TIMBER SUPPLY ANALYSIS REPORT
FOR TREE FARM LICENCE 38

FOR INTERNATIONAL FOREST PRODUCTS LIMITED
MANAGEMENT PLAN NO. 9

International Forest Products Limited
Empire Logging Division

Prepared by:

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Revised Final Version

Revised March 2004

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EXECUTIVE SUMMARY

A timber supply analysis has been completed as a component of Management Plan No. 9 for International Forest Products Limited (Interfor) Tree Farm Licence (TFL) 38. The analysis evaluates how current management, with emphasis on sustainable forest resource management values, affects the supply of harvestable timber over a 250-year period. In addition, the analysis includes a 20-year spatial feasibility on proposed harvest levels and quantifies the sensitivity of the results to uncertainty associated with modelling inputs.

A timber supply model was employed to forecast long-term timber availability under a variety of scenarios. The timber supply analysis provides the technical basis for the Chief Forester of British Columbia to determine an allowable annual cut (AAC) for TFL 38 for the next five years.

The current AAC for TFL 38 is 250 500 cubic meters, based on the Base Case analysis from Management Plan No. 8. While this AAC represents the harvest level in the short term, there is an associated harvest flow that represents the expected timber availability over the next 250 years.

Three concurrent harvest flow objectives have been established for the TFL:

- Maintain an initial harvest level which achieves short-term timber requirements;
- Limit shifts in harvest level to less than 10% of the level prior to the shift; and
- Achieve an even-flow long-term supply over a 250-year time horizon.

These objectives have been addressed within the context of sustainable forest resource management values including biodiversity, old growth management, recreation, wildlife and visual quality.

The inventory information used to define the resource characteristics for TFL 38 incorporates a number of recent updates to account for past disturbances, and updated inventories and management strategies for non-timber resources such as biodiversity, old growth, recreation, wildlife and visual quality values.

Approximately 54,357 hectares were determined to be productive forest. Only 32,349 hectares (59.5%) of this area is considered as part of the current net timber harvesting land base. The balance of the productive area has been reserved for the management and/or protection of non-timber resources or classified as inoperable.

The productive forest was subdivided into a number of overlapping management zones. Specific forest cover objectives were set for each zone, based on its management objectives. Management zone forest cover objectives were incorporated into the timber supply analysis procedure.

All analyses employed growth and yield estimates developed by J.S. Thrower and Associates. All employed the same land base classification. Using the new growth and yield inputs a timber flow pattern was developed, taking into consideration the timber flow policy stated above. Several alternative timber flows where explored. A scenario was selected as the Base Case and formed the basis for Management Plan No. 9.

The selected Base Case option results in a starting harvest of 250,500 cubic metres for five years. This harvest is then reduced by 10% in years 6-10, and then reduced by a further 4% to a long-term sustainable level of 217,500 cubic meters for the remainder of the time horizon. This long-term level is approximately 92% of the theoretical long run sustainable yield (LRSY), after allowance for non-recoverable losses and wildlife tree retention. LRSY is calculated based on harvesting all stands at culmination of mean annual increment (MAI). Given the imposition of conflicting forest cover and harvest scheduling objectives, the realized long-term level will always be less than the calculated LRSY.

Following selection of the base case, a series of sensitivity analyses were completed to test the impact of changing specific input assumptions.

The 20-Year Spatial Feasibility option indicates that the short-term harvest can be placed on the ground with all of the Base Case assumptions and cutblock adjacency in place. It was not designed to be an operational plan, but a test of timber availability given the current structural characteristics and spatial distribution of components of the resource, as well as the structural and spatial management objectives associated with the Forest Practices Code.

Based on the outcome of these analyses, it is proposed that the AAC for TFL 38 be set at 250 500 cubic meters for the next 5 years.

The proposed AAC is supported by three (3) critical factors:

1. The initial harvest level does not jeopardize the long-term even-flow level;
2. This level is relatively insensitive to fluctuations in key assumptions.
3. The 20-Year Spatial Feasibility analysis has demonstrated that the proposed AAC is spatially attainable for 20 years.

All timber supply requirements have been addressed within the context of sustainable forest resource management values including biodiversity, old growth management, recreation, wildlife and visual quality.

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1.0 Introduction

An analysis of timber supply has been completed as a component of Management Plan (MP) No. 9 for International Forest Products Limited (Interfor) Tree Farm Licence (TFL) 38. The analysis evaluates how current management, including significant allowances for management of non-timber resources, affects the supply of harvestable timber over a 250-year period. In addition, the analysis includes a 20-year spatial feasibility on proposed harvest levels and quantifies the sensitivity of the results to uncertainty associated with modelling inputs. The analytical methodology employs a forest level simulation model, which is used to forecast the long-term development of the forest given:

- A description of the initial forest conditions;
- Expected patterns of stand growth;
- A specified set of rules for harvesting and regenerating the forest;
- A specified set of forest structural characteristics; and
- Sustainable forest resource management values including biodiversity, old growth management , recreation, wildlife and visual quality.

The process enables forest managers to evaluate timber availability under a range of alternative scenarios. Furthermore, the timber supply analysis provides the technical basis for the Chief Forester of British Columbia to determine an allowable annual cut (AAC) for TFL 38 for the next five years.

Because of the changing nature of resource management objectives, as well as the dynamic nature of forest inventories, the timber supply predictions generated by these analyses are not viewed as static. For this reason, it is necessary to re-evaluate timber supply periodically, incorporating new sources of information and any changes to management objectives. This adaptive management process ensures that harvest strategies remain sustainable in the long term, even in the face of changing circumstances.

2.0 General Description of the Land Base and Tenure

TFL 38 was transferred to Interfor in February 1995. The license was obtained by an assignment from Weldwood of Canada that was approved by the Minister of Forests.

TFL 38 is located on the mainland coast, adjacent to the Soo Timber Supply Area (TSA). It includes the watersheds of the Ashlu and Elaho Rivers and the balance of the Squamish River system. The total area is approximately 189287 hectares, 71% of which is non-forested steep mountainous terrain and ice fields. Included within the TFL are approximately 251 hectares of Schedule A land. Approximately 63% of the operable forest area is mature comprised of western hemlock, balsam, western red cedar and Douglas-fir.

Continuous harvesting and forest management activities have occurred on the TFL since the 1950s. Since that time, approximately 10,100 hectares of second growth forest have been established and intensively managed. The current AAC is set at 250500 cubic meters per year. The Small Business Forest Enterprise Program (SBFEP) cut is 13118 cubic meters attributed to Schedule B lands.

Appendix 1 includes an overview map of TFL 38 and a map defining the extent of the productive landbase within the TFL.

3.0 Timber Flow Objectives

In the base case analysis, the choice(s) of harvest flow considered the following criteria:

- Maintain an initial harvest level which achieves short-term timber supply requirements;
- Limit any shifts in harvest level to less than 10% of the level prior to the shift; and
- Achieve a long term non-declining, sustainable harvest level.

These objectives must be achieved in the context of sustainable forest resource management values.

A number of different harvest flows were explored, including a non-declining even-flow scenario. Alternatives will be based on tradeoffs between short and medium-term harvest levels. Forest cover constraints and biological capacity of the net operable landbase ultimately dictate the harvest level.

4.0 Forest Information

A complete description of the information used in the Interfor TFL 38 MP No. 9 timber supply analysis is contained in the document "Timber Supply Analysis Information Package for TFL 38, Final Version", dated October 2002. This document has been included as part of the TFL 38 MP No. 9 submission, for review and acceptance by Ministry of Forests (MoF) staff.

