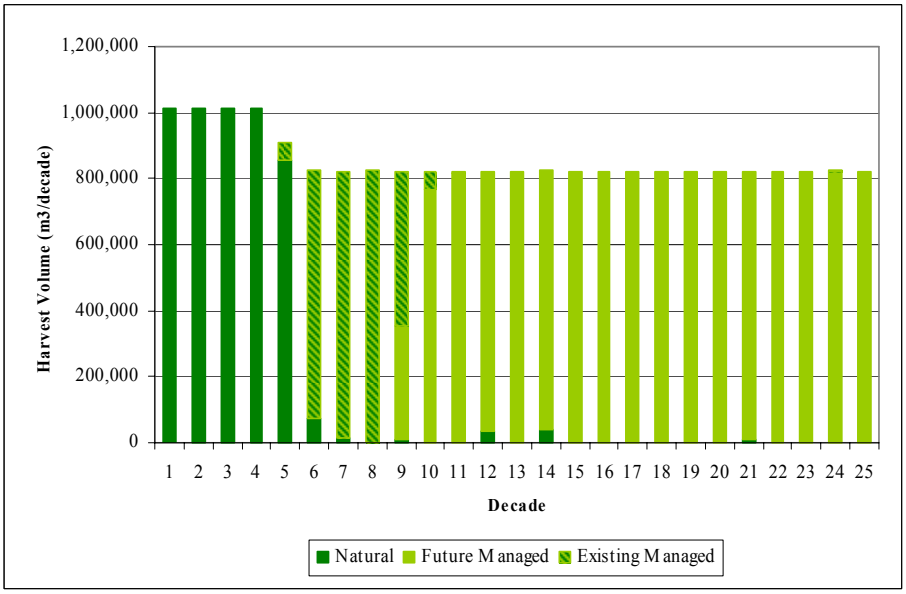

Figure 6.3 Timber Supply Sources – Basecase

Figures 6.4 through 6.6 show harvested area, average volume harvested per hectare and average harvested age for the Basecase.

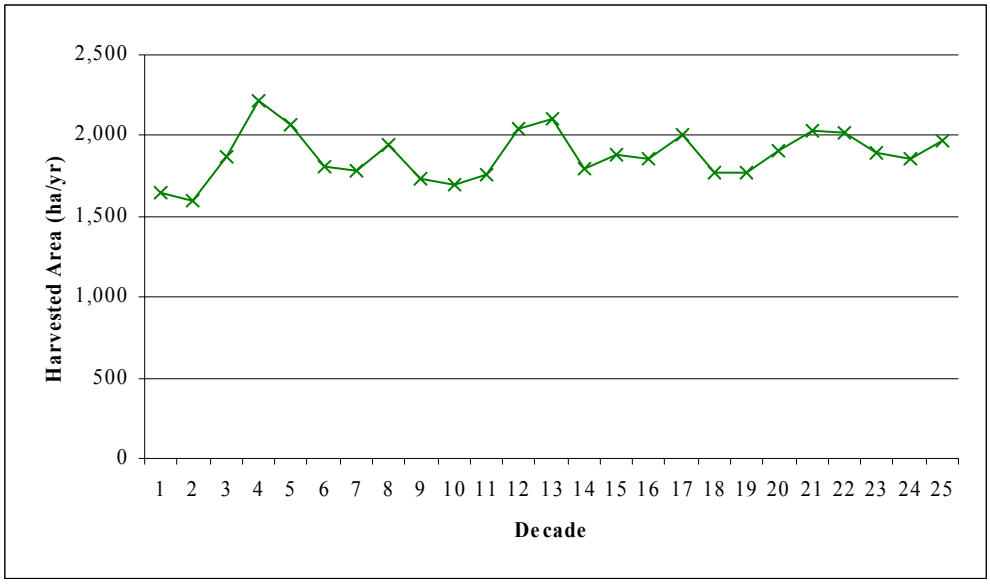

Figure 6.4 Harvested Area – Basecase

As seen in Figure 6.4, the volume per hectare is fairly variable. Each spike or dip in harvested area corresponds to an opposite rise or fall in average volume per hectare. This is shown in Figure 6.5 and the inverse relationship between the two variables can be seen by comparing the two graphs.

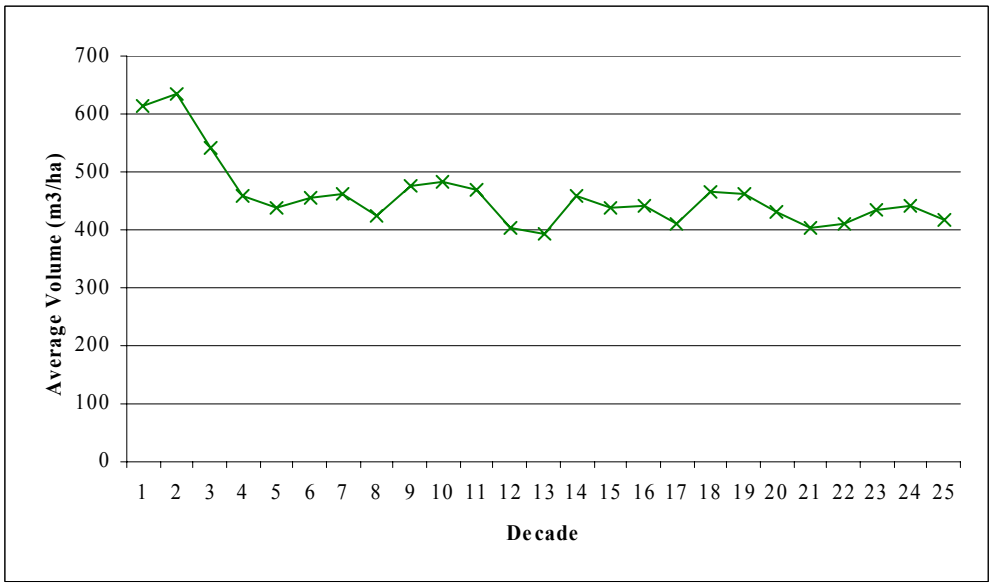

Figure 6.5 Average Harvested Volume per Hectare – Basecase

The average age harvested drops off sharply with the transition from natural to managed harvest and shows an overall downwards trend (Figure 6.6).

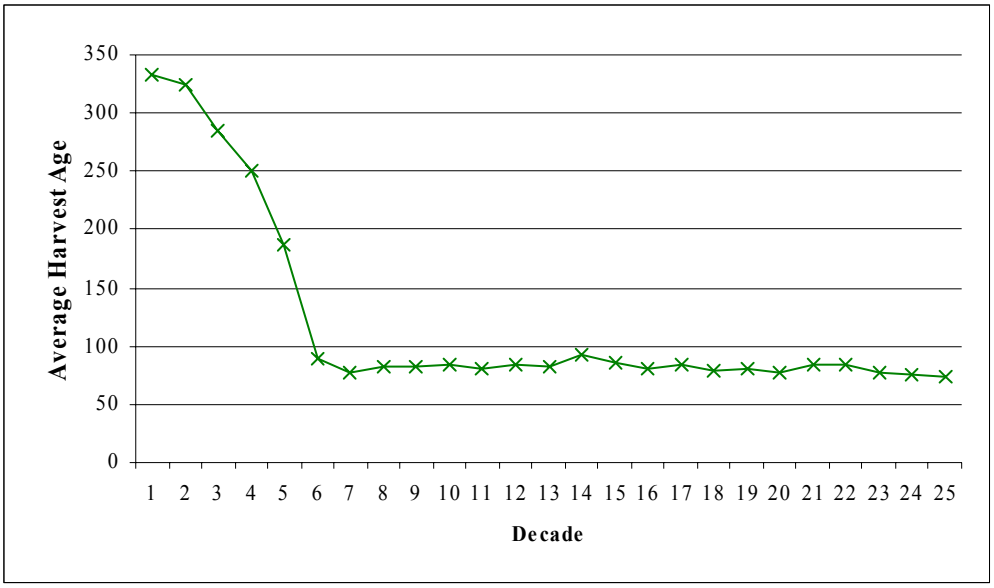

Figure 6.6 Average Harvested Age– Basecase

6.1.2 Ageclass Distribution

Figure 6.7 show the changes in forest structure over time. Each figure indicates the residual structure of TFL 55 and the area harvested.

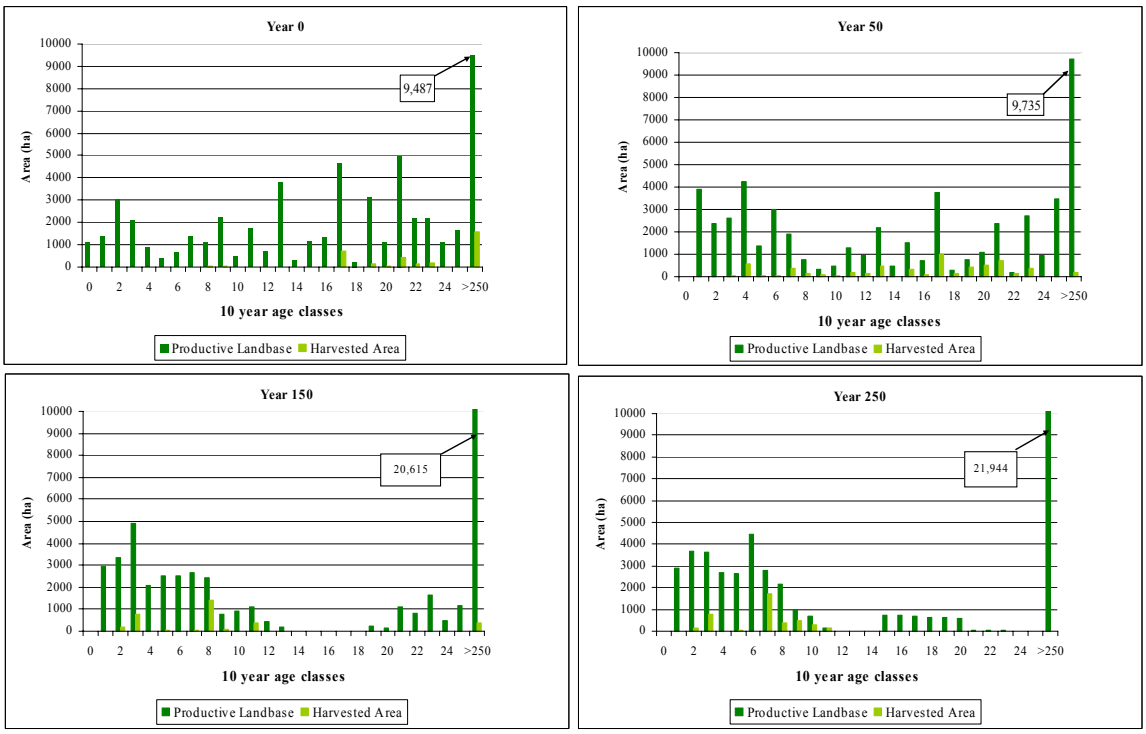

Figure 6.7 Age Class Distribution over Time – Basecase

While the harvestable old growth inevitably declines in the future, the total productive area greater than age 250 increases steadily over time, reaching just under 10,000 hectares by the end of period 5 and just under 22,000 hectares by the end of period 25.

6.1.3 Long Run Sustainable Yield (LRSY)

The long term harvest level is driven by the productive capacity of the harvestable landbase. The theoretical capacity is measured by the average maximum annual increment (MAI) for second growth managed stands. The calculations for the Basecase are shown in Table 6.3 and Table 6.4 for both natural and managed stands.

Table 6.3 Natural and Managed Forest LRSY

AU	THLB Area (hectares)			CMAI		LRSY	
	Natural	Managed	Total	Natural	Managed	Natural	Managed
1	156	70	227	3.88	7.33	879	1,660
2	96	17	113	3.31	8.01	373	903
3	102	4	106	2.70	6.34	286	671
4	225	30	255	2.85	5.61	726	1,431
5	55	86	140	4.54	5.95	637	835
6	98	2	100	3.43	7.26	343	726
7	109	38	147	2.47	7.09	363	1,039
8	25	200	225	3.27	7.37	736	1,658
9	535	75	610	3.23	6.39	1,971	3,895
10	256	88	344	3.66	6.55	1,258	2,255
11	645	701	1,346	2.89	6.11	3,891	8,229
12	1,549	174	1,723	3.15	5.98	5,427	10,294
13	346	316	662	2.85	6.01	1,884	3,980
14	1,135	23	1,158	2.38	6.21	2,756	7,194
15	1,509	2,601	4,110	2.61	6.35	10,726	26,097
16	1,863	256	2,119	3.57	6.76	7,558	14,319
17	1,605	244	1,850	2.55	6.38	4,716	11,791
18	411	149	560	2.38	5.16	1,332	2,890
19	190	24	215	2.45	5.13	526	1,101
20	855	83	938	1.89	4.71	1,769	4,420
21	92	37	128	3.19	4.58	409	588
22	418	30	449	2.34	4.11	1,049	1,845
23	2,492	1,198	3,690	2.15	4.66	7,948	17,179
24	122	25	146	1.85	2.67	271	391
25	780	199	979	2.01	4.07	1,966	3,986
Totals	15,671	6,668	22,339	2.68	5.79	59,802	129,375

LRSY is calculated for each analysis unit by multiplying CMAI by the total hectares in that analysis unit. To get the total LRSY for TFL 55, each analysis unit LRSY was summed.

Table 6.4 Theoretical Gross Maximum Harvest Level LRSY

THLB Area (ha)	Natural		Managed	
	Average CMAI	LRSY (m^3/yr)	Average CMAI	LRSY (m^3/yr)
22,339	2.68	59,802	5.79	129,375

The theoretical LRSY for natural stand is approximately 60,000m^3/year. This is 40% less than the Basecase short term harvest level of 100,000m^3/year. This indicates that the short term harvest is well above the productive capacity of the natural stands in TFL 55. This theoretical over harvest is done in anticipation that the harvest level will be sustained by the higher yields of the future managed stands.

The managed stand LRSY is approximately 130,000m^3/year. This is 2.16 times greater than the natural stand LRSY. The managed LRSY is also 41% greater than the Basecase long term harvest level of 81,000m^3/year. The difference indicates that the full productive capacity of the managed stands is not being captured. This can be attributed to management objectives that do not allow stands to be harvested at the MAI culmination age. Sensitivity issues that can affect the Basecase harvest flow are explored in the next section.

Figure 6.8 presents the Basecase harvest flow along with natural and managed LRSY.

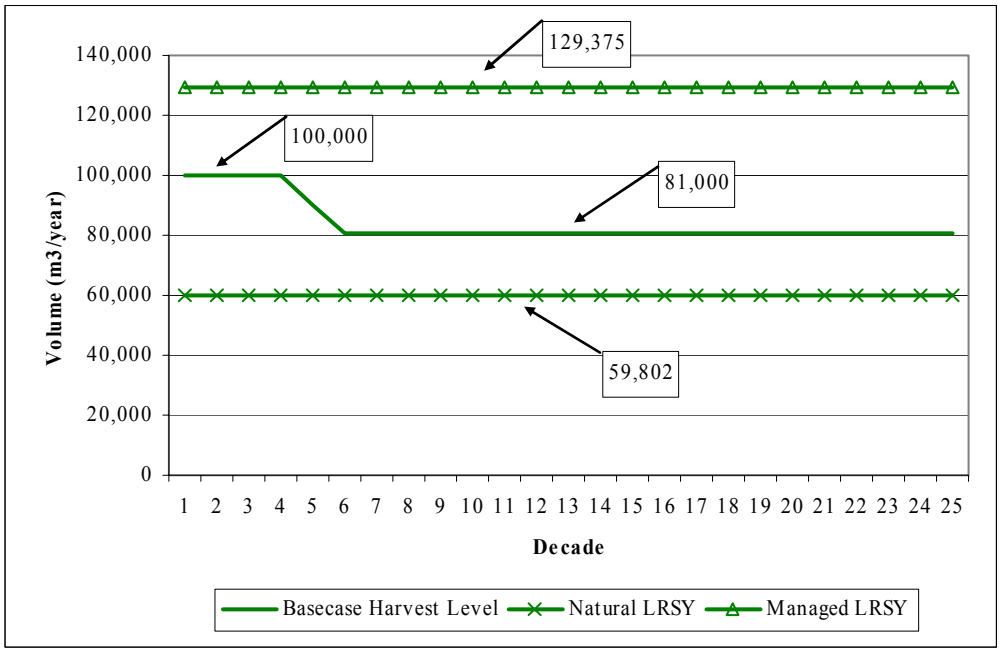

Figure 6.8 Basecase Harvest Flow and LRSY

7.0 SENSITIVITY ANALYSIS

Sensitivity analysis provides a measure of the upper and lower bounds of the Basecase harvest forecast and reflects the uncertainty of assumptions made in the Basecase. The magnitude of the change in the sensitivity variable(s) reflects the degree of uncertainty surrounding the assumption associated with that variable. By developing and testing a number of sensitivity issues, it is possible to determine which variables most affect results. This in turn facilitates the management decisions that must be made in the face of uncertainty.

