TIMBER SUPPLY ANALYSIS REPORT

NORTH COAST TIMBER SUPPLY AREA

TIMBER SUPPLY REVIEW 2006

VERSION 5

Prepared for:
The North Coast DFAM Group
FIA Project NC 6466 001

Prepared by:
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Victoria, B.C.

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April, 2006

Timberline
Forest Inventory Consultants

This document was prepared to support an allowable annual cut determination by British Columbia's Chief Forester. To learn more about this process please visit the following website:

http://www.for.gov.bc.ca/hts/

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April 11, 2006

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Attention : Ian Robertson, RPF
FIA Administrator

Reference: ***North Coast TSA 2006 Timber Supply Analysis – NC 6466 001***

Please accept this final analysis report for the TSR 3 portion of the project. The report includes updated results for the New Protected and Biodiversity Area and Ecosystem-Based Management scenarios based on new data provided by Ministry of Forests and Range.

It has been our pleasure working with you.

Yours truly,

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5	Amended report (EBM-2 scenarios)	April 11, 2006	Erik Wang

EXECUTIVE SUMMARY

A timber supply review process has been initiated for the North Coast Timber Supply Area (TSA). Timberline Forest Inventory Consultants Ltd., on behalf of the North Coast Defined Forest Area Management (DFAM) Group, has prepared timber supply information to support determination of the allowable annual cut (AAC). Timber supply reviews are conducted every five years and the determination is made by the B.C. Forest Service's Chief Forester. For the North Coast Timber Supply Area, the Chief Forester will determine a new AAC by late 2006.

The key documents supporting AAC determination are a data package describing the inputs to the timber supply analysis, this timber supply analysis itself, and a socio-economic analysis. The *Data Package* and *Socio-Economic Assessment* are appendices to this report.

The allowable annual cut for the North Coast TSA was set in 1985 at 600,000 m^3/year and was maintained at that level in the 1995 Timber Supply Review No. 1 (TSR 1) AAC determination. The *North Coast TSA Rationale for AAC Determination* was published for TSR 2 in January of 2001. At that time the AAC was reduced by 4% to 573,624 m^3/year.

This document presents the results of the timber supply analysis conducted in support of TSR 3. A base case analysis was prepared using the most current data sources and management assumptions based on current practice. The inputs to this analysis are documented in the *Data Package*. Any changes to these assumptions are reported in this analysis report.

The Base Case initial sustainable harvest level was determined to be 573,700 m^3/year, which represents no change from the TSR 2 AAC Determination. This level can be sustained for four decades, then declining to a maximum long-term sustainable harvest level of 429,900 m^3/year in 60 years.

A number of sensitivity analyses were conducted to explore the risk associated with various sources of uncertainty in the modelling assumptions and data. The following table summarizes the results of each sensitivity analysis with comparison to the Base Case. In comparing the sensitivity results to the Base Case, four time frames are illustrated.

First, the number of decades over which the current AAC can be maintained is presented. This provides an assessment of the risks surrounding continuation of the current AAC. The second timeframe, overall timber supply for the first 12 decades, is considered to be the transition from a primarily old-growth harvest, to primarily second growth. In terms of net present value, change during this time frame would have the greatest economic impact. The third time frame, total timber supply in decades 13-25, represents the long-term sustainable timber flow from the land base. Finally, the overall timber supply impacts across the entire time horizon are identified.

Summary of timber supply analysis results

Sensitivity	Decades at or above Current AAC	Percent of Base Case Harvest		
		Decades 1-12	Decades 13-25	Decades 1-25
Base Case	4	100	100	100
THLB + 10%	9	113	104	109
THLB – 10%	2	91	92	91
Remove area North of Nass River	1	86	89	87
Remove New Protected and Biodiversity Areas	1	73	73	76
Natural stand yields + 10%	9	113	100	107
Natural stand yields – 10%	1	92	100	96
Full SIBEC adjustment	25	169	198	184
85% SIBEC adjustment	25	135	153	144
Minimum harvest age + 10 years	2	95	100	97
Minimum harvest age – 10 years	6	105	100	102
VQO green-up height + 1 metre	5	104	100	102
VQO green-up height – 1 metre	3	98	100	99
Full old growth in low emphasis	4	100	100	100
Old growth age 200 years	4	100	100	100
EBM Scenario 1	1	89	95	92
EBM Scenario 2	0	67	71	69
EBM Scenario 2 with additional VQO harvest	1	90	79	84

The Base Case harvest level is based on a THLB that is 22% larger than that reported in TSR 2. As a result there are potential risks to this outcome if the actual THLB is smaller than that reported. This could occur for one of several reasons:

1. Higher level plans approved as a result of the North Coast and Central Coast LRMP processes, in the North Coast TSA recommend removing significant areas from the THLB. Based on the current new protected and biodiversity areas (using December 2005 mapping), which have been identified in the LRMP processes, this would reduce the THLB by approximately 23%. This reduction forces the initial harvest level (current AAC) to decline after one decade, 30 years earlier than noted in the Base Case.
2. Removing the area north of the Nass River would reduce the THLB by approximately 13%, which in turn would limit maintenance of the current AAC to one decade.
3. Implementing the Ecosystem-Based Management (EBM) rules, as modelled, for retention of old growth would also limit maintenance of the current AAC to one decade.

Several other factors assessed in the sensitivity analyses did demonstrate some downward pressure on the short-term timber supply. They included the possibility that existing natural yields are overstated, or that access to second growth stands could be delayed if minimum harvest ages are overly optimistic. There is no specific information indicating that these are likely possibilities.

Offsetting these downward pressures to the extent that the existing AAC could be maintained would require a significant improvement in productivity expectations for the remaining land base. This would be the case if the SIBEC productivity improvements were in fact realized. The 85% SIBEC scenario would provide enough upward pressure to largely offset the above factors. This is the case as there are no short-term timber flow constraints evident in the Base Case. As a result, much of the SIBEC gain can be realized immediately.

The timber supply was sensitive to volume estimates for natural stands as well. Increasing volume estimates by 10% for existing natural stands, modelled with VDYP, allowed the current AAC to be maintained for up to nine decades. Conversely reducing these volumes forced the initial harvest rate to decline after only 10 years. These stands support the harvest during the next 120 years and adjustments to the volume estimates will influence the harvest potential for the majority of that timeframe.

Timing of stand availability, as defined by minimum harvest age, did not impact the long-term harvest level but it did influence how long the initial harvest rate could be sustained. Reducing minimum harvest age by 10 years makes managed stands available sooner which in turn permits the harvest of existing natural stands over a reduced time frame. The initial harvest rate could be maintained for six decades with this reduction to minimum harvest age. Alternatively, increasing minimum harvest age by 10 years delays the availability of second growth volume and the initial harvest level was maintained for only 20 years.

The analysis included assumptions for resource emphasis areas to ensure objectives related to non-timber resources were addressed. Changes to green-up requirements in visually sensitive areas impacted the harvest level minimally in the short term, with no difference to the long-term level.

Revising the old growth requirements to include full old seral requirements in low biodiversity emphasis areas had no impact on the Base Case harvest estimate. Approximately 80% of the productive forest lies outside the THLB so much of the old forest requirements can be met by this portion of the land base. Similarly, reducing the age that defines “old” to 200 years did not alter the Base Case harvest. These results demonstrate that unless significant changes are made to the old forest requirements, as modelled in the EBM scenarios, there is no impact on timber supply.

Based on the current inventory and Base Case assumptions, the short-term timber supply for the North Coast TSA is stable at the current AAC of 573,624 cubic metres over the next four decades. The harvest is improved significantly by including SIBEC managed stand site index estimates in regeneration yields. Site index values based on mature inventory attributes are widely considered to underestimate managed stand yields. Therefore future stand yields are likely to be higher than indicated by the Base Case.

Other management issues are currently more important to the timber supply on the North Coast. The feasibility of the timber located north of the Nass River is uncertain. Without this portion of the TSA there will be a reduction in available timber within 10 years. New protected and biodiversity area exclusions and Ecosystem-Based Management objectives as modelled, could have a significant impact on the timber supply, depending on the final decisions associated with the North Coast and Central Coast LRMPs. It is therefore important to know the outcome of the LRMP’s, especially as they pertain to EBM and where harvesting will be allowed to occur, to understand the timber supply for the North Coast TSA.

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1.0 INTRODUCTION

Timberline Forest Inventory Consultants Ltd., on behalf of the North Coast DFAM Group (NCDFAM), has prepared timber supply information for the Provincial Timber Supply Review (TSR). These reviews are conducted every five years and assist the B.C. Ministry of Forests and Range (MoFR) Chief Forester in re-determining allowable annual cuts (AAC). For the North Coast Timber Supply Area (TSA), the Chief Forester is scheduled to determine a new AAC in late 2006.

Under the defined forest area management (DFAM) legislation, the responsibility to conduct timber supply analysis within a TSA can be transferred to the licensees operating within the TSA. The DFAM legislation requires the formation of a DFAM group that includes the holders of replaceable forest licences, BC Timber Sales (BCTS), and other holders of agreements that meet the prescribed requirements.

The DFAM group is completing the steps leading up to, and including the delivery of, timber supply analyses as follows:

- Collecting data and preparation of a data package which summarizes the data assumptions - land base, growth and yield, forest management practices, statement of management strategies, and analysis methods - that will be used, and the critical issues that will be examined in the timber supply analysis;
- Providing for an initial public and First Nations review of the data package;
- Completing the timber supply analysis and report;
- Completing a socio-economic analysis; and
- Providing for public and First Nations review of the timber supply and socio-economic analyses.

After the completion of these steps, the analysis report is submitted to the Chief Forester. The AAC is then set by the Chief Forester using the analysis report as one of the many factors required as part of the determination process.

In the North Coast Timber Supply Area the DFAM group is represented by the three forest companies and BCTS operating in the North Coast TSA portion of the North Coast Forest District in northwestern British Columbia, known collectively as the NCDFAM.

This analysis report documents the outcomes of the timber supply analysis performed for TSR 3.

1.1 DFAM Process

Preparation for the North Coast TSA TSR 3 analysis began in July 2003. The first step under the DFAM process is the preparation of the data package. The data package is a technical document that acts as the foundation for the timber supply analysis. It provides a clear description of information sources, assumptions, issues, and any relevant data processing or adjustments related to the land base, growth and yield, and management objectives and practices used in the analysis.

The first draft of the *North Coast Timber Supply Review Data Package* (*Data Package*) was completed in March, 2004. It was submitted at that time to the MoFR and was also made available for a public and First Nations review over a period of two months. Feedback was directly solicited from First Nations groups. The methodology used to carry out the public and First Nations review was documented and is provided in the *Data Package*. The feedback comments from the review process are also provided in this document.

The final version of the *Data Package* was completed in July 2004. The MoFR accepted it for use on September 13, 2004**.** It is provided with this analysis report as Appendix II. Note that changes have been made since the July 2004 version, and are documented in an updated Data Package dated June 2006 and in Section 6.1 of this report.

Under the DFAM process, the analysis report, and the *Socio-Economic Assessment North Coast Timber Supply Area* (*Socio-Economic Assessment*) (Appendix I), must go through a second public and First Nations review period of two months. The review period is expected to begin in April 2006. After the review period, the feedback will be included with the feedback from the first review period.

To facilitate the review processes, an Internet web site dedicated to the NCDFAM has been established at http://www.northcoastdfam.ca. This analysis report, appendices, background documents, and maps are being placed on this site. They will remain freely available for download by individuals from this site throughout the remainder of the AAC determination process.

2.0 GENERAL DESCRIPTION OF LAND BASE AND TENURE

The North Coast Timber Supply Area is located in northwestern British Columbia, and within the Coast Forest Region. The rugged terrain is largely dominated by western hemlock and western redcedar, with lesser components of sitka spruce and amabilis fir on richer sites and yellow-cedar at higher elevations.

The diverse landscape associated with the TSA is home to a variety of terrestrial and marine wildlife, including black-tailed deer, grizzly and black bears, wolves, sea mammals, raptors, and sea birds.

The total TSA area is approximately 1,830,000 ha. Only about 8% of this land base is considered available for timber harvesting, with the remainder being non-productive, inoperable, or constrained from harvesting for other reasons.

Overall TSA administration is the responsibility of the MoFR, North Coast Forest District. Figure 2.1 provides an overview of the North Coast TSA.

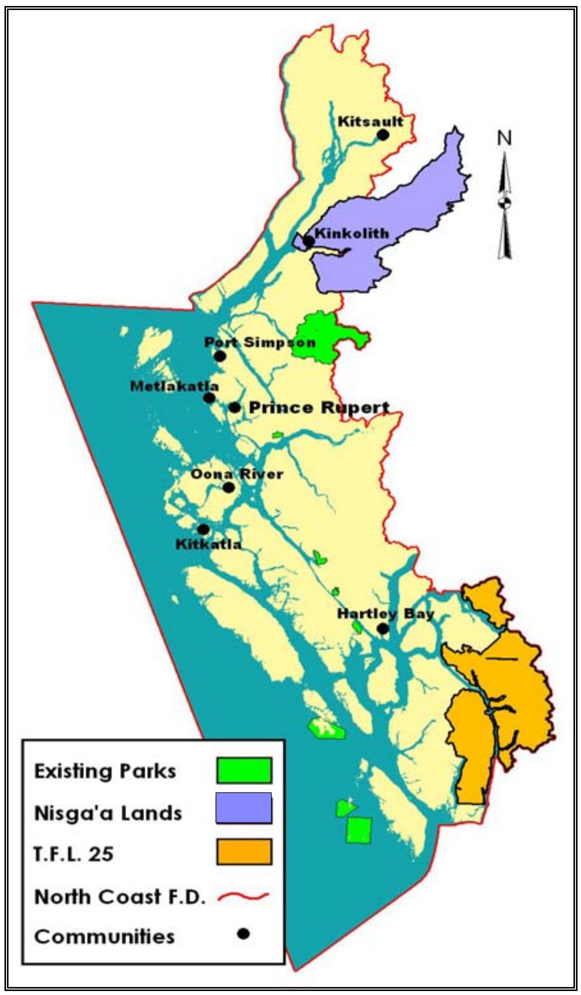

Figure 2.1 - Overview of the North Coast TSA

3.0 TIMBER FLOW OBJECTIVES

The objective of the analysis is to determine the capacity of the land base to sustain a timber flow, and any risks to this flow resulting from uncertainty in assumptions. The analysis goes beyond a simple calculation of capturing the growth potential of the land base. Many management objectives with overlapping and potentially conflicting goals must be met. The maximum sustainable timber flow must ensure that these objectives are met while capitalizing on the growth potential of the land base.

A number of alternative harvest flows are possible. For this analysis, the objective was to achieve a balance of the following timber flow objectives:

- Maintain the existing AAC of 573,624 cubic metres per year for as many decades as possible;
- Limit harvesting in visually sensitive areas (VQOs) to approximately 80,000 cubic metres per year, even if limits for disturbance forest cover constraints have not been reached. This represents recent performance by licensees in VQOs and is modelled with flexibility around the 80,000 cubic metre goal;
- Decrease the periodic harvest rate in acceptable steps (<=10%) when declines are required to meet all objectives associated with the various resources on the land base; and
- Achieve a maximum even-flow long-term supply where the total inventory is stable.

4.0 LAND BASE INFORMATION

A complete description of the data sources and assumptions used as the basis for the North Coast TSA 2006 analysis is contained in the *North Coast TSA Data Package*. This document is included as part of this analysis report in Appendix II. The following key data sources were employed in this analysis:

- Ministry of Forests and Range, Vegetation Resource Inventory (VRI) (1999 update, converted From previous format to VRI in 2001);
- Major Licensees, harvesting and road construction data (1999 to 2004);
- 2004 North Coast TSA Predictive Ecosystem Mapping (PEM);
- Ministry of Forests and Range, Scenic Area Mapping (2002);
- Ministry of Forests and Range, Visual Landscape Inventory (1999);
- Ministry of Forests and Range, North Coast site index adjustments (2004);
- Ministry of Forests and Range, Aboriginal Affairs Branch; First Nations Traditional Territories; and
- Central Coast and North Coast LRMP new protected and biodiversity areas (current to December 2005).