4.1 Growth and Yield

Yield tables have been developed by J. S. Thrower and Associates (JST). A report documenting this work and the results has been submitted by JST under separate cover. The following is a brief summary of the contents of that report.

1. Existing mature stands (> age 140) were assigned average volume lines (AVLs) based on a system of local inventory cruise plots, established in the late 1970s and 1992. These cruise plot timber volumes were audited in 1998 and found to be statistically acceptable. Average volumes/hectare were assigned to individual polygons, and stands are assumed to maintain these volumes until harvest.

2. Natural stand yield tables (NSYTs) for stands between ages 35 and 140 were developed using the provincial Variable Density Yield Prediction (VDYP) program (Batch Version 6.6d) and attributes extracted from the Forest Cover Inventory Database.

3. Managed stand yield tables (MSYTs) for existing stands < age 35, as well as all post-harvest regenerating (PHR) stands were developed using the provincial Table Interpolation Program for Stand Yield (TIPSY) (Batch Version 3.0a) and included:
    - Improved estimates of potential site index (PSI) for PHR stands using the results of the recently completed site index adjustment (SIA) and terrestrial ecosystem mapping projects for TFL 38;
    - Silviculture regimes for existing and future PHR stands developed by Interfor;
    - Impacts of planting improved stock in future PHR stands; and
    - Improved estimates of operational adjustment factors (OAFs) from the Terrestrial Ecosystem Mapping (TEM) project.

Yield tables were developed for all polygons on the Timber Harvesting Landbase, and then grouped into clusters (analysis units) for timber supply analysis purposes.

4.2 Land Base Classification

Land is classified based on four broad criteria:

1. It is unproductive for forest management purposes;
2. It is or will become inoperable under the assumptions of the analysis;
3. It is reserved from harvest in order to protect sustainable forest resource management values(ex. Old Growth Management Areas, Wildlife, Riparian Reserves); or
4. It is available for integrated use (including harvesting).

The area classification is presented in Figures 4.1 and 4.2. The total net harvestable land base of 32349 hectares includes 64 hectares of NSR lands, scheduled to be restocked. It represents harvestable area in conventional and aerial operability classes.

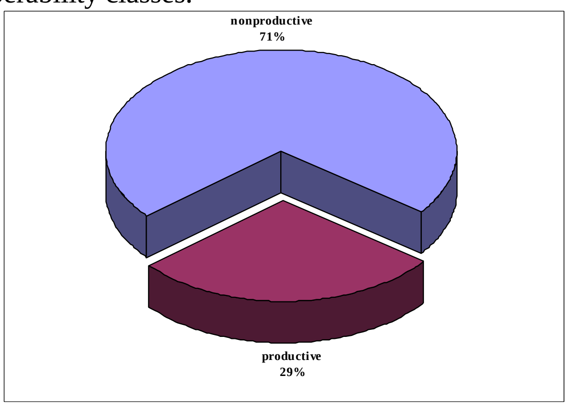


Figure 4.1. Distribution of total area (189 287 hectares)

The timber harvesting land base consists of all of the productive land expected to be available for harvest over the long-term. This land base is determined by reclassifying the total land base according to specified land base classification criteria. The unharvestable component includes exclusions such as low site removals and riparian reserves. Figure 4.2 provides a graphic representation of the land base reductions for TFL 38.

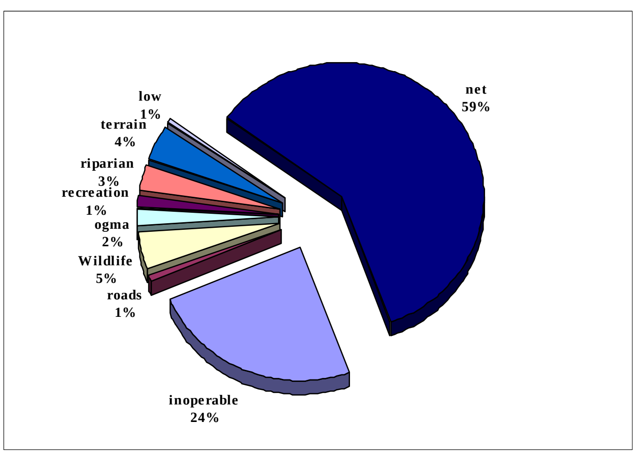


Figure 4.2. Distribution of productive area (54357 hectares)

4.2.1 Inventory aggregation

In order to reduce the complexity of the forest description for the purposes of timber supply simulation, considerable aggregation of individual stands is necessary. However, it is critical that these aggregations not obscure either biological differences in forest stand productivity, or differences in management objectives and prescriptions. Management differences are recognized by grouping stands into landscape units and resource emphasis zones on the basis of similarity of management objectives. Grouping stands into analysis units (or clusters) on the basis of similar species and site productivity captures biological similarity.

4.2.2 Landscape units

For planning purposes, TFL 38 has been subdivided into the Elaho and Upper Squamish Landscape Units (LU). In the timber supply analysis, all forest cover requirements must be met within the boundaries of these landscape units. Figure 4.3 summarizes the distribution of productive area by landscape unit**. While these landscape units extend beyond the borders of the TFL, only the portions contained within the TFL are included in this analysis.**

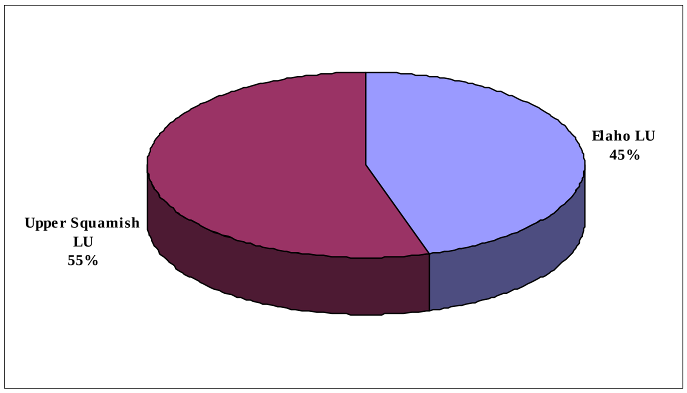
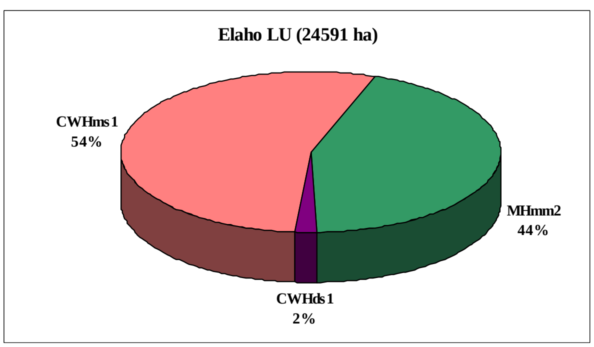


Figure 4.3. Distribution of productive area (54357 ha) by landscape unit

Figure 4.4 summarizes the distribution of productive area by biogeoclimatic zone (BEC) zone.



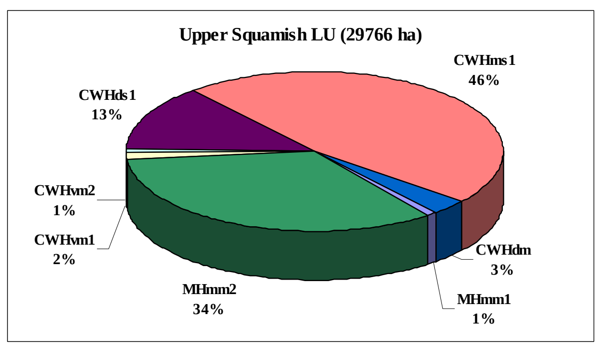


Figure 4.4. Distribution of productive area by BEC zone

4.2.3 Resource management zones

The land base has also been segregated into Resource Emphasis Areas (REAs) to facilitate the application of management criteria. These include:

- Polygonal-based visual quality objective (VQO) zones;
- Mountain goat management areas; and
- Integrated resource management (IRM) zones.

