Morice and Lakes Timber Supply Area
Innovative Forest Practices Agreement

Morice TSA Timber Supply Analysis Scenario Report

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1.0 Introduction

The Morice and Lakes Timber Supply Areas Innovative Forest Practices Agreement (M&L IPFA) was awarded in 1999 by the Ministry of Forests under Section 59.1 of the British Columbia Forest Act.

The M&L IPFA is a partnership between six regional forest licensees (Babine Forest Products Company, Canadian Forest Products Ltd, Decker Lake Forest Products Ltd, Fraser Lake Sawmills, Houston Forest Products Company, and L&M Lumber Ltd) and the BC Ministry of Forests Timber Sales Program in both the Morice and Lakes Timber Supply Areas. Tweedsmuir Forest Ltd. is a limited liability corporation formed under the Companies Act of BC, and is a subsidiary company of the M&L IFPA holders. Tweedsmuir Forest Ltd. is directed by a board of directors representing each of the IFPA holders and acts as the delivery mechanism for the IFPA.

The IFPA program was designed to enable licensees to explore new forest management ideas in an operational setting to enhance timber supplies, community stability and social and environmental values. The M&L IFPA program in particular is founded on the development of sustainable forest management plans for both the Morice and Lakes TSA that accommodates the range of other resource uses and interests.

A description of the inputs and assumptions used for this analysis can be found in the documents, "Morice TSA Timber Supply Information Package for the Base Case Scenario" and "Morice TSA Timber Supply, Comparison of Base Case and Decision Scenario Inputs and Assumptions."

In order to support the AAC determination for the M&L IFPA, Tweedsmuir Forest Ltd. is also responsible for preparing a Timber Supply Analysis Report documenting the results of the Decision Scenario analysis while making comparisons to the Base Case Scenario.

The purpose of the Timber Supply Analysis Report is:

- to provide a detailed account of the factors related to timber supply that the Chief Forester must consider under the Forest Act when determining an allowable annual cut (AAC) and the impact that these factors had in the Morice TSA Timber Supply Analysis;

- to provide Forest Service staff with the opportunity to review data and information/processes that were used in the Timber Supply Analysis;

2.0 Description of the Morice Timber Supply Area

The Morice Timber Supply Area (TSA) is situated on the western edge of British Columbia's central Interior Plateau and covers approximately 1.5 million hectares (Figure 1). The TSA is bordered on the west by the Kalum and Bulkley TSAs, on the south by Tweedsmuir Provincial Park, on the north by the Fort St. James Forest District, and on the east by the Lakes TSA. The borders of the Morice TSA correspond with those of the Morice Forest District, one of six districts in the Prince Rupert Forest Region. The TSA is administered by the forest district office in Houston. The population of the Morice TSA is about 5,500 according to the 1996 census, a 9% decrease since 1991. The main community is Houston, which is home to about three-quarters of the TSA population. The remainder of the population lives in smaller communities such as Topley and Granisle, or on the many ranches and farms along the Highway 16 corridor and in the area from Owen Lake to Francois Lake.

The Morice TSA lies along the western edge of B.C.'s Interior Plateau, with the Cascade Mountains to the west. Extending from the most northerly tip of Babine Lake in the north to Ootsa and Whitesail lakes in the south, the TSA has a gentle, rolling landscape in the north and east, becoming more mountainous in the southwest. Major rivers include the Bulkley, Morice and Nadina. The overall climate is transitional between coast and interior, with cool summers and cold winters. The forests of the Morice TSA are fairly diverse.

However, within the landbase currently considered available for timber harvesting, lodgepole pine is the dominant species occupying more than 50% of the landbase. The two other major species are hybrid spruce and subalpine fir (balsam). Trembling aspen, amabilis fir, western hemlock and mountain hemlock also occur in minor amounts. Over 60% of the forests in the TSA are currently mature and old; over time the forest will consist more predominantly of younger stands (less than 120 years) as a result of harvesting.

Currently a Mountain Pine Beetle epidemic is threatening most of the pine forest within the TSA, where 80% of the pine forest is expected to be under some form of MPB attack by 2013 and dead by 2018. This Decision Scenario analysis examines the impact of the Mountain Pine Beetle and investigates innovative ways to target the most susceptible pine forests for harvesting prior to being attacked thereby minimizing a fall-down in TSA. The current allowable annual cut (AAC) in the Morice TSA is 1,961,117 million cubic metres.

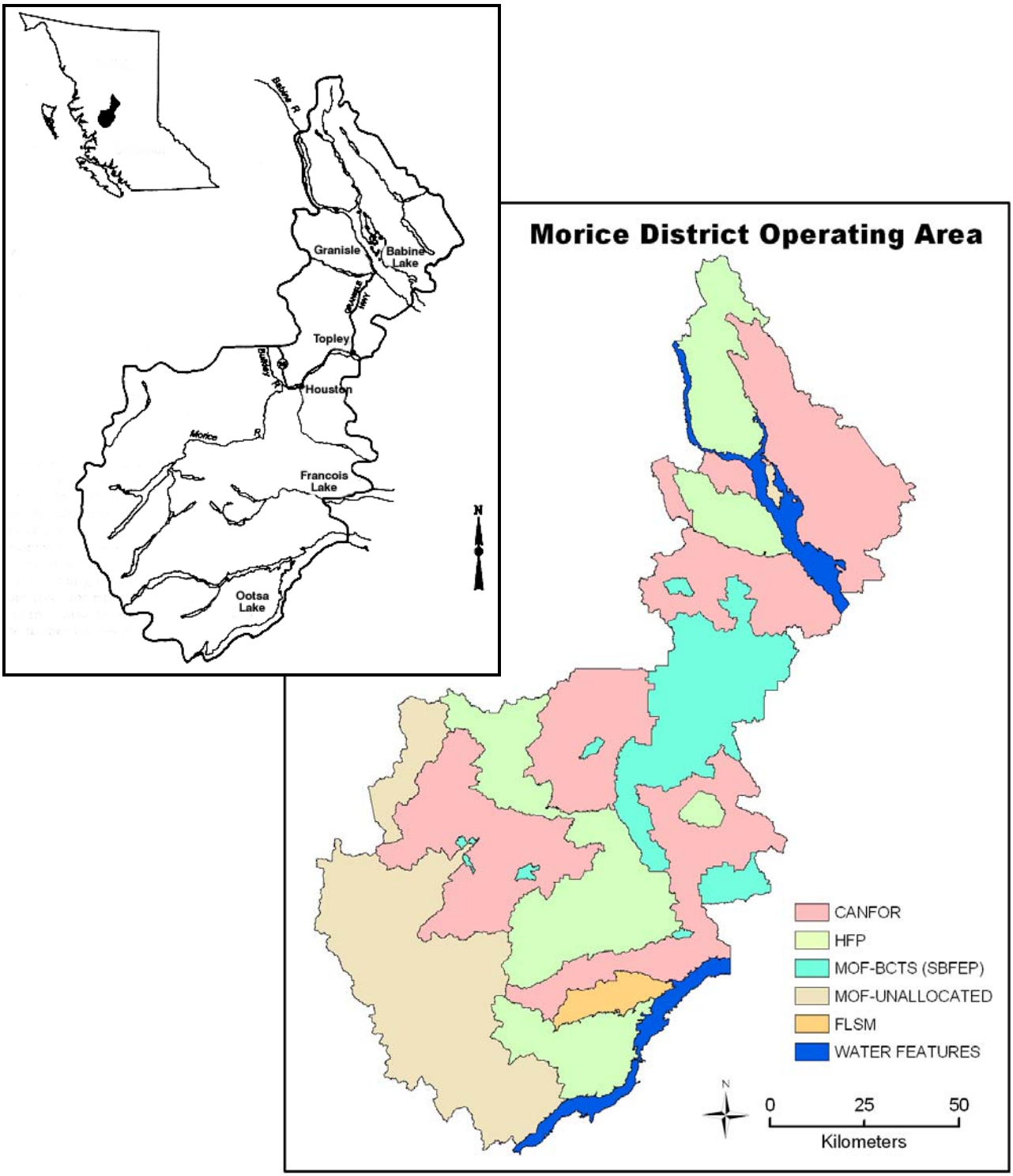

Figure 1. Map of the Morice Timber Supply Area, Prince Rupert Forest Region

3.0 Timber Supply Analysis Methods

The purpose of this analysis was to examine both the short- and long-term timber harvesting opportunities in the Morice TSA, under different management regimes (i.e. scenarios) and develop a preferred management strategy. Circumstances that could not be foreseen (i.e. the MPB epidemic) when the project was initiated required a change in focus, where the scenarios were modified mid-stream and certain scenarios have different growth & yield response rates, and different targets/assessment of targets so direct comparison of scenarios becomes difficult, however general trends can be deduced. The culmination to the learning scenario process is the Decision Scenario, which models current forest management practices and the current Mountain Pine Beetle epidemic. The timber supply model used for this analysis was the Tesera Scheduling Model (TSM) developed by Tesera Systems Inc. A description of the model can be found in the following section.

3.1 Forest Estate Modelling

Timber Supply Analysis Model Name: Tesera Scheduling Model (TSM).

Model Developer: Tesera Systems Inc.

Model Type: Spatially explicit integrated simulation/optimization model.

Model Review and Approval: The BC Ministry of Forest's Timber Supply Branch has reviewed TSM in all its potential modes of operation and accepted the use of TSM for providing decision support related to Allowable Annual Cut (AAC) determinations (Appendix 1).

Model Description:

TSM is a hybrid between simulation-based models and heuristic-based optimization models, and draws on the strengths of each towards solving resource management problems. In conjunction with its supporting applications (for automated treatment unit generation [block coverages] and road network creation), TSM is part of a comprehensive integrated resource management modelling suite.

TSM can be run in either **aspatial** or **spatial** modes, and in either of two algorithmic approaches – **sequential simulation** or **simulated annealing** (optimization). For the **Morice TSA Timber Supply Analysis,** TSM was run in the **spatial mode** using the **simulation** algorithm and, therefore, these capabilities of TSM are described.

In its **spatial mode**, TSM maintains the spatial location of forest stands, harvest units, resource development zones, special management areas, and other landbase resource and values, it is capable of not only providing estimates of timber supply, forest inventory and resource indicator changes over time, but also provides a direct linkage between strategic, tactical, and operational planning since analysis results can be displayed on a map and land-based inventory (i.e. forest cover) changes are clearly tied to treatment unit polygons.