4.1 Land Base Classification

Many sources of data were used to compile information on the land base within the North Coast TSA. The main source of land base information was the vegetation resources inventory (VRI). This inventory replaced the forest cover data set used in TSR 2. However, many of the attributes traditionally used during the land base classification process were no longer provided within the VRI. The transition from forest cover to VRI required some assumptions during the land base classification process that are documented in the *Data Package*.

To identify the timber harvesting land base (THLB), the TSA lands are first classified into four broad categories:

- Non-productive for forest management purposes;
- Inoperable, or will become inoperable, under the assumptions of the analysis;
- Unavailable for harvest for other reasons (*e.g.* sensitive slopes, wildlife habitat or recreation); or
- Available for integrated use (including harvesting).

The following areas do not contribute to the timber harvesting land base:

- Non-crown – areas not managed by the MoFR, including parks and ecological reserves;
- Nisga'a lands;
- Non-productive – areas not occupied by forest, or capable of supporting forests (swamp, water bodies, alpine, *etc.*);
- Inoperable areas – areas unavailable for harvesting due to accessibility or economic factors:
- Non-commercial cover – areas covered by brush or non-commercial tree species;
- Low productivity sites – timber growth is too slow due to low productivity;

- Non-merchantable stands (problem forest types) – low stocking or crown closure, and stands with a majority of pine or deciduous (except stands < 60 years old);
- Environmentally sensitive areas (ESAs) – including unstable soils, avalanche hazards, problem regeneration, and hydrologic sensitivity;
- Riparian (streamside) areas – buffer zones to protect ecosystems adjacent to streams, lakes, and swamps;
- Cultural heritage resources – a reduction across the land base to account for archaeological sites, structural features, heritage landscape features and traditional use sites;
- Wildlife tree patches (WTPs) – small reserves for wildlife that remain in harvested areas;
- Existing roads – developed in the GIS database for specific road locations with the appropriate non-productive width for each road category;
- Woodlot license – one woodlot license, approximately 400 ha in size does not contribute to the THLB; and
- Non-productive NSR (non-satisfactorily restocked) – areas of non-stocked lands that are not expected to regenerate to productive timber;

An inventory audit was conducted on the new re-inventory in 2001, which confirmed that the old forest cover inventory used in TSR 2 significantly underestimated stand volumes. With increased volumes in the forest cover attributes, it was recommended by both Licensees and the Ministry of Forest to re-visit the operability mapping. During the operability review, additional areas previously consider inoperable were reclassified and added to the operable land base. This revised operability mapping was subsequently approved for use in TSR 3 by the Chief Forester in 2003. The results of the land base classification can be found in Table 4.1 and Figure 4.1.

Table 4.1 - North Coast TSA land base classification

Land Base Classification	Productive Area by Classification (ha)	Reduction (ha)	Net Remainder (ha)
Total Area on Inventory File			**3,093,115**
Non-TSA area		336,257	
Salt water		925,974	
Total TSA land base			**1,830,883**
Non-crown		40,138	
Nisga'a lands		55,389	
Non-productive		859,454	
Productive Forest			**875,902**
Productive Reductions			
Inoperable	685,627	685,627	
NCBr	271	23	
Low productivity	394,057	5,844	
Non-merchantable	155,708	1,161	
ESAs	288,980	20,345	
Riparian (RRZ,RMZ)		12,201	
Culturally significant		1,507	
WTPs		1,492	
Existing roads		1,592	
Woodlots	370	212	
Permanent NSR	157	91	
Total Reductions		730,095	
Current THLB			**145,808**
NSR			2,336
Immature			24,479
Mature			118,993
Less future roads		7,838	
Long-Term THLB			**137,970**

Overall, approximately 145,800 hectares were determined to be currently available for timber harvesting, as compared to 119,130 hectares in the last timber supply review (TSR 2). This represents an increase of 22%, mainly attributable to a re-inventory of roughly half of the TSA since TSR 2 and revisions to the operability classification.

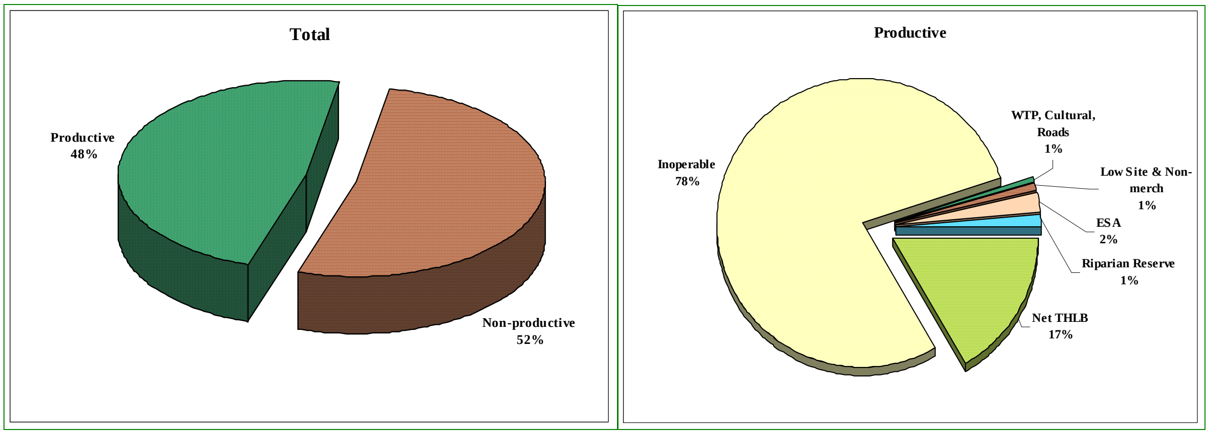

Figure 4.1 - Land base classification

The THLB consists of all of the productive land expected to be available for harvest over the long term. This land base is determined by classifying the total land base according to specified land base classification criteria.

Spatial exclusions from productive land include areas classified as inoperable, low site, and deciduous leading stands. There are also reductions to address cultural significance, wildlife tree patches and riparian, which were assigned to the land base as small percentage removals.

4.2 Ecosystem andForest Inventories

The productive forested area of the North Coast TSA is 875,902 ha. The following land categories are excluded from the productive land base:

- All saltwater;
- Non-crown lands, only ownership codes 62-C and 69-C are included;
- Nisga'a lands; and
- Non-productive types (type identity 6 and 8 in the VRI).

Biogeoclimatic (BEC) mapping provides information on the range of ecological units that occur within the TSA. For a detailed description of the sites identified refer to *Land Management Handbook 26, A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region B.C.* (Ministry of Forests, June, 1993). The distribution productive area by BEC unit is shown in Figure 4.2.

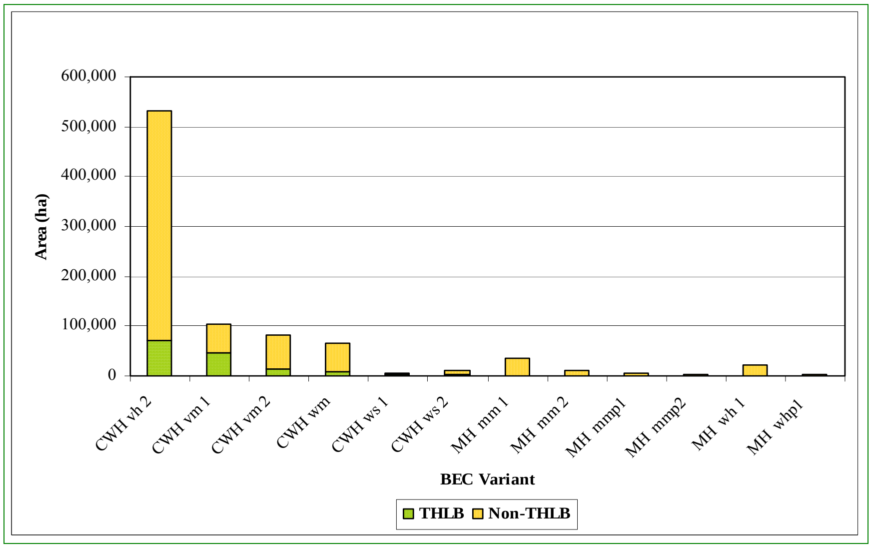

Figure 4.2 - Productive area by Biogeoclimatic Zone

Forest stands are generally categorized by leading species. The distribution of the timber harvesting land base area by leading species and age class is shown in Figure 4.3.

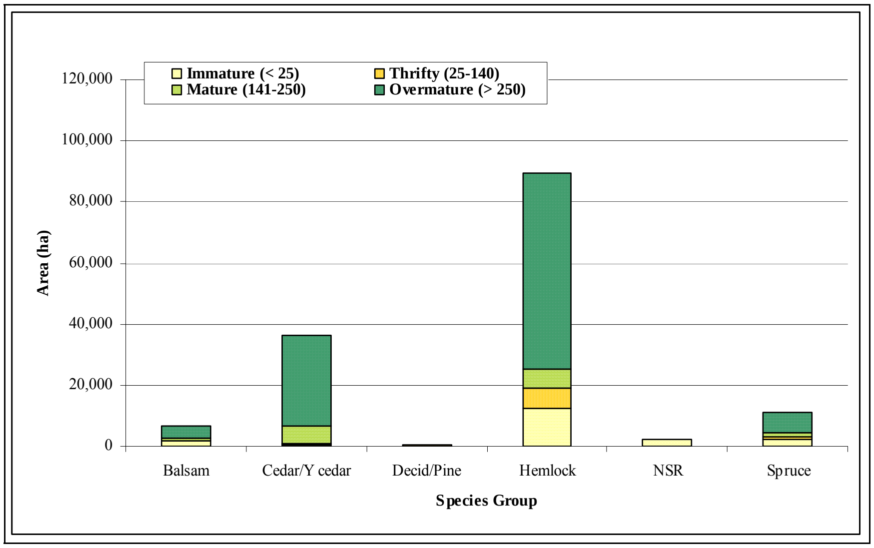

Figure 4.3 - THLB by leading species and age class

4.3 Inventory Aggregation

As part of the modelling process stands are aggregated for many purposes. They are grouped in order to represent areas designated for special management considerations and they are also aggregated to model stands with similar growth patterns.

4.3.1 Landscape Units

For planning purposes, the North Coast TSA has been subdivided into 64 landscape units, but only 55 of these include productive land and have therefore been included in the timber supply analysis. Specific management constraints are associated with these landscape units.

4.3.2 Resource Emphasis Areas

The productive land base was assigned to resource emphasis areas (REAs) to facilitate the modelling of management requirements. In the North Coast TSA, polygonal-based visual quality objective (VQO) zones are incorporated into the analysis as REAs. A total of 543 VQO polygons were modelled in this analysis. VQOs comprise 44,785 ha of THLB. For each category (M-modification, PR-partial retention, R-retention, and P-preservation) the figure indicates the proportions of the area that fall into the THLB and non-THLB land base classifications. Both classifications are considered to contribute to the management requirements within the VQO polygon.

Any area within the THLB that is not classified as visually sensitive was assigned to the integrated resource management (IRM) REA. These areas may be non-visible or visible but are not considered to be visually significant, and therefore have fewer restrictions on harvesting. For modelling purposes the IRM areas were aggregated within each landscape unit, resulting in 53 modelling units. The distribution of the REAs is presented in Figure 4.4.

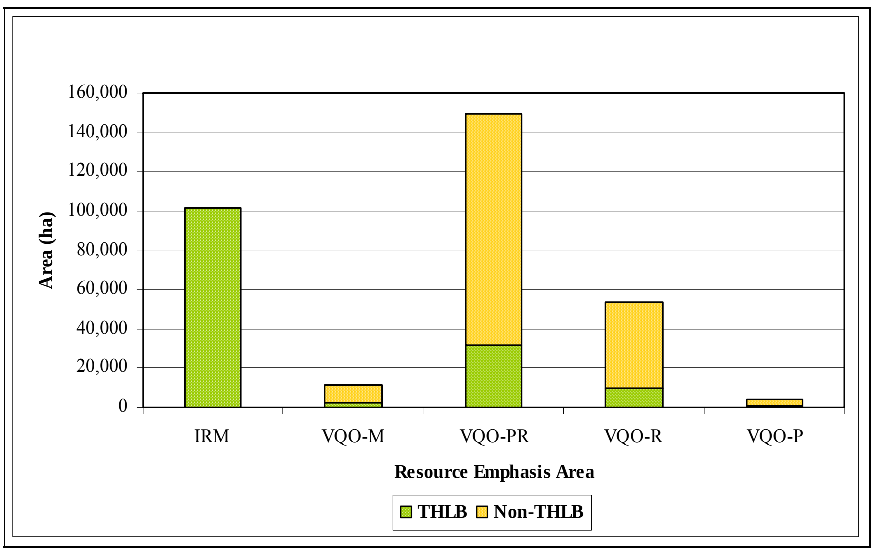

Figure 4.4 - Distribution of resource emphasis areas

Twenty-five percent of the productive land base falls within VQO REAs. However, a large proportion of each REA is found in the non-THLB. This is relevant because the non-THLB can contribute to fulfilling the management requirements for each VQO REA, thereby reducing the pressure on the THLB. The remaining area is classified as Integrated Resource Management (IRM). Within this area only a general 3-metre green-up requirement is applied.

4.3.3 Analysis Units

The inventory was aggregated into analysis units to capture biological and productivity similarity for modelling purposes. Analysis units were defined on the basis of:

- Species groupings (9);
- Site classes (3); and
- Management regime.

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 projected over time through the use of yield models. Yield tables are categorized into either natural stands or managed stands because of distinct growth pattern differences between the two types of stands. Existing natural and managed stands are differentiated based on stand age. All natural and managed stand yield tables were developed by J.S. Thrower & Associates Ltd. and incorporated into the timber supply forecasts for the base case and sensitivity analyses. The parameters used to define the yield table inputs were identified in the approved *North Coast Timber Supply Analysis Data Package*.

4.4.1 Natural Stands

Natural stand yield tables were developed for 46 analysis units as described in the *Data Package*. Inputs into the yield tables included inventory site index, species composition, stocking class, and crown closure. The yield tables were developed using the MoFR model Variable Density Yield Prediction (VDYP), version 6.0. The outputs are average yield tables calculated by analysis unit.

4.4.2 Managed Stands

Managed stand yield tables were developed for 57 analysis units identified in the Data Package. Inputs included species composition from the inventory (compiled by analysis unit), silviculture regimes by analysis unit, and site index estimates from the inventory (used in the base case) and the site index biogeoclimatic ecosystem classification (SIBEC) estimates (used in the SIBEC sensitivity analyses). The yield tables were developed using the MoFR BatchTIPSY (version 3.2) program for managed stands. Managed stand yield tables were generated by analysis unit and 10-metre site index class. Yield tables by analysis unit were the area-weighted average of the component yield tables.

4.4.3 Harvest System

Clearcutting was assumed to be the predominant harvesting system, with the exception of non-VQO types with helicopter access. In these latter types, variable retention (VR) harvesting was modelled on 50% of the areas based on current and recent harvesting practices since TSR 2.

To achieve the 50% target, stands were selected for VR treatment based on the cedar component. Those stands with at least 20% cedar were selected for VR. Overall, approximately 9,400 hectares were assigned to the VR regime. In these types it was assumed that 40% of the stand volume would be retained at each harvest entry. Stand growth rates were adjusted to account for the impact of this residual component on regeneration development. While it is expected that VR harvesting will also be employed in VQO types, it was assumed that the disturbance constraints and the attendant harvest patterns applied to these types would account for the impact associated with VR.