To allow meaningful comparison between sensitivity analyses, each sensitivity is built on the Basecase with only the evaluated assumption being altered. All other assumptions remain unchanged. In each analysis, the changes in availability were first assessed, using the Basecase harvest level, and imposing the alternative assumption to be tested. Based on the changes in availability, a new harvest level was sought, adhering to the flow policy described earlier in section 3.0.

Sensitivity issues and their corresponding sections are summarized in Table 6.1. The timber supply impacts are illustrated in Sections 7.1 through 7.20 and a summary of the results is shown in Table 8.1. Unless otherwise stated, short term is defined as from periods 1 - 4, the mid term is from periods 5 - 12 and the long term is from periods 13 - 25.

7.1 TIMBER HARVESTING LANDBASE ±5%

This option tested the sensitivity around the inclusion and exclusion of 5% THLB. Area was shifted between the non-contributing landbase (non-THLB productive) and the contributing (THLB) to simulate changes in operable landbase definition.

In the case of THLB +5%, this is modelled by increasing the area of each THLB polygon by 5% and decreasing each productive non-THLB polygon appropriately (by 3.4%) so that the total productive landbase remains constant. The opposite applies for THLB -5% and Table 7.1 shows the flux of area between contributing and non-contributing landbase.

Table 7.1 Summary of Area Shift between THLB and Non-THLB Productive Landbase

Area	Basecase	THLB +5%	THLB -5%
THLB (ha)	22,341	23,458	21,224
Non-THLB Productive (ha)	32,762	31,645	33,879
Total Productive Area (ha)	55,103	55,103	55,103
Area shift (ha)	-	1,117	-1,117
% change THLB area	-	5.0%	-5.0%
% change non-THLB productive	-	3.4%	-3.4%

The impact of increasing the THLB 5% is an overall harvest level increase of 4% as can be seen in Table 7.2 and Figure 7.1. The impact of decreasing the THLB by 5% is an overall decrease of 12%. Figure 7.2 shows the available timber for the Basecase and this sensitivity.

Table 7.2 Annual Harvest Levels- Basecase and THLB ±5%

Decade	Annual Harvest Level (m^3/year)		
	Basecase	THLB + 5%	THLB -5%
1 – 4	100,000	104,000	88,000
5	90,000	93,500	79,000
6 – 250	81,000	84,500	71,000

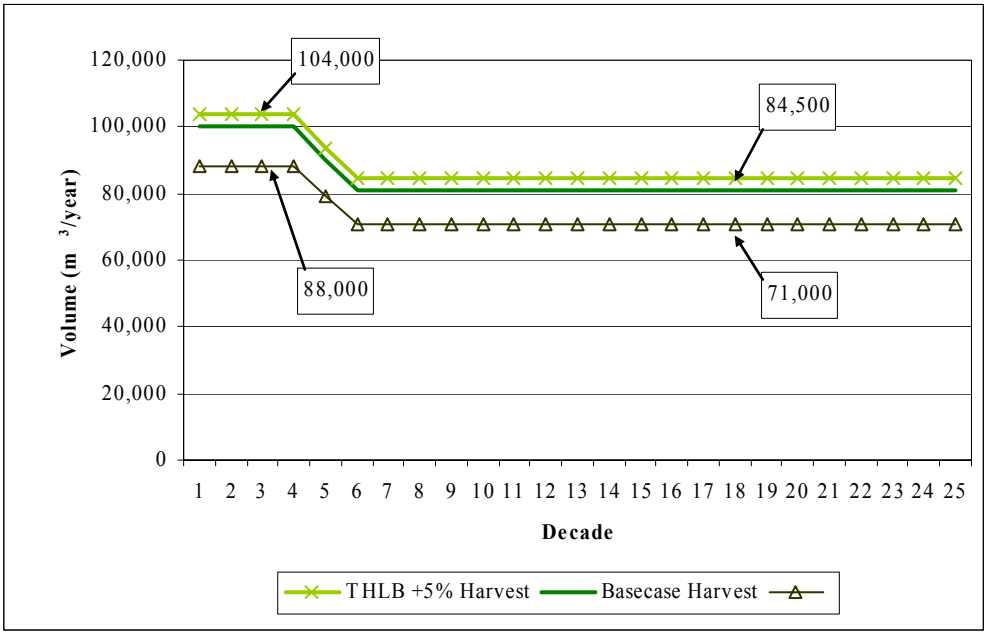

Figure 7.1 Harvest Levels - Basecase and THLB ±5%

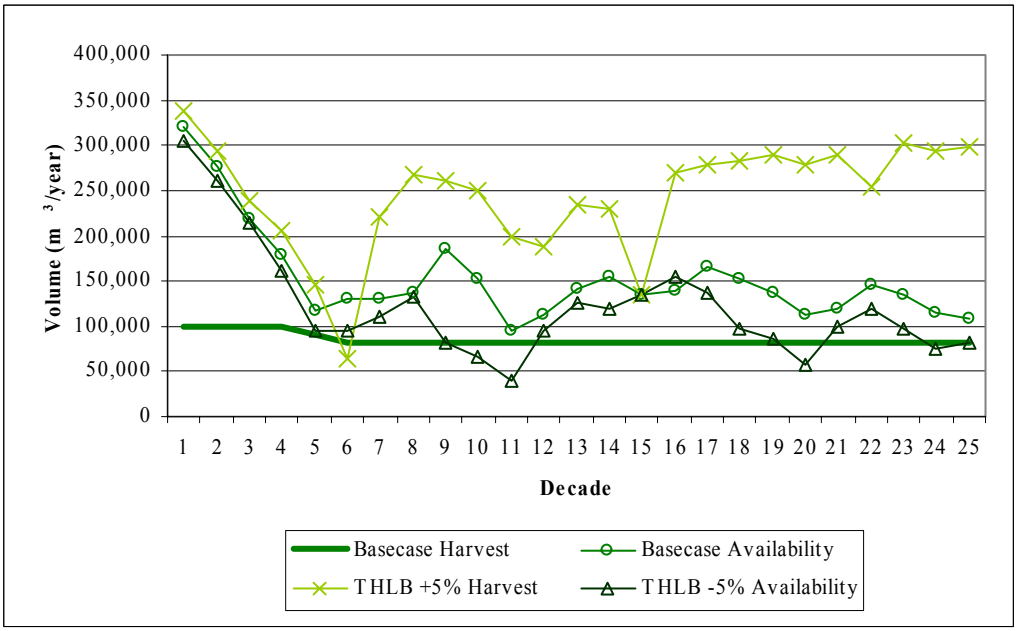

Figure 7.2 Timber Availability- Basecase and THLB ±5%

Figure 7.2 shows that the THLB+5% sensitivity has more timber available for harvest in every period except for period 6. The dip in available timber in decade 6 is the result of a scheduling event that denies a series of blocks to be harvested. When the short term harvest level is increased the schedule becomes more similar to the Basecase and the increased harvest level is achieved as seen in Figure 7.1.

7.2 MP NO. 3 OPERABILITY

The operability layer was updated by LP in 2005 to better reflect current practice and capture changes in classification through VRI and updated netdowns. This sensitivity assesses the timber supply impact of this change in landbase. Table 7.3 and Figure 7.3 show the annual harvest levels of the Basecase and the operability used in MP No.3.

Table 7.3 Annual Harvest Levels- Basecase and MP No. 3 Operability

Decade	Annual Harvest Level (m^3/year)	
	Basecase	MP No. 3 Operability
1 – 4	100,000	88,000
5	90,000	79,000
6 – 250	81,000	76,000

The overall change in harvest level as a result of using the old operability is a 10% decrease in the short term and 12% decrease in the mid and long term. It can be seen in Figure 7.4 that the timber availability drops below the Basecase harvest level, forcing the drop in harvest level.

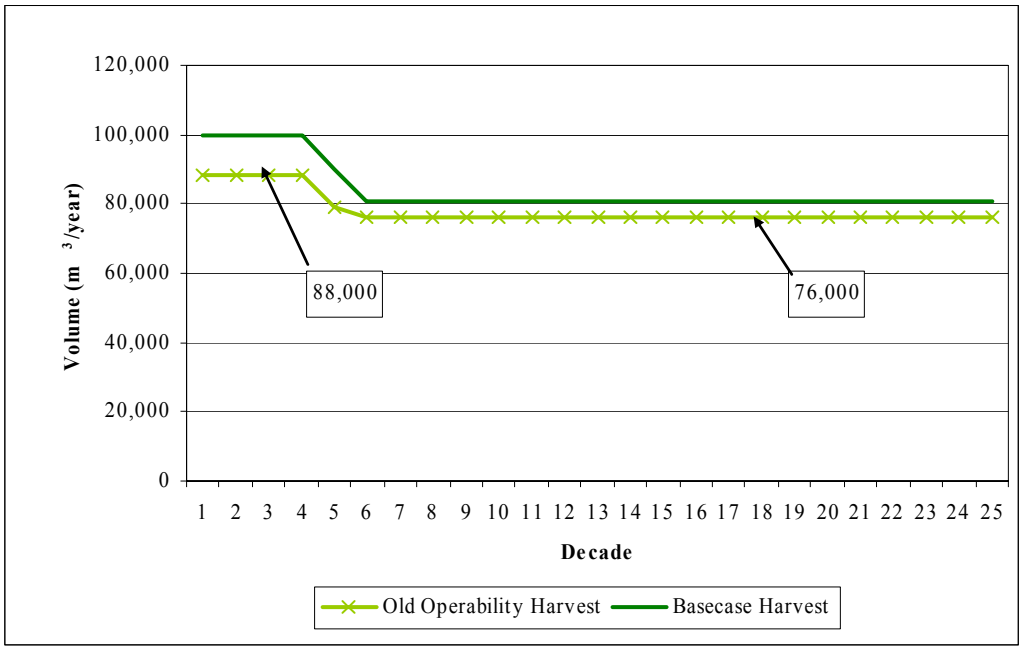

Figure 7.3 Harvest Levels - Basecase and MP No. 3 Operability

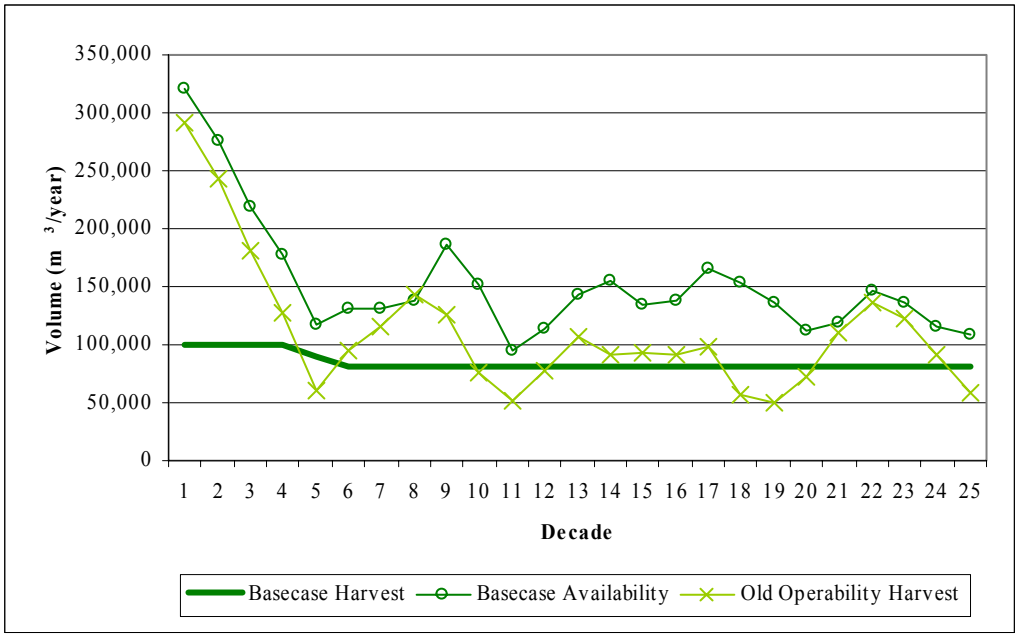

Figure 7.4 Timber Availability - Basecase and MP No. 3 Operability

7.3 NATURAL STAND YIELDS ±10%

All natural stand yields (created using VDYP) were increased and decreased by 10%. As it is only current natural stands that are altered (analysis units 1 – 25), the short term is most effected. This can be seen clearly in the harvest level in Figure 7.5 and Table 7.4 as the lines converge in the long term. The timber availability is shown in Figure 7.6.

When natural stand yields are altered +10%, there is an increase of 10% in the short term which drops to a 1% decrease in the mid and long term. When natural stand yields are altered -10%, there was a decrease of -10% in the short term with the mid and long term harvest level maintained at Basecase level.

Table 7.4 Annual Harvest Levels- Basecase and Natural Stand Yields ±10%

Decade	Annual Harvest Level (m^3/year)		
	Basecase	Natural Stand Yields +10%	Natural Stand Yields -10%
1 – 4	100,000	110,000	90,000
5	90,000	99,000	81,000
6	81,000	89,000	81,000
7 – 250	81,000	80,000	81,000

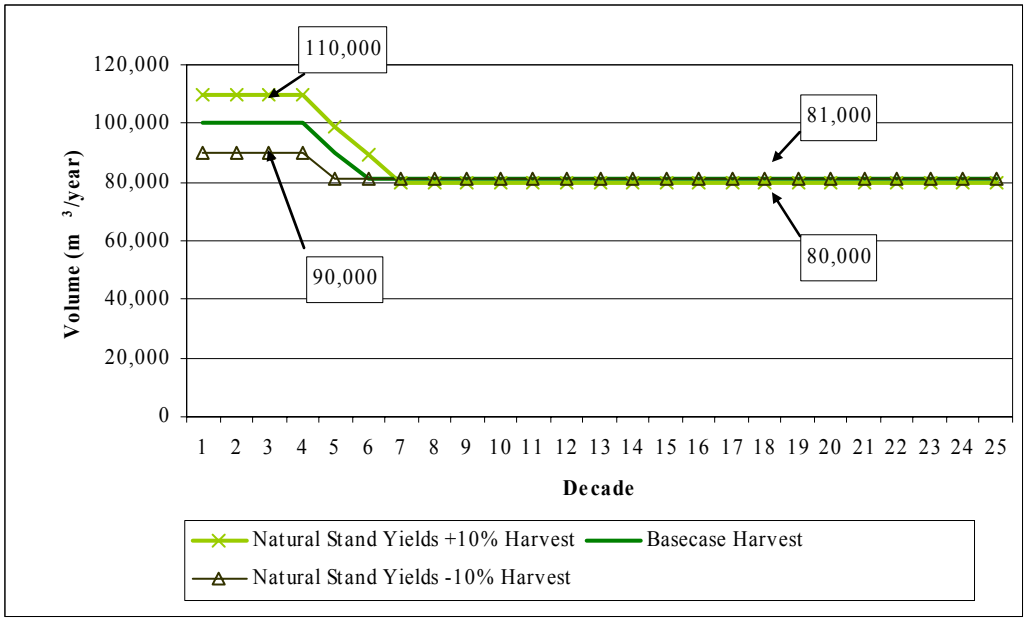

Figure 7.5 Harvest Levels - Basecase and Natural Stand Yields ±10%

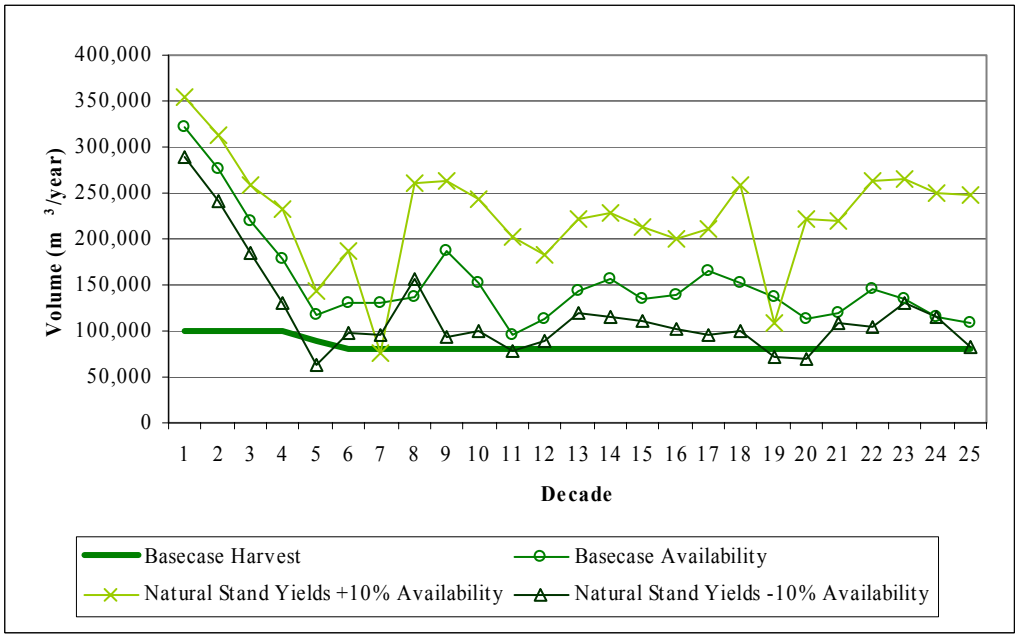

Figure 7.6 Timber Availability- Basecase and Natural Stand Yields ±10%

7.4 MANAGED STAND YIELDS ±10%

All managed stand yields (TIPSY yields) were increased and decreased by 10% through alteration of OAFs. The harvest level is shown in Table 7.5 and Figure 7.7. As it is only managed stands that are affected and these are more predominant in the future than present, the mid and long term is most affected. This can be clearly seen in Figure 7.7 and Figure 7.8 as the timber harvest and availability lines diverge in the long term.