Spatial relationships between polygons within the dataset are defined through an adjacency table, generated via GIS, which lists for each polygon in the dataset its adjacent neighbour polygons. Spatial constraints and/or targets such as visual quality objectives, patch distribution targets, connectivity and proximity requirements can be modelled explicitly rather than through the forest cover target approximations required under an aspatial approach.

3.2 Growth and yield

The underlying growth and yield assumptions used for this Timber Supply Analysis follow the standard BC Ministry of Forests (BCMoF) protocol. Growth and yield projections were obtained using the Variable Density Yield Prediction (VDYP) and Table Interpolation Program for Standard Yields (TIPSY) based on the TSR2 data inputs and assumptions for the Morice TSA. A detailed description of how growth and yield information was compiled and used in the analysis is contained in the attached growth and yield report that has been submitted and approved by the BC Ministry of Forests (Appendix 2).

4.0 Results

This section presents the results of the Timber Supply Analysis for the Base Case and Decision Scenario, as well as a number of other Scenarios that were developed as part of the IFPA mandate. The Base Case Scenario documents the current management that is occurring on the landbase and shows the sustainability of the fibre flow while still maintaining values as per the TSR2 analysis. The Base Case results will be summarized in Section 4.1. For information on the inputs and assumptions for the Base Case Scenario, refer to the report "Morice TSA Timber Supply Information Package for the Base Case Scenario" (Appendix 3). Other Scenarios were modeled that examined the impact of different management intents, on the landbase. The harvest flow from these Scenarios will be highlighted in section 4.2. (Alternative Scenario Results). The Decision Scenario results will be highlighted in section 4.3

4.1 Base Case Results

The mandate for the IFPA Base Case required that data inputs and assumptions remain consistent with those implemented under the TSR2 analysis. Any deviations were restricted to the conversion of aspatial approximation assumptions to their spatial equivalents, use of better, more up-to-date inventory information if available and to implement TSR2 assumptions as intended.

It has been acknowledge that several key assumptions under the Morice TSR2 analysis do not reflect current forest management practices being implemented by the licensees within the Morice TSA. As a result, additional management practices were modeled in the Base Case scenario including:

- Implementation of spatial Biodiversity Patch Targets. Under the TSR2 analysis, the maximum block size was 60 ha and a 3-metre green-up adjacency was modelled.

- TSA-wide implementation of seral stage targets by Biodiversity Emphasis Options (BEOs) and Landscape Unit as per the Landscape Unit Planning Guidebook. Under the TSR2 analysis, seral targets for old & mature forest for NDT3 ecosystems were applied using blended 45-45-10 targets.

- Old Growth Management Area (OGMA) Targets were modelled based on BEO and Landscape Unit as per the Landscape Unit Planning Guidebook. Under the TSR2 analysis, seral targets for OGMAs applied the 45-45-10 if the BEOs were not identified or approved at the time.

- Use of slope classifications to define VEG heights on the landbase and assess denudation targets whereas the TSR2 analysis assumed a 5-metre VEG height for visual polygons across the entire TSA.

- Adjusting the fixed harvest schedule for the first 5-year period to ensure that the predicted harvest levels do not exceed current AAC levels.

4.1.1 Base Case Harvest Forecast

The Base Case harvest forecast represents the current management within the TSA, while still maintaining many of the TSR2 analysis requirements. Consequently, the Base Case Scenario does not incorporate the increased volume losses due to the MPB epidemic or attempt to mitigate the volume

losses. The Base Case harvest forecast will be compared against the TSR2 analysis harvest forecast, shown in Figure 2. The overall Base Case harvest forecast is 3% lower than the TSR2 analysis harvest forecast. The 9% increase in harvest levels from Period 10 to 21, results from how the adjacency was modeled by the different Timber Supply models and the assumptions that were made. TSR2 analysis used an aspatial approximation to model 3-metre adjacency rules and 5-metre Visually Effective Green-up (VEG) Height for visually sensitive areas. Whereas, the Base Case used current practices, i.e. spatial biodiversity patch size targets and slope-based VEG to model the issues, with the net effect enabling more timber to be harvested in the medium term while still meeting the same non-timber targets set in the TSR2 analysis.

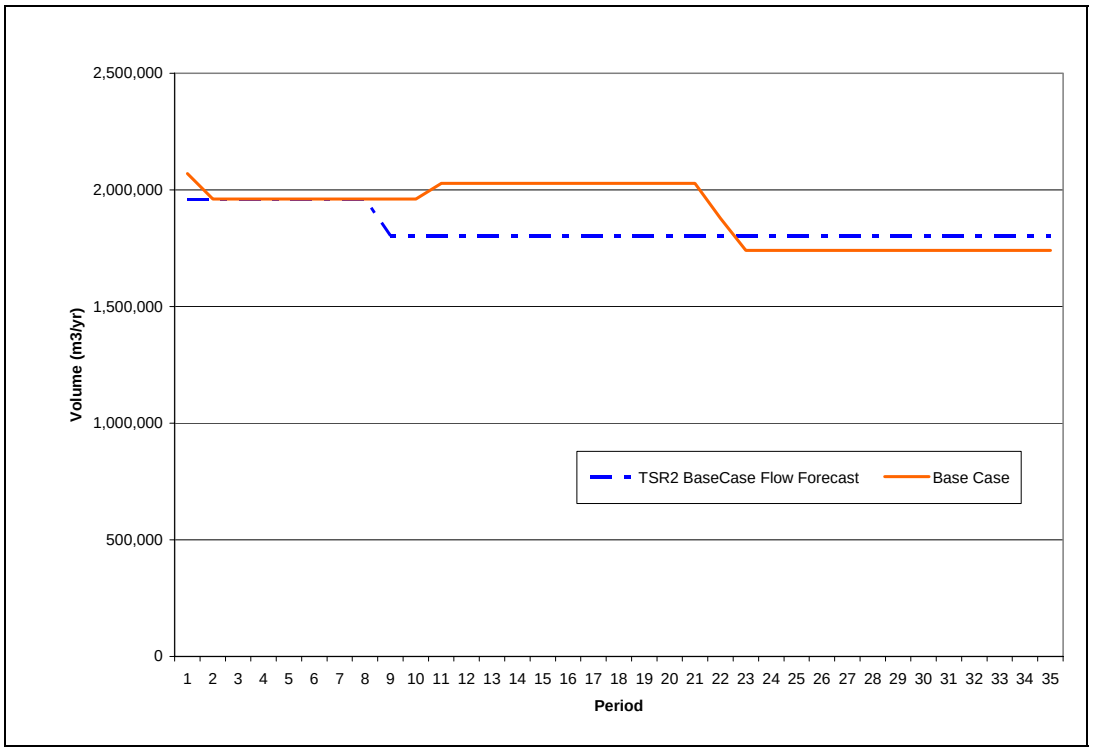

Figure 2. Comparison of TSR2 Harvest Forecast and Base Case Harvest Forecast

In the short- and medium- terms, the harvest level for the Morice TSA depends on the current growing stock (i.e. older natural stands). The long-term harvest level is dependant on the conversion of the landbase to a managed status which starts to contribute to the harvest in period 9. This decrease in the Base Case harvest forecast from Periods 22 to 35, relative to the TSR2 analysis harvest forecast is due to managed stands in the Base Case being harvested closer to Minimum Harvest Age (MHA); therefore it does not approach the higher culmination volumes (Figure 3).

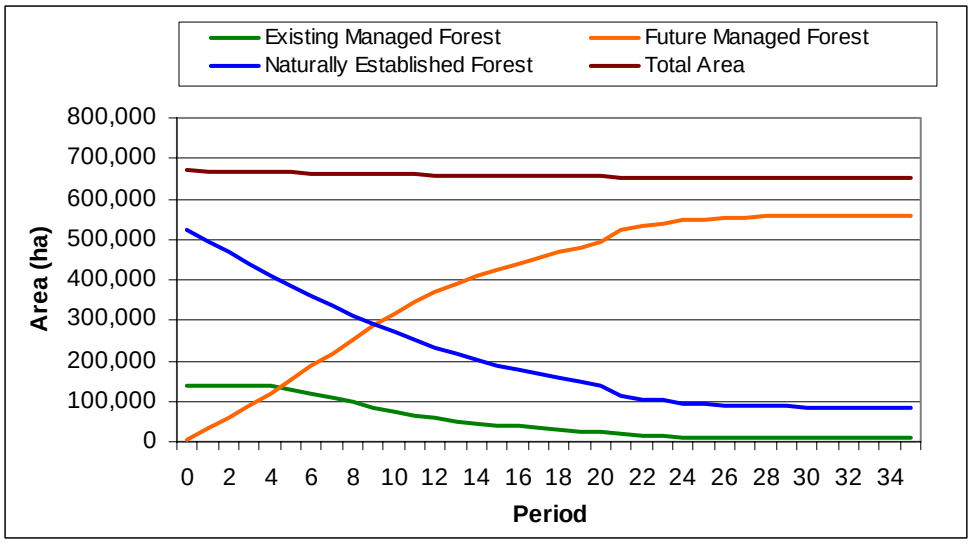

Figure 3. Base Case THLB Landbase Transitions Over Time by Area

4.2 Alternative Scenario Results

Various Scenarios were developed to reflect changes in management options from the original Base Case analysis in order to determine maximum potentials of the landbase given different management objectives such as recreation, agriculture/range, timber and natural disturbance.

4.2.1 Ecosystem Scenario

The intent of this Scenario is to mimic the spatial and temporal landscape patterns associated with natural processes such as fire, insects, disease and wind throw. It also tests the theory that all people oriented and naturally oriented resource objectives can be achieved through ecosystem based management. Localized ecosystem based targets for patch size and seral stage targets guide timber harvesting practices. Additionally, natural succession is implemented.

A series of successional pathways were developed for stands according to their biogeoclimatic variants, leading and secondary species, site productivity and stand age. When a stand is harvested it starts at the beginning of its pre-assigned successional pathway. After harvest, a stand is subject to a regeneration delay appropriate to natural regeneration. Regeneration through plantation is not applied in this Scenario. If a stand reaches succession age without being harvested it will proceed to the curve appropriate to the next stage of succession. All the yield curves in this Scenario (except for existing managed stands) represent natural growth rates and are therefore derived from VDYP.