4.4.4 Minimum Harvest Ages

Minimum harvest ages were assigned as outlined in Table 4.2.

Table 4.2 - Minimum harvest age criteria

Criteria	Natural Stands	Managed Stands (clearcut)	Managed Stands (variable retention)
Mean annual increment (MAI)	95% of culmination	95% of culmination	95% of culmination
Minimum Volume	375 m^3/ha	375 m^3/ha	na
Minimum diameter (DBH)	na	35 cm	na

4.4.5 Productivity

The rate at which a stand grows is determined by the underlying site productivity, and the chosen stand management regime. The productivity of a stand is measured using a site index. In the Base Case analysis, site index for natural and managed stands was calculated from the existing forest inventory. Figure 4.5 shows the distribution of inventoried stand site index classes for the THLB.

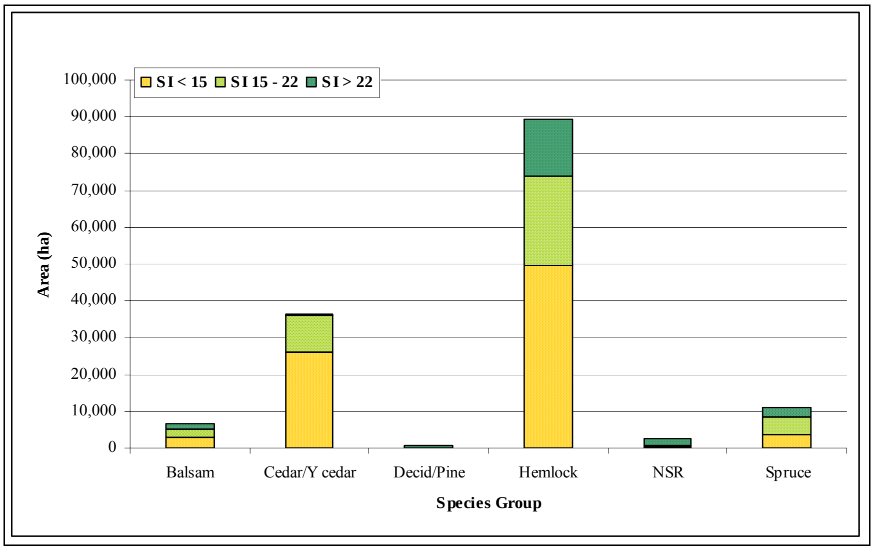

Figure 4.5 - Site index distribution

A SIBEC analysis was completed by J.S. Thrower & Associates Ltd. Data inputs into the analysis included the North Coast Predictive Ecosystem Map (PEM) and the SIBEC field data. Allen Banner, Regional Research Ecologist (Coast Forest Region), led development of the PEM and Shamaya Consulting created and calibrated the PEM knowledge tables. Dave Yole and Geoff Cushon completed the PEM accuracy assessment.

The PEM accuracy assessments revealed that additional ground sampling and table adjustment modifications are needed to increase the reliability limits of the PEM data. Since SIBEC values use the PEM information tables to determine second growth productivity, the SIBEC information will only be considered in a sensitivity analysis and not as part of the Base Case. All other analysis scenarios will use inventory site index values for both existing and regeneration yields.

MoFR Research Branch provided SIBEC data for the BEC subzones in the North Coast TSA. SIBEC site indices (first and second approximation estimates) were assigned to resultant polygons created from the overlay of the forest cover and PEM for all species in the forest cover label. Weighted site index by species was then calculated for each forest cover polygon based on the site series components for the operable land base.

The results show an overall managed site index of 23.8m for the operable area which represents an increase of 61% to the inventory site indices in the operable area. The majority of the operable area (92%) had available SIBEC estimates; the remaining 8% was assigned inventory site indices.

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 aspatial harvest schedules for the North Coast timber supply analysis. This model uses a geographic approach to land base 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 and 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 aggregated (aspatial) harvest schedules that incorporate all integrated resource management considerations. Explicit spatial feasibility factors, for example silviculture block green-up and adjacency, were not modelled in the analysis. Given the number of land base netdown factors which were not determined spatially, such spatial resolution was not deemed to be useful.

Harvest priorities were generally based on the "oldest first" harvest rule. In addition, harvesting in approximately 25 watersheds was assigned the highest priority over the first two decades of modelling. These watersheds represent areas that are currently being developed and/or have approved forest development plans in place.

The rate of disturbance within VQOs was constrained to supply approximately 80,000 cubic metres/year of harvest from those areas. This harvest level, which was not modelled as a fixed limit to provide periodic flexibility, is based on both recent performance by the licensees since TSR 2 and that higher harvest levels were not operationally feasible under current market conditions.

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 (inventory), 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 land base;
- *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 mid-term harvest targets do not compromise long-term growing stock stability. Also, modelled harvest levels included allowances for non-recoverable (un-salvaged) losses (10,100 m^3/year). Non-recoverable losses reflect the volume of timber lost each year to fire and blowdown based on the 20-year average. Harvest figures presented in this report exclude this amount unless otherwise stated.

Over the next rotation it may be necessary to reduce harvest levels prior to achieving the long-term level. 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 long-term productive capacity of the land base. 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. This is due to the imposition of minimum harvest ages and forest cover requirements, which alter time of harvest.

5.1 Interpreting Timber Availability

Harvest flow has traditionally been the primary indicator used to evaluate the timber supply impacts of various management scenarios. However the harvest flow for a given scenario does not necessarily reveal the timing of timber supply constraints, and therefore the opportunities to relax these constraints and improve timber supply. This is addressed more explicitly by tracking timber availability, which is the total volume of merchantable timber that could be harvested in any given period without violating any forest cover requirements. The profile of timber availability provides valuable insight into the timber supply dynamics of a given scenario. In general, the periods with the least amount of timber available control the resulting harvest flow.

The timber availability profile has the most utility when used to compare management scenarios. When comparing different management scenarios using timber availability profiles, it is critical to use the same harvest request in both scenarios. In doing so the differences in the timber availability profiles can be entirely attributed to differences in the management assumptions and are not clouded by differences in modelled harvest. In the sensitivity analyses, Section 7 of this report, when two timber availability profiles are displayed on the same graph, the profiles are created using the same Base Case harvest flow. The logical progression is as follows:

1. Establish the base case harvest flow;
2. Determine timber availability associated with the base case;
3. Rerun the analysis with the changed assumption, but with the same harvest levels as the base case;
4. Assess the difference in availability due to the change in assumption (the change isolated from further complication associated with a change in harvest levels); and
5. Rerun the analysis with the changed assumption but modify the harvest to determine the sustainable harvest flow.

Figure 5.1 provides an example to demonstrate the interpretation of availability levels, using the North Coast TSA TSR 3 Base Case harvest schedule and one of the sensitivities completed for the analysis.

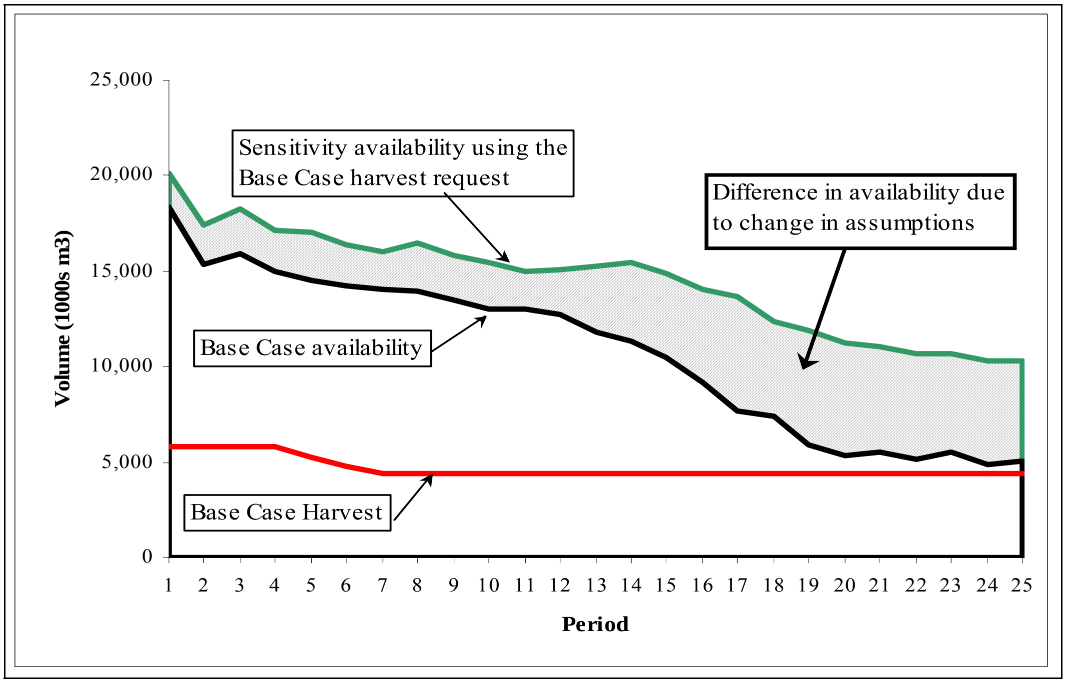

Figure 5.1 - Interpretation of available volume graphs

The Base Case harvest shows an initial decline in available timber resulting from harvesting available mature forest during the first 10 years. There is a steady decline in available volume for the Base Case, with the lowest levels experienced during the last 60 years of the planning horizon. To ensure a stable level of total growing stock throughout the 250-year simulation, it is necessary to reduce the harvest during decades five through seven.

A change in an assumption(s) for the sensitivity analysis resulted in an overall increase in timber availability, which would permit an increase above the projected Base Case harvest level. In general, it appears that the short and mid-term harvest level could be increased to the initial harvest rate modelled in the Base Case. At decade 10 there is approximately 2.4 million cubic metres of additional available volume, which if distributed evenly over the first 100 years of modelling, could provide approximately 24,000 m^3/year of harvest. The long-term level could also be improved compared to the Base Case with similar requirements related to maintaining a stable growing stock level.

6.0 TIMBER SUPPLY ANALYSIS RESULTS

This section presents the Base Case harvest flow profile established through analysis of timber supply. In Section 7, sensitivity analyses that address the issues associated with a large degree of uncertainty are also presented. The sensitivity issues that were tested are listed in Table 6.1.

Table 6.1 - Sensitivity analyses evaluated

Issue	Sensitivity Levels to be Tested
Land base	Adjust timber harvesting land base by +/- 10% Remove landscape units north of Nass from the THLB Remove new protected and biodiversity areas from the THLB
Growth and yield	Adjust natural stand yields by +/- 10% SIBEC SI adjustments for managed stand yields SIBEC less 15% SI adjustments for managed stand yields Adjust minimum harvest ages +/- 10 years
Visual landscape	Adjust VQO green-up requirements by +/- 1 metre
Old-growth	Full OG requirements from year 1 of simulation Reduce OG age to 200 years
Ecosystem-based management	EBM 1 – revised old seral based on site series surrogates EBM 2 – exclude new protected and biodiversity areas and revised old seral EBM 2 – exclude new protected and biodiversity areas and revised old seral, additional harvesting in visual areas

6.1 Base Case

The Base Case scenario represents the projected timber flows based on current practice with the best available information. The assumptions employed in this analysis are documented in the *Data Package*. However, it was necessary to alter some of these assumptions as the analysis was developed. The changes include:

- Stands harvested since the update of the forest inventory, labelled as "Harv2003" in the resultant database, were classified as one year old regeneration;
- Low productivity sites and non-merchantable forest types were not removed if they have a history of logging on the site;
- All leading deciduous stands greater than 60 years of age were excluded from the THLB;
- Existing road reductions were based on a GIS buffering process, not the specific area (1,697 ha) stated in the Data Package;
- A larger set of analysis unit definitions were developed, with additional breakdowns for variable retention and thinning treatments;
- Minimum harvest age for regeneration in variable retention stands must only meet the culmination of MAI requirement, no volume or diameter targets are required;

- No modelling to address community watershed objectives because these areas were completely excluded from the THLB;
- Limit disturbance in VQO areas to harvest approximately 80,000 m^3/year from those areas, (this was not modelled as a fixed target or limit);
- Variable retention harvesting assumptions as outlined in Section 4.4.3; and
- Harvest as much as possible from priority watersheds (areas that are currently being developed and/or have approved forest development plans in place) for the first 20 years of simulation. Harvesting will only occur in other areas when constraints shut down harvesting in all of the priority watersheds.

The timber supply flow pattern utilized in the Base Case was developed following the harvest flow objectives outlined in Section 3.0. The maximum sustainable timber flow for the TSR 3 Base Case over a 250-year time horizon is presented in Figure 6.1 and Table 6.2. For comparison, the harvest flow values from the TSR 2 Base Case are also provided.

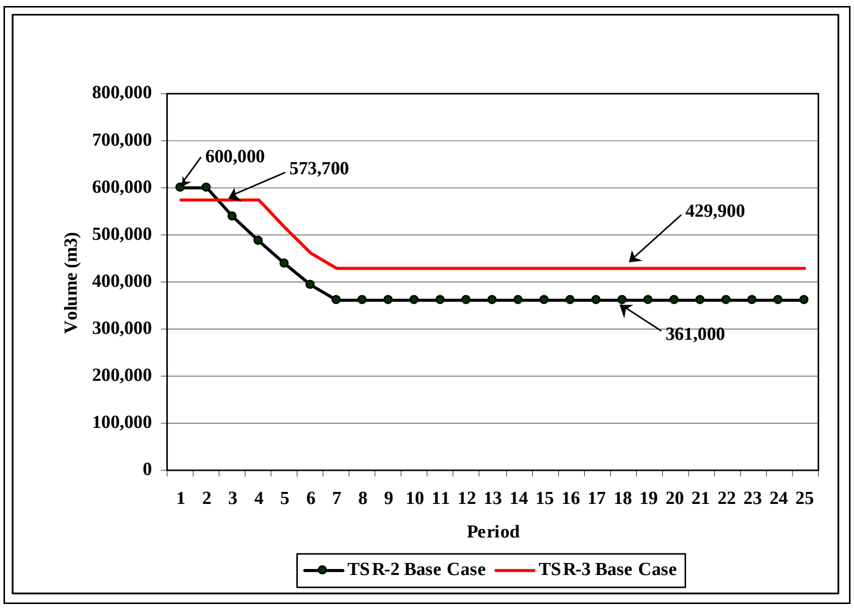

Figure 6.1 - Base Case annual harvest flow for TSR 3 and TSR 2

Table 6.2 - Base Case harvest flow for TSR 3 and TSR 2

Decade	Net Annual Harvest (m^3/year)	
	TSR 2	TSR 3
1	600,000	573,700
2	600,000	573,700
3	540,000	573,700
4	486,000	573,700
5	437,400	515,500
6	393,777	462,900
7+	361,000	429,900

The TSR 3 Base Case harvest flow starts at 573,700 m^3/year (the actual AAC is 573,624, rounded for analysis purposes). This level can be maintained for four decades. The TSR 2 Base Case started at a higher level, but then had to decrease quickly to a mid-term level below the current AAC. A higher initial harvest level for the TSR 3 Base Case was not selected because it would have required a compensating step down in the mid-term. Selecting a consistent harvest level through the short and mid-term meets the first timber supply objective "to maintain the initial harvest level of 573,624 m^3/yr for as many decades as possible". Therefore, no further adjustments to short and mid-term harvest flow pattern were required.

Subsequent to the fourth decade, the harvest level decreases by three approximately 10% decadal steps to a long-term maximum sustainable harvest level of 429,900 m^3/year by decade seven. This long-term level is approximately 19% higher than the TSR 2 long-term harvest level, while overall, the TSR 3 Base Case analysis shows a 15% increase over TSR 2. These increases are primarily due to the 22% increase in the THLB employed in TSR 3. However, the potential increase associated with this larger THLB was somewhat modified by the VQO harvest rate constraint described in Section 5.0. This constraint was not imposed on the TSR 2 Base Case.