Table 7.5 Annual Harvest Levels- Basecase and Managed Stand Yields ±10%

Decade	Annual Harvest Level (m^3/year)		
	Basecase	Managed Stand Yields +10%	Managed Stand Yields -10%
1 – 4	100,000	100,000	100,000
5	90,000	90,000	90,000
6	81,000	90,000	80,000
7 – 250	81,000	90,000	73,000

When managed stand yields were raised 10%, the harvest level is that of the Basecase in the short term and is increased by 11% in the mid and long term. When managed stand yields were lowered by 10%, the harvest level is unchanged in the short term and is decreased by 10% in the mid and long term.

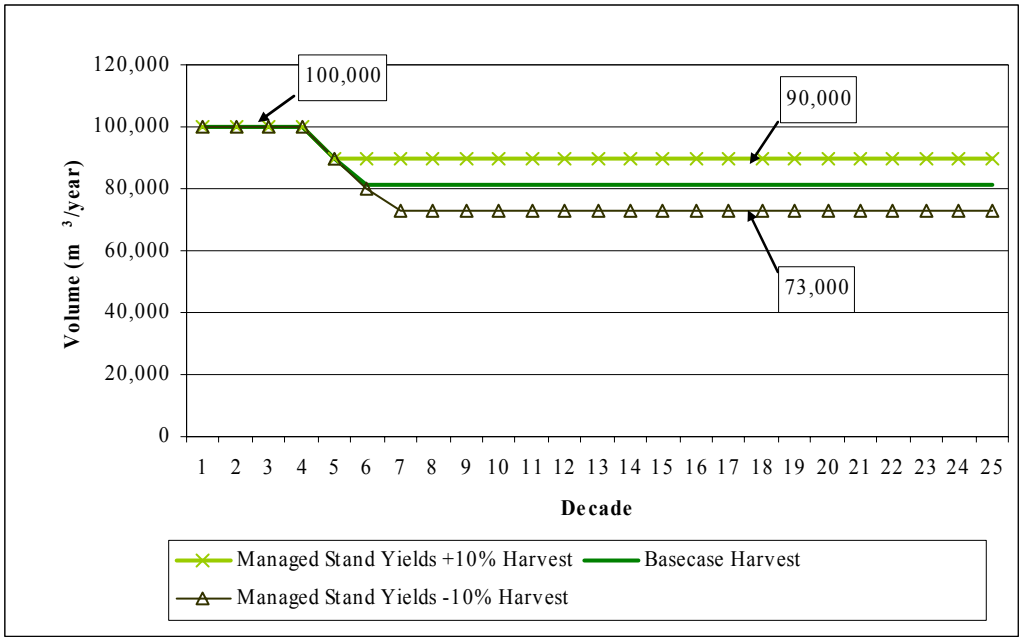

Figure 7.7 Harvest Levels - Basecase and Managed Stand Yields +10%

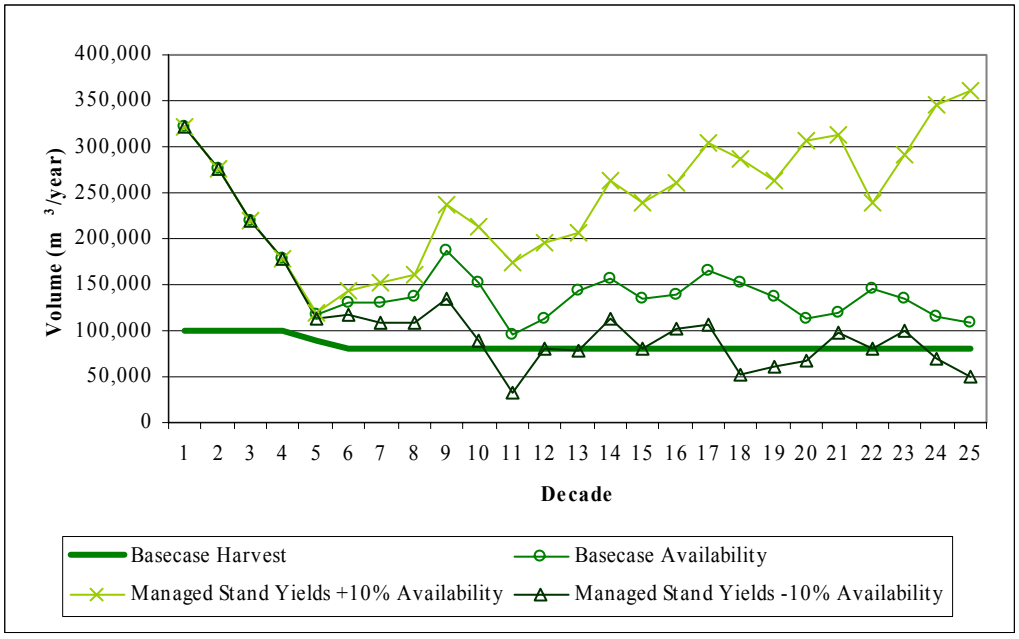

Figure 7.8 Timber Availability- Basecase and Managed Stand Yields -10%

7.5 MINIMUM HARVEST AGES ±10 YEARS

Minimum harvest ages were increased and decreased by 10 years. As Table 7.6 and Figure 7.9 show, decreasing the minimum harvest age by 10 years results in a mid and long term harvest level increase of 1% with the short term harvest level at that of the Basecase. Increasing the minimum harvest age results in a short and mid term decrease of 6% and a 2% increase in the long term harvest level. The increase in long term harvest here is a reflection of being able to utilise that timber not able to be harvested in the short term. Figure 7.10 shows the timber availability for the scenarios.

Table 7.6 Annual Harvest Levels- Basecase and Minimum Harvest Ages ±10 years

Decade	Annual Harvest Level (m^3/year)		
	Basecase	Minimum Harvest Age +10yrs	Minimum Harvest Age -10yrs
1 – 4	100,000	94,000	100,000
5	90,000	84,500	90,000
6 – 120	81,000	76,000	82,000
130 – 250	81,000	83,000	82,000

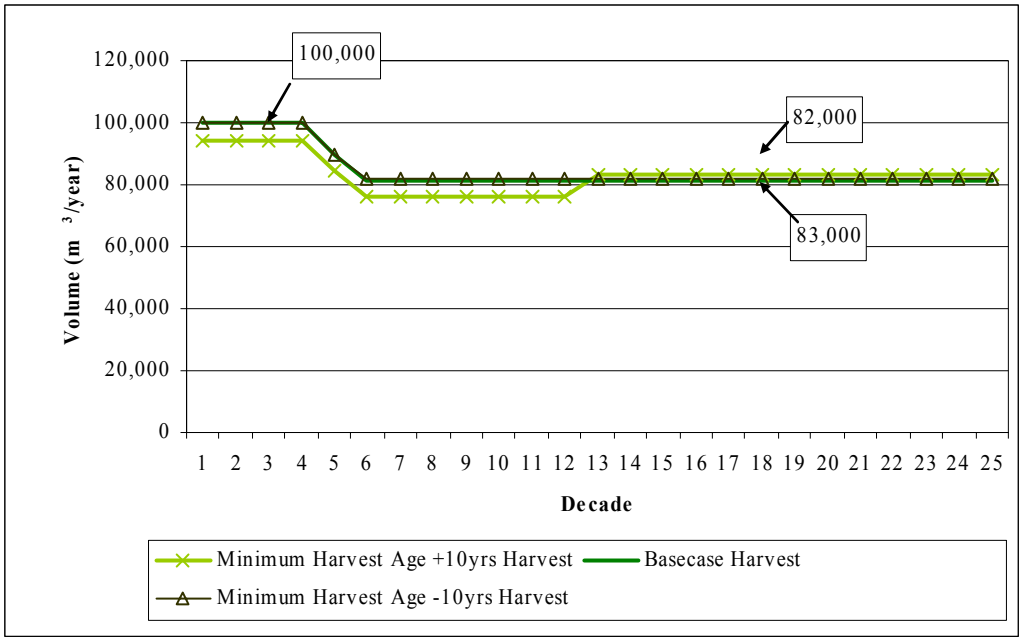

Figure 7.9 Harvest Levels - Basecase and Minimum Harvest Ages ±10 years

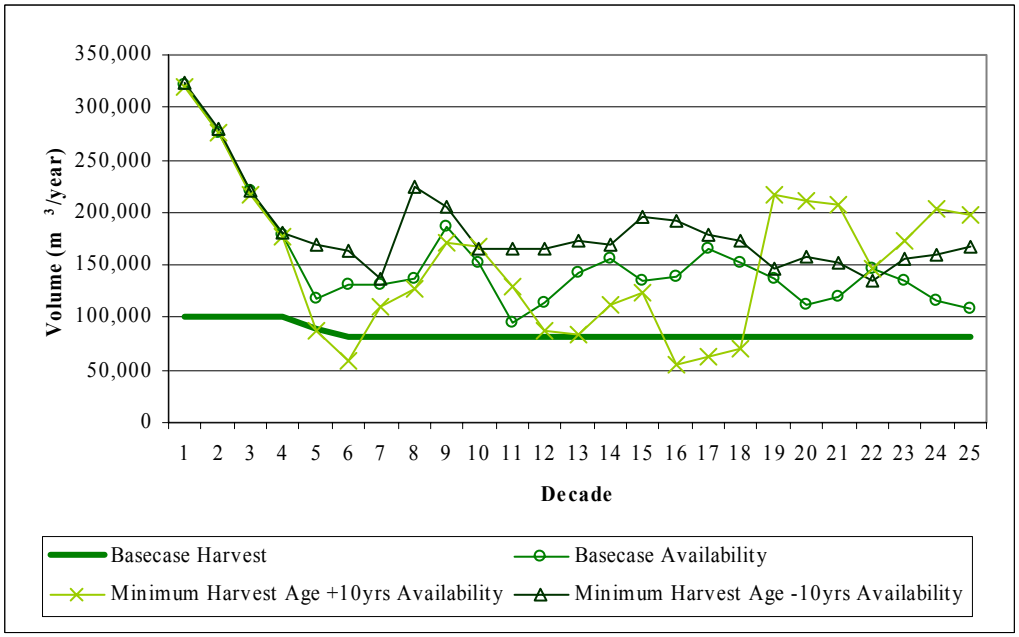

Figure 7.10 Timber Availability- Basecase and Minimum Harvest Ages ±10 years

7.6 REGENERATION DELAYS ±5 YEARS

The regeneration delay was increased from two years in the Basecase to seven years for this sensitivity. As Table 7.7 and Figure 7.11 show, increasing the regeneration delay by five years has the impact of decreasing the harvest level by 5% in the short term and by 6% in the mid and long term. Figure 7.12 shows the timber availability for this sensitivity.

Table 7.7 Annual Harvest Levels- Basecase and Regeneration Delay +5 years

Decade	Annual Harvest Level (m^3/year)	
	Basecase	Regeneration Delay +5yrs
1 – 4	100,000	95,000
5	90,000	85,500
6 – 250	81,000	76,500

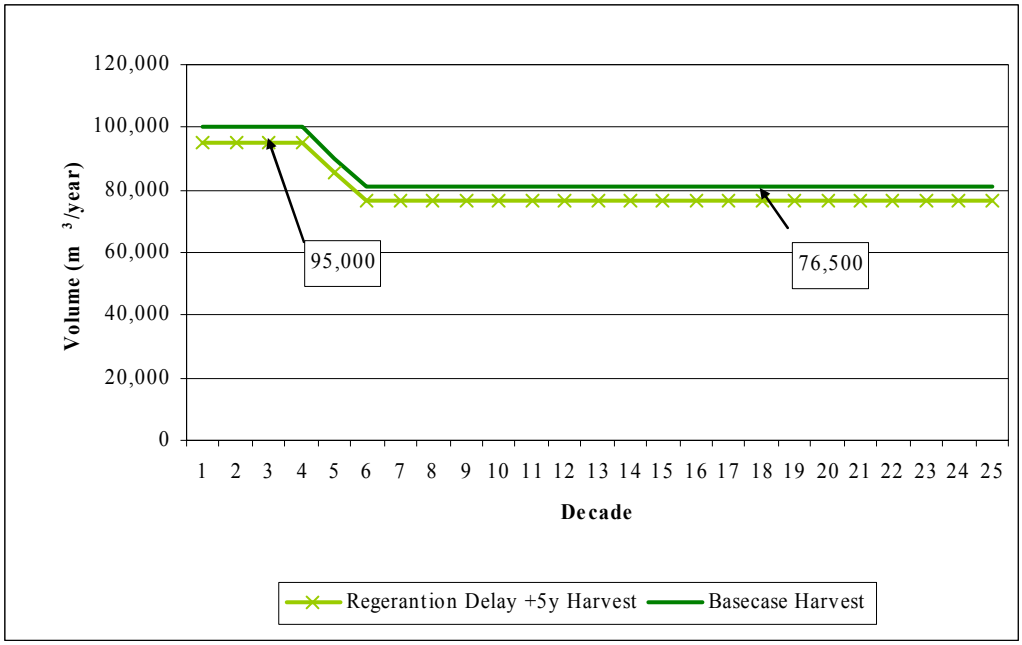

Figure 7.11 Harvest Levels- Basecase and Regeneration Delay +5 years

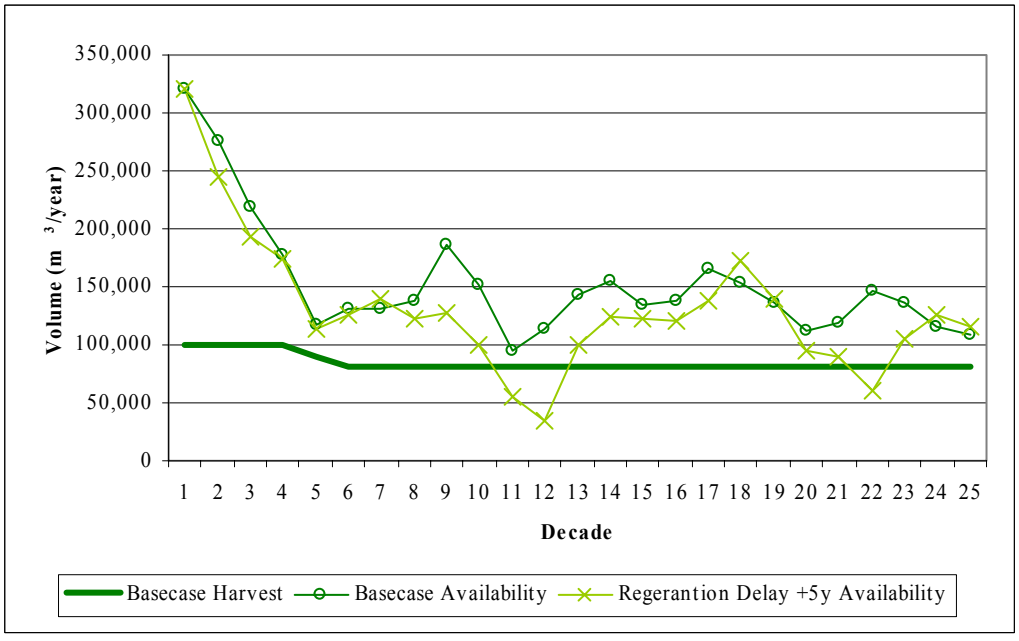

Figure 7.12 Timber Availability- Basecase and Regeneration Delay +5 years

7.7 TURN OFF GENETIC GAINS

Genetic gains were removed from future managed stands (200 series AUs) by omitting the genetic gain input into TIPSY. Table 7.8 and Figure 7.13 show that removing genetic gains has no short term effect on the harvest level but decreases the mid and long term harvest level by 4%. Figure 7.14 shows the timber availability for this sensitivity and illustrates that the effect of genetic gains is stronger in the long term than short term. This is logical as genetic gains are applied to managed stands which have insignificant harvestable area now but will be prominent in the long term.