4.2.4 Analysis units / clusters

To capture biological similarity, the inventory has been assembled and aggregated into analysis units (or clusters) on the basis of:

- Site productivity;
- Species composition; and
- Silviculture regimes.

5.0 Timber Supply Analysis Methods

Timberline's proprietary simulation model CASH6 (**C**ritical **A**nalysis by **S**imulation of **H**arvesting), Version 6.2g was used to develop harvest schedules for all options and sensitivity analyses included in the TFL 38 timber supply analysis.

This model uses an aspatial and spatial 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 stages where required at the landscape unit level. It should be noted that in this analysis, old-growth is accounted for explicitly through the definition of Old Growth Management Areas (OGMAs). These areas are excluded from harvesting, and the retention category is used to monitor the levels of old growth to ensure that seral stage targets are met.

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

In these analyses, timber availability is forecasted in decadal time steps (periods). The main output from each analysis is a projection of the amount of future growing stock, given a set of growth and yield assumptions, and planned levels of harvest and silviculture activities. Growing stock is characterized in terms of operable volume *(total volume on the timber harvesting 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 medium term harvest targets do not compromise long-term growing stock stability. Also, modeled harvest levels included allowances for non-recoverable losses. Harvest figures reported here exclude this amount unless otherwise stated.

Depending upon the harvest flow option explored, 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 basic 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.

6.0 Base Case

6.1 Introduction

This option reflects current management performance based on the date of commencement for the preparation of MP No. 9. The analysis incorporates:

- Updated forest inventory database;
- Current management regimes;
- Current definition of operability;
- Updated recreation features inventory;
- Updated visual landscape inventory;
- Definition of biodiversity in accordance with Landscape Unit Planning Guide (LUPG);
- Draft Landscape Unit Plan including Old Growth Management Areas (OGMAs);
- Updated stream / riparian classifications;
- Definition of riparian reserves on TRIM-based streams consistent with the Riparian Management Area Guidebook, and with extended buffers on S5 and S6 classifications;
- Wildlife management strategies for grizzly bear, mountain goat, bald eagle, and moose;
- Slope stability mapping;
- New Terrestrial Ecosystem Mapping (TEM) of International Forest Product's Tree Farm Licence 38, B.A. Blackwell and Associates Ltd.;
- New Potential Site Index Estimates for the Main Commercial Species on TFL 38, J.S. Thrower & Associates Ltd.;
- Variable retention harvesting;
- Definition of merchantable stands and utilization standards;
- Definition of non-recoverable losses (NRLs);
- Minimum harvest ages;
- Silvicultural standards; and
- Forest health.

Six Base Case timber flow scenarios have been developed, specifically:

- ***BASE CASE A***: Maintain non-declining harvest level for the entire 250 year time horizon;
- ***BASE CASE B***: Maintain an initial harvest level of 250500 cubic meters per year for two decades;
- ***BASE CASE C:*** Maintain an initial harvest level of 250500 cubic meters per year for three decades;
- ***BASE CASE D:*** Maintain an initial harvest level of 250500 cubic meters per year for four decades.
- ***BASE CASE E:*** Maintain an initial harvest level of 250500 cubic meters per year for one decade.
- ***BASE CASE F:*** Maintain an initial harvest level of 250500 cubic meters per year for five years.

The results of the Base Case options and their respective attendant timber flows are presented in Table 6.1 and Figure 6.1.

Table 6.1. Net harvest levels – Base Case

Years	Base Case A	Base Case B	Base Case C	Base Case D	Base Case E	Base Case F
1-5	217500	250500	250500	250500	250500	250500
6-10	217500	250500	250500	250500	250500	225500
11-20	217500	250500	250500	250500	225450	217500
21-30	217500	225400	250500	250500	225450	217500
31-40	217500	225400	214100	250500	225450	217500
41-50	217500	214100	203400	214100	214100	217500
51-60	217500	203400	203400	203400	203400	217500
61-70	217500	203400	203400	183060	206000	217500
71-80	217500	200000	203400	164754	217500	217500
81+	217500	217500	217500	217500	217500	217500

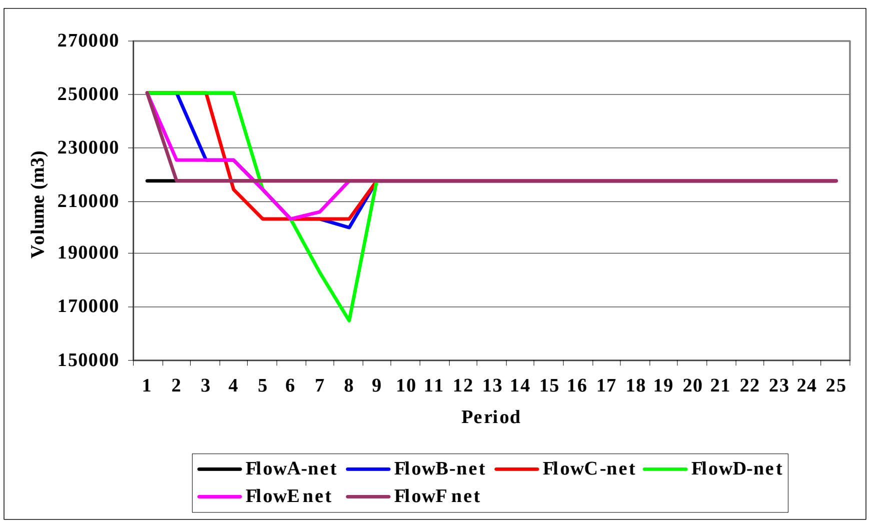


Figure 6.1. Net harvest levels – Base Case options

As shown above, a number of alternative harvest flows were evaluated for the Base Case. They explore opportunities to alter the short and mid-term harvest without compromising long-term objectives. Base Case F was selected as the basis for sensitivity analysis, as it achieves the long-term non-declining harvest flow policy, while allowing for maintenance of the existing AAC for the next five-years. Scenarios B-E show that extending the current AAC beyond five years results in future harvests falling below the long-term level.

The long-term sustainable level of 217500 cubic meters per year is approximately 9.2% below the theoretical long-term LRSY (237235 cubic meters) based on maximizing MAI.

This difference results from two factors:

- Allowance for wildlife tree patches and variable retention harvesting; and
- Conflicting forest cover and harvest scheduling objectives.

Figure 6.2 displays the 250-year growing stock (inventory) profile associated with Base Case F. Operable inventory within the harvestable land base declines steadily for 6 decades after which harvesting emphasis has shifted from existing mature types to second growth. Beyond this point, growth and harvest rates equalize, and inventory remains relatively stable to the end of the simulation period. Merchantable inventory (operable volume above minimum harvest age) stabilizes at decade 9. ***Available growing stock represents the maximum merchantable volume that could be harvested in a given decade without violating forest cover constraints***. Availability reaches minimum's in decades 9 and 15. The harvest flow is largely controlled by these minimums. Further increases prior to decade 9 could result in the medium term harvest falling below the mid-term minimum, which is contrary to the harvest flow policy adopted in these analyses.