The timing of the timber supply shortages is most clearly demonstrated by studying the availability of merchantable volume that could be harvested in a given decade without violating forest cover constraints. Figure 6.2 displays the 250-year growing stock (inventory) profile, including a line indicating the volume available for harvest at each decade. There are clearly no short-term limitations to timber available. In terms of identifying opportunities to enhance timber supply, this pattern is significant. Because timber availability is most limited at the end of the planning horizon, any changes in assumptions regarding productivity, or other factors which increase timber availability at any point in the planning horizon, can impact timber supply as early as the first decade.

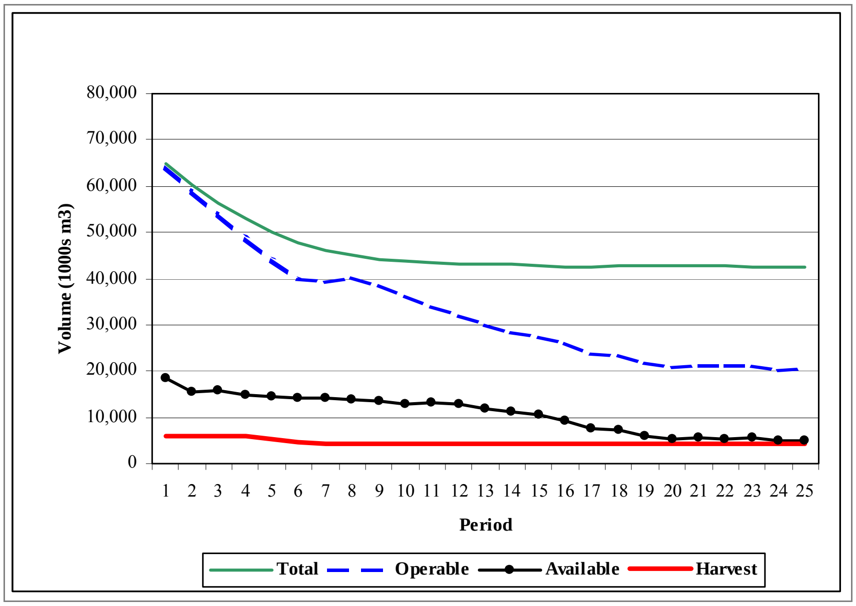

Figure 6.2 - Base Case growing stock profile

6.1.1 Harvest Trends

Figure 6.3 shows the sources of the base case timber harvest over the modelled time horizon. For the first 12 decades, the majority of the harvest comes from the existing natural stands. Only a small proportion of the harvest over this time comes from managed stands. At decade 13, the first major harvest from the regenerated managed stands begins. For the remainder of the modelled time horizon, the majority of the harvest is produced from managed stands through their subsequent rotations. Small harvests of natural stands occur throughout the modelled time horizon as natural stands that were reserved from harvest to meet management objectives are freed through the recruitment of other stands in their place.

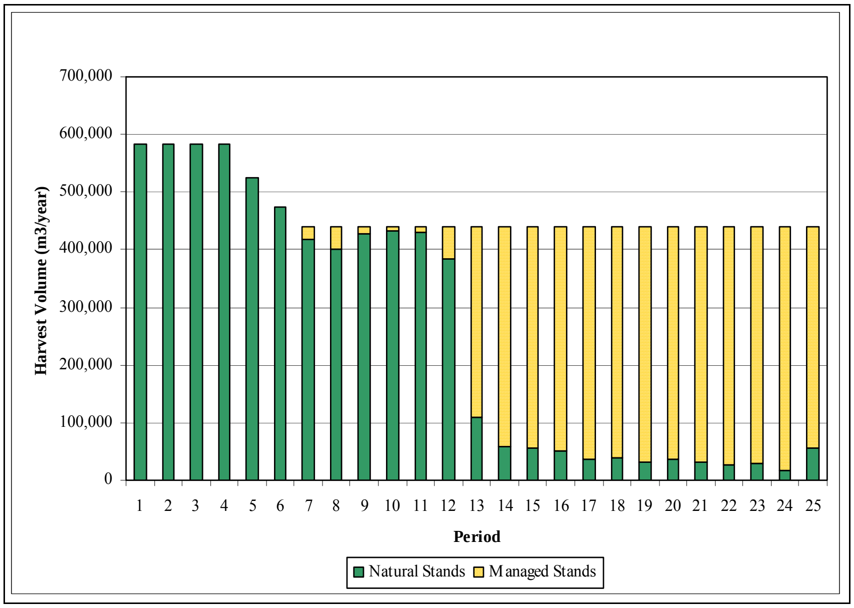

Figure 6.3 - Base Case timber supply sources

As specified in Section 5.0, disturbance constraints placed on visual quality REAs allow approximately 80,000 cubic metres of annual harvest. A fixed limit or target was not assigned to these areas because recent performance by the licensees has fluctuated during the last five years. Overall, the volume harvested in VQOs ranges from 71,600 cubic metres to 97,200 cubic metres, with an average annual harvest of 82,800 cubic metres. Figure 6.4 illustrates the actual VQO harvest level over the planning horizon.

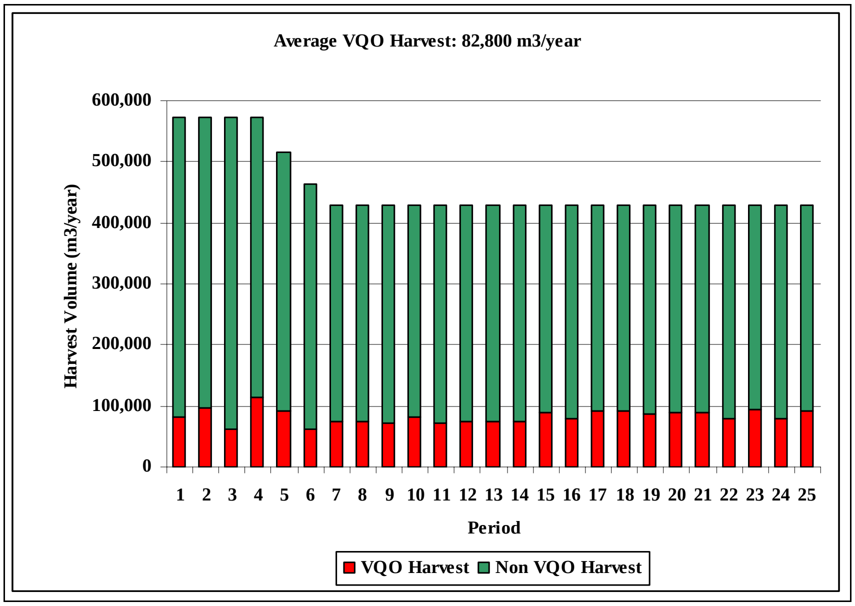

Figure 6.4 - Total and VQO harvest levels

Figures 6.5 and 6.6 show the average volume per hectare, area, age and diameter harvested per year in the Base Case. Figure 6.5 illustrates a significant reduction on harvested area in decade 13 and a corresponding increase in average stand yield, as the harvest shifts from existing to managed stands. This is also reflected in Figure 6.6, as a significant reduction in average harvest age. However, in the longer term these indicators tend to stabilize.

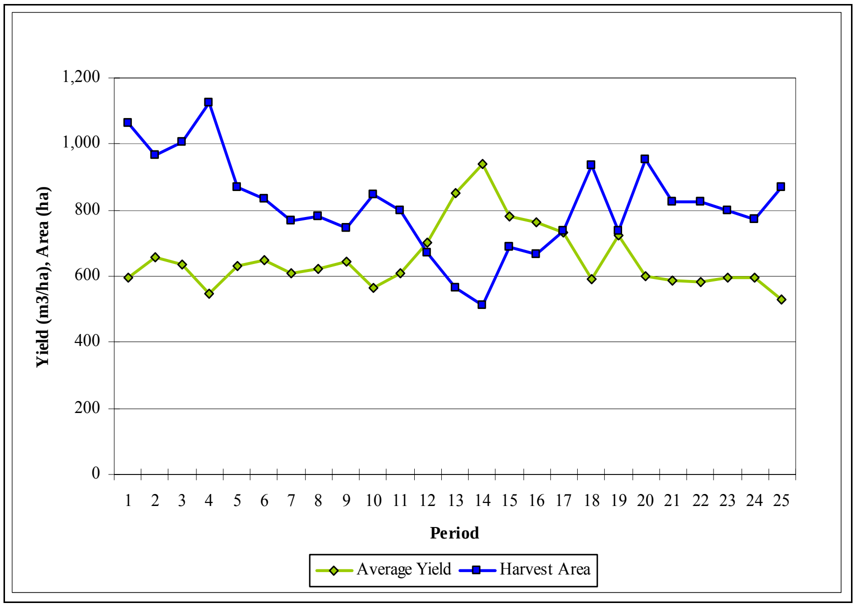

Figure 6.5 - Base Case average harvest area and stand yield

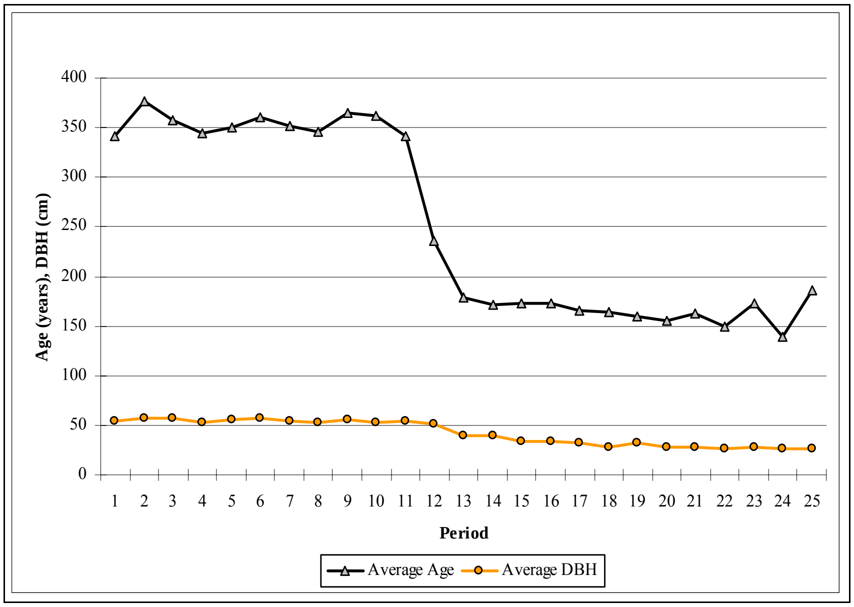

Figure 6.6 - Base Case average harvest age and stand diameter (DBH)

6.1.2 Age Class Distribution

Figures 6.7 through 6.11 display the age class distribution for the productive land base at different points in the 250-year time horizon. The areas are partitioned into THLB and non-THLB. The harvest for each decade of simulation is also presented. Age classes are 10-year categories with age class 26 representing all stands 251 years and older.