Table 7.8. Annual Harvest Levels- Basecase and No Genetic Gains

Case	Annual Harvest Level (m^3/year)	
	Basecase	No Genetic Gains
1 – 4	100,000	100,000
5	90,000	90,000
6 – 250	81,000	78,000

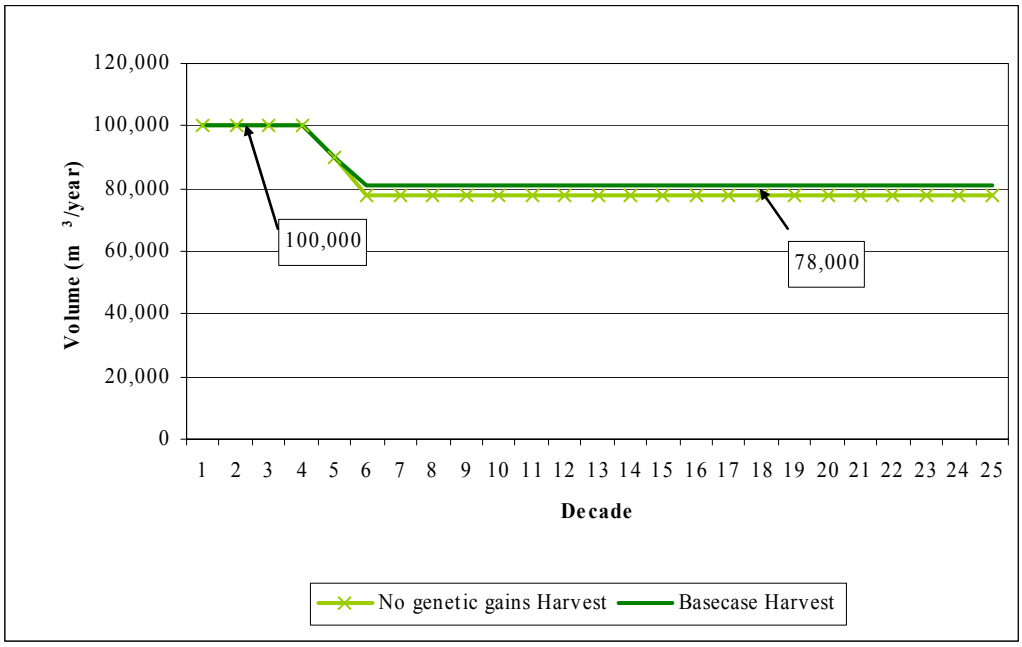

Figure 7.13 Harvest Levels- Basecase and No Genetic Gains

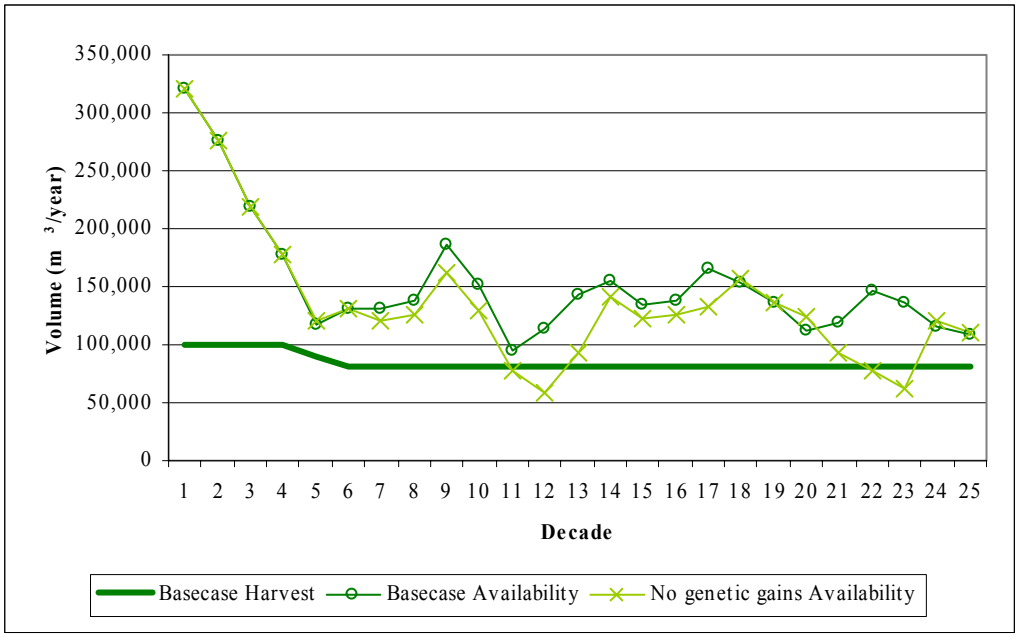

Figure 7.14 Timber Availability- Basecase and No Genetic Gains

7.8 NO SITE INDEX ADJUSTMENT

This sensitivity tests the impact of introducing SIA as an estimate of site productivity. It uses old site index values with no SIA as were used in the previous analysis (MP No. 3). Table 7.9 and Figure 7.15 show that without SIA, the harvest level decreases 20% in the short term and 34% in the mid and long term from the Basecase.

Table 7.9 Annual Harvest Levels- Basecase and No SIA

Case	Annual Harvest Level (m^3/year)	
	Basecase	No SIA
1 – 4	100,000	80,000
5	90,000	71,000
6	81,000	62,000
7 – 250	81,000	54,000

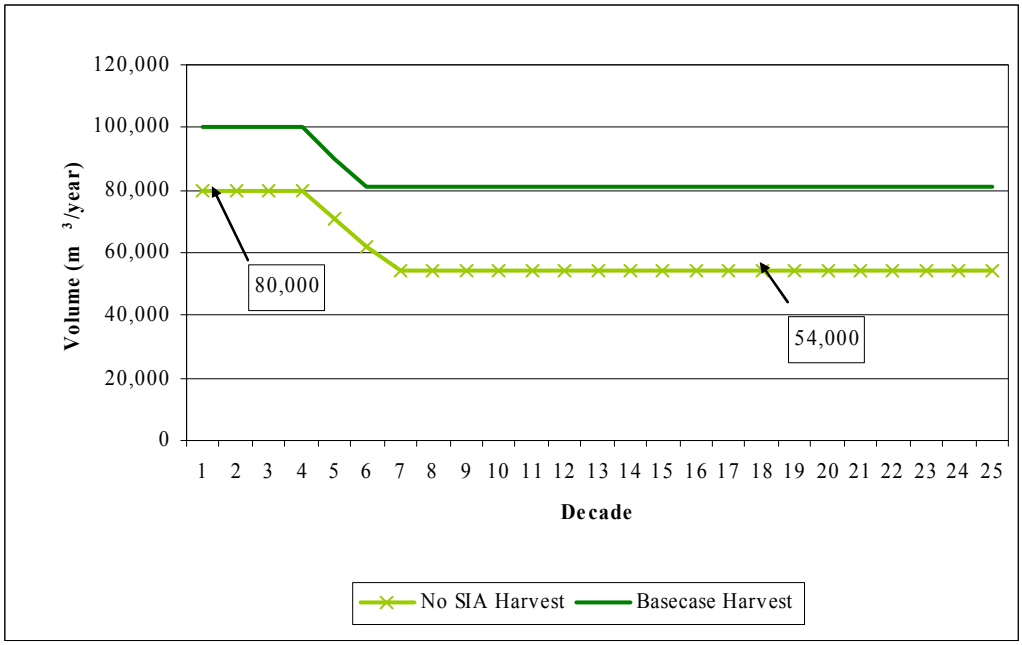

Figure 7.15 Harvest Levels- Basecase and No SIA

Figure 7.16 shows that the downwards pressure resulting from not using SIA is very strong in the mid and long term. SIA is implemented on future and existing managed stands so it is logical that the effect of SIA becomes apparent when the harvest swiftly switches from natural to managed stands in period 6.

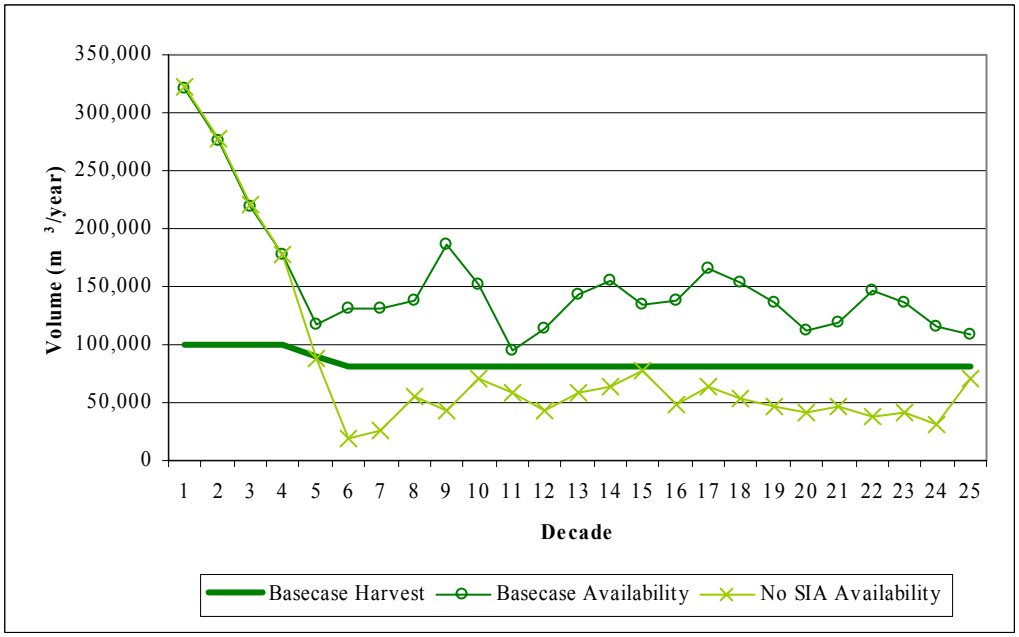

Figure 7.16 Timber Availability - Basecase and No SIA

7.9 MANAGED STAND SI ±1 M

Managed stand site index was increased and decreased by one meter in TIPSY to understand how sensitive the timber analysis results are to changes in site index. By altering site index growth rates and the MAI are also altered and so correspondingly the minimum harvest age at which minimum volume and DBH values are reached is also changed. Therefore to ensure a thorough approach, minimum harvest ages were also adjusted accordingly in this sensitivity.

Table 7.10 Annual Harvest Levels- Basecase and Managed Stands SI ±1 meter

Decade	Annual Harvest Level (m^3/year)		
	Basecase	Site Index +1m	Site Index -1m
1 – 4	100,000	102,000	96,000
5	90,000	92,000	86,500
6 – 250	81,000	87,000	76,500

Table 7.10 and Figure 7.17 show that when site index estimates for managed stands are increased by one meter, the harvest level increases by 2% in the short term and 7% in the mid and long term. When site index is decreased by one meter, the short term is decreased by 4% and the mid and long term by 6%.

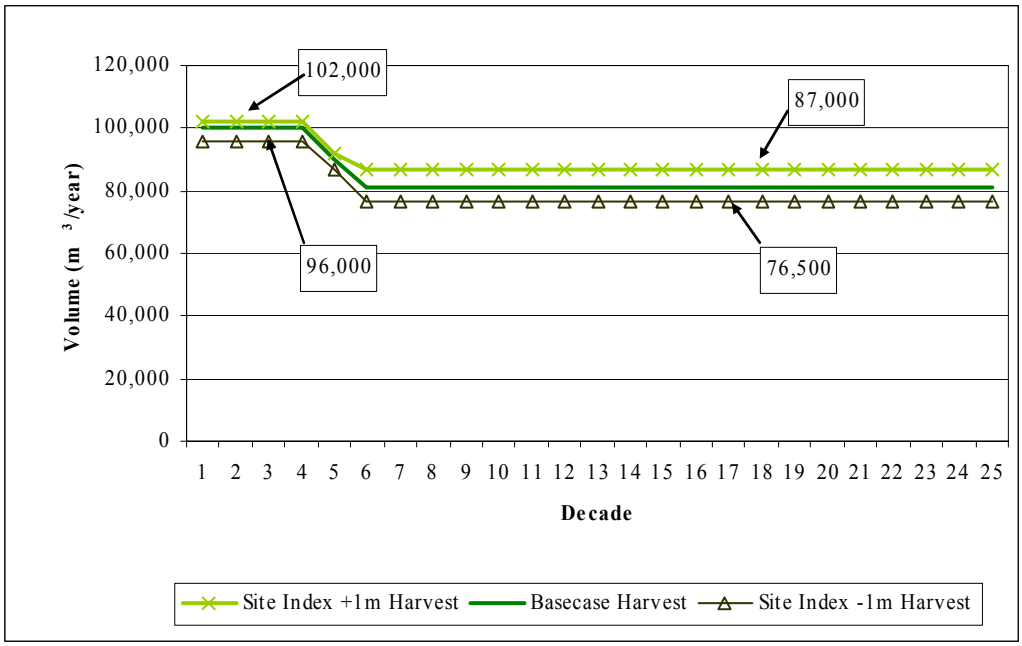

Figure 7.17 Harvest Levels- Basecase and Managed Stands SI ±1 meter

The timber availabilities for this scenario can be seen in Figure 7.18 below. They illustrate that SI changes effect the model more as time passes because growth accumulates.