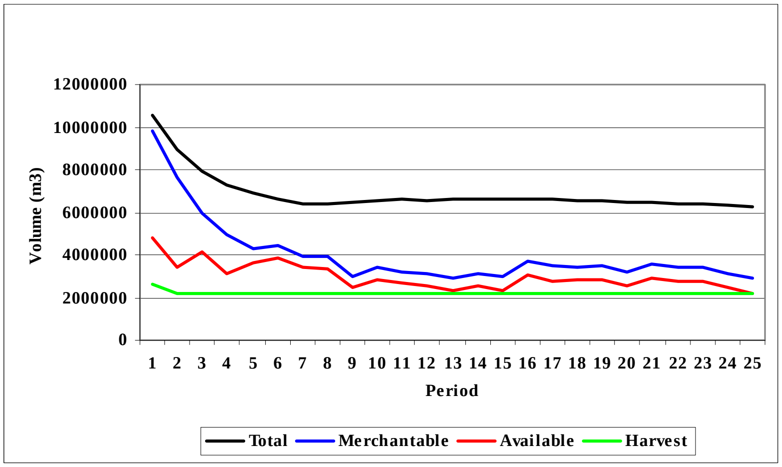


Figure 6.2. Growing stock profile – Base Case F

Figure 6.3 shows the sources of timber for the harvest over the entire 250-year time horizon. For the first 60 years most of the harvest comes from the existing mature forest. This reflects the "oldest-first" harvest scheduling strategy, which is to maximize harvest by capturing volume in the mature forest first. At year 61, the harvest from the current existing stands begins to shift to the future managed forest.

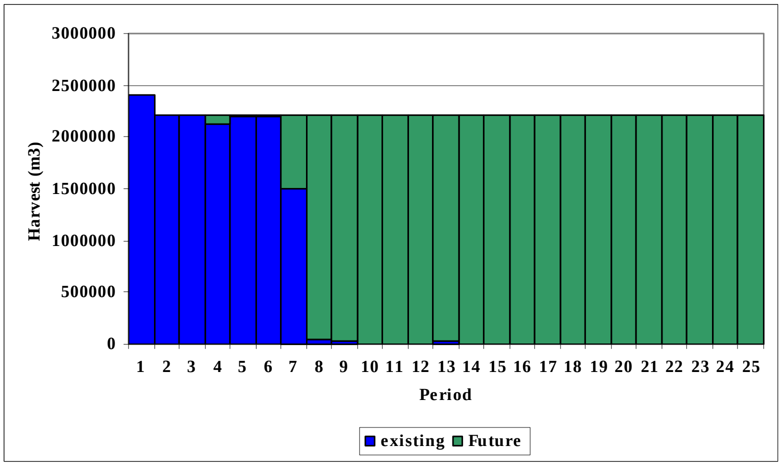


Figure 6.3. Timber supply sources – Base Case

Figures 6.4 through 6.6 show average harvested age, volume per hectare and area harvested per year. The shift in average harvest age declines sharply as harvesting shifts from mature types to second growth.

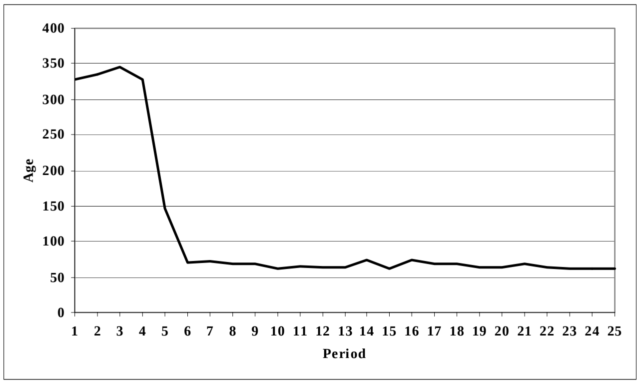


Figure 6.4. Average harvested age – Base Case F

As seen in Figure 6.5 the average volume per hectare fluctuates around an average of 550 cubic meters/ha over the planning horizon. Although the average harvested age drops sharply during the shift to second growth forest, the volume per hectare stays relatively consistent due to higher managed stand yield expectations.

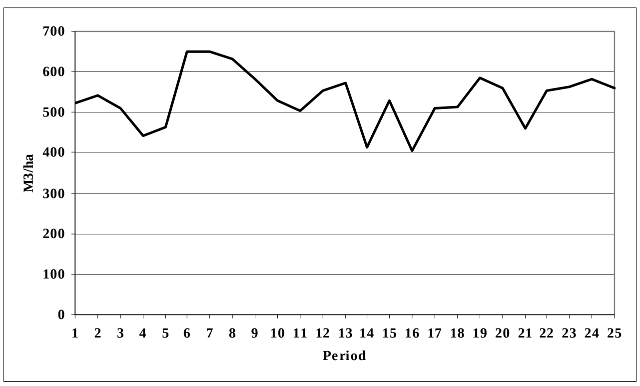


Figure 6.5. Average harvested volume per hectare – Base Case F

The average area harvested remains relatively constant over the planning horizon at approximately 415 hectares per year (Figure 6.6).

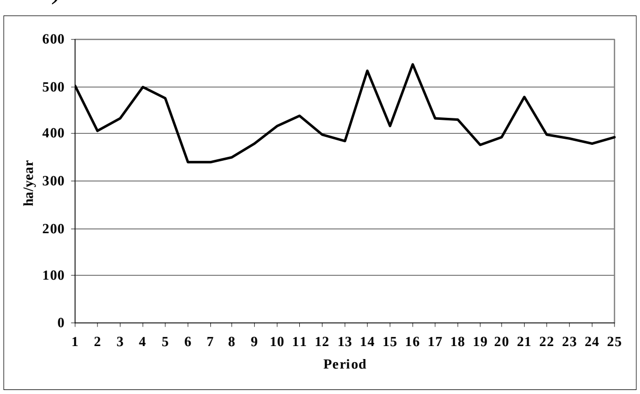


Figure 6.6. Average area harvested – Base Case F

6.1.1 Age class distribution

Figure 6.7 shows the changes in forest structure over time. Each figure indicates the residual structure of the total productive forest, including the unharvestable (non-contributing) components.