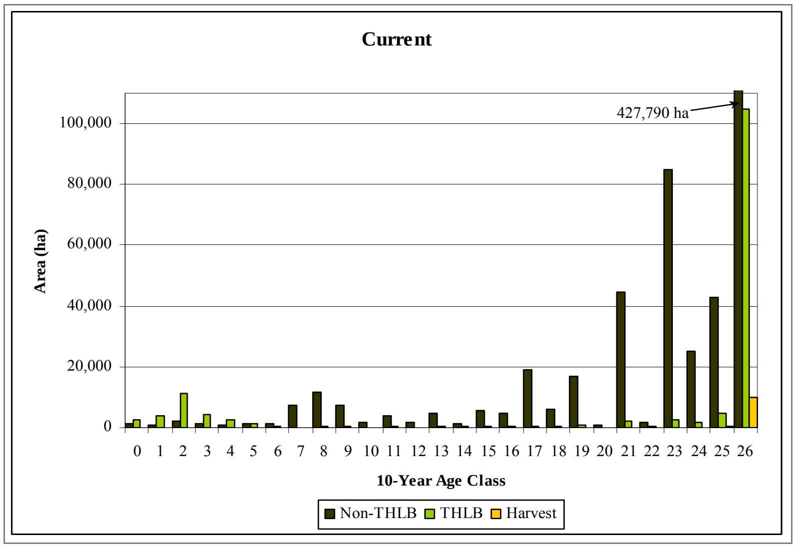

Figure 6.7 - Current age class distribution

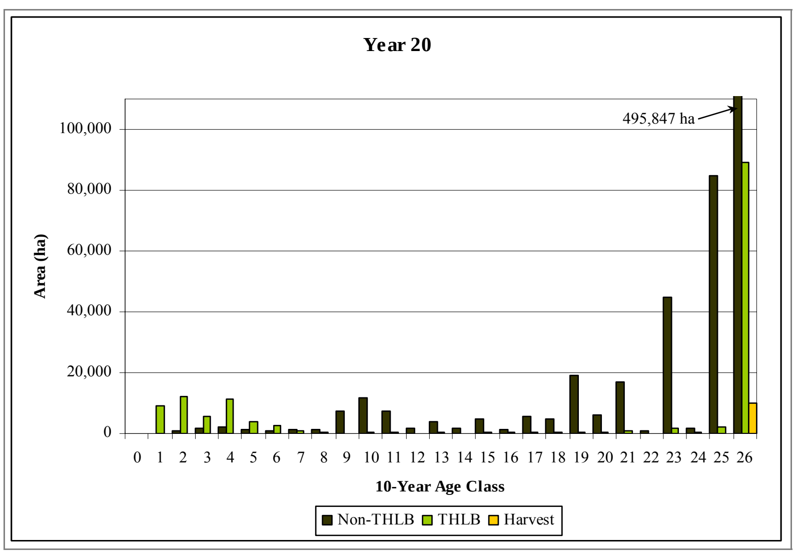

Figure 6.8 - Age class distribution at year 20

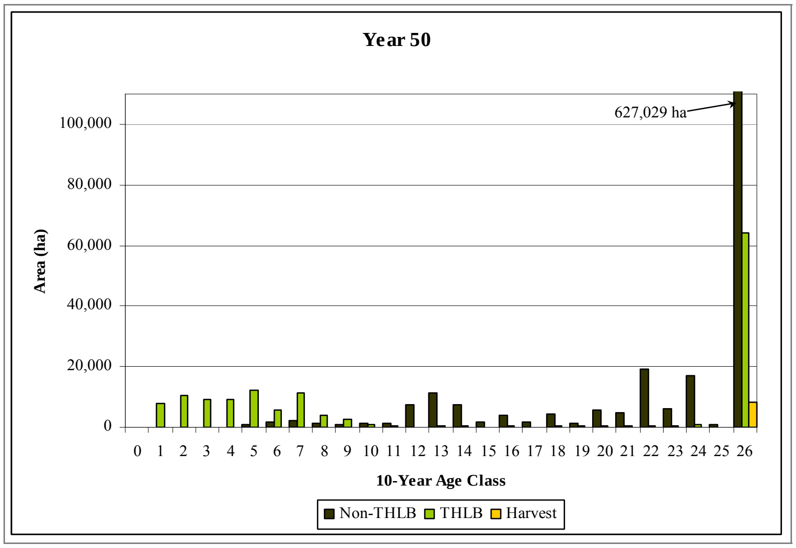

Figure 6.9 - Age class distribution at year 50

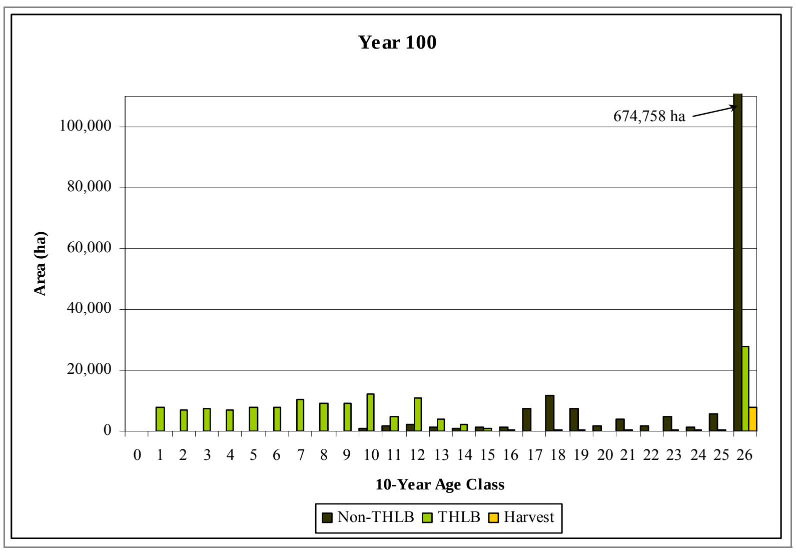

Figure 6.10 - Age class distribution at year 100

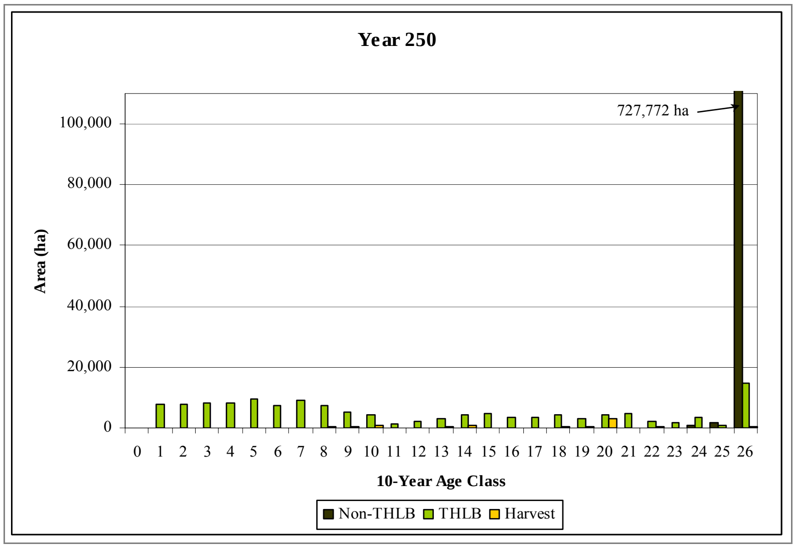

Figure 6.11 - Age class distribution at year 250

On the THLB, the transition from old growth to second growth is clearly evident. However, while Figure 6.6 above showed a prominent shift to harvesting in younger stands after 100 years, Figures 6.10 and 6.11 indicates that a substantial component of old growth is still being retained on the THLB. This is necessary to meet old-growth retention biodiversity requirements.

The non-THLB forest was not disturbed at any time during the analysis simulations. These stands represent approximately 84% of the productive forest. Although it might be unrealistic for these areas to age continuously, occasional stand break-up events, which are expected every 250 to 350 years, would not influence the results of the analysis.

6.1.3 Long Run Sustainable Yield

The maximum sustainable harvest level is determined in part by the productive capacity of the harvestable land base. The theoretical productive capacity of the land base is measured in terms of the long-term sustainable yield (LRSY). This value is calculated from the area-weighted average culmination mean annual increment (MAI) of the stands within the THLB. The LRSY values for both the existing natural stands and the future managed stands are shown in Table 6.3 for the Base Case.

Table 6.3 - Base Case natural and managed forest LRSY

Description	Natural	Managed
THLB (including NSR) (ha)	145,808	145,808
- future roads + timber licences (ha)	- 7,838	- 7,838
= net long-term land base (ha)	= 137,970	= 137,970
average MAI (m^3/yr/ha) at culmination age	* 3.02	* 3.96
= theoretical gross long-term (m^3/yr)	= 416,669	= 546,361
- wildlife reductions (4.2%) (m^3/yr)	- 16,979	- 23,121
- non-recoverable losses (NRLs) (m^3/yr)	- 10,100	- 10,100
= theoretical net long-term (m^3/yr)	= 389,590	= 513,140

While the age structure of the forest provides for initial harvests which are significantly higher than long-term productivity levels, short-term harvest levels should not be set so high that they compromise long-term harvest opportunities. The theoretical net long-term sustainable yield for managed stands is approximately 513,100 m^3/year. In contrast, the realized long-term harvest level in the Base Case is 429,900 m^3/year, or approximately 84% of LRSY.

Given the forest cover constraint and harvest scheduling requirements within the TSA, this realized level will always fall below LRSY, and 84% is a reasonable achievement. It is important to note that the recent SIBEC study which estimated managed stand site indices based on new information indicates a much higher average MAI and LRSY for the managed (future) forest. Figure 6.12 presents the base case harvest flow along with the natural and managed stand LRSY.

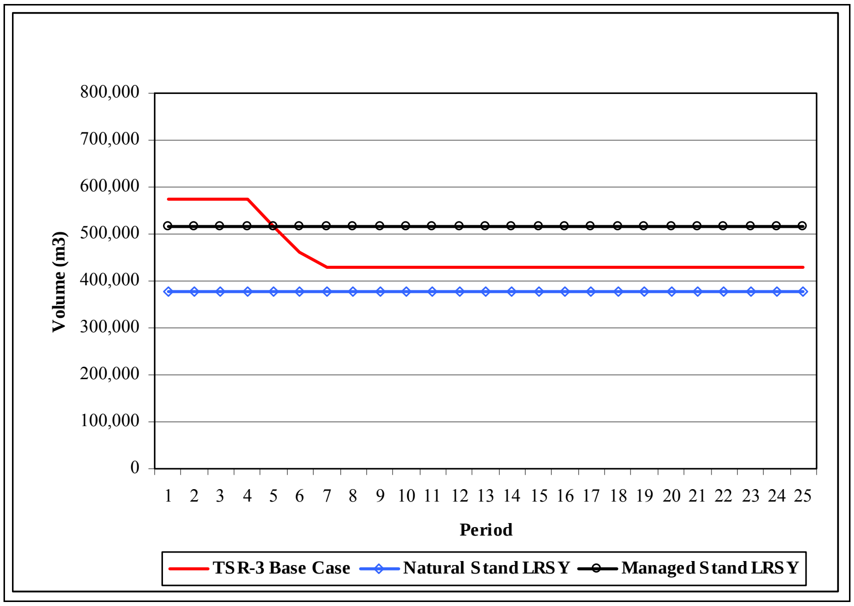

Figure 6.12 - Base Case harvest flow and LRSY

6.1.4 Harvest Flow Alternatives

Many harvest pattern options are available. For the Base Case, two alternative harvest flow options were explored. The first alternative was the maximum Even Flow harvest. A second alternative harvest flow was also explored, where the first decade harvest level was increased beyond the current AAC. Over the last 5 years, harvesting in the North Coast TSA has fallen below the AAC by a total of approximately 629,300 cubic metres. This amount was added to the first decade harvest, and the harvest levels in decades 2-25 were adjusted accordingly to avoid future shortfalls. The results are shown in Figure 6.13 and Table 6.4.

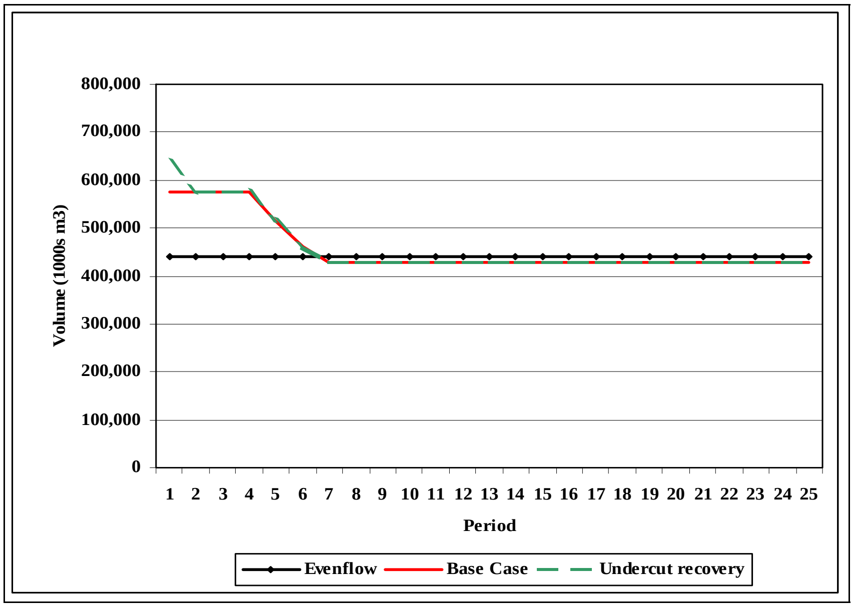

Figure 6.13 - Alternative harvest flows

Table 6.4 - Alternative harvest flows

Decade	Net Annual Harvest (m^3/year)		
	Base Flow	Even Flow	Undercut Recovery
1	573,700	439,100	636,800
2	573,700	439,100	573,700
3	573,700	439,100	573,700
4	573,700	439,100	573,700
5	515,500	439,100	515,500
6	462,900	439,100	462,900
7+	429,900	439,100	429,900

The Even Flow scenario demonstrates only a slight opportunity to increase the long-term harvest level above the base level (approximately 2%). Overall however, the objective of sustaining the existing AAC for four decades has no significant long-term timber supply cost.

Capturing the 2000-2004 undercut of 629,300 cubic metres during the next 10 years of harvest has no impact on the Base Case harvest rate. The factors that influence availability in the short and mid-term are not significant enough to force a reduction in estimated harvest for this scenario. Increasing the harvest target in the first decade has no negative impact on long-term levels. This harvest rate demonstrates that there is some flexibility in the short-term harvest rate for the North Coast TSA using the Base Case assumptions.

7.0 SENSITIVITY ANALYSIS

Sensitivity analysis provides a measure of the upper and lower bounds of the base case harvest forecast, reflecting either the general uncertainty inherent in assumptions made in the base case, or possibility that a base case assumption could change. In the former situation, an arbitrary change is generally applied to the variable in question, reflecting the degree of uncertainty associated with that variable. In the latter case, the specific change is incorporated into the analysis. 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 of sensitivity analyses, they are performed using the base case, varying only the assumption being evaluated. All other assumptions remain unchanged.

Changes in timber availability are assessed in sensitivity analysis, as discussed in Section 5. In each sensitivity analysis the Base Case harvest level is imposed on the data model with the alternative assumption to be tested. Available growing stock was determined for each decade by setting an infinite harvest target for that period, and imposing the Base Case harvest request for all other periods. This process was repeated for each period. In this way, the impact on availability of the alternative assumption through the entire analysis time frame was determined. Based on the changes in availability, a new harvest level was then sought, adhering to the flow policy described earlier. In adjusting the flow to reflect the alternate assumption, short-term harvest levels were altered first, followed by mid-term and finally long-term levels.

The sensitivity issues were earlier listed in Table 6.1. The timber supply impacts are illustrated in Sections 7.1 through 7.5. In each case, the analysis is conducted as follows:

1. Alter the parameter (*eg*. land base size);
2. Rerun the analysis with the Base Case harvest to observe the impact on timber availability; and
3. Adjust the harvest level to compensate for the change in availability.

In altering the harvest levels, the objective was to extend or contract the time frame over which the starting harvest could be maintained, and adjust the step-downs and long-term levels as well to achieve long-term growing stock stability.

For each sensitivity the impact of the changed parameter on Base Case timber availability is illustrated graphically, as well as the growing stock profile associated with the adjusted harvest level.

7.1 Land Base

The timber supply modelling exercise assumes that the size of the THLB will remain constant over the modelled time horizon (except for losses to future roads). With land use values changing over time, there is some uncertainty associated with this assumption. In these sensitivities, the size of the THLB was increased or decreased by 10% uniformly across all stands. There was a proportional shift in the non-THLB to compensate so that the total land base area remained constant.

7.1.1 Increase Timber Harvesting Land Base by 10%

As shown in Figure 7.1, increasing the THLB by 10% results in a corresponding increase in timber availability. This in turn provided an opportunity to extend the initial harvest level for an additional five decades, and increase the long-term level by approximately four percent as well (Table 7.1). Overall, the timber supply over the full time horizon was increased by approximately nine percent.

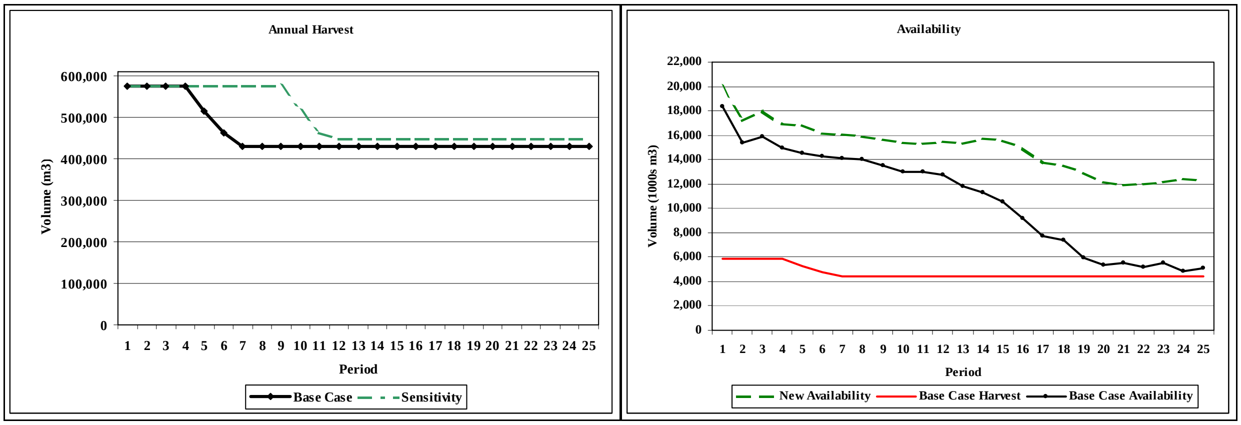

Figure 7.1 - Impact of increasing the THLB by 10%

Table 7.1 - Impact of increasing THLB by 10%

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	573,700
4	573,700	573,700
5	515,500	573,700
6	462,900	573,700
7	429,900	573,700
8	429,900	573,700
9	429,900	573,700
10	429,900	515,500
11	429,900	462,900
12+	429,900	448,400

7.1.2 Decrease Timber Harvesting Land Base by 10%

In a similar fashion, reducing the size of the THLB by 10% results in a decrease in timber availability (Figure 7.2), and a corresponding decrease in the sustainable timber supply (Table 7.2). The impacts are again proportional to the change in the size of the land base.