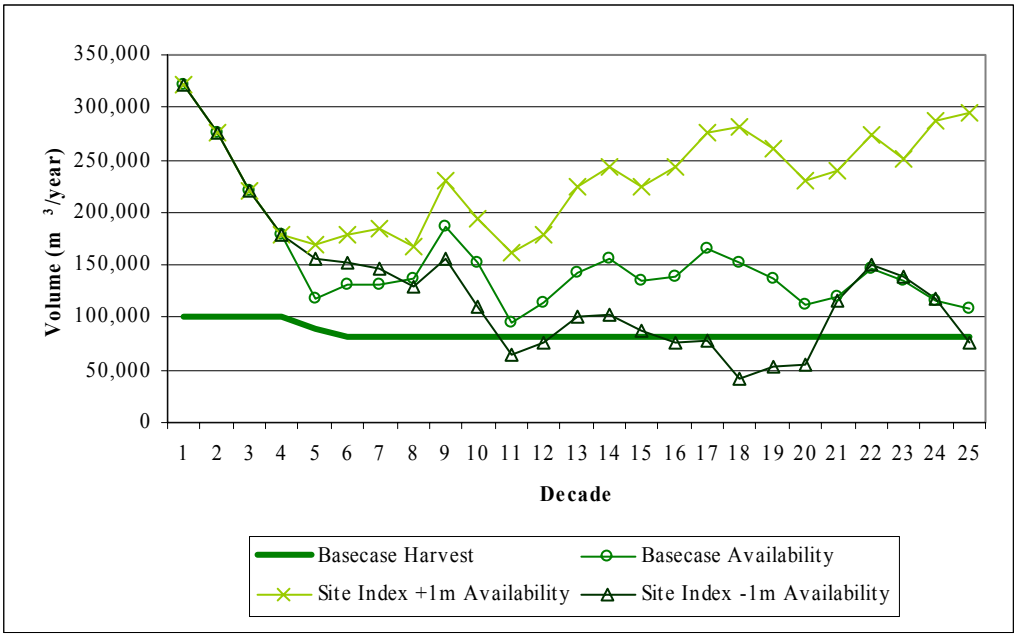

Figure 7.18 Timber Availability- Basecase and Managed Stands SI ±1 meter

7.10 NO INVENTORY ADJUSTMENT

This sensitivity tests the impact of having no VRI adjustment. Table 7.11 and Figure 7.19 show the harvest level impacts. With no inventory adjustment, the harvest level drops by 18% in the short term and 10% in the mid and long term. Figure 7.20 shows the timber availability which shows a fairly uniform decrease across the 250 year time period.

Table 7.11 Annual Harvest Levels- Basecase and No Inventory Adjustment

Decade	Annual Harvest Level (m^3/year)	
	Basecase	No Inventory Adjustment
1 − 4	100,000	82,000
5	90,000	73,000
6 − 250	81,000	73,000

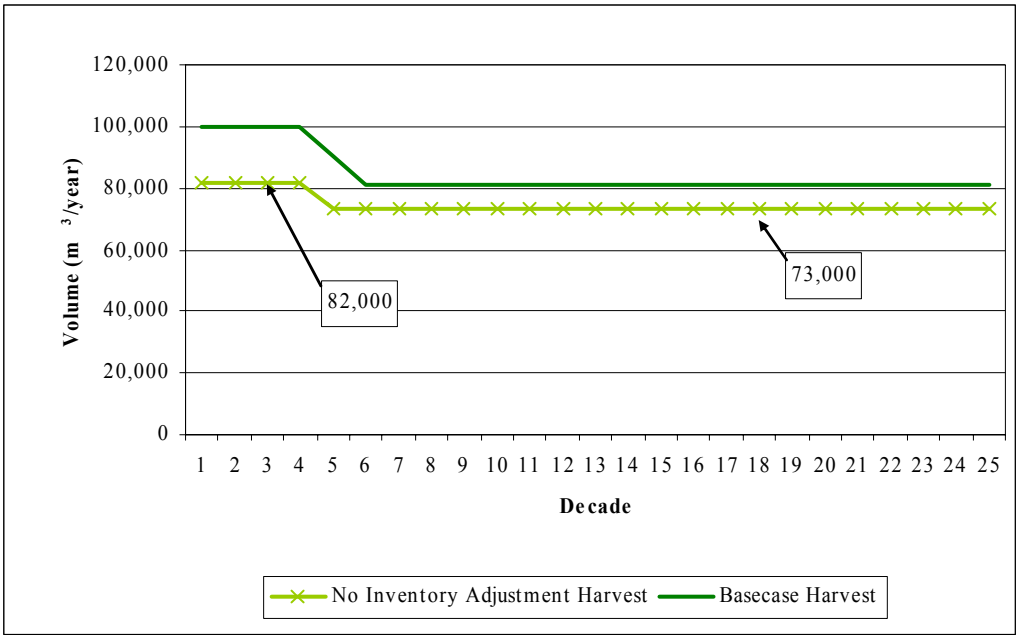

Figure 7.19 Harvest Levels- Basecase and No Inventory Adjustment

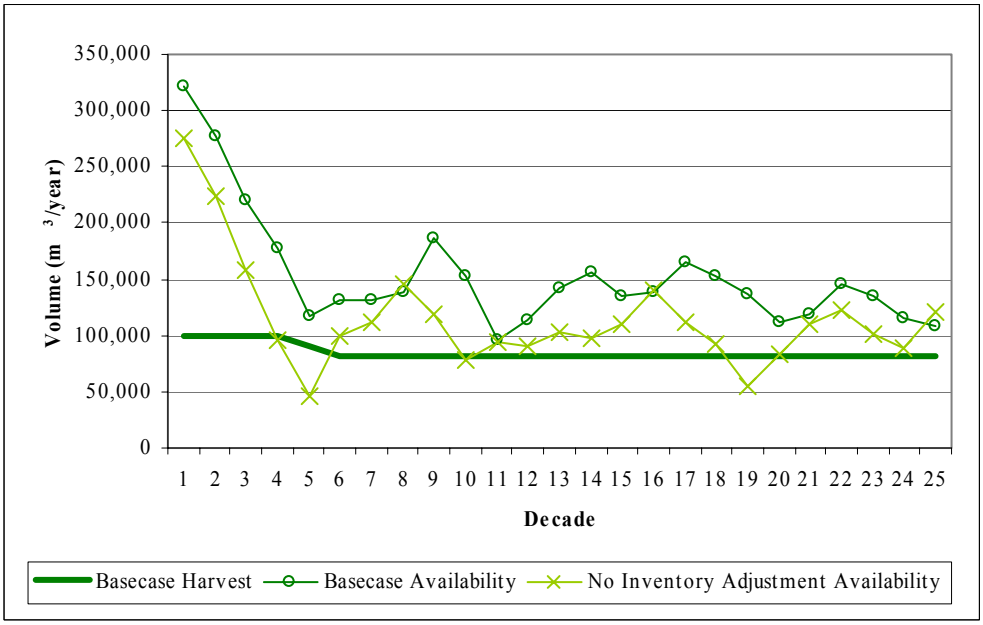

Figure 7.20 Timber Availability- Basecase and No Inventory Adjustment

7.11 TURN OFF ADJACENCY AND TURN ON IRM

IRM disturbance constraints were imposed in place of adjacency constraints (for three periods). These allowed no more than 25% area with stands below two meters tall. This constraint was fulfilled by each LU/BEC variant combination (consistent with the previous analysis MP No. 3) and was implemented on the THLB only. Each caribou zone also had a distinct IRM disturbance constraint imposed. This approach is very stringent and is modelling the most tightly controlled IRM scenario possible.

The effect of using IRM constraints is a decrease of 7% in the long term compared to the Basecase as shown in Table 7.12 and Figure 7.21.

Table 7.12 Annual Harvest Levels- Basecase and No Adjacency with IRM

Case	Annual Harvest Level (m^3/year)	
	Basecase	IRM Constraints
1 – 4	100,000	100,000
5	90,000	90,000
6 – 250	81,000	75,000

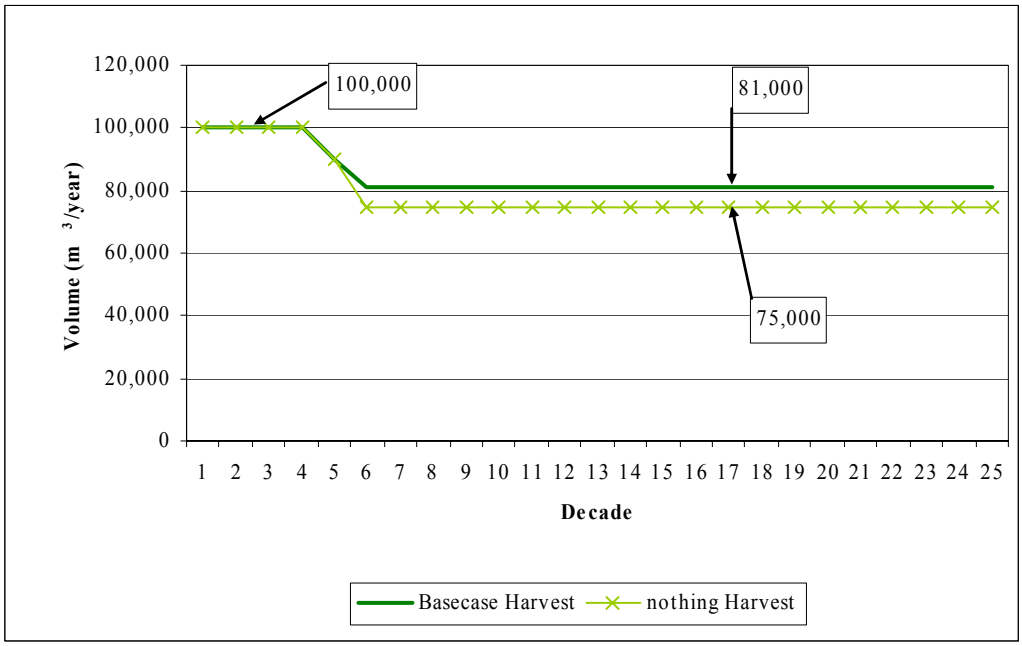

Figure 7.21 Harvest Levels- Basecase and No Adjacency with IRM

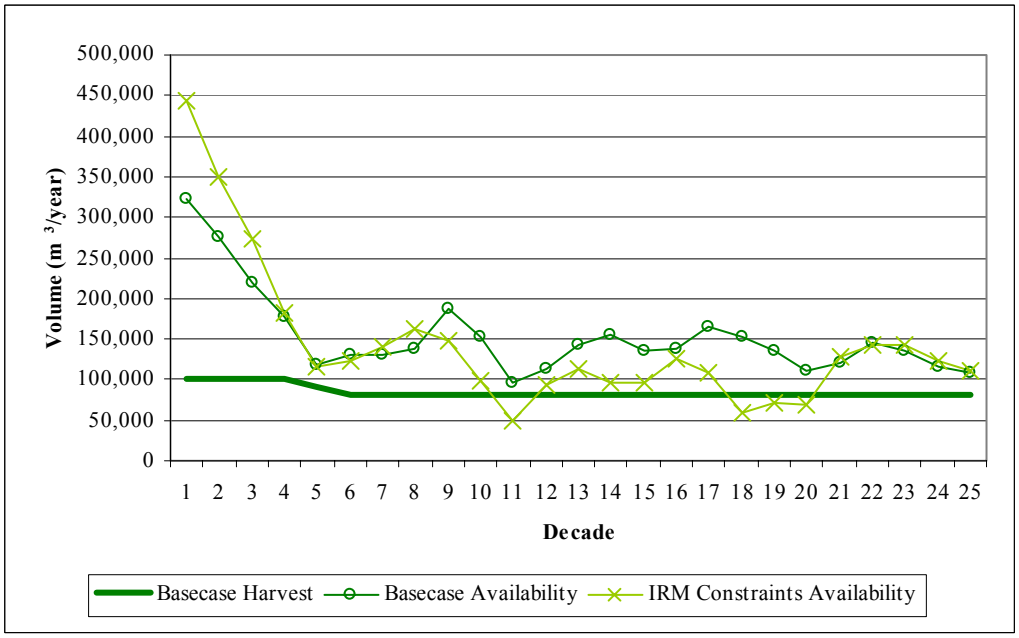

Figure 7.22 Timber Availability- Basecase and No Adjacency with IRM

7.12 IRM GREEN-UP HEIGHTS ±1M

In the previous sensitivity, IRM disturbance constraints were imposed in place of adjacency constraints and allowed no more than 25% area with stands below two meters tall. This sensitivity tests the impact of varying this height by one meter.

This sensitivity tests the alteration of IRM green-up heights which do not exist in the Basecase. Therefore, these two sensitivities are benchmarked against the previous sensitivity in section 7.11: "Turn Off Adjacency and Turn On IRM". This benchmark has an initial harvest of 100,000m^3/year which drops to 75,000m^3/year in the long term. The availabilities have been run using this harvest level.

Figure 7.23 and Table 7.13 show that there is no impact to the harvest level from changing the IRM green-up heights by 1 meter. Since the harvest level and timber availability are identical, for all three scenarios, they are all shown on the same graph.

Table 7.13 Annual Harvest Levels- Basecase and Green-up Heights ±1 meter

Decade	Annual Harvest Level (m^3/year)		
	IRM Basecase	Green-up heights +1m	Green-up heights -1m
1 – 4	100,000	100,000	100,000
5	90,000	90,000	90,000
6 – 250	75,000	75,000	75,000

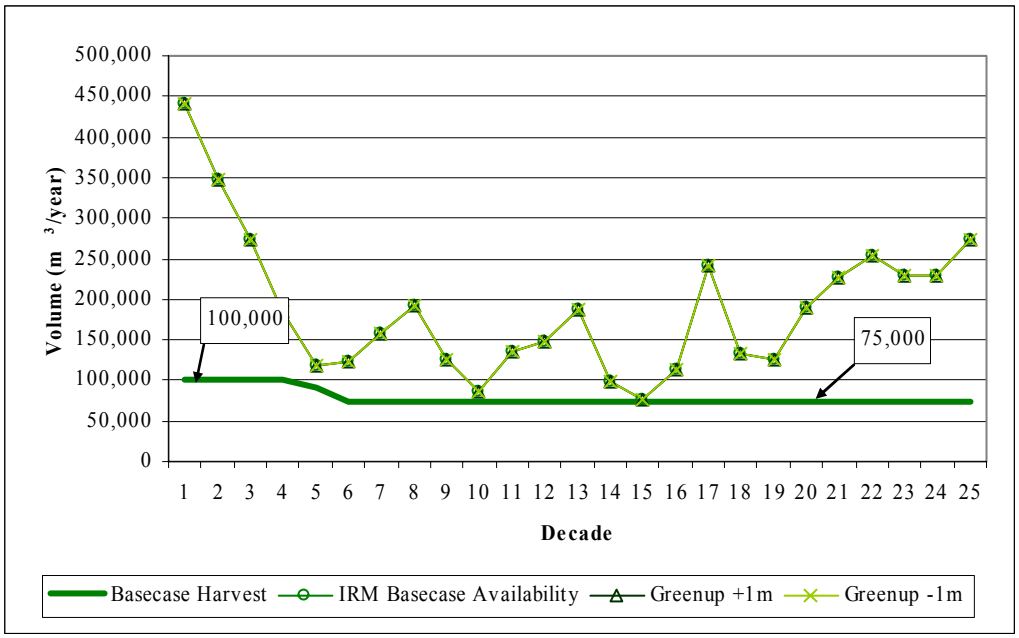

Figure 7.23 Harvest Levels and Timber Availability- IRM Basecase

7.13 CARIBOU RETENTION AT 60%

Caribou habitat management is subject to ongoing reassessment and is therefore a source of some uncertainty. Modifications could be made to either the amount of area managed for caribou

habitat or to the forest cover objectives applied to the habitat. The timber supply impacts of such modifications are of interest to all groups engaged in caribou habitat management in TFL 55 (B.C. Ministry of Forests, 2004).

This sensitivity tests the dependence of the timber supply on caribou constraints. 60% minimum retention was a figure supplied by LP as one of interest. The requirements for landbase below the caribou line in both BEC zones (ESSF and ICH) were increased from a minimum cover requirement of 40% over age-class 8 to 60% over age-class 8. As shown in Table 7.14, the other two requirements were left unchanged. The 70% requirement was not lowered to 60% because conflicts with the aim of testing the impact of increasing caribou constraint.

Table 7.14 Caribou Retention Requirements by BEC, Operability and Age-class

BEC zone	1994 Operability	Ageclass	Min. Retention (%)	
			Basecase	60% Sensitivity
ESSF	Above	>= 8	70	70
ICH	Above	>= 8	70	70
ESSF	Below	>= 8 & 9	40 & 10	60 & 10
ICH	Below	>= 8 & 9	40 & 10	60 & 10

Table 7.15 and Figure 7.24 show that the effect of increasing caribou retention requirements to 60% below the 1994 operability line is to decrease the harvest level 24% in the short term and 23% in the mid and long term from the Basecase. A heavily constraining availability is shown in Figure 7.25.