4.2.1.1 Ecosystem Harvest Forecast

The long-term harvest level achieved in the Ecosystem Scenario was less than half of the Base Case, shown in Figure 4. There are a number of factors for this dramatic decrease in timber supply in the Ecosystem Scenario.

1. Wildlife Tree Retention areas are increased, from approx. 54,000 ha in the Base Case analysis to approx. 72,000 ha in this Scenario. Wildlife Tree Retention is applied on a harvest block level,

where between 1% and 25% of a block's area or volume is retained for wildlife trees until ecological rotation age is achieved on the cut-over portion.

2. The successional pathways used for the Ecosystem Scenario are based on natural, un-managed stands – therefore all volumes are based on natural (VDYP) curves which when compared to managed stands do not attain volume as quickly in the stands lifespan and are generally have lower volumes.
3. Across the TSA, Minimum Harvest Ages (MHA) are set to the ecological rotation age, or mean fire return interval.
    - In the Mountain Hemlock zone; MHA is 350 years.
    - In the Coastal Western Hemlock zone; MHA is 200 years.
    - In the ESSF zone, MHAs range from 180 to 650 years.
    - In the SBSmc2 and wk3, MHA is 133 years except in the 09/10 site series where it is 200 years.
    - In the SBSdk3; MHA is 93 years except for the 09 site series where it is 250 years.

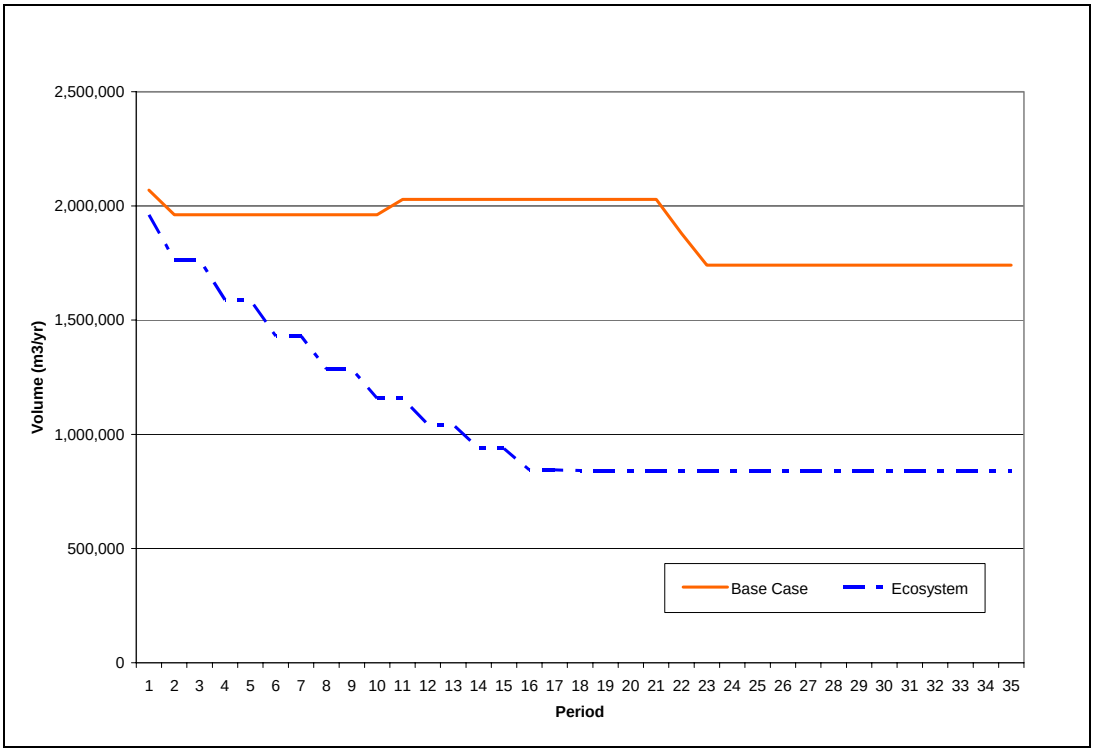

Figure 4. Harvest Forecast Comparison between Ecosystem and Base Case Scenario

4.2.2 Recreation Scenario

In this Scenario recreation, tourism and scenic values are paramount over other resource values. The intent is to maintain and enhance a range of recreational opportunities and quality recreation experiences across the landbase. Access is managed to support recreational opportunities. Visual resources are also

managed to support recreational experiences. Wilderness values are protected from adverse impacts related to recreational activities.

4.2.2.1 Recreation Harvest Forecast

Under the Recreation Scenario, the current Morice TSA AAC of 1,961,117 m^3/yr is not sustainable across the planning horizon (Figure 5). After 20 years, four harvest level reductions were required in years 20, 30, 40 and 50. The first and second at 10%, the third at 2.4% and the last, 51 years from now, at 4.7% resulting in a Long-Term Harvest Level of 1,612,606 m^3/yr.

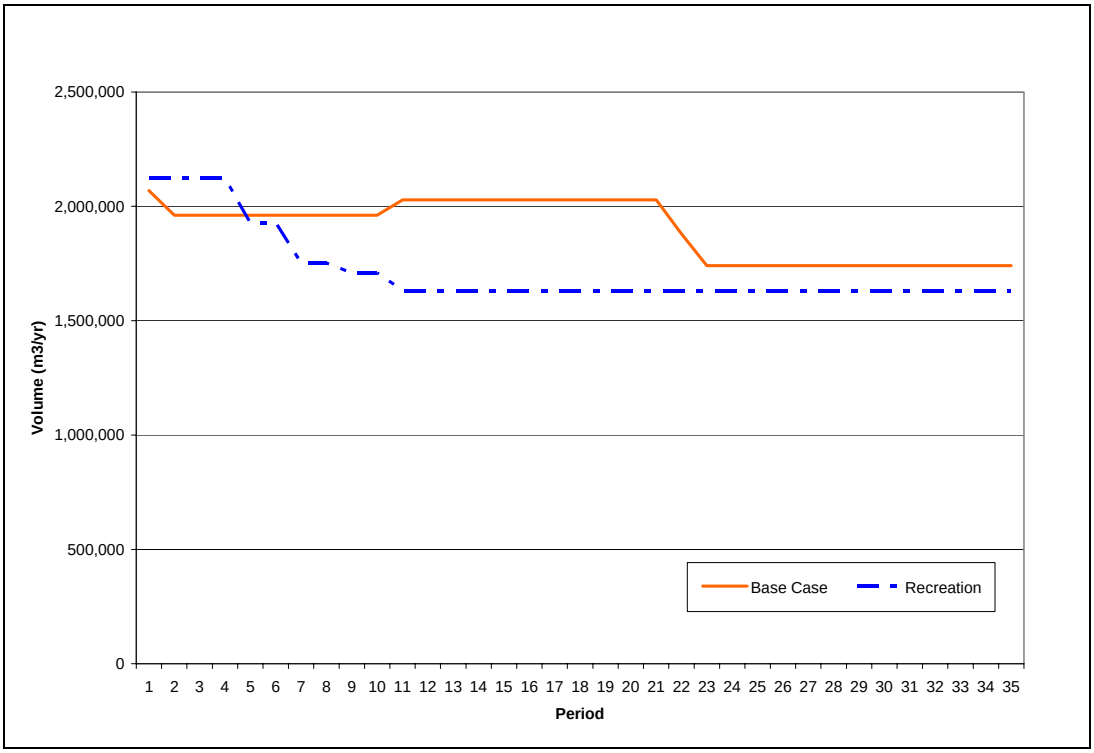

Figure 5. Harvest Forecast Comparison between Recreation and Base Case Scenario

Relative to the Base Case Scenario, harvest levels obtained under the Recreation Scenario were 7.8% higher over the short-term. On average, harvest levels were 14.6% less over the mid-term and 6.9% less over the long-term. As mentioned, the initial harvest level was maintained for the first 20 years of the flow projection rather than 40 years, as achieved under the Base Case.

The primary reasons for differences between the Recreation Scenario and the Base Case Scenario are described in the next few paragraphs.

A number of changes to the THLB definition had resulted in a 4% reduction in harvestable landbase. However there was a general trade-off in that some more productive areas were removed and some less productive areas were brought in to the THLB. These differences in the THLB from the Base Case definition included:

- No harvesting permitted in areas accessed through fly-in fishing lakes buffers (removed from THLB);
- No harvesting permitted in areas within fly-in fishing lake buffers (removed from THLB);
- No harvesting permitted in buffers around high value recreation trails (removed from THLB);

- No harvesting permitted in buffers around classified angling waters (removed from THLB);
- Treed non-productive areas were included in the THLB.
- Areas currently considered uneconomic were included in the THLB.
- Environmentally sensitive areas were included in the THLB.
- Wildlife Tree Retention areas were included in the THLB.
- Riparian Management Areas were included in the THLB.

The growth and yield projections used in the Recreation Scenario were the same set of curves that were used in the Forest Productivity Scenario.

As well, many of the constraints were removed from this Scenario, such as seral constraints, patch size targets and green-up constraints. The amount of area subjected to Visual Quality Objectives (VQOs) was expanded and they were assessed using Visually Effective Green-up (VEG) height was based on slope classes. The VQOs were also adjusted upwards one-level above those used in the Base Case, so Modification became Partial Retention, Partial Retention became Retention, and Retention Zones became Preservation. VQOs were applied to additional areas, including buffers around fishing lakes and cabins and the Morice River flood plain. A comparison of the areas within each VQO classification has been supplied in Table 1 for the Base Case and Recreation Scenarios.

Table 1. Comparison of VQO Classifications Between the Base Case and Recreation Scenario

VQO Category	Base Case VQO THLB Area	Recreation VQO THLB Area	Percent (%) Retention in Each VQO Category
Modification	23,719	0	
Partial Retention	184,784	32,819	15
Retention	25,164	152,368	5
Preservation	2,138	30,291	1

4.2.3 Agriculture and Range Scenario

In this learning Scenario, agriculture and range values are optimized by gradually expanding range tenure areas during the harvest schedule planning horizon and providing targets intended to maintain or enhance the quality of range tenure lands. Harvest flow policies are optimized to maintain the harvest flow relative to agriculture and range values that may adversely influence harvest flow. This is done through intensive silvicultural practices and increasing the timber harvesting landbase area by inclusion of area that was not utilized in the Base Case Scenario.