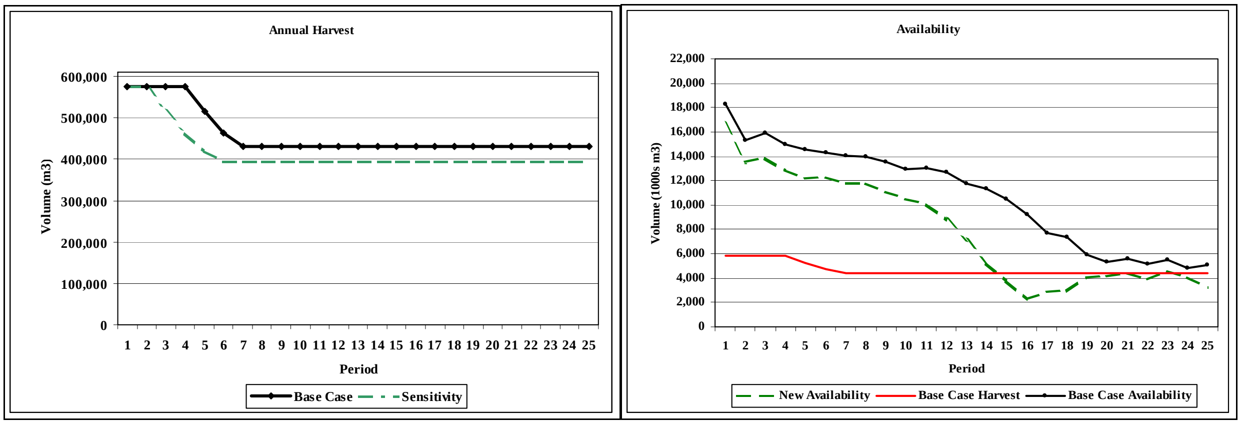

Figure 7.2 - Impact of decreasing the THLB by 10%

Table 7.2 - Impact of decreasing THLB by 10%

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	515,500
4	573,700	462,900
5	515,500	417,400
6	462,900	394,400
7+	429,900	394,400

7.1.3 Remove Area North of the Nass River

In the last AAC determination, the Chief Forester expressed concern over the operational and economic feasibility of accessing timber north of the Nass River. As a result, the harvest level in this area was partitioned separately. This sensitivity was completed to determine the impact of removing this area from the timber harvesting land base. This represents a reduction of 16,540 hectares (13%) in the size of the THLB. The results are presented in Figure 7.3 and Table 7.3. Predictably, removal of this area results in a total reduction in timber supply over the planning horizon of approximately 13% as well.

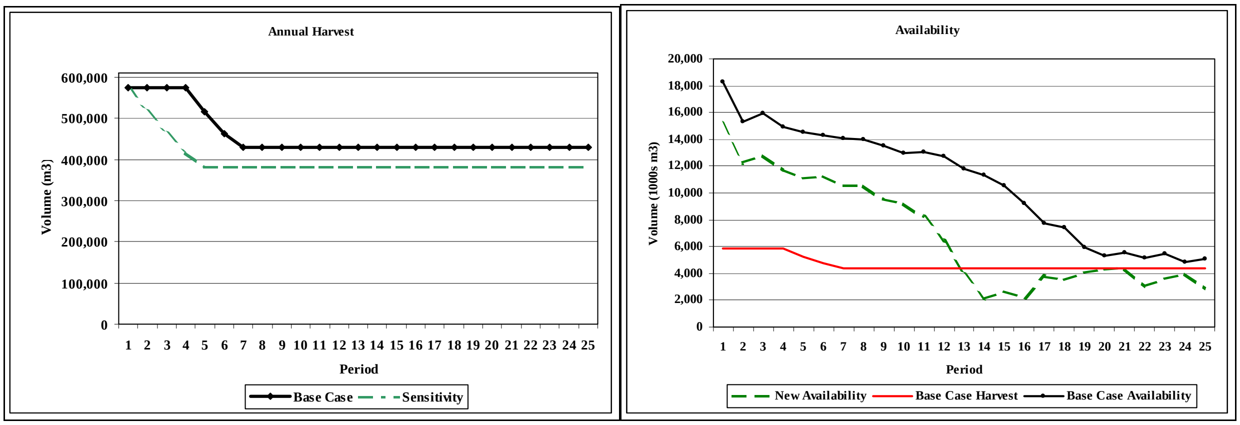

Figure 7.3 - Impact of removing the area north of the Nass River

Table 7.3. - Impact of removing the area north of the Nass River

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	515,500
3	573,700	462,900
4	573,700	415,600
5	515,500	382,400
6	462,900	382,400
7+	429,900	382,400

7.1.4 Remove New Protected and Biodiversity Areas

The North Coast and Central Coast Land and Resource Management Planning (LRMP) processes are complete for the North Coast TSA. On February 7th, 2006 the B.C. government announced land use decisions for the LRMP areas. The land use decisions provide final land use zoning for protected areas, biodiversity areas and ecosystem based management operating areas. Management direction for the protected areas and biodiversity areas does not allow for commercial logging, in effect making these areas a no harvest zone for timber supply purposes.

The total THLB included in these new protected and biodiversity areas amounts to 33,019 hectares, or 23% of the Base Case THLB. Therefore, removal of these areas from the timber harvesting land base has a significant impact on long-term timber availability, as illustrated in Figure 7.4. It is possible to sustain the Base Case short-term harvest for one decade before declining at 10% per decade to the long-term level. The reduction in harvest is shown in Table 7.4. Overall, there is a 24% reduction in timber supply over the planning horizon.

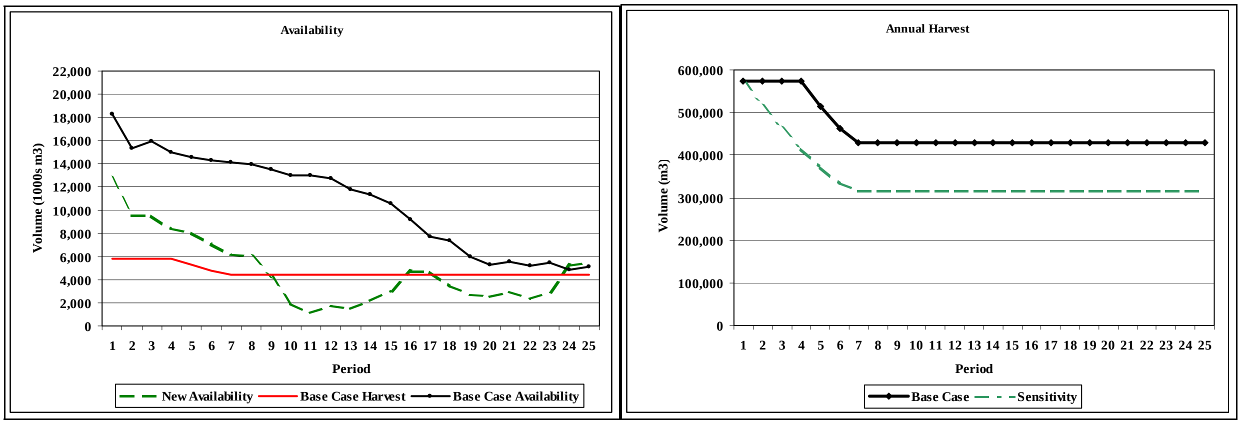

Figure 7.4 - Impact of removing the new protected and biodiversity areas

Table 7.4 - Impact of removing the new protected and biodiversity areas

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,900
2	573,700	515,500
3	573,700	462,900
4	573,700	415,600
5	515,500	373,100
6	462,900	334,700
7+	429,900	315,300

7.2 Growth and Yield

There is an inherent level of uncertainty surrounding estimates of yield for both existing natural stands, and the managed stands established following harvesting. In the case of existing stands, these uncertainties relate to the confidence limits surrounding the existing forest inventory. In the case of future stand yield forecasts, site index is the primary growth and yield driver. Site index estimates derived from height/age measurements in existing mature forest types are known to significantly underestimate the true productive capacity of the land base. Positive site index adjustments of several meters or more can result in large increases in stand yield forecasts.

Both of these issues are explored in the following sections.

7.2.1 Increase Natural Stand Site Yields by 10%

Increasing natural stand yields has an immediate and approximately proportional impact on timber availability, as illustrated in Figure 7.5, allowing for the maintenance of the initial harvest level for an additional five decades. The impact is a 13% increase in harvest over the first 11 decades. However, as the managed stand yields were not adjusted, in the longer term the harvest level steps down to the Base Case level.

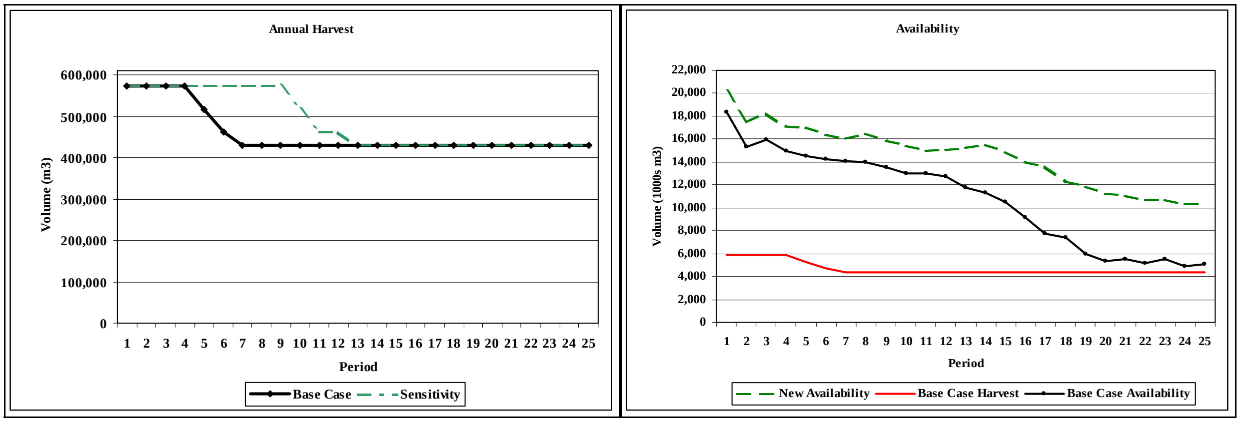

Figure 7.5 - Impact of increase natural stand yields by 10%

Table 7.5 - Impact of increasing natural stand yield by 10%

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	573,700
4	573,700	573,700
5	515,500	573,700
6	462,900	573,700
7	429,900	573,700
8	429,900	573,700
9	429,900	573,700
10	429,900	515,500
11	429,900	462,900
12+	429,900	429,900

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7.2.2 Decrease Natural Stand Yield by 10%

Decreasing natural stand yields by 10% has a similar impact on timber availability (Figure 7.6) and harvest level (Table 7.6). Overall, harvests in the first 11 decades were reduced by approximately 8%.

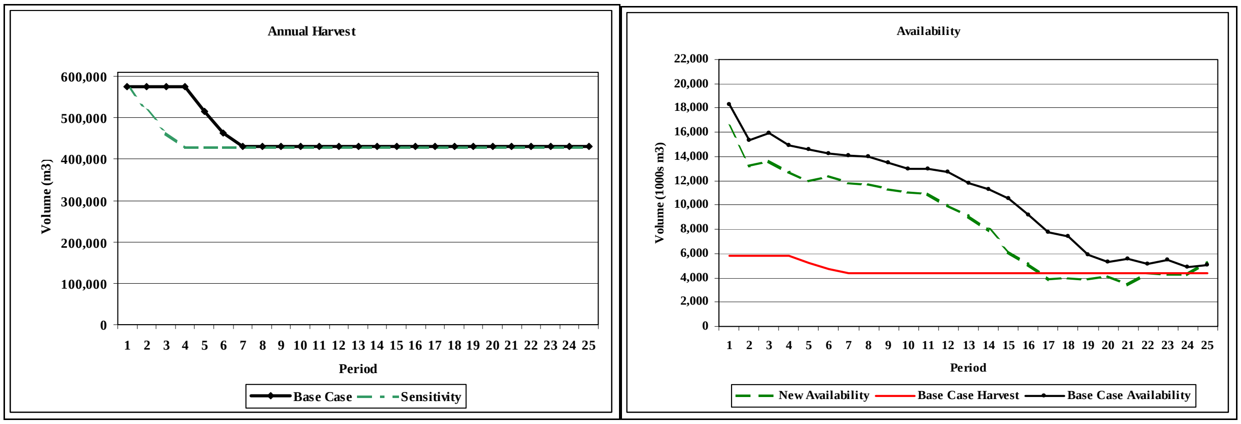

Figure 7.6 - Impact of decreasing natural stand yields by 10%

Table 7.6 - Impact of decreasing natural stand yields by 10%

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	515,500
3	573,700	462,900
4	573,700	427,900
5	515,500	427,900
6	462,900	427,900
7+	429,900	427,900

7.2.3 Increase Managed Stand Site Index – Full SIBEC Adjustment

As discussed in Section 4.4.5, managed stand site index values are substantially increased from inventory-based values through the shift to SIBEC based estimates. These SIBEC estimates could not be used for the Base Case because the reliability limits of the PEM data need to be improved. This PEM data is the basis for assigning SIBEC values. All other analysis scenarios will use inventory site index values for both existing and regeneration yields.

Use of SIBEC values in the development of managed stand yield forecasts increases the average MAI by approximately 105%. The effect of this increase on long-term timber availability is substantial, as shown in Figure 7.7. It is shown in Table 7.7 that the impact on long-term harvest levels is approximately proportional to this increase in MAI. In addition, as there are no short-term constraints on timber availability, a large increase in harvest levels can be achieved immediately.

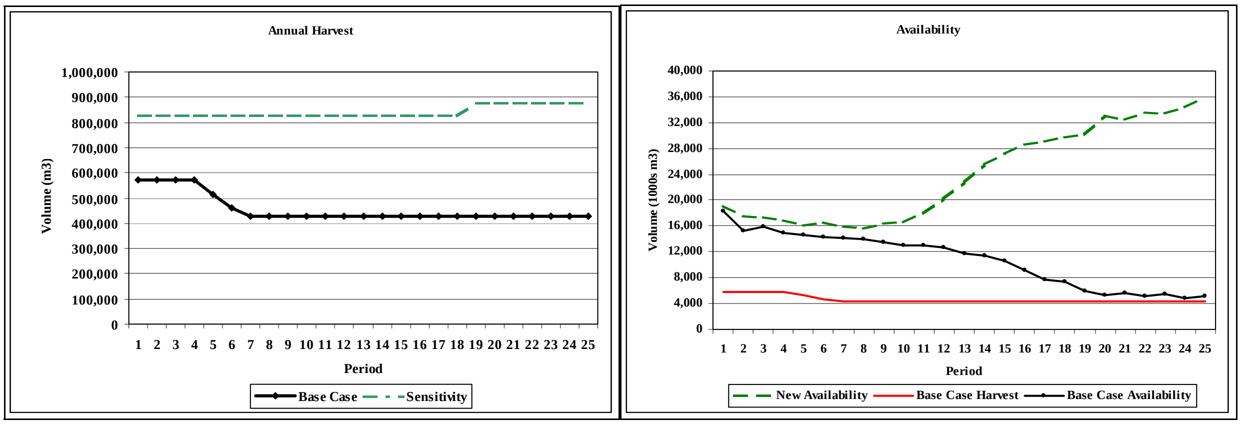

Figure 7.7 - Impact of applying full SIBEC adjustments to managed stand yield forecasts

Table 7.7 - Impact of applying full SIBEC adjustments to managed stand yield forecasts

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	826,600
2	573,700	826,600
3	573,700	826,600
4	573,700	826,600
5	515,500	826,600
6	462,900	826,600
7-18	429,900	826,600
19+	429,900	875,200

7.2.4 Increase Managed Stand Site Index – 85% SIBEC Adjustment

The SIBEC study completed by J.S. Thrower & Associates identified some of the risks and uncertainties associated with the new SIBEC estimates, as noted in Section 4.4.4. These concerns potentially include the PEM inaccurately assigning productive site series across the land base. To quantify the potential impact of an overestimation, an analysis was completed where the SIBEC estimates were arbitrarily reduced by 15%. The results are shown in Figure 7.8 and Table 7.8. The modified SIBEC values resulted in an increase in MAI of only 55% as compared to the base case, which in turn had a proportionally lower impact on timber supply.