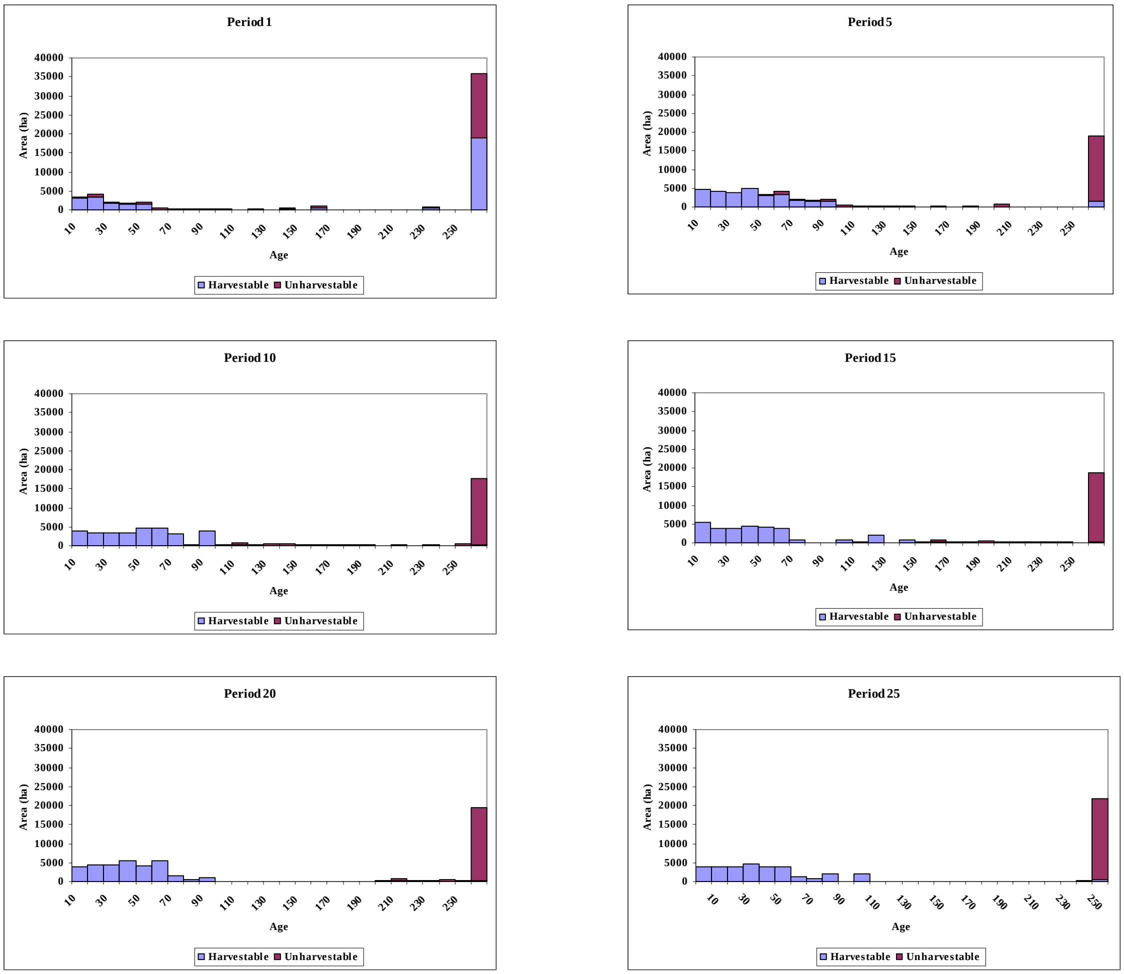


Figure 6.7. Age class distribution over time – Base Case F

While the harvestable old growth inevitably declines in the future, the total productive area greater than age 250 increases steadily over time, reaching approximately 17 500 hectares by the end of decade 10 and 21 800 hectares by the end of decade 25. In other words, 32% of the productive forest is above age 250 by the end of the first rotation, and 40% by the end of the second rotation.

This has very positive implications with respect to retention objectives on the TFL. It should be noted that harvestable area in the 251+ age class (520 ha) remains at the end of the simulation as a result of recruitment to meet forest cover requirements.

Seral stage objectives are met through the establishment of Old Growth Management Areas (OGMAs). Forest cover objectives are modelled at the REA or LU / REA level.

6.2 Summary – Base Case F

Base Case F provides for maintenance of the existing AAC for the next five years, stepping down to a non-declining harvest of 217500 cubic meters which can be sustained to the end of the 250-year time horizon.

The long-term harvest level is driven by the productive capacity of the harvestable land base. The theoretical capacity is measured by the average MAI for second growth managed stands. The calculations (rounded) for the Base Case are shown in Table 6.2

Table 6.2. Natural and managed forest LRSYs

Description	Volume
Current THLB	**32349 (ha)**
- future roads	-1112 (ha)
= Long term THLB	**31237 (ha)**
x mai	8.4 (m^3/ha/year)
= LRSY	**261342 (m^3/year)**
- WTP/VR	20907 (m^3)
- NRL	3200 (m^3)
= NET LRSY	**237235** (m^3)
LTHL	217500 (m^3)
% of LRSY	**92 %**

In the Base Case, the theoretical long-term harvest level of 237,235 cubic meters (net of WTP, variable retention and NRL volumes) could be attained if all stands were harvested at MAI culmination age. The realized long term net level of 217 500 cubic meters is approximately 8% lower, as stands cannot always be harvested at this age due to harvest scheduling requirements conflicting with forest cover objectives. Sensitivity issues that can affect the Base Case harvest flow are explored in the next section.

7.0 Sensitivity Analysis

Sensitivity analysis provides a measure of the upper and lower bounds of the Base Case harvest forecast, reflecting the uncertainty of assumptions made in the Base Case. The magnitude of the change in the sensitivity variable(s) reflects the degree of uncertainty surrounding the assumption associated with that variable. By testing a number of sensitivity issues, it is possible to determine which variables most affect results. This 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 F option and varying only the assumption being evaluated. All other assumptions remain unchanged. In each analysis, the changes in availability were first assessed, using the Base Case harvest level, and imposing the alternative assumption to be tested. Available growing stock was determined for a given decade, by setting an infinite harvest target for that period, and imposing the Base Case level for all other periods. In this way, the impact on availability of the alternative assumption was determined. Based on the changes in availability, a new harvest level was sought, adhering to the even-flow policy described earlier. In other words, the timber flow over the entire 250 year time horizon was adjusted by the same amount in each period. Sensitivity issues are summarized in Table 7.1. The timber supply impacts are illustrated in Sections 7.1 through 7.12.

Table 7.1. Current management sensitivity analyses

Issue	Sensitivity Levels to be Tested	Section
Land base	• adjust timber harvesting land base by +/- 10%	7.1
Growth and yield	• adjust existing (VDYP) stand yields by +/- 10%	7.2
	• adjust future (TIPSY) managed stand yields by +/- 10%	7.3
	• adjust managed minimum harvest ages by +/- 10 years	7.4
	• adjust regeneration delay by +/- 1 year	7.5
Forest cover	• alter maximum area below green-up by +/- 5 years in IRM zone	7.6
	• alter VQO denudation to minimum requirement	7.7
	• alter retention constraint in the mountain goat zone +/- 10%	7.8
	• alter disturbance constraint in mountain goat zone +/- 5%	7.9
Summary	• summary of sensitivity issues / impacts	7.10

7.1 Adjust THLB

In order to assess the sensitivity of the timber supply to changes in the harvestable land base, the THLB was adjusted by +/-10% (3235 ha). The intent was to model the effect of a change in the THLB, not a change in the overall productive area. In the –10% scenario, 10% of each harvestable type was reclassified as unharvestable. In this case, it was necessary to reduce the harvest profile proportionally by 10 %. In the +10% scenario, a proportion of each unharvestable type was reclassified as harvestable. A 10% increase or decrease in the THLB had a proportional effect on Base Case harvest levels (Table 7.2, Figure 7.1). This confirms that availability, and consequently timber supply, is more closely tied to inventory issues than forest cover requirements.

Table 7.2. Net harvest levels – adjust timber harvesting land base

Years	Annual Harvest Level (m^3 / year)		
	THLB –10%	Base Case F	THLB +10%
1-5	250500	250500	250500
6-10	225500	225500	225500
11-250	196500	217500	238500