4.2.3.1 Agriculture and Range Harvest Forecast

Figure 6 shows that within the first 5 years, the harvest level is 3,965,288 m^3/yr, due primarily to prescribed harvests, which exceed the target harvest level by 25% or 784,674 m^3/yr. After the first five years the rate of prescribed harvesting declines substantially and the harvest level of 3,180,614 m^3/yr is maintained for the remainder of the first 4 decades.

After the first 4 decades, two successive decadal declines of 10% are required followed by a final 8% reduction to a Long-Term Harvest Level (LTHL) of 2,373,506 m^3/yr, 61 years from now.

The higher harvest level was obtained under the Agriculture/Range Scenario throughout the planning horizon relative to the Base Case primarily due to:

- Areas retained within the THLB, including naturally forested non-productive areas, environmentally sensitive areas, recreation areas, riparian management areas, and areas unavailable for harvest due to economic constraints; and
- The removal of maximum opening sizes of 60 ha with 3-metre green-up and adjacency requirements, followed by removal of denudation requirements within visually sensitive areas.

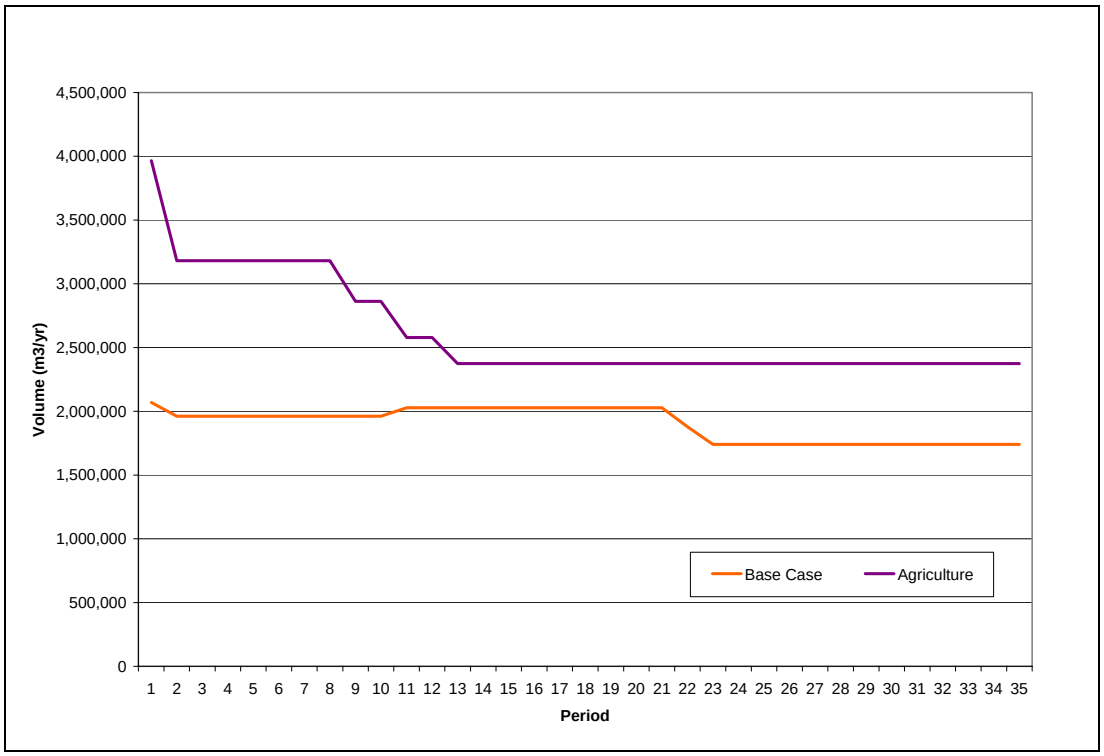

Figure 6. Harvest Forecast Comparison between Agriculture and Base Case Scenarios

The THLB landbase increased relative to the Base Case from 670,421 ha to 841,230 ha, an increase of 170,809 ha or 25.5%. Reasons for these increases were:

- Non-commercial brush (NCBR) was rehabilitated when adjacent stands were being harvested, therefore NCBR will remain in the THLB. In the Base Case Scenario, these areas were removed from the THLB.
- Consistent with the guiding principles of the Agriculture and Range Scenario, ESAs were not removed from the THLB
- In the Base Case Scenario, agriculture leases and grazing leases were removed from the THLB. Whereas in the Agriculture and Range Scenario, 159 ha of agriculture leases were removed from the THLB, but 4,409 ha of grazing leases remained in the THLB and was harvested, after harvesting of Forest Development Plan blocks was completed. When harvesting of grazing leases begins, at least 10% of the operable grazing lease area in the TSA will be harvested each year. After grazing leases are harvested they will not contribute to THLB. Conversion of grazing leases will be completed in 10 years.

- Eligible high potential agriculture areas within agriculture expansion zones were converted to agricultural land.
- Deciduous-leading stands within existing and potential range tenure areas were included in the THLB to enhance grazing potential. Deciduous stands outside the existing/potential range areas were excluded from the THLB as per the Base Case Scenario.
- The following riparian management areas were retained in the Agriculture Scenario, unlike the Base Case Scenario where this area was removed from the THLB:
    - a 10 metre riparian reserve zone (RRZ) on L1 lakes less than 1000 hectares
    - a 50 metre riparian reserve zone (RRZ) along S1 rivers
    - a 30 metre RRZ along S2 streams
    - a 20 metres RRZ along S3 streams
    - a 20 metre riparian management zone (RMZ) along S1 rivers and S2 streams
    - a 50 metre riparian management zone (RMZ) on L1 lakes less than 1000 hectares;
    - a 10 metre riparian reserve zone around W1 and W5 wetlands; and
    - RMZ's along S1 and S2 streams.

The prescribed harvest area in the first period includes Forest Development Plan (FDP) blocks, grazing leases and agriculture expansion zone areas scheduled for conversion to non-THLB agriculture and range tenures. The prescribed area rate of harvesting and conversion of grazing leases and eligible high potential agriculture area within each of the six agriculture expansions zones is unique to the IFPA Agriculture Scenario and the fixed-scheduled harvest area influences achieved harvest volumes/areas at the outset (Period 1) of the Scenario planning horizon Figure 7.

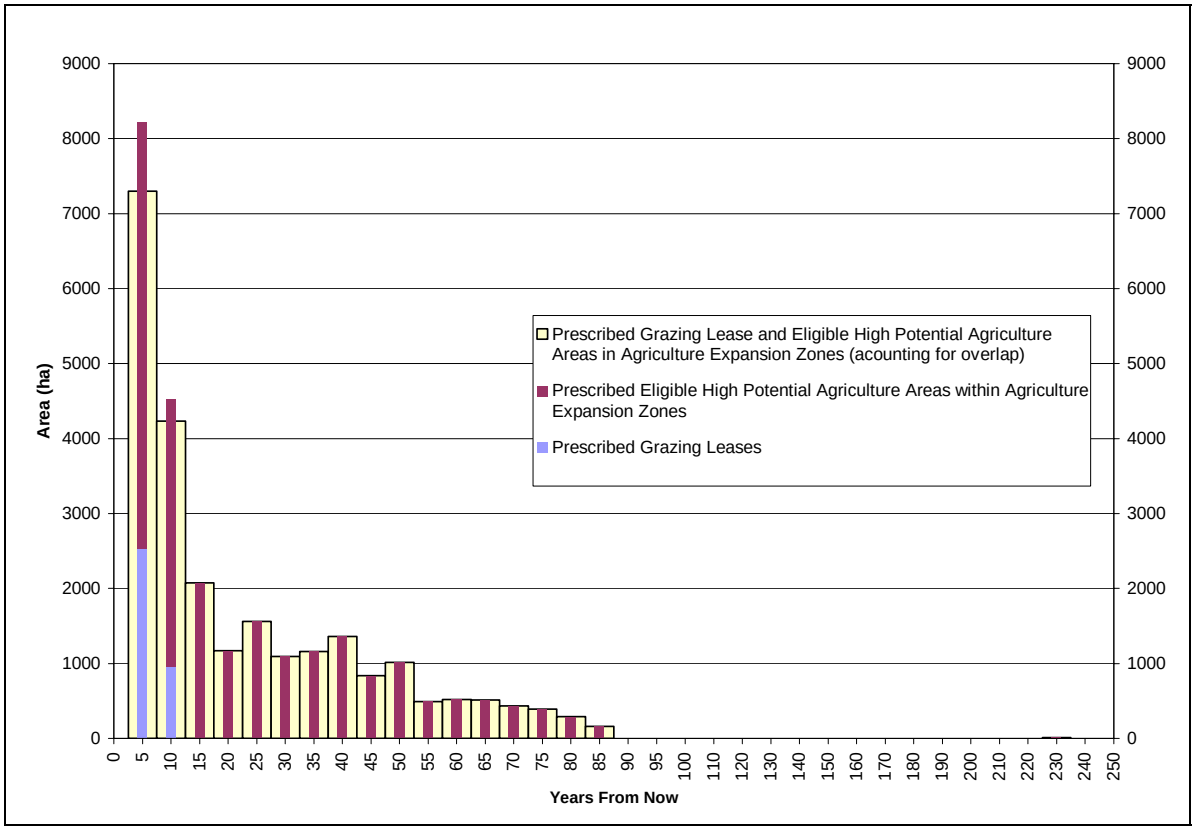

Figure 7. Grazing Lease/High Potential Agriculture Areas

In terms of growth and yield, the Agriculture/Range curves were based on a number of conditions that would increase the site potential. Those include:

- Stand status was redefined so that stands established prior to 1987 or which did not have a pre-existing silviculture treatment were natural stands. Those stands harvested after 1987 and had pre-existing silvicultural treatments were considered managed stands.
- The following intensive silviculture treatments and adjustments were applied to account for better productivity estimates:
    - genetically improved stock
    - immature plantation history
    - operational adjustment factors
    - regeneration assumptions
    - site productivity
    - unsalvaged losses (dead wood potential)
    - utilization
    - volume exclusion for mixed species stands
    - updated forest cover disturbance

As well, certain constraints were changed for this Scenario, these included:

- Addition of a 1-metre green-up height was applied for cutblocks up to a maximum 60 ha, within the existing and potential range tenure areas.
- Outside of the existing and potential range tenure areas, maximum cut block size, green-up or adjacency constraints, seral requirements and patch size target requirements were not applied whereas they were applied in the Base Case Scenario.
- Removal of the denudation requirements within visually sensitive areas, whereas they were applied in the Base Case Scenario.