Table 7.15 Annual Harvest Levels- Basecase and 60% Caribou Requirements

Decade	Annual Harvest Level (m^3/year)	
	Basecase	Caribou retention at 60%
1 − 4	100,000	76,500
5	90,000	69,000
6 − 250	81,000	62,000

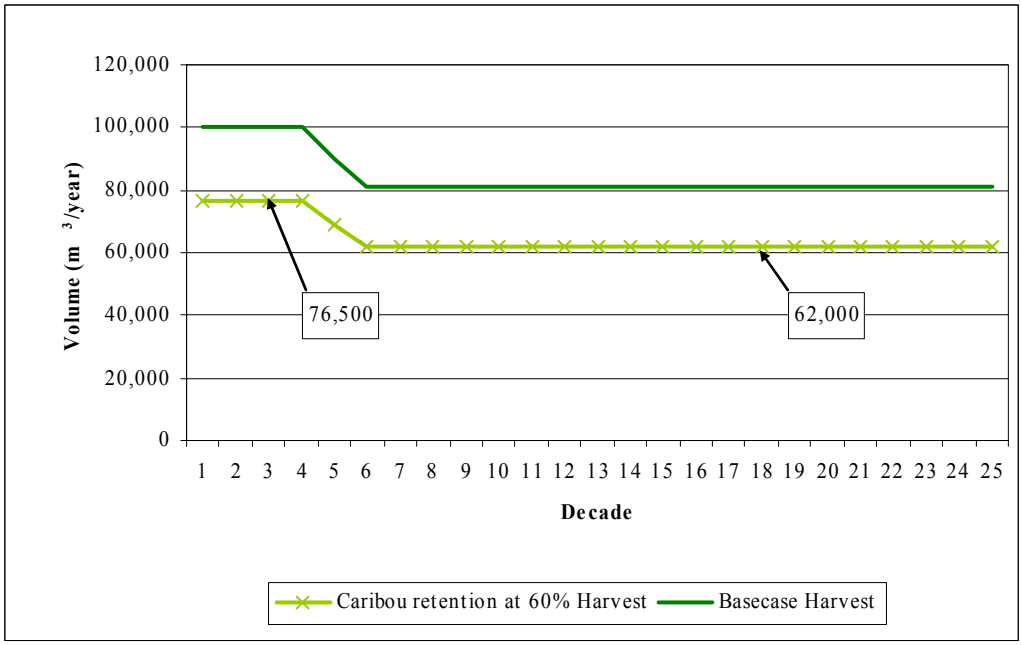

Figure 7.24 Harvest Level- Basecase and 60% Caribou Requirements

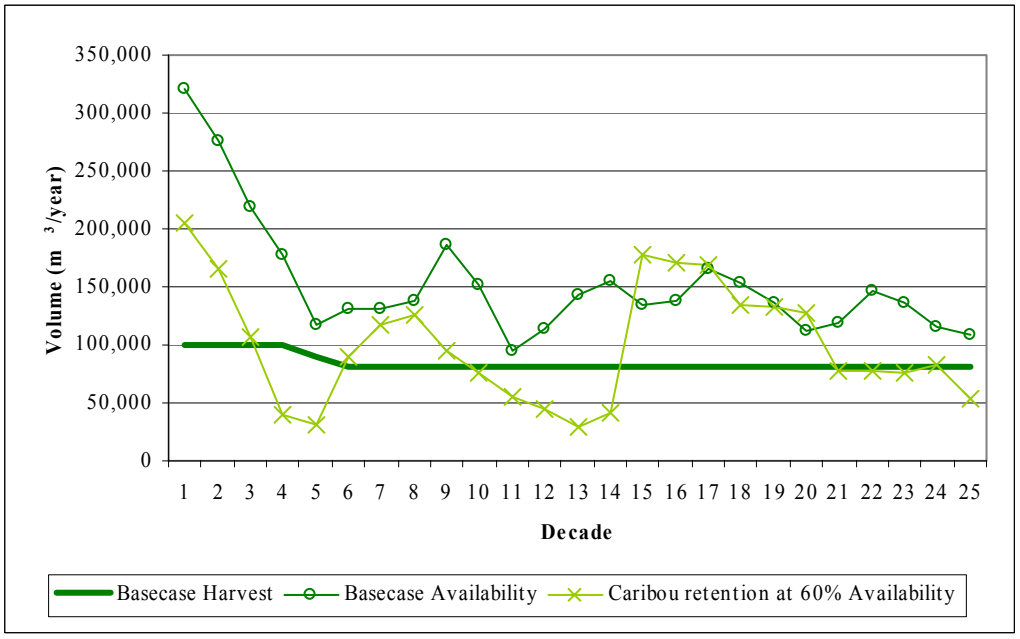

Figure 7.25 Timber Availability- Basecase and 60% Caribou Requirements

7.14 NO CARIBOU RETENTION

This sensitivity tests the effect on the timber supply of removing all caribou retention constraints. When all caribou retention requirements are removed, the harvest level increases by 14% from the Basecase. This is illustrated in Figure 7.26, Table 7.16 and in Figure 7.27 where a large increase in availability is apparent.

Table 7.16 Annual Harvest Levels- Basecase and No Caribou Retention

Decade	Annual Harvest Level (m^3/year)	
	Basecase	No Caribou Retention
1 − 4	100,000	114,000
5	90,000	102,500
6 − 250	81,000	92,500

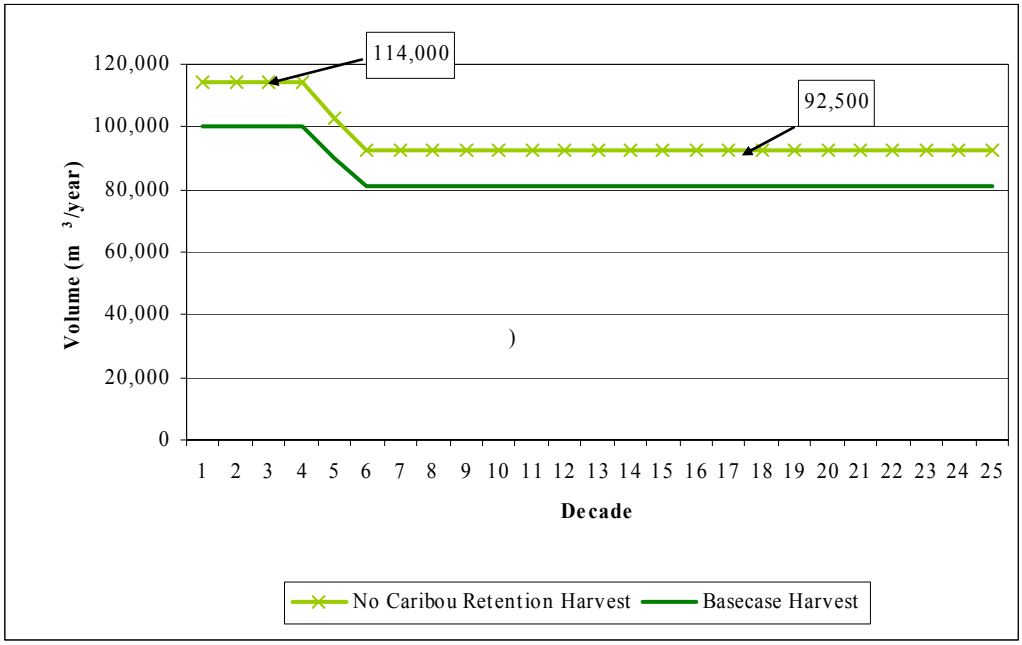

Figure 7.26 Harvest Level- Basecase and No Caribou Retention

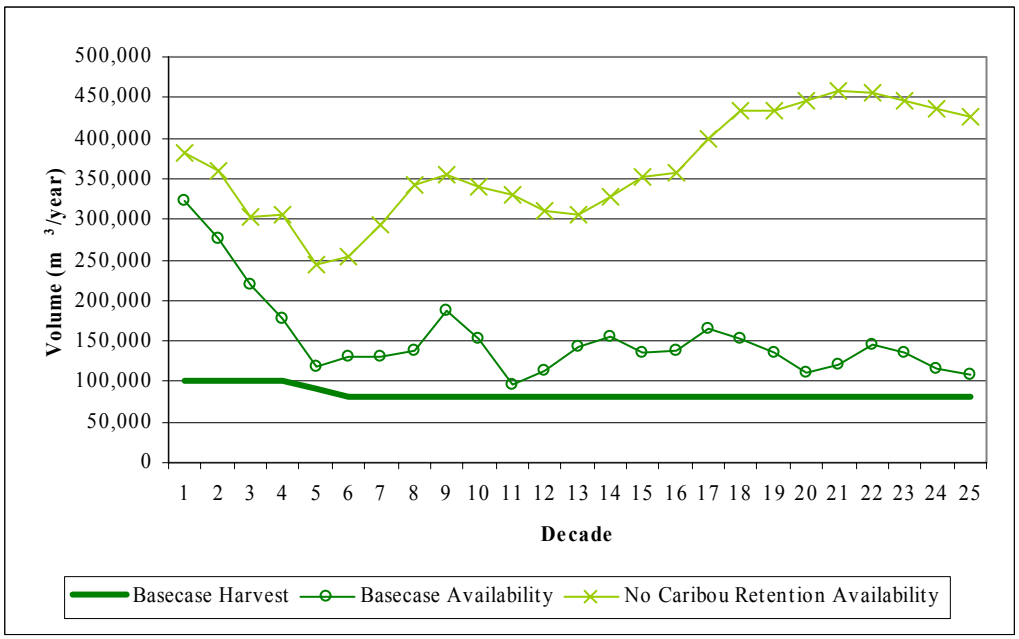

Figure 7.27 Timber Availability- Basecase and No Caribou Retention

7.15 HEMLOCK MERCHANTABILITY 60%

The Basecase defines non-merchantable stands as stands over the age 140 with over 80% Hemlock or Balsam. This sensitivity tests the timber supply impact of changing the non-merchantable definition to 60% for Hemlock. In doing this, the THLB is reduced by 1,298 hectares (6%). This results in a decrease in harvest level of 10% in the short term and 6% in the mid and long term as shown in Table 7.17 and Figure 7.28. Figure 7.29 presents the timber availabilities of the Basecase and this sensitivity.

Table 7.17 Annual Harvest Levels- Basecase and Hemlock Merchantability at 60%

Decade	Annual Harvest Level (m3/year)	
	Basecase	Hemlock Merchantability at 60%
1 − 4	100,000	90,000
5	90,000	80,000
6 − 250	81,000	76,000

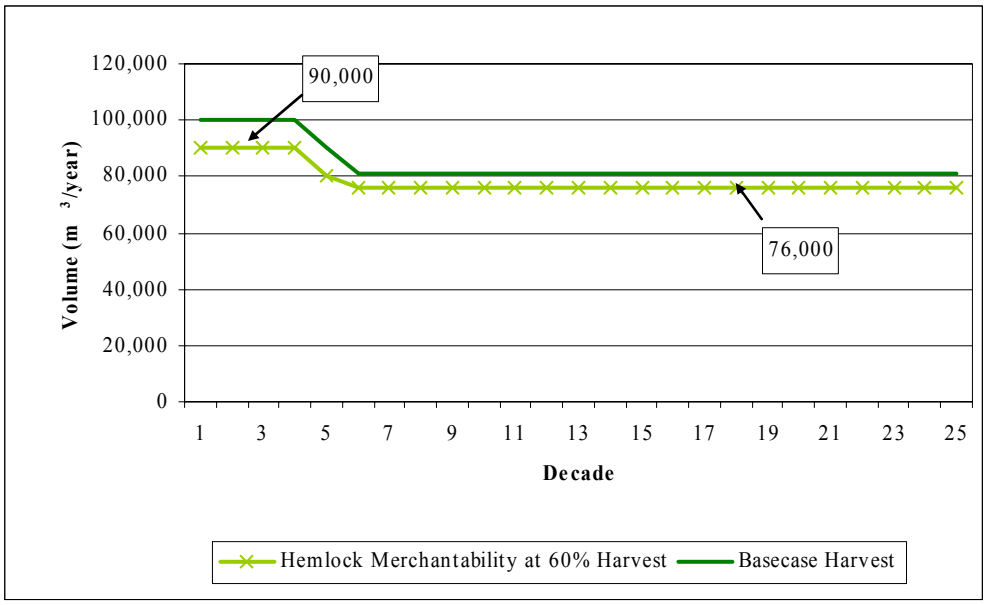

Figure 7.28 Harvest Levels- Basecase and Hemlock Merchantability at 60%

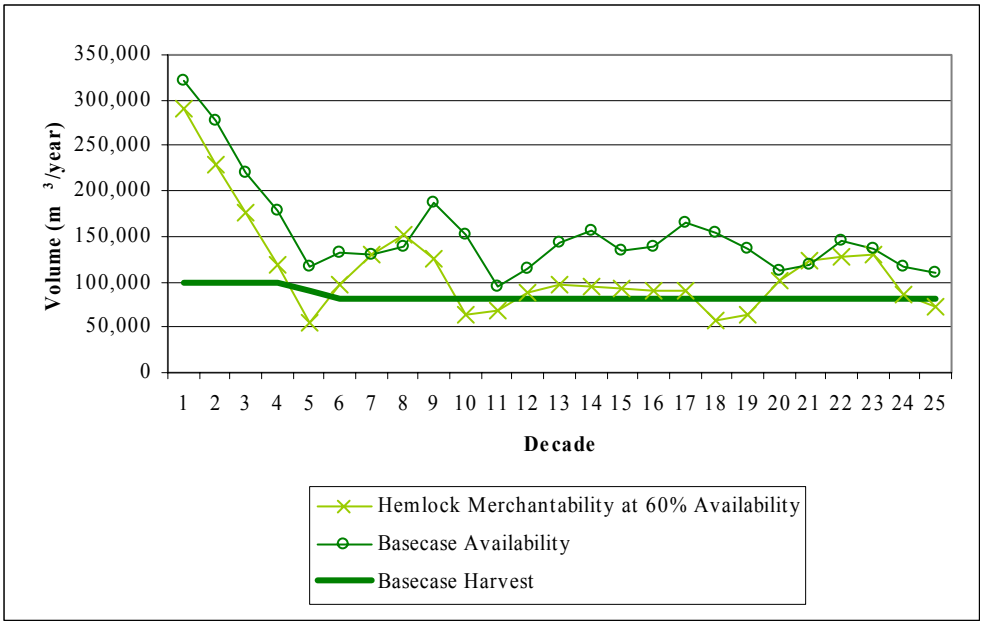

Figure 7.29 Timber Availability- Basecase and Hemlock Merchantability at 60%

7.16 LANDSCAPE LEVEL BIODIVERSITY

In the Basecase, landscape-level biodiversity is controlled by maintaining a minimum percentage of mature timber in each LU/BEC zone for the operable and inoperable. These seral requirements are legislated in the *Revelstoke Higher Level Plan Order* and are shown below in Table 7.18. This sensitivity tests the impact of the traditional approach of having seral zones include the full productive land base- i.e. no proportional representation.

Table 7.18 Seral requirements and Area for TFL 55

Seral Zone- LU/BEC/BEO	Basecase	Sensitivity	Seral Requirements- Area (%) greater than given age	
			Mature	Old
r17 ESSFvc I	227	230	36% >120	19% >250
r17 ESSFvc L	4,514	10,025	n/a	19% >250
r17 ESSFvv L	164	892	19% >120	19% >250
r17 ESSFvv L	634	1,377	19% >120	19% >250
r17 ICHvk1 I	2,880	3,566	34% >100	13% >250
r17 ICHvk1 L	5,730	7,335	n/a	13% >250
r17 ICHwk1 I	46	46	34% >100	13% >250
r5 ESSFvc L	2,036	14,768	n/a	19% >250
r5 ICHvk1 I	2,200	3,121	34% >100	13% >250
r5 ICHvk1 L	4,261	7,774	n/a	13% >250
r5 ICHwk1 L	498	666	n/a	13% >250
r5 ICHwk1 I	924	978	34% >100	13% >250

Table 7.18 summarises the area in each seral zone for the Basecase (24,114 ha) and Landscape Level Biodiversity Sensitivity (50,778 ha). Table 7.19 and Figure 7.30 show that the impact on harvest level of this sensitivity is to increase the short term by 4% and the mid and long term by 3%. The respective timber availabilities are shown in Figure 7.31.

Initially, in this sensitivity, a strong pinch point in period 6 was limiting harvest as a result of altering the harvest schedule in such a way that several blocks become unavailable at decade 6. This occurrence has been avoided by changing the order in which the blocks are harvested in the sensitivity to be more similar to the Basecase harvest schedule. This was achieved through the queuing up of those stands found to be out of harvest order at decade 6. Queuing up a stand affects the model by having that stand considered for harvest sooner. Stands not queued are considered for harvest in order of their age: using the harvest oldest first rule.