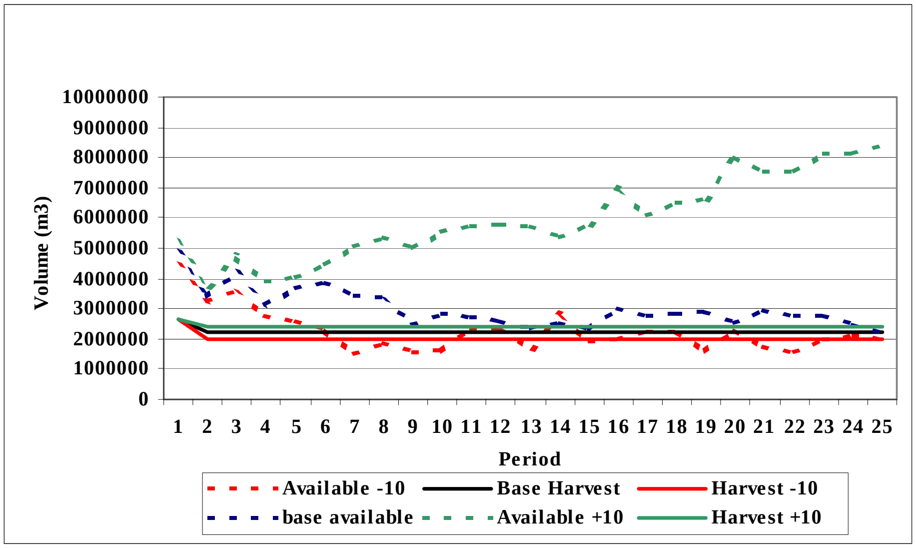


Figure 7.1. Net harvest levels – adjust THLB by +/- 10%

7.2 Adjust Existing Stand Yields

A test of the sensitivity of the timber supply to changes in natural stand yield table (NSYT) forecasts was completed. In this case, yield forecasts for existing natural stands were adjusted by +/- 10%. No changes were made to yield forecasts for existing managed or future managed stands. Overall, changing NSYT expectations by +/- 10% has an impact on timber supply, as shown in Table 7.3 and Figure 7.2

Table 7.3 Net harvest levels – adjust existing stand yields

Years	Annual Harvest Level (m^3 / year)		
	NSYT –10%	Base Case	NSYT +10%
1-5	250500	250500	250500
6-10	225500	225500	225500
11-20	217500	217500	224000
21-100	202000	217500	224000
101-130	214000	217500	217500
131-250	216000	217500	224000

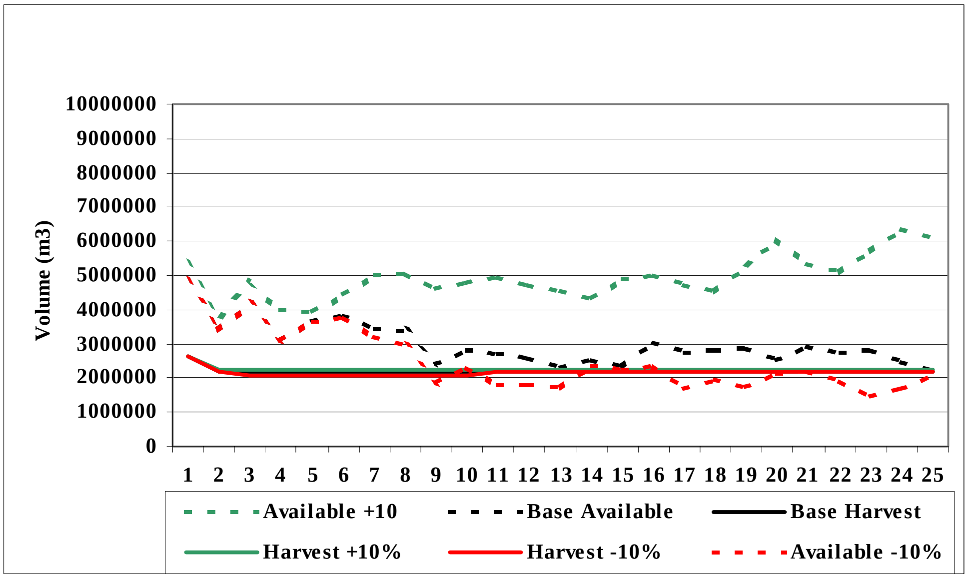


Figure 7.2 Net harvest levels – adjust existing stand yields by +/- 10%

7.3 Adjust Managed Stand Yields

A test of the sensitivity of the timber supply to changes in managed stand yield table (MSYT) forecasts was also completed. In this case, no changes were made to yield forecasts for existing natural stands. Overall, changing MSYT expectations by +/- 10% has a similar impact on timber supply as did the changes to natural yields, as shown in Table 7.4, figure 7.3. It should be noted that the timing of availability impacts changes in these two sensitivities.

Table 7.4. Net harvest levels – adjust managed stand yields

Years	Annual Harvest Level (m^3 / year)		
	MSYT –10%	Base Case	MSYT +10%
1-5	250500	250500	250500
6-10	225500	225500	225500
11-20	217500	217500	225000
21-90	200500	217500	225000
91-250	200500	217500	237500

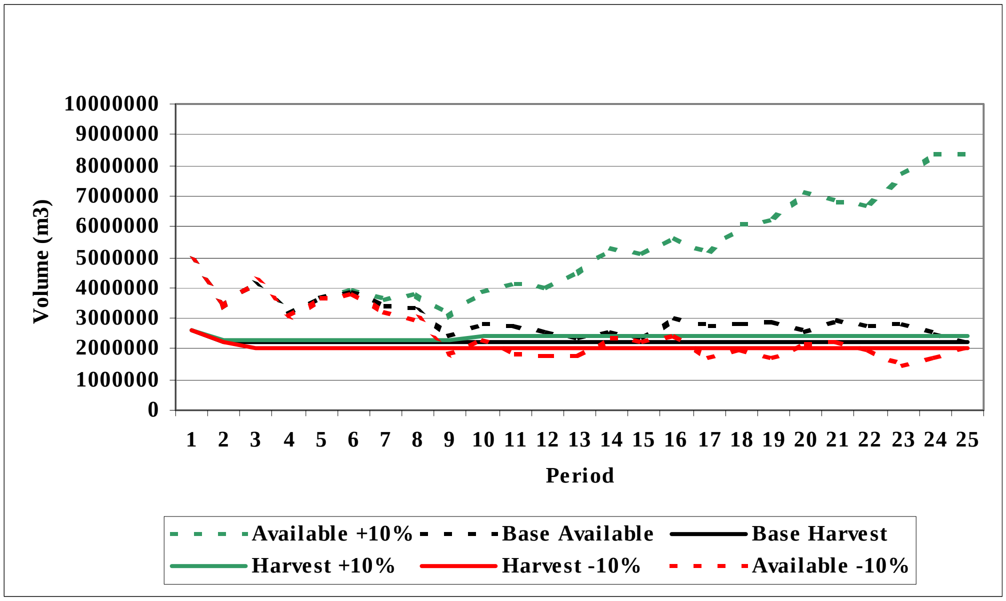


Figure 7.3. Net harvest levels – adjust managed stand yields by +/- 10%

7.4 Adjust Minimum Harvest Ages

Minimum harvest ages for future managed stands were based on the age at which mean annual increment (MAI) in volume culminates. This is an arbitrary approach, representing a conservative estimate of this age; *i.e.* in some cases it is reasonable to expect to harvest stands at an earlier age. The sensitivity to this assumption was tested by arbitrarily adjusting minimum harvest ages by +/- 10 years.

The results are presented in Table 7.5 and Figure 7.4. As the Base Case timber supply is significantly constrained by the availability of second growth timber in decades 9-15, the timber supply is sensitive to reductions in this availability when increasing the minimum harvest age by 10 years. On the other hand, when decreasing the minimum harvest age by 10 years availability in the long-term increases, however, harvest levels are only marginally above those documented in the Base Case. Since stands are harvested further away from culmination less volume per hectare, and hence, more area must be harvested.