4.2.4 Forest Productivity

The intent of the Forest Productivity Scenario is to recognize that timber values are paramount over other resource values. Timber production is maximized based on harvest flow policies consistent with the Base Case Scenario through intensive silviculture treatments and more accurate site productivity estimates. Many areas currently excluded from the THLB under the Base Case are rolled back into timber production. Growth and yield was also adjusted to account for MPB epidemic based on the Provincial Mountain Pine Beetle Projections (2005), spatially identified silviculture treatments and better site productivity estimates using SIBEC and OGSI site index adjustments.

4.2.4.1 Forest Productivity Harvest Forecast

The intent of the Forest Productivity Scenario was to maximize the cut for the first 40 years while still meeting the long-term harvest level (LTHL). The minimum harvest ages were applied to the stands culmination of mean annual increment (CMAI) – which represents the point at which stands produce the most average annual increment in yield and thereby, reflects the maximum capacity of the forest to produce timber.

The Forest Productivity harvest forecast when compared against the Base Case harvest forecast shows an increase in timber supply over the planning horizon Figure 8. The average short-term (0-40 years) increase is 43% with mid-term (41-100 years) and long-term (100-250 years) increases of 33% and 51% respectively.

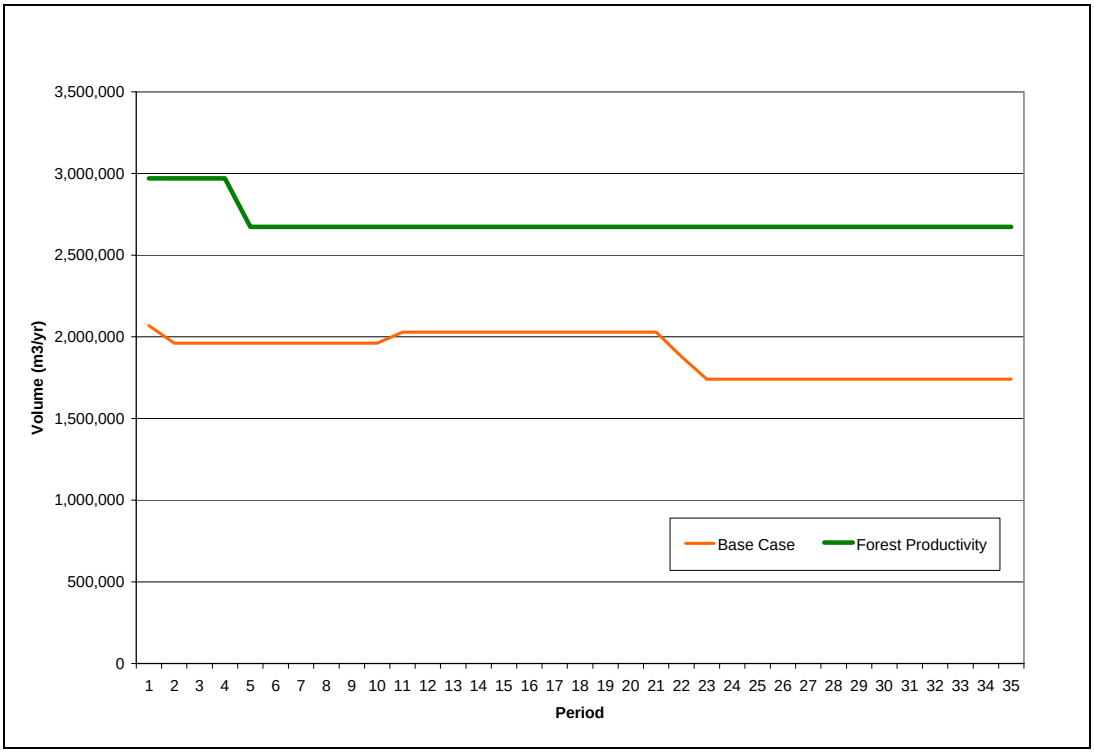

Figure 8. Harvest Forecast Comparison between Forest Productivity and Base Case Scenarios

The primary factors for the increased timber available in the Forest Productivity Scenario are due to an increased landbase, increased growth and yield responses and a lack of constraints acting on the landbase.

In terms of the landbase, the THLB changed from 670,421 ha in the Base Case Scenario to 1,027,190 ha for the Forest Productivity Scenario, an increase of 356,770 ha or 53 % mainly due to the inclusion of the following areas that were previously excluded in the Base Case:

- NCBR areas are being rehabilitated to managed plantations.
- Proposed Protected Areas that had a 10-year deferral in the Base Case Scenario were allowed to be harvested.
- Inoperable stands were included in the THLB.
- Problem forest types were included in the THLB.
- Non-merchantable forest types were included in the THLB.

In terms of growth and yield, adjustments were made to account for increased site productivity as well as the Mountain Pine Beetle (MPB) epidemic. The various adjustments are listed below:

- Curves were adjusted to account for Mountain Pine Beetle epidemic by using the Provincial Mountain Pine Beelte Projections (2005). The cummultive kill percentage was used to provide the residual stand volumes after attack by Bec/LU combinations..
- Stand status was redefined so that stands established prior to 1987 or which did not have a pre-existing silviculture treatment were natural stands. Those stands harvested after 1987 and had pre-existing silvicultural treatments were considered managed stands.

- Included site index adjustments for SIBEC, and OGSI where SIBEC was not available,
- Incorporated Genetic worth due to planting GI stock
- For Managed Stand Yield Tables (both existing and future), the following OAF1 factors will be applied: Pine Leading Stands = 0.88 (12% yield reduction) and All other stands = 0.93 (7% yield reduction). These revised estimates were based on the report "EFMPP, Operational Adjustment Factors, 1999 – 2000, Final Report".
- the Managed Stand Yield Tables were adjusted to account for the following intensive silviculure treatments:
    - Backlog Brushing
    - Fertilization, Late Rotation
    - Fertilization, Repeat
    - Genetically Improved Stock
    - Immature Plantation History
    - Incremental Spacing
    - Regeneration Assumptions
    - Unsalvaged losses (dead wood potential)
    - Utilization
    - Vegetation management
    - Volume exclusion for mixed species stands
    - Forest Cover Disturbance
    - Pruning

Constraints which were not included in the Forest Productivity Scenario relative to the Base Case Scenario include:

- patch size target requirements;
- denudation requirements within visually sensitive areas;
- Wildlife Tree Retention targets;
- biodiversity targets;
- seral stage targets; and
- OGMAs.

4.3 Decision Scenario Results

The intent of the Decision Scenario was to review and incorporate the best management practices based on knowledge gained from each of the Learning Scenarios. Using the Morice LRMP, management targets and requirements were implemented that best balance social, environmental and economic stakeholders objectives – thereby allowing tradeoffs to be made between competing resource value objectives. The Decision Scenario represents the culmination of the main modelling component of the Morice IFPA project. This Scenario forms the basis for the Sustainable Forest Management Plan, which guides forest management operations. However, additional sensitivities can be based off this information for further analysis as needs require.

The information defining the landbase and growth and yield of this Scenario can be found in the report “Comparison of Base Case and Decision Scenario Inputs and Assumptions” Report, dated April 14th, 2005 (Appendix 4).

The intent during modelling of the Decision Scenario was to maximize the harvest of pine in periods 2 and 3 (years 6-15), to mitigate the effects of the MPB epidemic while avoiding the creation of a growing stock trough in the mid-term. At the same time, an attempt was made to achieve a Long-Term Harvest Level similar to the Base Case Scenario harvest forecast.

The applied harvest rules were based on targeting the relative oldest first stands and those having the highest percentage of pine volume for the first 40 years and then switching the targeting to the Higher Risk categories (Extreme/High) of the Spruce Bark Beetle, Mountain Pine Beetle and Western Bark Beetle.

For leading pine stands, the minimum harvest criteria was based on a combination of 60 years of age and achieving a minimum volume/ha of 150m^3/ha. For Spruce, the minimum harvest criteria was based on achiving a minimum volume/ha of 150m3/ha while Balsam and other leading stand types had to attain a minimum volume/ha of 200m3/ha.

Some of the assumptions related to modelling MPB can be found in Appendix 2, but for simplicity they've been summarized below:

- Decrease in volume due to Mountain Pine Beetle has been modelled until 2013, with appropriate volume responses being generated after the epidemic;
- The shelf-life was assumed to be 5-years;
- Residual stand volume after attack was estimated using the percent kill estimates by Landscape Unit; and
- Spread of MPB was model, using the annual percent kill estimates within each LU.

The Decision Scenario harvest forecast when compared against the Base Case harvest forecast shows an increase in harvested timber in the short-term, with a general decrease in harvest during the long-term (Figure 9).