Table 7.19 Annual Harvest Levels- Basecase and Landscape Level Biodiversity

Decade	Annual Harvest Level (m3/year)	
	Basecase	Landscape Level Biodiversity
1 − 4	100,000	104,000
5	90,000	93,500
6 − 250	81,000	83,500

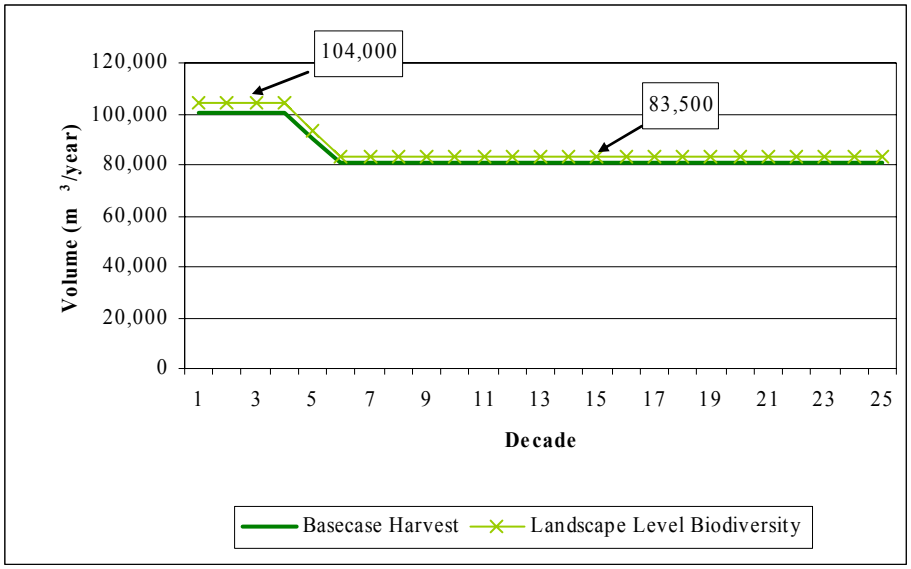

Figure 7.30 Harvest Levels - Basecase and Landscape Level Biodiversity

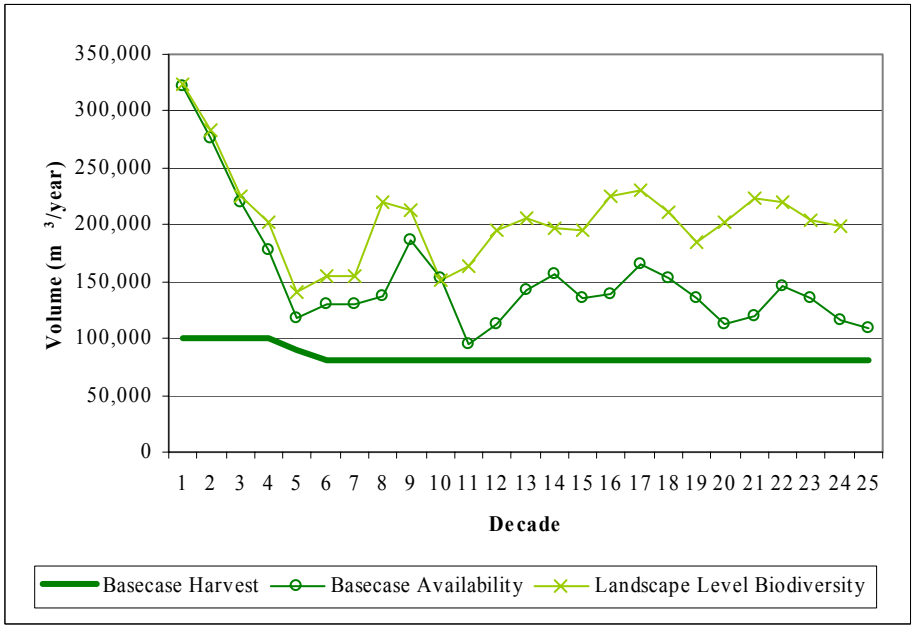

Figure 7.31 Timber Availability- Basecase and Landscape Level Biodiversity

7.17 TURN OF DISTURBANCES IN NON-THLB

The method by which non-THLB is modelled can affect the timber supply because even though this landbase does not contribute to harvesting, it can still contribute to fulfilling forest cover objectives such as caribou constraints. In reality, there is some level of natural disturbance in the non-THLB. The MP No. 4 Basecase models natural disturbances in the non-THLB by implementing annual harvest disturbances in each BEC variant that results in a seral stage distribution in accordance with the natural range of variation (NROV) defined in the *Biodiversity Guidebook*.

If natural disturbances are not modelled, the non-THLB all becomes old and an unrealistic portion of forest cover requirements can be fulfilled by this land. TFL 55 MP No. 3 allowed the non-THLB to age continuously. This sensitivity will be similar to MP No. 3 in this respect and will test the impact of modelling disturbances in the non-THLB.

Table 7.20 Annual Harvest Levels- Basecase and No Disturbance in the Non-THLB

Decade	Annual Harvest Level (m^3/year)	
	Basecase	No disturbance in the non-THLB
1 – 4	100,000	100,000
5	90,000	90,000
6 – 250	81,000	86,000

By modelling the non-THLB with no disturbances, there was no increase in the short term harvest level but an increase of 6% in mid and long term harvest level as shown in Table 7.20 and Figure 7.32.

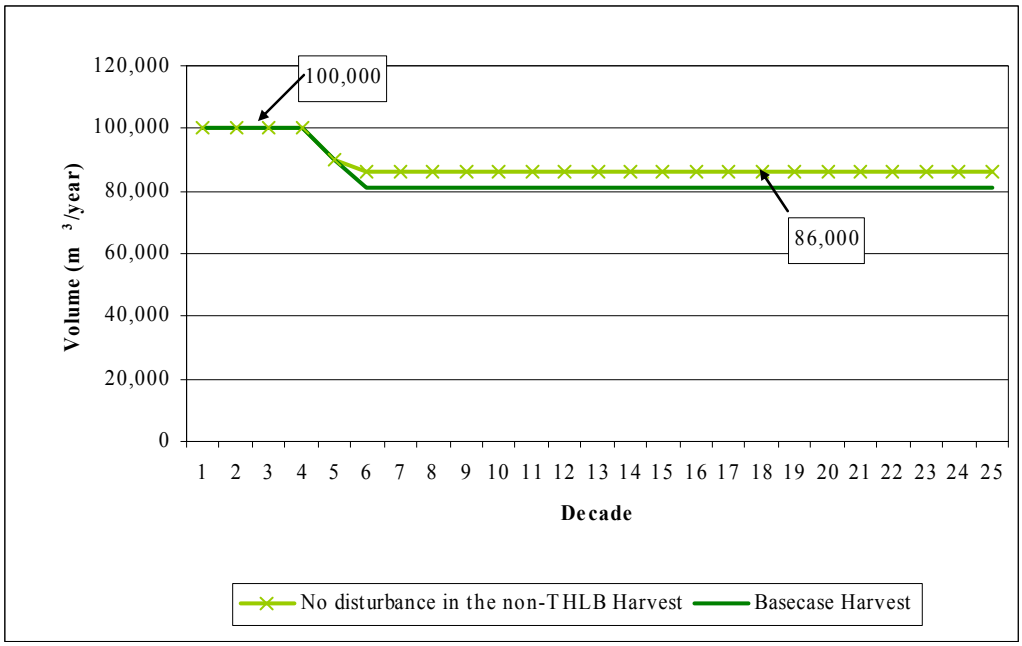

Figure 7.32 Harvest Levels - Basecase and No Disturbance in the Non-THLB

Figure 7.33 shows that the differences in timber availability are larger in the long term than the short term. This is because as the THLB moves from principally older natural stands to younger managed stands, the non-THLB contribution to forest cover requirements becomes more valued and results in more timber available.

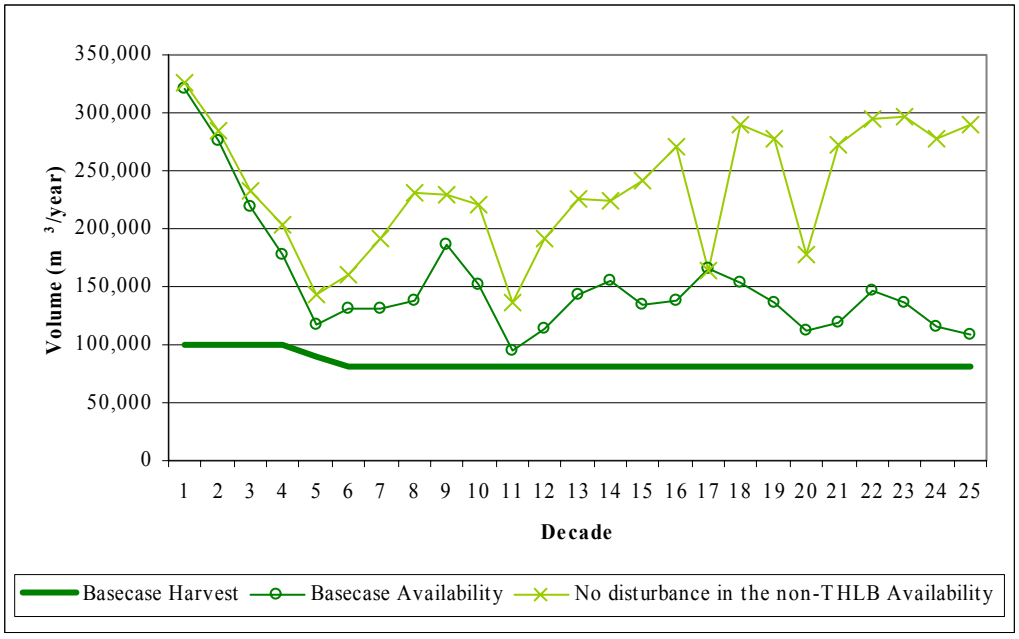

Figure 7.33 Timber Availability- Basecase and No Disturbance in the Non-THLB

7.18 Relative Oldest First and Maximum Volume Harvest Rules

The Basecase uses the oldest first harvest rule. This sensitivity individually tests the impact of using either the relative oldest first harvest rule or the maximum volume harvest rule. The relative oldest first harvest rule calculates the difference between actual age and minimum harvest age and stands with the greatest difference are given the greatest harvest priority. The maximum volume harvest rule maximises volume per hectare.

Both alternative harvest rules- relative oldest first and maximum volume harvest, result in a 4% decrease in the mid and long term harvest level when compared to the Oldest First Harvest Rule used in the Basecase. Table 7.21 and Figure 7.34 show the harvest levels and Figure 7.35 shows the timber availabilities.

Table 7.21 Annual Harvest Levels- Basecase and Alternate Harvest Rules

Decade	Annual Harvest Level (m^3/year)		
	Basecase	Relative Oldest Rule	Maximum Volume t Rule
1 – 4	100,000	100,000	100,000
5	90,000	100,000	100,000
6	81,000	81,000	81,000
7 – 250	81,000	78,000	78,000

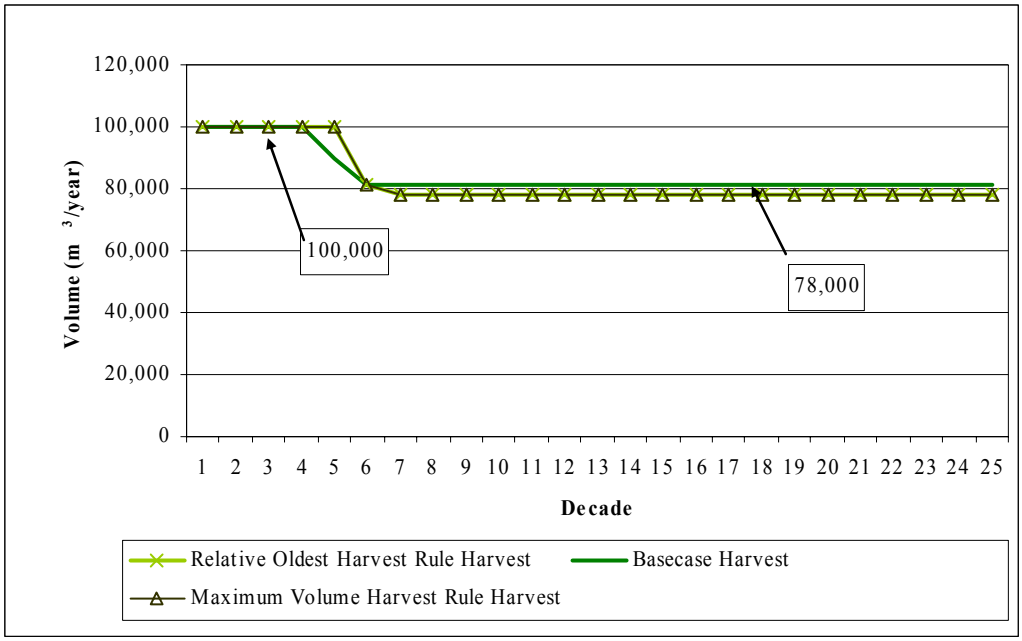

Figure 7.34 Harvest Levels - Basecase and Alternate Harvest Rule

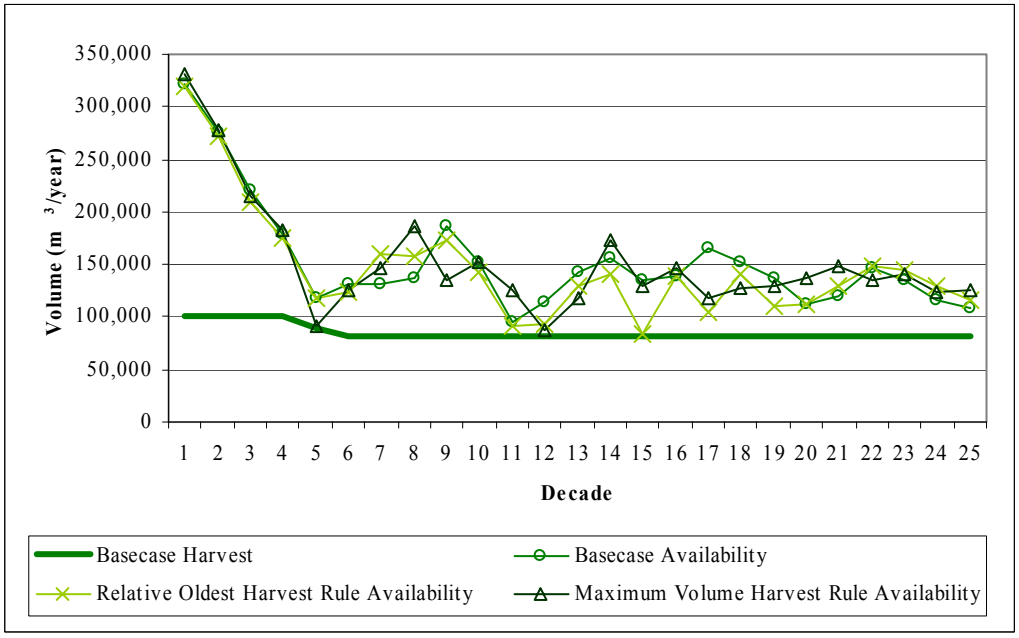

Figure 7.35 Timber Availability- Basecase and Alternate Harvest Rule

7.19 PRIORITIZE HARVEST OF DOUGLAS-FIR AND CEDAR

Stands in analysis units that were Douglas-fir or Cedar leading were prioritised for harvest. Changing the harvest priority of Douglas-fir and Cedar had the effect of increasing the harvest level by 1%. Harvest levels are shown in Table 7.22 and Figure 7.36 and the timber availability is shown in Figure 7.37 below.