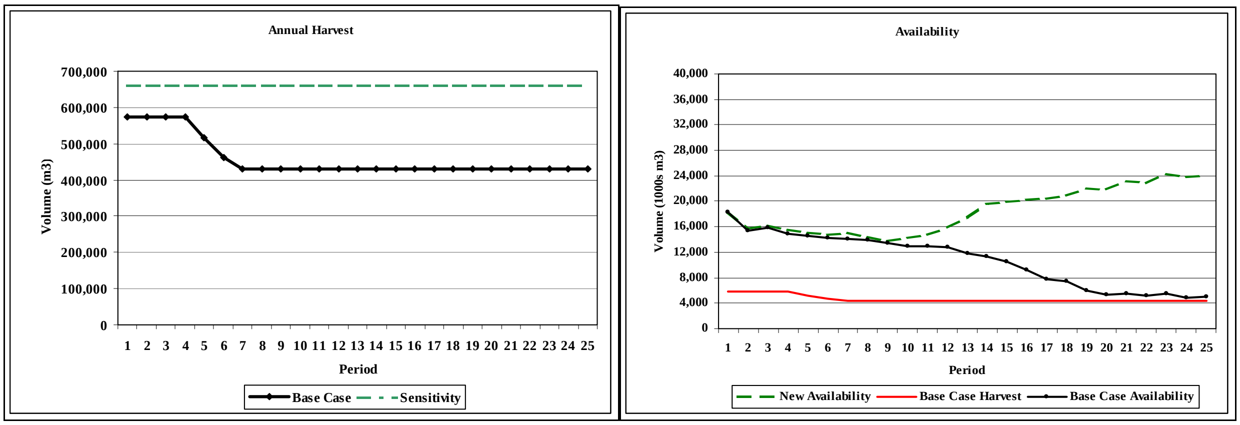

Figure 7.8 - Impact of applying 85% SIBEC adjustments to managed stand yield forecasts

Table 7.8 - Impact of applying 85% SIBEC adjustments to managed stand yield forecasts

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	658,500
2	573,700	658,500
3	573,700	658,500
4	573,700	658,500
5	515,500	658,500
6	462,900	658,500
7+	429,900	658,500

7.2.5 Decrease Minimum Harvest Age by 10 Years

The Base Case minimum harvest ages were derived based on the criteria outlined in Section 4.4.4. In this sensitivity analysis, these ages were arbitrarily reduced by 10 years. The impact on timber availability is to accelerate the availability of harvestable volumes from second growth stands. As shown in Figure 7.9, this increased availability starts to show significantly in decade 12. As there are no other short-term constraints on timber availability, this allows the starting harvest level to be extended for an additional two decades. However, as overall forest productivity is not altered, the long-term harvest level remains unchanged.

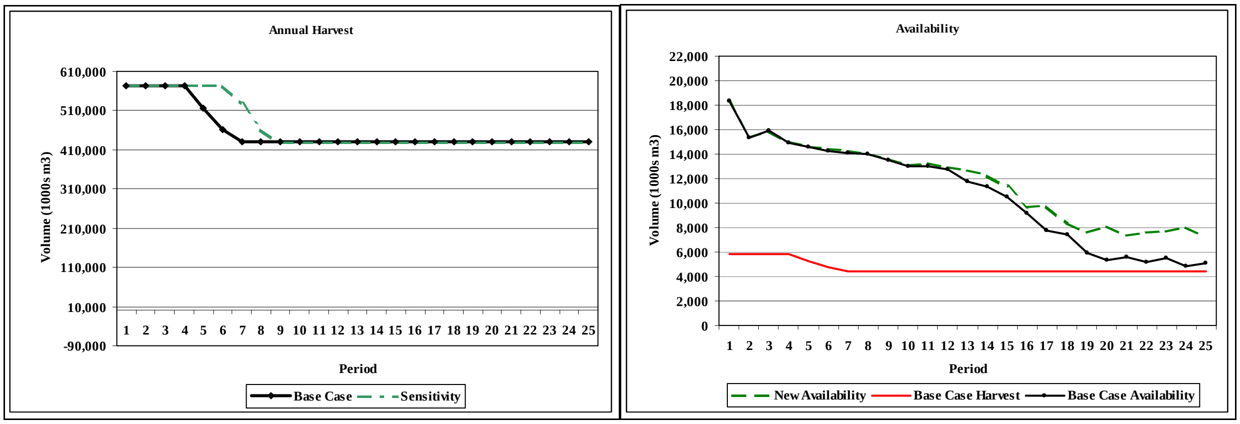

Figure 7.9 - Impact of decreasing minimum harvest age by 10 years

Table 7.9 - Impact of decreasing minimum harvest age by 10 years

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	573,700
4	573,700	573,700
5	515,500	573,700
6	462,900	573,700
7	429,900	525,500
8	429,900	462,900
9+	429,900	429,900

7.2.6 Increase Minimum Harvest Age by 10 Years

Similarly, increasing the minimum harvest age by 10 years has the opposite effect, as shown in Figure 7.10 and Table 7.10.

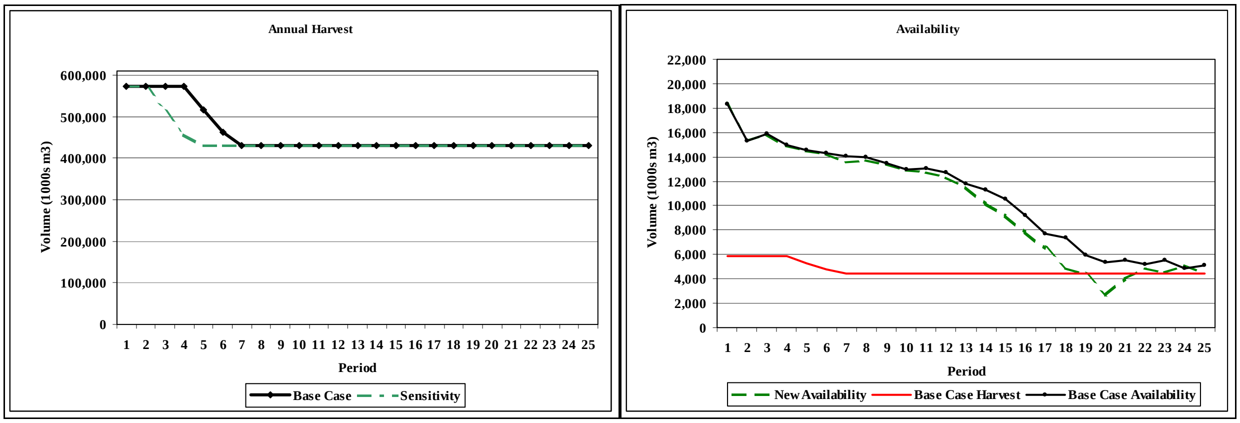

Figure 7.10 - Impact of increasing minimum harvest age by 10 years

Table 7.10 - Impact of increasing minimum harvest age by 10 years

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	510,500
4	573,700	457,900
5	515,500	429,900
6	462,900	429,900
7+	429,900	429,900

7.3 Visual Landscape

In the Base Case analysis, green-up height requirements for VQO zones were set at 7 metres, with the exception of modification zones, which were set at 4 metres. In these sensitivity analyses, these requirements were arbitrarily altered by 1 metre. The results are summarized in Sections 7.3.1 and 7.3.2. In both cases, the results are shown to be moderately sensitive to this alteration.

7.3.1 Increase VQO Green-up Height Requirements by 1 Metre

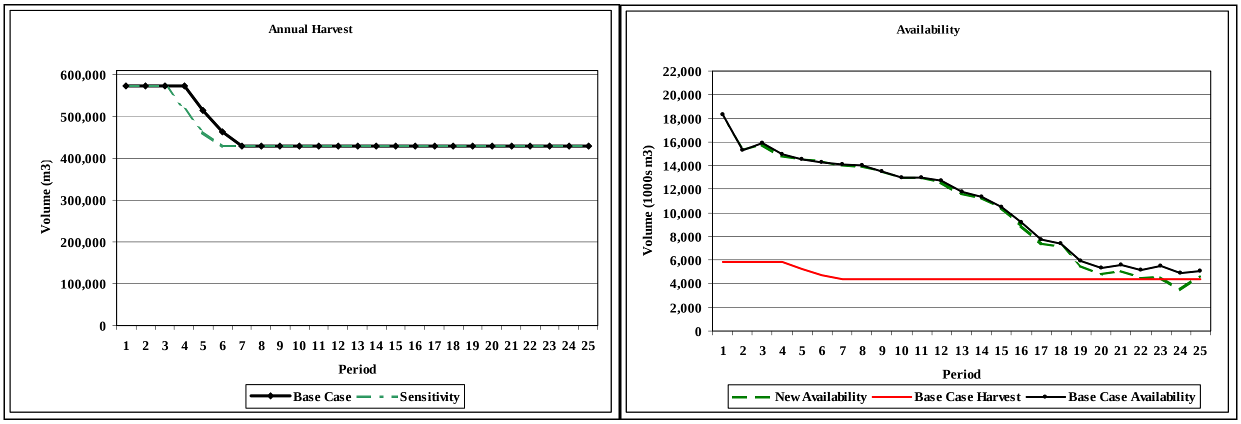

Figure 7.11 - Impact of increasing VQO green-up height requirement by 1 metre

Table 7.11 - Impact of increasing VQO green-up height requirement by 1 metre

Decade	Net Annual Harvest (m^3/year)	
	Base Case	**Sensitivity**
1	573,700	573,700
2	573,700	573,700
3	573,700	573,700
4	573,700	515,500
5	515,500	462,900
6	462,900	429,900
7+	429,900	429,900

7.3.2 Decrease VQO Green-up Heights by 1 Metre

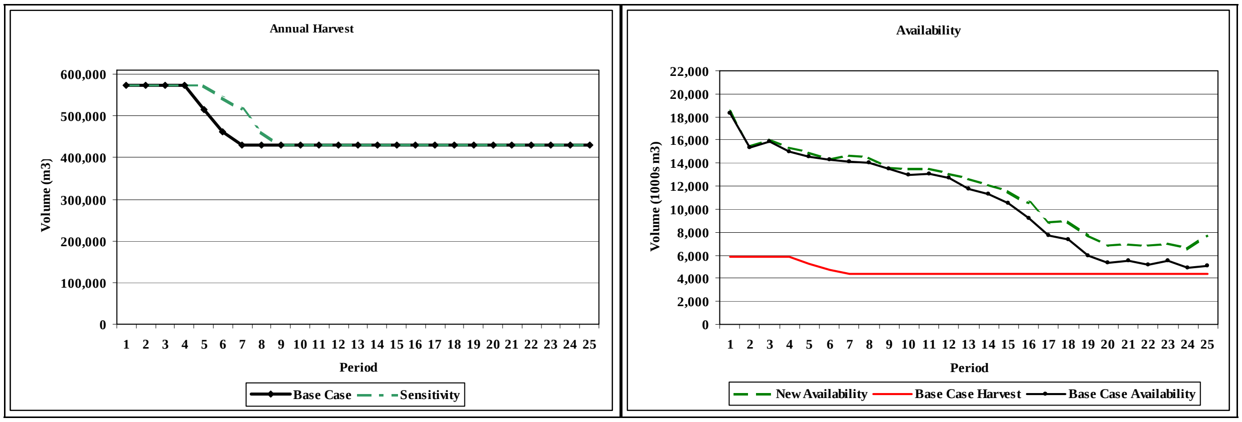

Figure 7.12 - Impact of decreasing VQO green-up height requirement by 1 metre

Table 7.12 - Impact of decreasing VQO green-up height requirement by 1 metre

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	573,700
3	573,700	573,700
4	573,700	573,700
5	515,500	573,700
6	462,900	544,700
7	429,900	462,900
8+	429,900	429,900

7.4 Old Growth Seral Stage Requirements

In the Base Case, it was assumed that old-growth seral requirements in low emphasis biodiversity areas could be met over three rotations. The retention constraints were therefore set to achieve only 1/3 of this requirement initially. The impact of starting out with the full requirement was tested, and found to have no impact on timber availability and harvest flow. As well, reducing the minimum age for old growth from 250 years to 200 years had no impact on the Base Case harvest level.

With the high percentage of forest classified as non-THLB, most of this old growth requirement can be met outside of the THLB, and most of this old growth is well beyond the age 250 threshold.

7.5 Ecosystem-Based Management

In April of 2001, Government established the Coast Information Team (CIT), the Coast Forest Conservation Initiative, and Rainforest Solutions Project to develop independent information and analyses in support of ecosystem-based management (EBM). The EBM analyses would cover the north and central coastal region of British Columbia, including Haida Gwaii/Queen Charlotte Islands. Both Government and the DFAM group agreed to attempt to model EBM, since portions of the EBM Handbook could potentially be considered by Cabinet as higher level objectives in accordance with recommendations made by the LRMP table.

Some of the primary objectives associated with EBM include maintenance of:

- Old growth management strategies;
- Wildlife corridors;
- Riparian reserve networks; and
- Site series representation at various levels of scale.

During the timber supply analysis process, it was quickly recognized that modelling all of the EBM objectives would be difficult due to the complexity involved. The following is a summary of the methodology for implementing the EBM site series representation into the timber supply analysis.

1. Ministry of Sustainable Resource Management (MSRM), Skeena Region provided a list of site series surrogates based on species and site class categories. These surrogates define the old seral percentage requirement and age (from range of natural occurrence assumptions). In addition, there was a list of "rarity classes" for all of the BEC variants present on the North Coast land base.
2. These surrogates were linked to the existing analysis units identified for the analysis.
3. Rarity class was assigned to each stand based on its BEC variant-surrogate combination.
4. Final analysis aggregates were developed based on landscape unit BEC variant and site series surrogate.
5. Old seral percentage and age were assigned based on the information from MSRM.

7.5.1 EBM Scenario 1

Scenario 1 assumptions include the maintenance of the following landscape level objectives:

- 70% of the natural occurrence of old seral for site series surrogates that are modal, uncommon or rare;
- 30% of the natural occurrence of old seral for site series surrogates that are common or very common; and
- Less than 50% of all site series surrogates in mid seral.

The rules used to model old seral requirements allow stands to reach "old" status at younger ages than modelled in the Base Case. Typically all stands in the North Coast TSA must be 250 years old to be considered old. However, the ages defining old seral provided by MSRM were as young as 120 years for some areas.

The EBM constraints were applied assuming that the full Base Case THLB is available for harvesting. It is clear from Figure 7.13 and Table 7.13 that the impact of these constraints is significant. While it is possible to achieve the existing AAC for one decade, long-term levels are reduced by approximately 5%, and the overall timber supply is reduced by approximately 8%.

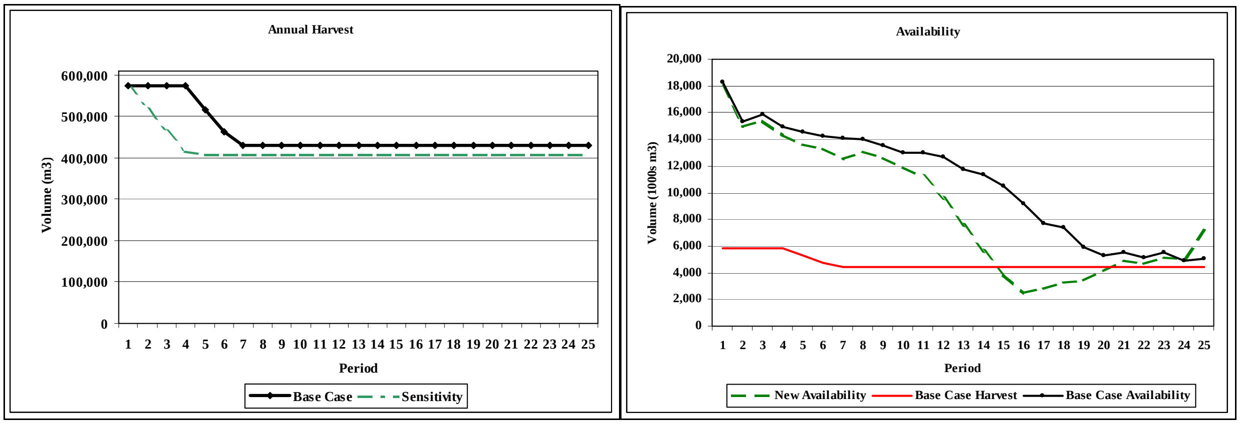

Figure 7.13 - Impact of implementing EBM Scenario 1

Table 7.13 - Impact of implementing EBM Scenario 1

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,700
2	573,700	515,500
3	573,700	462,900
4	573,700	415,600
5	515,500	406,800
6	462,900	406,800
7+	429,900	406,800

7.5.2 EBM Scenario 2

Scenario 2 combines removal of the new protected and biodiversity areas with the assumptions from EBM Scenario 1, including the requirements for old seral representation on the remaining land base as described in Section 7.5.1.