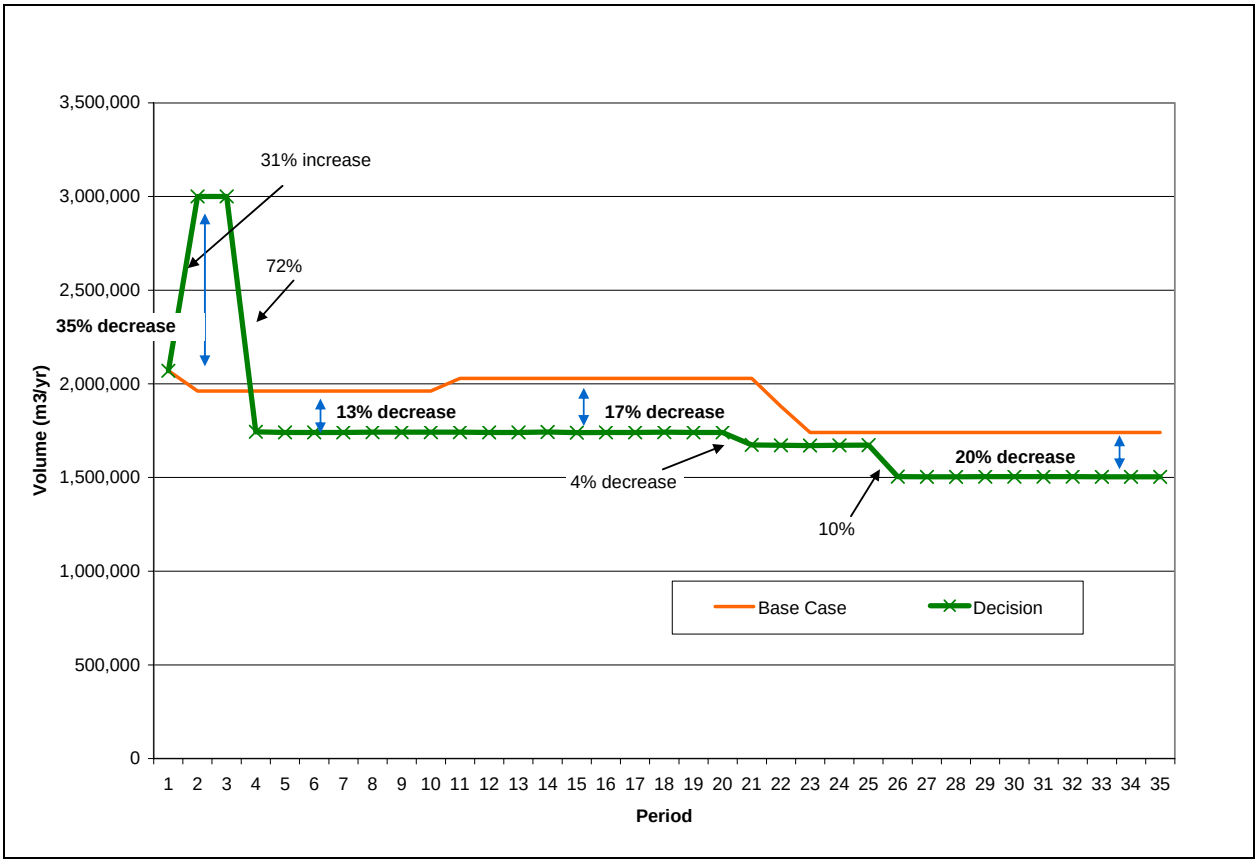

Figure 9. Decision Scenario Harvest Flow Forecast

These decreases in available volume are due to:

- Lack of available growing stock above MHA and MHV levels in the mid-term due to the pre-emptive harvest of pine within the periods 2 and 3 (years 6-15) to mitigate further MPB spread.
- Visual Sensitivity constraints in the short-term lock up 306 visually sensitive areas, ~153,000 ha of productive forest (those greater than 1000 ha have been graphed and are contained in Appendix 5).
- Seral constraints as identified in the Morice LRMP are also a factor in the reduction of mid and long-term harvest levels. (See graphs contained in Appendix 5).

Other harvest levels intended to mitigate the impending MPB epidemic in the Morice TSA were tested, from an annual harvest level ranging from 2.0 million - 4.0 million in periods 2-4 (years 6-20). However, it was felt by the Technical Committee that an annual harvest of 3.0 million cubic metres for periods 2 and 3 (years 6-15) would be the best solution to mitigate the effects of the MPB epidemic while at the same time conserving other resource values. See Figure 10 for a sample of the harvest flows tested.

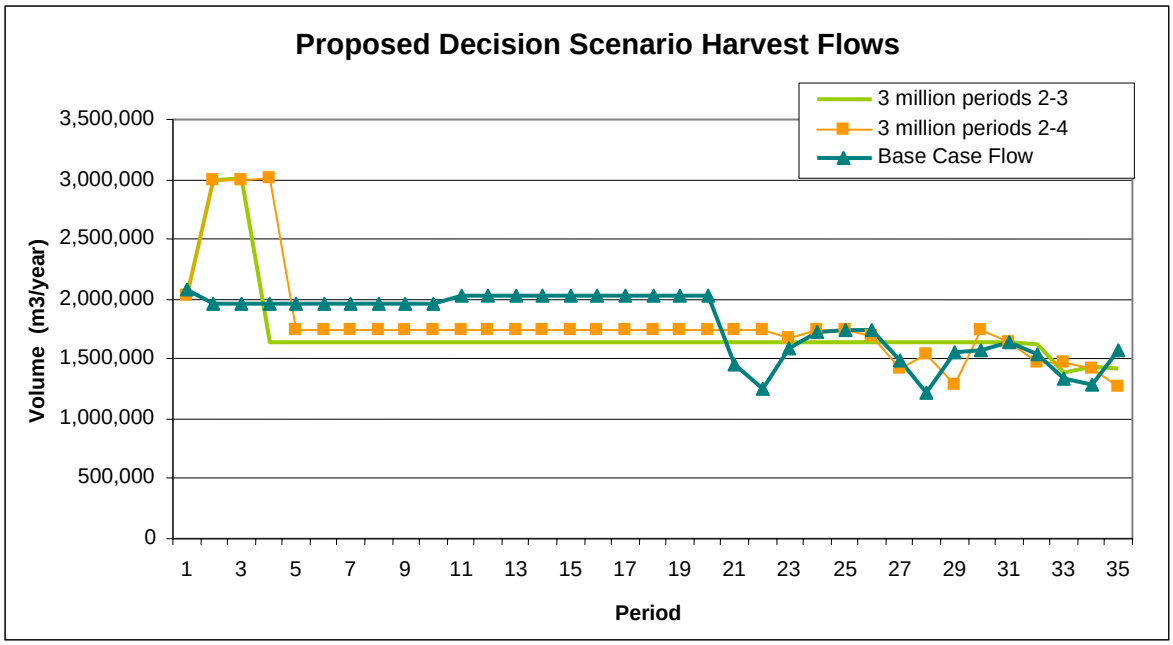

Figure 10. Sample of the Alternative Harvest Flows Tested

A majority of the Morice TSA has timber in the mature and over-mature age classes, so the harvest forecast is dependant upon these old age classes being maintained until the younger growing stock becomes of merchantable age. The growing stock graphs (Figure 11 and Figure 12) shows the growing stock on the landbase over time, as well as the harvest volumes and the dead wood component from the MPB epidemic. These graphs represent the entire landbase, including the THLB and non-THLB portions of the landbase.