Table 7.22 Annual Harvest Levels- Basecase and Priority to Douglas-fir and Cedar

Decade	Annual Harvest Level (m^3/year)	
	Basecase	Douglas-fir and Cedar First
1 – 4	100,000	101,000
5	90,000	91,000
6 – 250	81,000	82,000

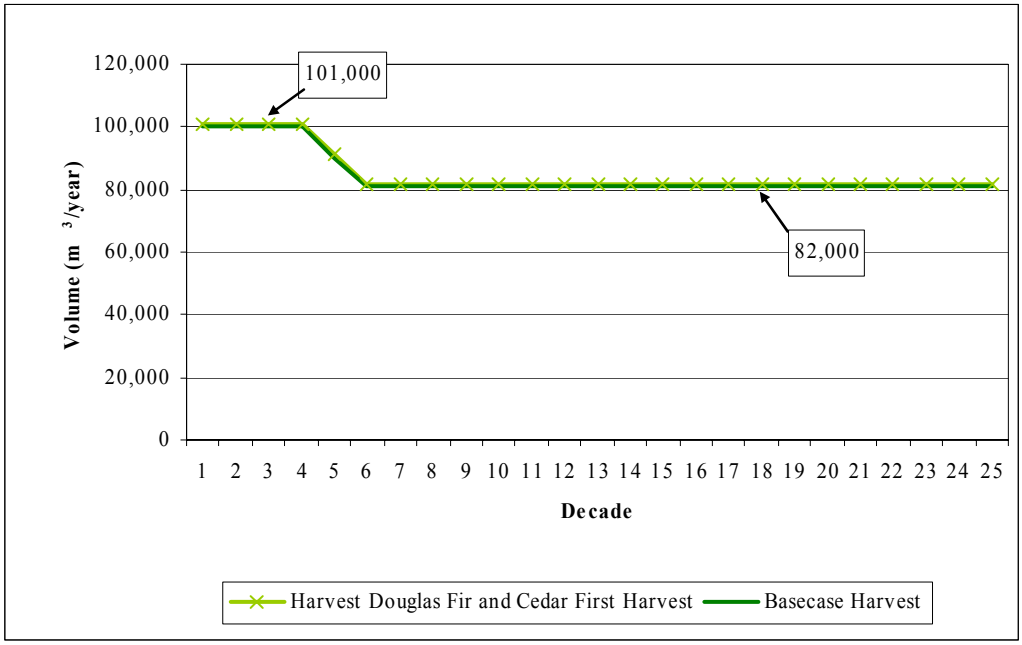

Figure 7.36 Harvest Levels- Basecase and Priority to Douglas-fir and Cedar

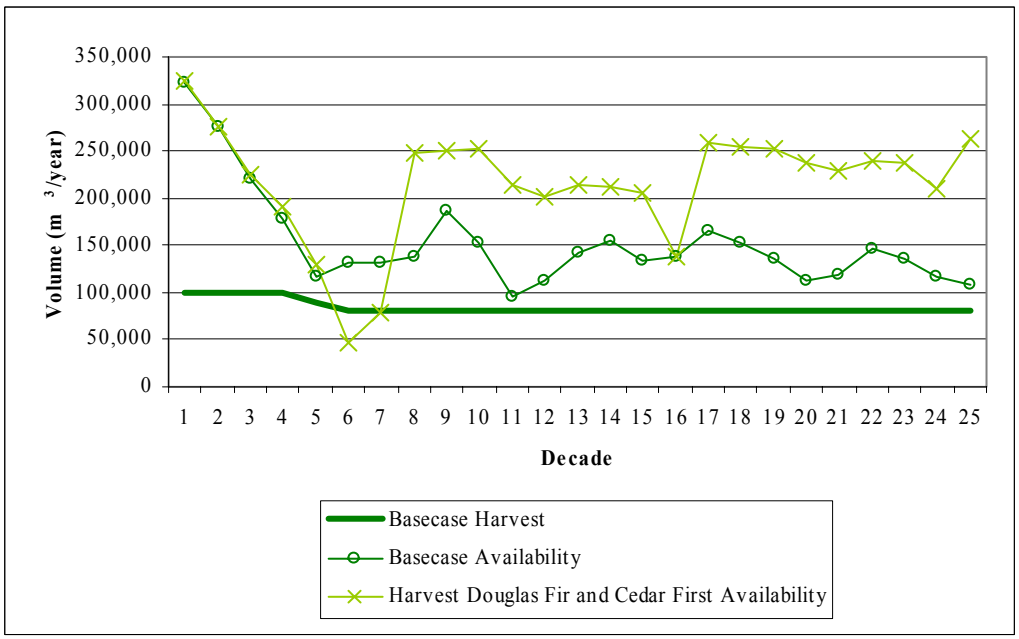

Figure 7.37 Timber Availability- Basecase and Priority to Douglas Fir and Cedar

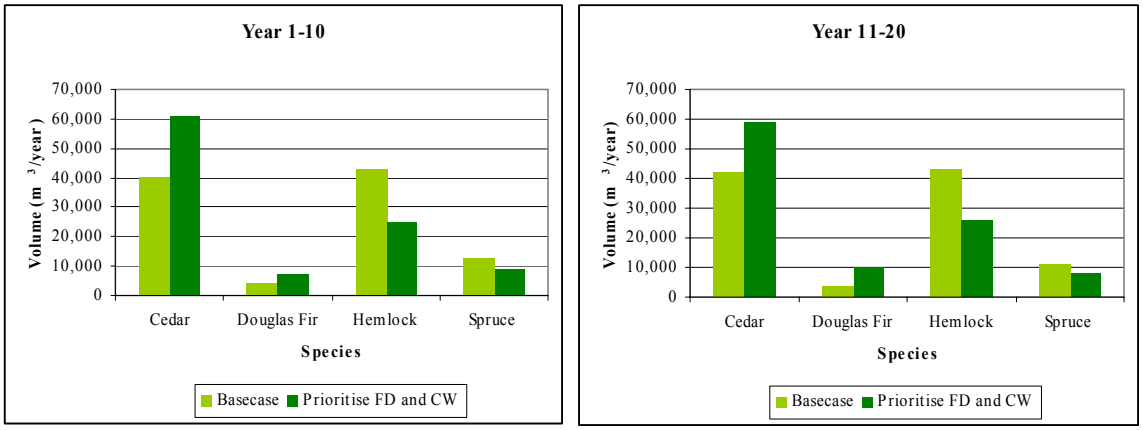

Figure 7.38 Change in Species Harvested for Two Periods from the Basecase

Figure 7.38 shows the change in species composition harvested. Increased amounts of Cedar and Douglas-fir are harvested at the expense of Hemlock and Spruce. The trend is consistent between year 1 - 10 and year 11 - 20.

7.20 ALTERNATE HARVESTS

There are many alternative harvest profiles available for any given landbase when considering variables such as the harvest level, how long the harvest level is maintained for and how sharply the harvest level is increased or decreased. These variables impact both the short and long-term harvest levels.

There are many practical constraints on harvest levels such as present harvest levels and volume smoothness over time to reflect operational and market inflexibility. These constraints are modelled by limiting changes in the harvest level to less than 10% of the previous harvest level and by initially starting at a realistic harvest level.

There are three sensitivities in this section:

1. The first sensitivity is "Maximum Short-Term Harvest" and will test the impact on timber supply of maximizing the initial harvest level for 10 years with the < 10% step down rule in effect down to a preset long term level.;
2. The second sensitivity is the "Maximum Non-Declining Harvest Level" which tests the maximum flat line level; and
3. The third sensitivity is "Sustaining the Present AAC of 90,000m^3/year as Long as Possible" before stepping down to find a stable long term harvest level.

The harvest levels are shown in Table 7.23 and Figure 7.39. The timber availabilities are identical to the Basecase as they are under all the same constraints and are therefore not shown.

The maximum harvest possible for the next 10 years is 126,000m^3/year. The maximum non-declining yield is 84,000m^3/year. A harvest level of 90,000m^3/year can be sustained until period 10.

Table 7.23 Annual Harvest Levels- Basecase and Maximum Short Term Harvest

Period	Annual Harvest Level (m^3/year)			
	Basecase	Maximum 10 year Harvest	Maximum Non declining yield	90,000m^3 as long as possible
1	100,000	126,000	84,000	90,000
2	100,000	126,000	84,000	90,000
3	100,000	113,000	84,000	90,000
4	100,000	102,000	84,000	90,000
5	90,000	92,000	84,000	90,000
6	81,000	82,000	84,000	90,000
7	81,000	80,000	84,000	90,000
8	81,000	80,000	84,000	90,000
9	81,000	80,000	84,000	90,000
10	81,000	80,000	84,000	90,000
11	81,000	80,000	84,000	80,000
12	81,000	80,000	84,000	80,000
13	81,000	80,000	84,000	80,000
14	81,000	80,000	84,000	80,000
15	81,000	80,000	84,000	80,000
16	81,000	80,000	84,000	80,000
17	81,000	80,000	84,000	80,000
18	81,000	80,000	84,000	80,000
19	81,000	80,000	84,000	80,000
20	81,000	80,000	84,000	80,000
21	81,000	80,000	84,000	80,000
22	81,000	80,000	84,000	80,000
23	81,000	80,000	84,000	80,000
24	81,000	80,000	84,000	80,000
25	81,000	80,000	84,000	80,000

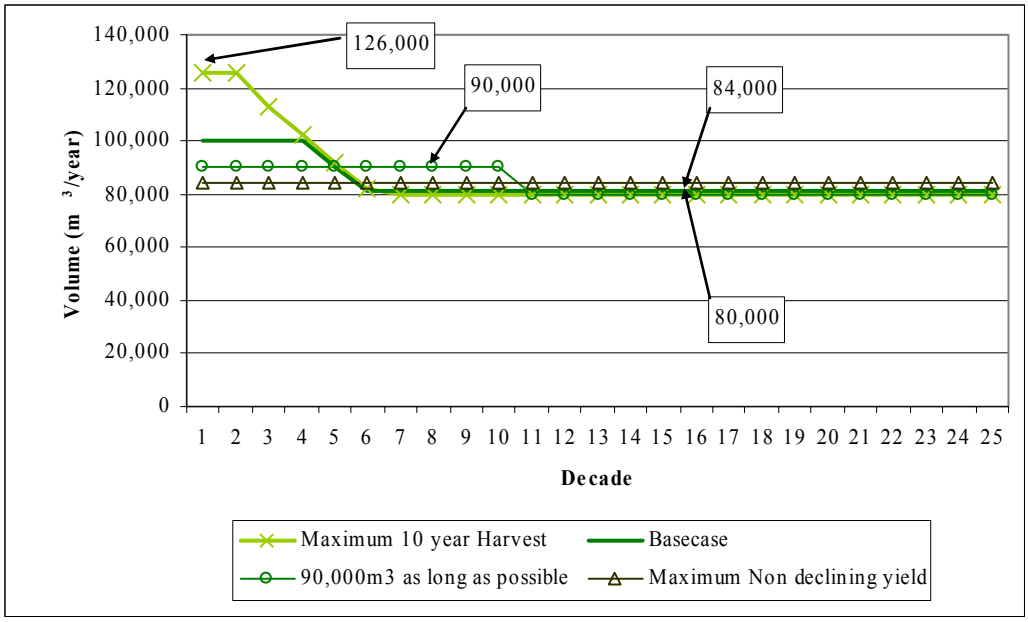

Figure 7.39 Harvest Levels - Basecase and Maximum Short-term Harvest

8.0 DISCUSSION OF RESULTS

The analyses have revealed many interesting results and have provided insight into the processes that influence timber supply in TFL 55. This section will explore some of the more significant results that had a particular impact; such as caribou, inventory and productivity.

8.1 RESOURCE MANAGEMENT AREAS- CARIBOU

Caribou RMZs have a very significant impact on the timber supply of TFL 55. Two sensitivity analyses were conducted to assess the impact of changing specific aspects of the analysis assumptions for caribou habitat.

The first analysis increased the forest cover objective applied to 60% retention as described in Table 7.14 to simulate increased restriction due to caribou. This sensitivity decreased the harvest level by an average of 23%, demonstrating that significantly increasing requirements for mature forest cover in caribou habitat could substantially decrease timber supply over all time frames.

The second sensitivity had all caribou requirements removed- all areas previously caribou were dealt with under adjacency requirements. Removal of these requirements resulted in a significant increase in timber supply of 14% from the Basecase.

For one RMZ to have such a large timber supply impact is unusual, but for the case of TFL 55, seral is the only other overlapping RMZ. This means that when the caribou restriction is removed, there is only seral left to constrain harvest through RMZ mechanisms. If there were other overlapping RMZs present in TFL 55, the caribou impact would appear less significant.

8.2 PHASE 2 VEGETATION RESOURCE INVENTORY

The phase 2 VRI adjustment was investigated in sensitivity section 7.10 where the age, height and volume adjustment was excluded. The removal of these adjustments resulted in the harvest level decreasing by 18% in the short term and 10% in the mid and long term, demonstrating the strong upwards pressure exerted by this factor from MP No. 3 to MP No. 4.

8.3 SITE INDEX ADJUSTMENT

The SIA was investigated in sensitivity section 7.8 where the site index was not adjusted and the inventory site indices were used. The removal resulted in the harvest level decrease of 20% in the short term and 34% in the mid and long term. This shows the influence that site indices have on managed stand yields and in turn, the impact on timber supply. The large impact highlights the underestimation of site productivity in previous analyses.

8.4 SENSITIVITY ANALYSES

Table 8.1 provides a summary of the impacts of the sensitivity issues explored in this section. Impacts shown represent aggregate differences over the periods indicated, and are rounded to the nearest percentage value.

Unless otherwise stated; short term is defined as from periods 1 - 4, the mid term is from periods 5 - 12 and the long term is from periods13 - 25. For easy of summarising, Table 8.1 does not include those harvest levels only maintained for 1 period that were needed to keep decadal changes in harvest less than 10%.

Table 8.1 Sensitivity Analyses- Summary of Percentage Impacts

Scenario		% Difference from Basecase		
Section	Title	Short Term	Mid Term	Long Term
7.0	Basecase	0%	0%	0%
7.1	Timber harvesting landbase +5%	4%	4%	4%
7.1	Timber harvesting landbase -5%	-12%	-12%	-12%
7.2	Old operability	-10%	-12%	-12%
7.3	Natural stand yields +10%	10%	-1%	-1%
7.3	Natural stand yields -10%	-10%	0%	0%
7.4	Managed stand yields + 10%	0%	11%	11%
7.4	Managed stand yields -10%	0%	-10%	-10%
7.5	Minimum harvest ages +10 years	-6%	-6%	2%
7.5	Minimum harvest ages -10 years	0%	1%	1%
7.6	Regeneration delays +5 years	-5%	-6%	-6%
7.7	Turn off genetic gains	0%	-4%	-4%
7.8	No SIA	-20%	-34%	-34%
7.9	Managed stand SI +1 m	2%	7%	7%
7.9	Managed stand SI -1 m	-4%	-6%	-6%
7.10	No Inventory Adjustment	-18%	-10%	-10%
7.11	Turn off adjacency and turn on IRM	0%	-8%	-8%
7.12	IRM Green-up heights +1 meter	0%	0%	0%
7.12	IRM Green-up heights -1 meter	0%	0%	0%
7.13	Caribou retention at 60%	-24%	-23%	-23%
7.14	No caribou retention	14%	14%	14%
7.15	Hemlock Merchantability at 60%	-10%	-6%	-6%
7.16	Landscape Level Biodiversity	4%	3%	3%
7.17	Turn of disturbances in non-THLB	0%	6%	6%
7.18	Relative oldest first	0%	-4%	-4%
7.19	Maximize volume harvested	0%	-4%	-4%
7.20	Prioritize FD and CW Harvest	1%	1%	1%

9.0 REFERENCES

Sterling Wood Group Inc. 2000. *Selkirk Tree Farm Licence 55 Management Plan 3*. Victoria B.C.

BC MSRM. 2005. *Revelstoke Higher Level Plan Order*, MSRM, Victoria, BC.

Government of B.C. 1995. *Biodiversity Guidebook*.

Timberline Forest Inventory Consultants Ltd. 2005. *TFL 55 – Vegetation Resource Inventory Statistical Adjustment.* Kelowna B.C.

Timberline Forest Inventory Consultants Ltd. 2005. *TFL55 – Timber Supply Analysis Information Package*. Selkirk Tree Farm Licence 55 Management Plan No. 4. Kelowna B.C.

B.C Ministry of Forests. 2004. *Revelstoke Timber Supply Area Analysis Report*. Victoria B.C.

Appendix 1: Information Package


Timberline
Forest Inventory Consultants