Table 7.5. Net harvest levels – adjust minimum harvest ages

Years	Annual Harvest Level (m^3 / year)		
	MHA –10 years	Base Case	MHA +10 years
1-5	250500	250500	250500
6-10	225500	225500	225500
11-20	217500	217500	217500
21-100	217500	217500	203500
101-250	217500	217500	226000

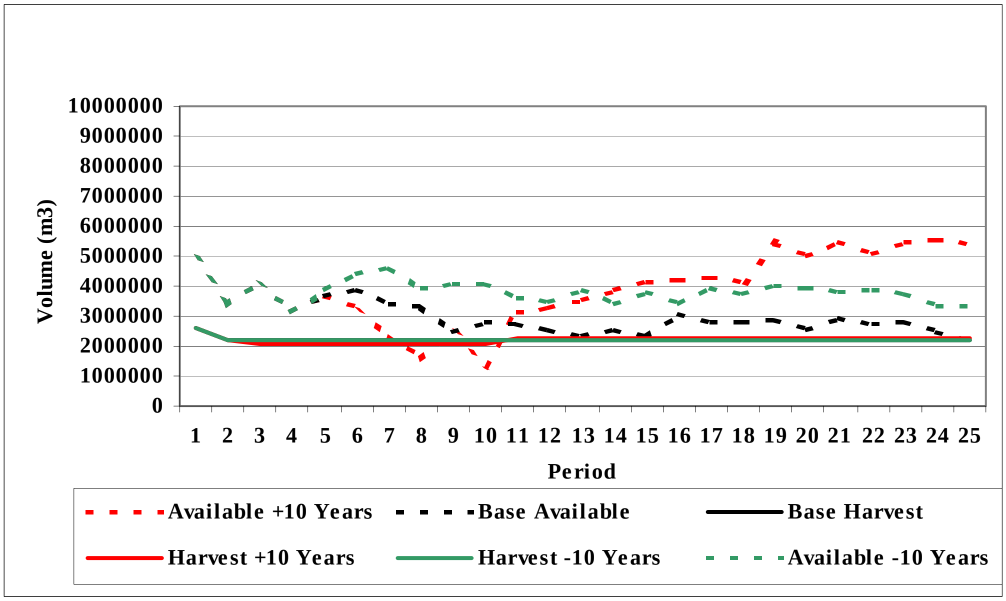


Figure 7.4. Net harvest levels – adjust minimum harvest ages by +/- 10 years

7.5 Adjust Regeneration Delay

Regeneration delays are set at 1-2 years in the base case, depending upon analysis unit. Increased regeneration delays impose limitations on harvesting since the time required by trees to reach merchantability and green-up height is prolonged. As a result, timber availability was reduced and harvest levels could not be realized when increasing regeneration delays by one year. The harvest level would have to be reduced to 215000 AAC. Conversely, reducing regeneration delays by one year increased timber availability. Consequently the harvest levels could be increased to 220,000. As shown in Table 7.6, and Figure 7.5, a +/- one-year reduction in regeneration delay has a proportional impact on the even-flow timber harvest.

Table 7.6. Net harvest levels – alter regeneration delay

Decade	Annual Harvest Level (m^3 / year)		
	Delay -1	Base Case	Delay +1
1-5	250500	250500	250500
6-10	225500	225500	225500
11-20	220000	217500	217500
21-250	220000	217500	214000

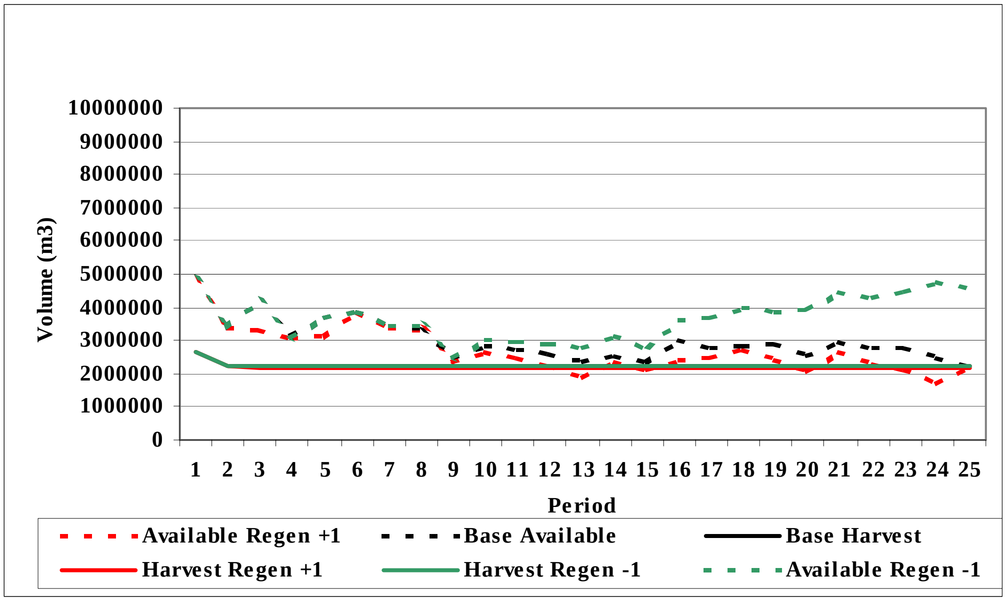


Figure 7.5. Net harvest levels – alter regeneration delay

7.6 Alter Maximum Disturbance Levels – IRM

In the Base Case, maximum disturbance levels for these zones are set at 33%; *i.e.* the amount of area in the net harvestable land base below green-up cannot exceed 33%. The sensitivity to this assumption was tested by arbitrarily adjusting maximum disturbance levels by +/- 5%. As shown in Table 7.7 and Figure 7.6, the timber supply is insensitive to changes in this objective since the amount of available timber is able to absorb any upward or downward pressure. In Period 15 the availability for the IRM –5% falls a trace short of the harvest level. The shortfall was so small we deemed it insignificant. Clearly, at these levels (+/- 5%), forest cover requirements within the IRM zone are not constraining timber supply.

Table 7.7. Net harvest levels – alter maximum disturbance levels

Years	Annual Harvest Level (m^3 / year)		
	IRM -5%	Base Case	IRM +5%
1-5	250500	250500	250500
6-10	225500	225500	225500
11-250	216500	217500	217500

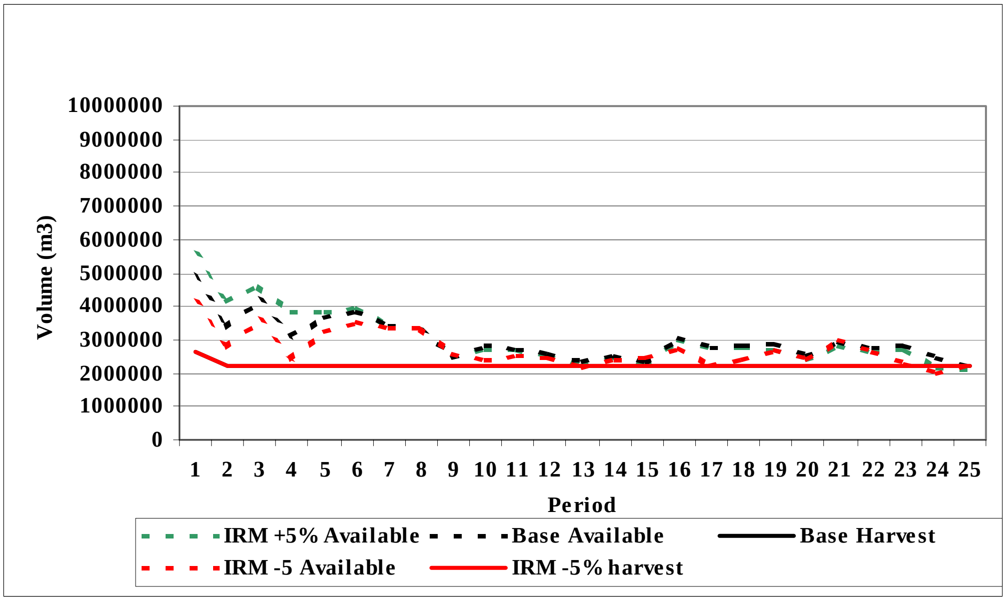


Figure 7.6. Net harvest levels – alter maximum disturbance levels

7.7 Alter Maximum and Minimum Denudation Levels – VQO

In the Base Case, the VQO percent denudation ranges were determined based on the maximum percent denudation ratings for each VQO. This was based on a range of 1.0 – 5.0% for retention (R) polygons, 5.1 – 15.0% for partial retention (PR) polygons, and 15.1 – 25.0% for modification (M) polygons.