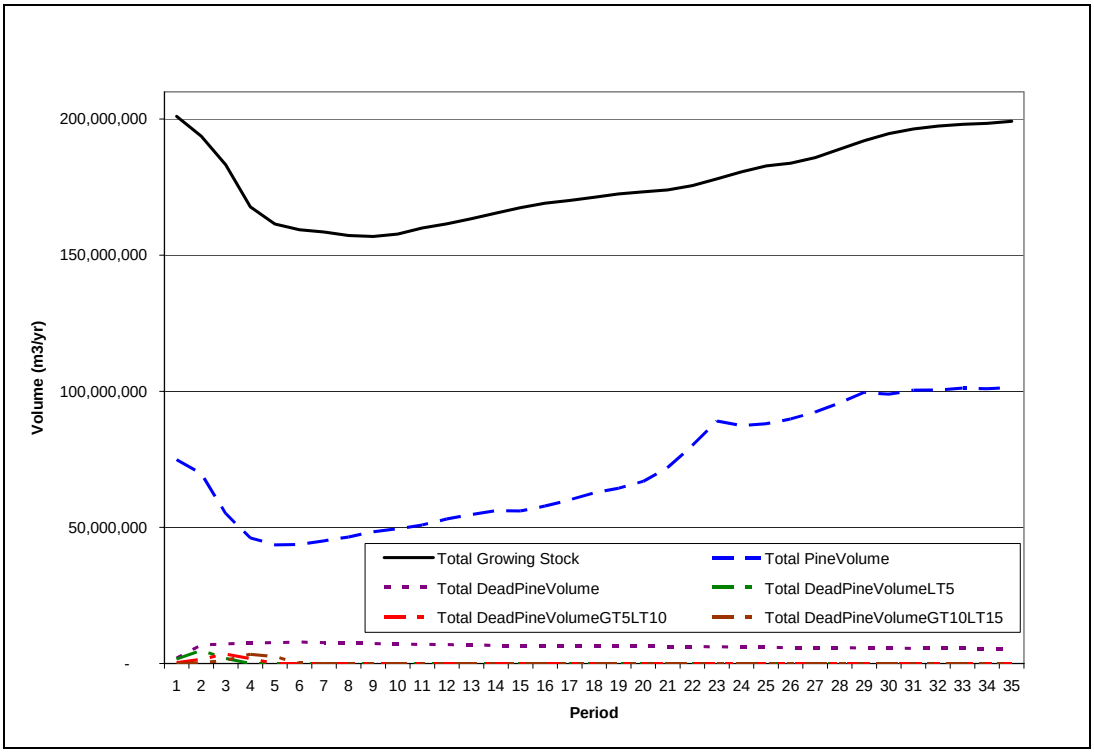

Figure 11. Total Growing Stock

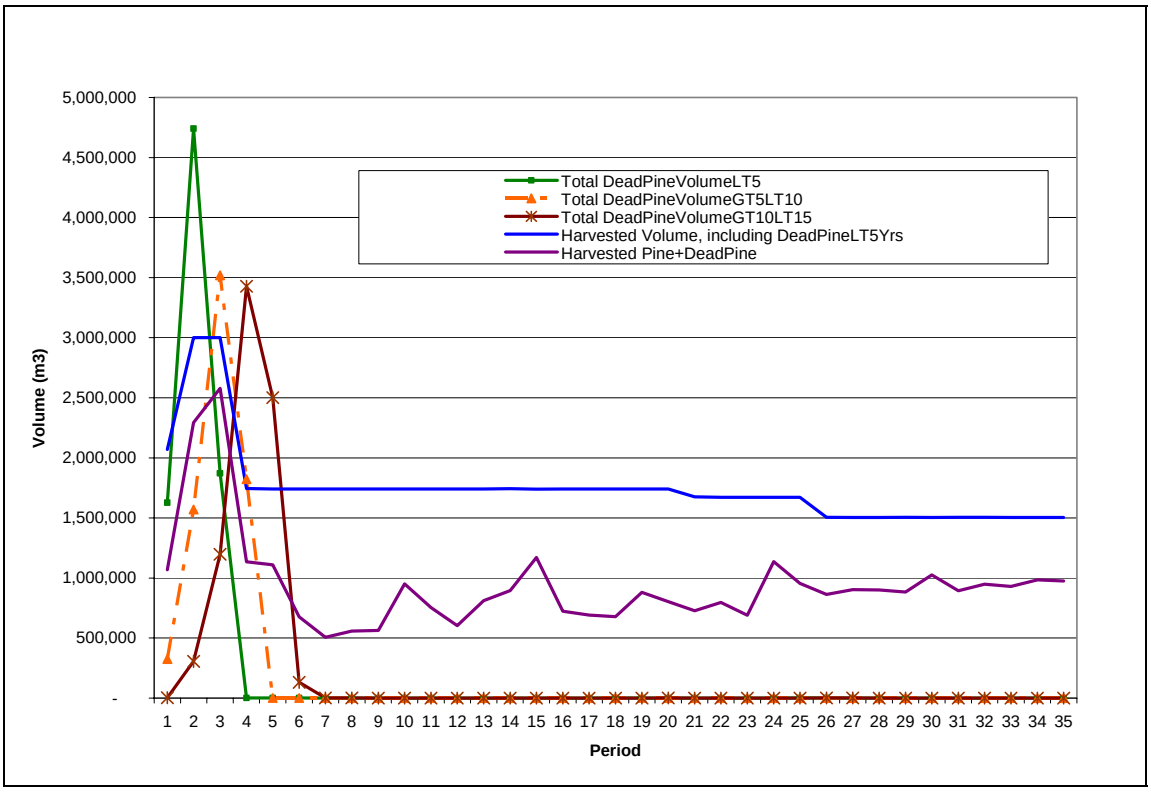

Figure 12. Pine Volumes in Relation to Harvest Volumes

In Periods 2 to 4 (years 6-20) much of the mature and over-mature pine age classes are being liquidated due to the Mountain Pine Beetle (MPB) epidemic. Within the THLB a pre-emptive targeting of the susceptible MPB stands using BCMPB projections prior to actual attack was successful in preventing a short- or mid-term trough in the timber supply. The susceptible pine stands within the THLB area were converted to a managed status as soon as possible, thereby minimizing the MPB threat and getting these stands onto higher yielding Pine stands. Outside the THLB area, all stands were modeled using the successional pathways as developed in the ecosystem Scenario.

The next series of figures will summarize the THLB portion of the landbase. Figure 13, shows that the landbase is rapidly converted from natural to managed status and that within the THLB there is very little area following the successional pathways. This lack of area using the successional pathways is important, since it means that most of the stands within the THLB recover to the minimum harvest specifications after the MPB epidemic, hence they were not put on the ecosystem successional pathways in the first place.

Figure 14, shows the growing stock within the THLB portion of the landbase. There are a few main points to mention from this graph:

1. Total growing stock is starting to level off within the THLB portion of the landbase. The future managed stand yields make up approximately 77% of the volume by period 35, with 15% in naturally established forest and 6 % in existing managed forest, with the remainder 2% in successional forest type pathways.
2. The future managed stand growing stock (and hence total growing stock) is still increasing in period 35, so it suggests that the future harvest level could be increased further, however this harvest forecast past 250 years was not modelled during the late stages of this analysis.
3. The harvest volume within periods 1-4 occur within naturally established forest as per the intent of this Scenario. The naturally managed and existing managed forest types decline over time due to increased harvesting within these type groups and reaches an equilibrium in period 25 onwards due to forest cover constraints.

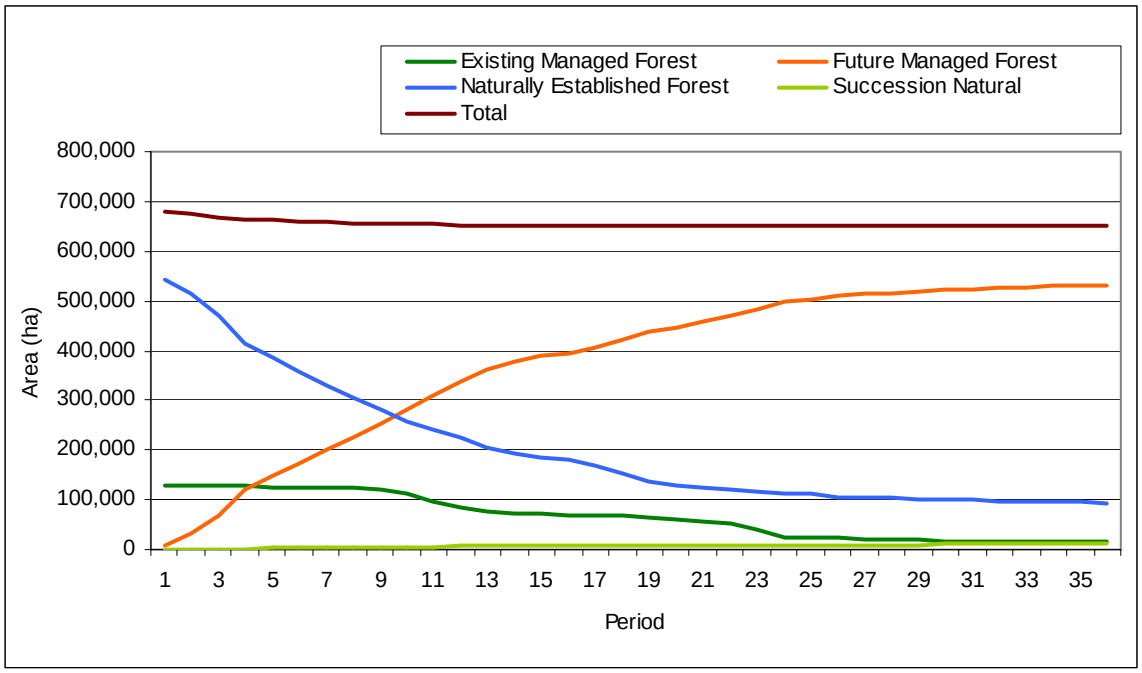

Figure 13. THLB Landbase Transitions Over Time by Area

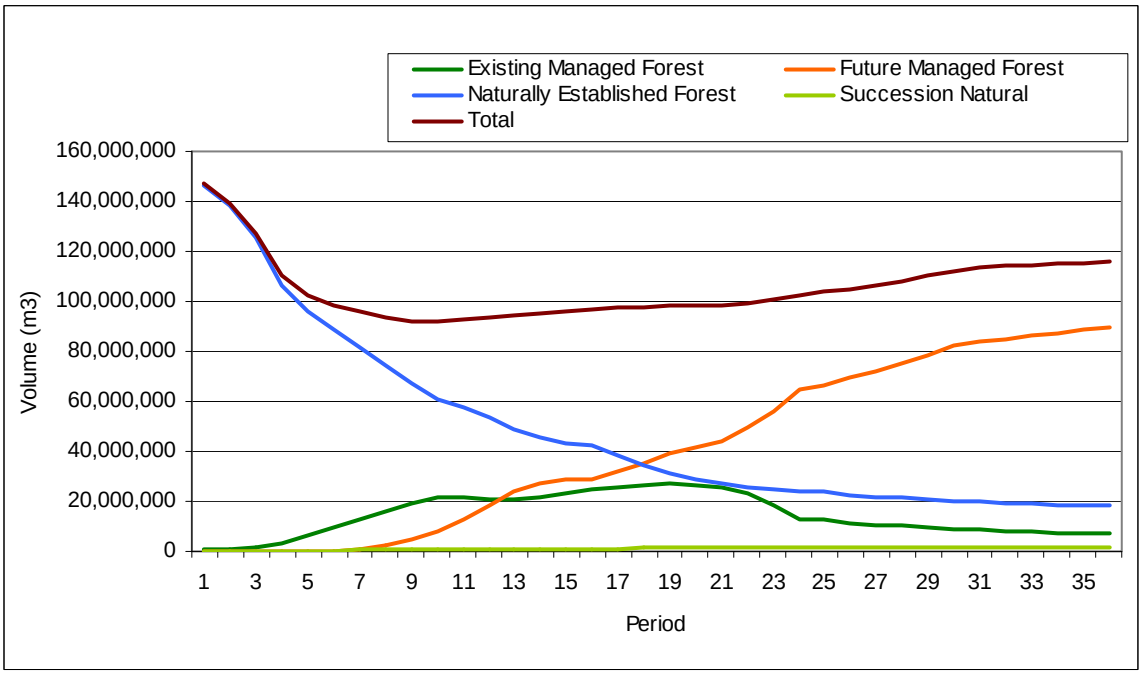

Figure 14. THLB Landbase Transitions Over Time by Volume

The harvest results in terms of average age, area and volume harvested over time will be documented in the succeeding sets of figures. Figure 15 tracks the area-weighted average harvest age for this Scenario.

Initially the harvest is concentrated in older stands, with harvest targeting priorities based on highest pine volumes. During the first 40 years the average harvest age is approximately 175 years. The average harvest age then gradually declines where in period 23 (130 years from now) it is 121 years, as the harvest moves to existing and future managed stands. The average age of the stands harvested over the long-term is approximately 79 years of age. It should be noted that areas without any constraints acting on them will typically have a lower average harvest age then areas where harvesting is limited due to these constraints.

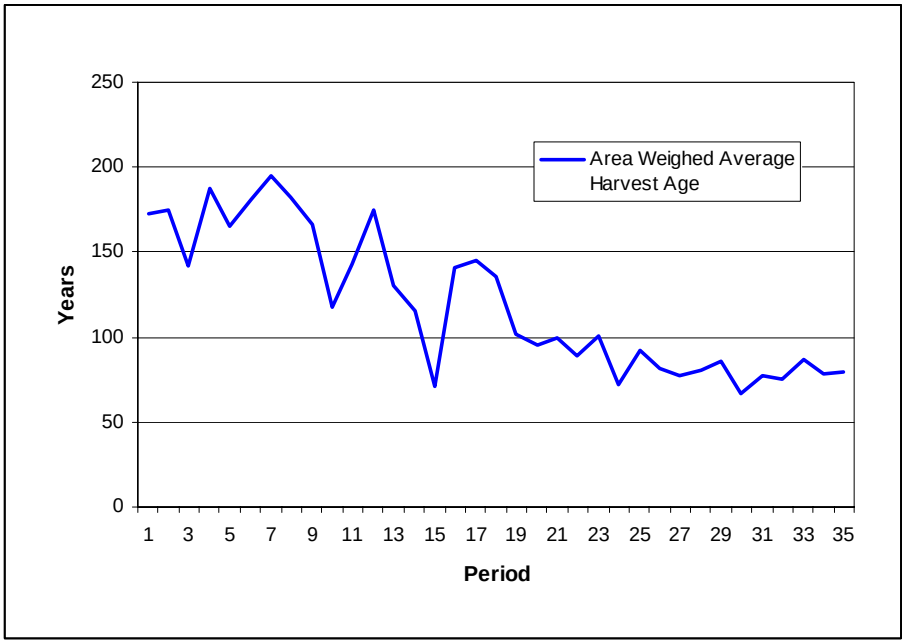

Figure 15. Average Harvest Age Over Time

Figure 16 illustrates the average volume per hectare harvested over time. The first 8 periods where the harvest is primarily concentrated in the naturally established forest, the average volume per hectare harvested is approximately 315 m^3/ha, ranging from 261 m^3/ha to 345 m^3/ha. The succeeding periods where the forest has been converted to a managed status, the average volume harvested is about 273 m^3/ha, ranging between 245 to 317 m^3/ha.