As shown in Figure 7.14 and Table 7.14, timber availability is reduced considerably. It is not possible to achieve the existing AAC, even for one decade without significant declines in the mid and long-term harvest levels. Therefore a reduction of 24% was applied in the first decade of the simulation. Overall, the timber supply is reduced by approximately 31%. This result is predictable given that the impact of the new protected and biodiversity area removal alone was 24%.

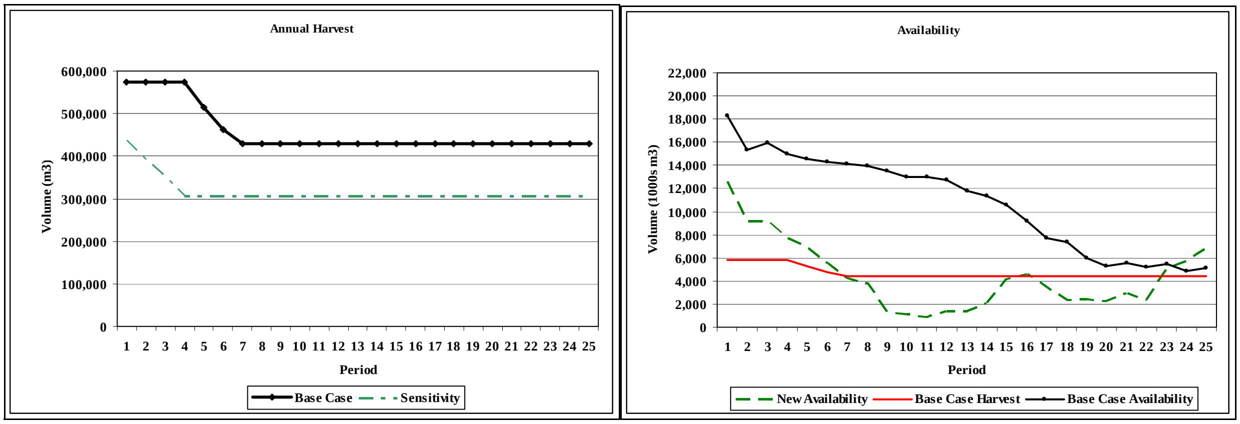

Figure 7.14 - Impact of implementing EBM Scenario 2

Table 7.14 - Impact of implementing EBM Scenario 2

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	435,200
2	573,700	390,400
3	573,700	350,400
4	573,700	305,600
5	515,500	305,600
6	462,900	305,600
7+	429,900	305,600

7.5.3 EBM Scenario 2 with Additional Harvesting in VQO Areas

This analysis scenario is the same as the EBM Scenario 2 outlined in the previous section except that the limit of 80,000 m^3/year from VQO areas is not enforced. The prescribed disturbance forest cover constraints are imposed on the individual VQO polygons to ensure objectives related to visually sensitive areas are maintained.

Figure 7.15 and Table 7.15 show that timber availability is improved considerably over the EBM 2 scenario described in Section 7.5.2. With additional harvesting in VQO areas the current AAC can be achieved for one decade. After that time declines of 10% per decade are necessary until the long-term level is reached in year 51 of the simulation. Overall, the timber supply is approximately 19% lower than the harvest schedule developed for the Base Case. It is however 17% higher than the total harvest achieved in the EBM 2 scenario.

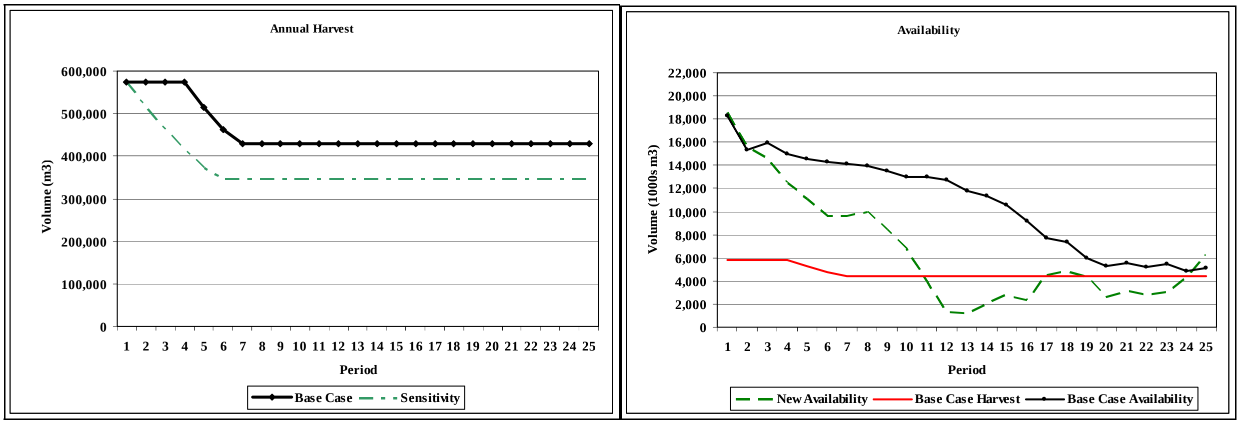

Figure 7.15 - Impact of implementing EBM Scenario 2 with additional VQO harvesting

Table 7.15 - Impact of implementing EBM Scenario 2 with additional VQO harvesting

Decade	Net Annual Harvest (m^3/year)	
	Base Case	Sensitivity
1	573,700	573,900
2	573,700	515,500
3	573,700	462,900
4	573,700	415,600
5	515,500	373,000
6	462,900	346,000
7+	429,900	346,000

7.6 Summary of Sensitivities

In comparing the sensitivity results to the Base Case, four time frames are illustrated. First, the number of decades over which the current AAC can be maintained is presented. This provides an assessment of the risks surrounding continuation of the current AAC. The second timeframe, overall timber supply for the first 12 decades, is considered to be the transition from a primarily old-growth harvest, to primarily second growth. In terms of net present value, change during this time frame would have the greatest economic impact. The third time frame, total timber supply in decades 13-25, represents the long-term sustainable timber flow from the land base. Finally, the overall timber supply impacts over the entire time horizon are identified.

The results are summarized in Table 7.16.

Table 7.16 - Summary of sensitivity analyses results

Sensitivity	Decades at or above Current AAC	Percent of Base Case Harvest		
		Decades 1-12	Decades 13-25	Decades 1-25
Base Case	4	100	100	100
THLB + 10%	9	113	104	109
THLB – 10%	2	91	92	91
Remove area North of Nass River	1	86	89	87
Remove new protected and biodiversity areas	1	73	73	76
Natural stand yields + 10%	9	113	100	107
Natural stand yields – 10%	1	92	100	96
Full SIBEC adjustment	25	169	198	184
85% SIBEC adjustment	25	135	153	144
Minimum harvest age + 10 years	2	95	100	97
Minimum harvest age - 10 years	6	105	100	102
VQO green-up height + 1 metre	5	104	100	102
VQO green-up height - 1 metre	3	98	100	99
Full old growth in low emphasis	4	100	100	100
Old growth age 200 years	4	100	100	100
EBM Scenario 1	1	89	95	92
EBM Scenario 2	0	67	71	69
EBM Scenario 2 with additional VQO harvest	1	90	79	84

8.0 DISCUSSION OF RESULTS

The analyses described in this report were developed to provide input into the process of determining the AAC for the North Coast TSA. In doing so, a timber supply harvest rate was sought that would maintain the existing AAC for as long as possible while achieving a stable long-term supply. The results of this analysis indicate that the existing AAC can be maintained for four decades under the Base Case assumptions. Recognizing that this is based on a THLB that is 22% larger than that reported in TSR2, there are risks to this outcome if the actual THLB is smaller than that reported. This could occur for one of several reasons:

1. Higher-level plans are approved as a result of the North Coast and Central Coast LRMP processes that recommend removing significant areas from the THLB. Based on the current new protected and biodiversity areas which have been identified in the LRMP processes, the THLB would be reduced by approximately 23%. This reduction would clearly preclude maintaining the existing AAC for even one decade.

2. Removing the area north of the Nass River would reduce the THLB by approximately 13%, which in turn would limit maintenance of the current AAC to one decade.

3. Implementing the EBM rules for retention of old growth and mid-seral also would limit maintenance of the current AAC to one decade.

Several other factors assessed in the sensitivity analyses did demonstrate some downward pressure on the short-term timber supply. They included the possibility that existing natural yields are overstated, or that access to second growth stands could be delayed if minimum harvest ages are overly optimistic. There is no specific information indicating that these are likely possibilities.

Offsetting these downward pressures to the extent that the existing AAC could be maintained would require a significant improvement in productivity expectations for the remaining land base. This would be the case if the SIBEC productivity improvements were in fact realized. The 85% SIBEC scenario would provide enough upward pressure to largely offset the above factors. This is the case as there are no short-term timber flow constraints evident in the Base Case. As a result, much of the SIBEC gain can be realized immediately.

8.1 Inventory and Productivity Issues

The timber supply is sensitive to changes in the yield estimates for natural mature stands. These stands will support the majority of the harvest for next 120 years, and will continue to provide some volume for up to 250 years, based on the results of the Base Case. Reducing the volume estimates for natural stands forces the annual harvest to decline after 10 years, three decades earlier than in the Base Case. Conversely, increasing volumes in natural stands by 10% allows the current AAC to be maintained for nine decades. The MoFR inventory audit completed prior to TSR 2 indicates that although natural stand volumes were slightly overestimated, the differences were not statistically significant.

Improvements to managed stand volumes provide a dramatic increase in annual harvest potential as demonstrated by the SIBEC scenarios. The degree to which managed stand volumes will improve is uncertain, but the general consensus is that managed stand yields based on inventory site index under estimates those future yields. Applying the full SIBEC adjustment improves the short-term harvest by 44%, and the long-term harvest is more than doubled compared with the Base Case. With 85% of the

SIBEC adjustment applied to managed stand yields the increase is 15% short term, and 53% long term compared with the Base Case.

Changes to minimum harvest age alter the Base Case harvest, because it affects how soon managed stands will become available. This is especially important as the inventory of existing mature stands is utilized during the next 100 to 120 years. Reducing minimum harvest ages allows the current AAC to be maintained for 60 years, whereas increasing these ages forces a drop in annual harvest after only two decades. In both cases the current AAC is not affected for at least 20 years. Adjustment to the minimum harvest ages of the natural stands is not an issue because the vast majority of these stands are well above minimum harvest age, as indicated in the current age class distribution (Figure 6.7).

8.2 Resource Emphasis Issues

Assumptions for individual resource emphasis assumptions had minimal impact on the harvest level established for the Base Case. Adjusting the VOQ green-up requirements by one metre only affected the duration of the current AAC by one decade. Long-term harvest was not affected by these changes.

Adjusting the old growth requirements by imposing full old seral requirements in low emphasis biodiversity areas did not affect the Base Case harvest level. The fact that more than 80% of the productive forest is outside the THLB is the primary reason for this result. Even with eventual stand breakup in non-THLB areas, old forest will predominate in the North Coast TSA.

Similarly, reducing the age that defines old growth to 200 years has no impact on the Base Case harvest level. These results indicate that unless the changes to old forest requirements are significantly different from the Base Case, as demonstrated in EBM Scenario 1, the timber supply is not affected.

8.3 Conclusions

Based on the current inventory and Base Case assumptions, the short-term timber supply for the North Coast TSA is stable at the current AAC of 573,624 cubic metres over the next four decades. The harvest is improved significantly by including SIBEC managed stand site index estimates in regeneration yields. Site index values based on mature inventory attributes are widely considered to underestimate managed stand yields. Therefore future stand yields are likely to be higher than indicated by the Base Case.

Other management issues are currently more important to the timber supply on the North Coast. The feasibility of the timber located north of the Nass River is uncertain. Without this portion of the TSA there will be a reduction in available timber within 10 years. New protected and biodiversity area exclusions and Ecosystem-Based Management objectives as modelled, could have a significant impact on the timber supply, depending on the final decisions associated with the North Coast and Central Coast LRMPs. It is therefore important to know the outcome of the LRMP processes, especially as they pertain to EBM and where harvesting will be allowed to occur, to understand the timber supply for the North Coast TSA.

9.0 REFERENCES

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10.0 GLOSSARY

Allowable annual cut (AAC)	The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.
Analysis unit	A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.
Base case harvest forecast	The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.
Basic sector	Sectors of the economy, such as forestry, tourism and mining, that create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.
Biodiversity (biological diversity)	The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.
Biogeoclimatic (BEC) variant	A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.
Biogeoclimatic zones	A large geographic area with broadly homogeneous climate and similar dominant tree species.
Coniferous	Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.
Cutblock	A specific area, with defined boundaries, authorized for harvest.

Cutblock adjacency	The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.
Deciduous	Deciduous trees shed their leaves annually and commonly have broad-leaves.
Employment coefficient	The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.
Employment multiplier	An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.
Environmentally sensitive areas	Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.
Forest cover objectives	Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see **Cutblock adjacency and Green–up**).
Forest inventory	An assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and visual quality.
Forest Practices Code	Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.
Forest type	The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.

Free-growing — An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.

Green-up — The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.

Growing stock — The volume estimate for all standing timber at a particular time.

Harvest forecast — The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.

Higher level plans — Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.

Indirect and induced jobs — Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.

Inoperable areas — Areas defined as unavailable for harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.

Integrated resource management (IRM) — The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.

Landscape-level biodiversity — The *Landscape Unit Planning Guide* provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.

Landscape unit	A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.
Long-term harvest level	A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.
Mature seral	Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.
Management assumptions	Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.
Mean annual increment (MAI)	Stand volume divided by stand age. The age at which average stand growth, or MAI, reaches its maximum is called the culmination age (CMAI). Harvesting all stands at this age results in a maximum average harvest over the long term.
Minimum harvestable age (MHA)	The age at which a stand of trees is expected to achieve a merchantable condition. The minimum harvestable age could be defined based on maximize average productivity (culmination of mean annual increment), minimum stand volume, or product objectives (usually related to average tree diameter).
Model	An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.
Natural disturbance type (NDT)	An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more older forests.

Not satisfactorily restocked (NSR) areas	An area not covered by a sufficient number of well-spaced trees of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.
Operability	Classification of an area considered available for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.
Person-year(s)	One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.
Protected area	A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).
Riparian area	Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Scenic area	Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.
Sensitivity analysis	A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.
Seral stages	Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.
Site index	A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.

Stand-level biodiversity	A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.
Stocking	The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.
Table Interpolation Program for Stand Yields	A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.
Timber harvesting land base	Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Timber supply area (TSA)	An integrated resource management unit established in accordance with *Section 7* of the *Forest Act*.
Tree farm licence (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.
Ungulate	A hoofed herbivore, such as deer.
Unsalvaged losses	The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.
Variable Density Yield Prediction model	An empirical yield prediction system supported by the Ministry of Sustainable Resource Management, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed species composition.

Visual quality objective (VQO)	Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.
Volume estimates (yield projections)	Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.
Watershed	An area drained by a stream or river. A large watershed may contain several smaller watersheds.
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.
Woodlot licence	An agreement entered into under the *Forest Act*. It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.

APPENDIX I – NORTH COAST TIMBER SUPPLY AREA SOCIO-ECONOMIC ASSESSMENT

Under separate cover.

APPENDIX II – NORTH COAST TIMBER SUPPLY AREA TIMBER SUPPLY ANALYSIS DATA PACKAGE

Under separate cover.