In this sensitivity analysis, the VQO denudation percentages were altered to reflect the minimum and maximum ranges. Applying the minimum percentage had a downward pressure on the harvest level on mid and long-term supply, due to a reduced availability in the critical decades 9-15 as shown in Table 7.8, and Figure 7.7. Consequently, mid and long-term harvest levels were unrealizable forcing the harvest level down to the 215000. Conversely the harvest level could be increased to 220000 when the VAC was maximized.

Table 7.8. Net harvest levels – alter denudation – VQO

Decade	Annual Harvest Level (m^3 / year)		
	VQO Min	Base Case	VQO Max
1-5	250500	250500	250500
6-10	225500	225500	225500
11-20	217500	217500	219500
21-250	214000	217500	219500

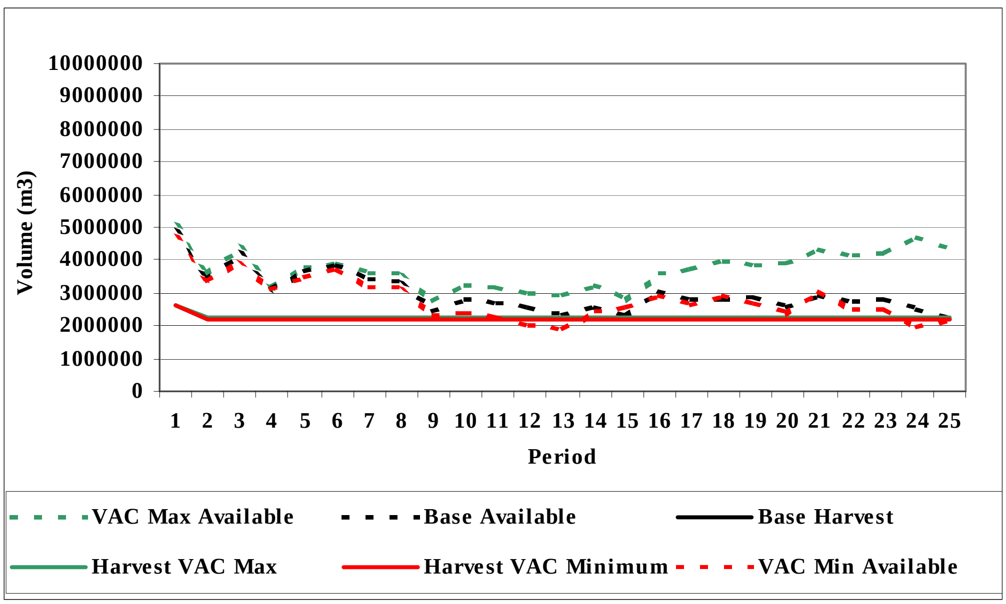


Figure 7.7. Net harvest levels – alter denudation levels – VQO

7.8 Alter Retention and Disturbance Requirement for Mountain Goat Zones

In the Base Case, maximum disturbance levels for these zones are set at 25%; *i.e.* the amount of area in the net harvestable land base below green-up cannot exceed 25%. The sensitivity to this assumption was tested by arbitrarily adjusting maximum disturbance levels by +/- 5%. The timber supply is insensitive to changes in this objective since the amount of available timber is able to absorb any downward pressure. Clearly, disturbance forest cover requirements within the Goat Management zone are not constraining timber supply.

In the Base Case, minimum retention levels for these zones are set at 50%; *i.e.* the amount of area in the net harvestable land base cannot fall below the 50% retention level. The sensitivity to this assumption was tested by arbitrarily adjusting minimum retention levels by +/- 10%. The timber supply is insensitive to changes in this objective. The levels (+/- 10%) minimum forest cover requirements within the Goat Management zone are not constraining timber supply and the impacts on availability were so insignificant that they could not be depicted graphically.

7.9 Summary of Sensitivity Issues

Table 7.9 provides a summary of the impacts of the sensitivity issues explored in this section. Impacts, represented as percentages, are only listed where the results differed from the Base Case by more than 0.5%. Impacts shown represent aggregate differences over the periods indicated, and are rounded to the nearest percentage value.

Table 7.9. Sensitivity analyses – summary of percentage impacts

Base Case Net Harvest (cubic meters/year)		**250500 yrs 1-5**
		225500 yrs 6-10
		217500 yrs 11-250
Issue Tested	**Sensitivity**	**Impact**
Adjust THLB	+ 3 235 ha	+10
	-3 235 ha	-10
Adjust existing VDYP yields	+10%	+3
	-10%	-3
Adjust TIPSY yields	+10%	+7
	-10%	-7
Alter minimum harvest age	+10 years	-6 (1)
(1) years 21-100	-10 years	0
Alter regeneration delay	+1 year	-1
	- 1 year	+1
Alter IRM disturbance %	+5%	0
	-5%	<1%
Alter VQO disturbance levels	Minimum	-1
	Maximum	+1
Alter goat disturbance levels	+5%	0
	-5%	0
Alter goat retention levels	+10%	0
	-10%	0

In summary, these sensitivity analyses demonstrated that inventory and stand yield factors do affect Base Case timber availability and harvest levels. Factors which affect the timing of second growth stands (minimum harvest age and regen delay) also have an effect, although less pronounced. Conversely, forest cover constraints have a relatively minor impact on availability, and on the even-flow timber supply.

8.0 Licensee Options

No other licensee options have been explored as part of this analysis

9.0 20-Year Spatial Feasibility Option

As laid out in the MoF guidelines for the preparation of the 20-year plan, the spatial plan sets out a hypothetical sequence of harvesting over a period of at least 20 years. The 20-year plan utilizes spatial constraints with little or no field information, to test achievement of a harvest level that conforms to current standards and practices as defined for the Base Case in the Timber Supply Analysis Information Package (October 2002, Final Version).

The TFL 38 20-Year Spatial Feasibility analysis has been prepared with these objectives in mind. It is not designed to be an operational plan, but a test of timber availability given the current structural characteristics and spatial distribution of components of the resource, and the structural and spatial management objectives associated with the Forest Practices Code.

A report (20-Year Spatial Feasibility Report, April 2003) detailing this analysis is being submitted under separate cover.

10.0 Recommendations

Based on the outcome of these analyses, it is proposed that the AAC for TFL 38 be set at 250500 cubic meters per year for the period January, 2004 to December 31, 2008. The harvest level is then reduced by 10% to 225,500 cubic meters per year in years 6-10, and then subsequently steps down by 4% to a long-term sustainable level of 217500 cubic meters per year for the remainder of the time horizon.

The proposed AAC is supported by three (3) critical factors:

1. The initial harvest level does not jeopardize the long-term even-flow level;
2. This level is relatively insensitive to fluctuations in key assumptions.
3. The 20-Year Spatial Feasibility analysis has demonstrated that the proposed AAC is spatially attainable for 20 years.

All timber supply requirements have been addressed within the context of sustainable forest resource management values including biodiversity, old growth management, recreation, wildlife and visual quality.

APPENDIX 1. Maps