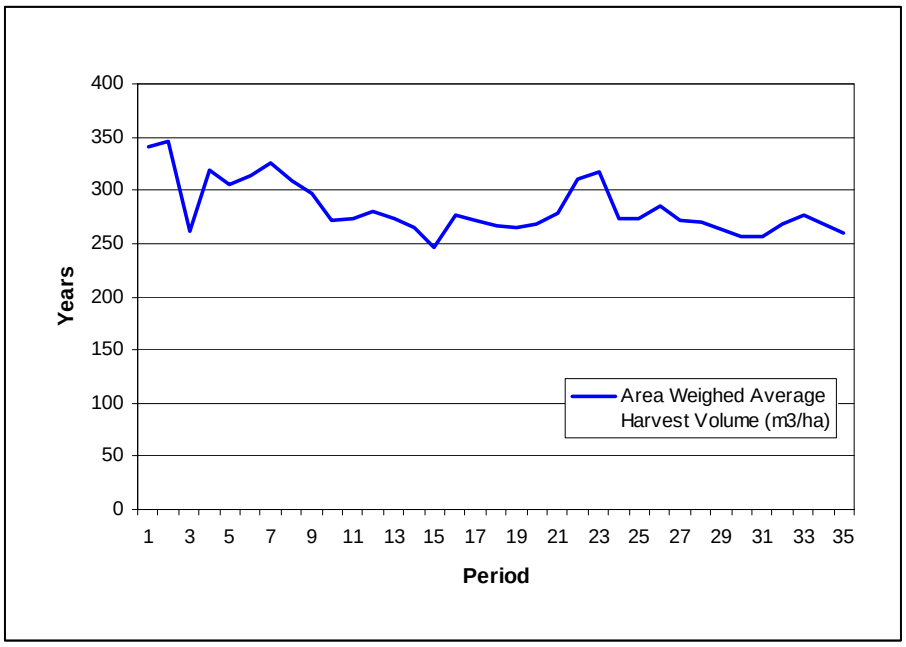

Figure 16. Average Harvest Volume Over Time

Figure 17 outlines the area harvested per period over time. The harvested area is generally higher in the short-term when the harvest is within the naturally established stands, then gets lower over time as the model is focused in managed stands.

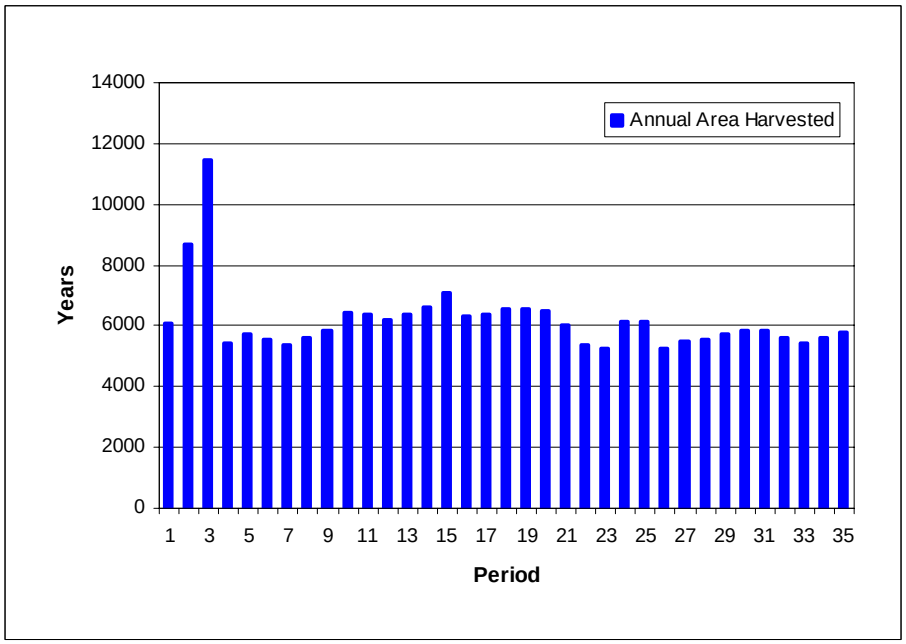

Figure 17. Area (ha) Harvested Over Time

The next series of graphs will illustrate the age class profile of the landbase over time (Table 2 and Figure 18). This will be based on the productive landbase, showing both the THLB and the non-contributing portion. There are approximately 1,106,111 ha of productive landbase on the Morice TSA with about 664,956 ha making up the THLB portion (based on the criteria specified by the Morice IFPA Technical Committee and documented in the "Comparison of Base Case and Decision Scenario Inputs and Assumptions" Report, dated April 14th, 2005 (Appendix 4).

The current age class structure is skewed more towards the later age classes (mature/over-mature), with 68% of the stands within the THLB above Minimum Harvest Age. Forty-three percent of the THLB was over 140 years of age (age class 8) and 4% of the THLB was over 250 years of age.

Stands within the non-contributing portion of the landbase contribute to the area required to meet biodiversity targets, seral stage targets, etc. For this analysis, the stands within the non-contributing areas were modeled using the ecosystem successional curve pathways, as directed by the Morice IFPA Technical Committee. These pathways were developed as part of the Morice IFPA Ecosystem Scenario and the resulting curves were approved by the appropriate government agencies.

The age classes of the THLB portion of the landbase within the Morice TSA are becoming regulated over time at a sustainable rate. There are some areas within the forested landbase that can not be harvested due to forest cover constraints and the non-THLB portion of the landbase ages according to the ecosystem successional pathways. In 250 years time, 37% of the THLB is above 140 years of age, with 16% being above 250 years of age. This represents a 6% decrease when compared to the current (time0) age class profile of area above 140 years of age, however also represents a 12% increase in area above 250 years of age.

Table 2. Age Classes and Corresponding Age Ranges used in the Age Class Profiles

Classification	Age Range
0	0
1	1-20
2	21-40
3	41-60
4	61-80
5	81-100
6	101-120
7	121-140
8	141-250
9	Greater than 250

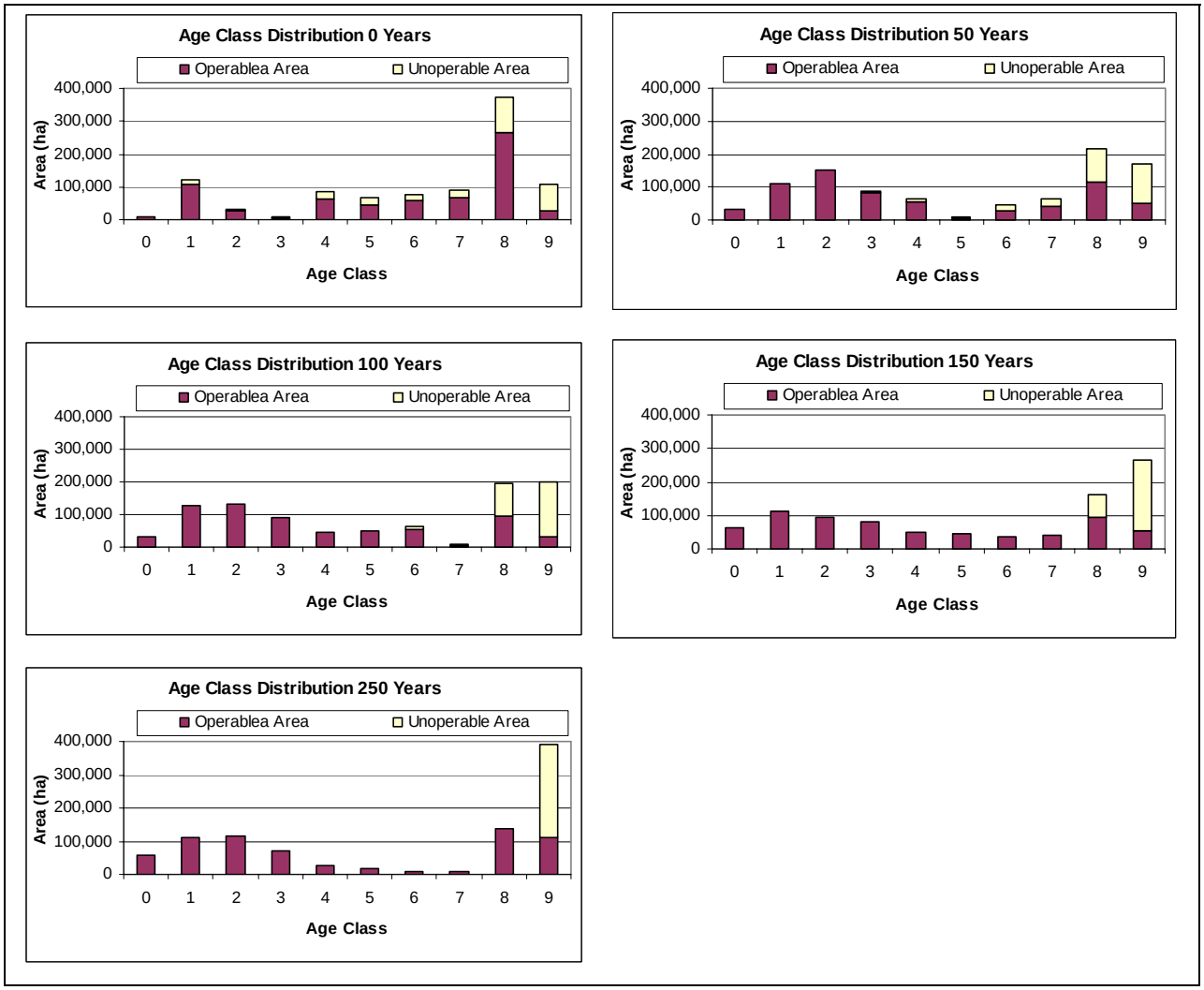

Figure 18. Age class Profile Over Time.