# RIVERSIDE FOREST PRODUCTS LIMITED
# TFL 49 - OKANAGAN TREE FARM LICENCE
# MANAGEMENT PLAN No. 3

## TIMBER SUPPLY ANALYSIS REPORT

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**February 1998**

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February 28, 1998

Ministry of Forests
Timber Supply Branch
595 Pandora Avenue
Victoria, BC
V8W 3E7

Attention: Greg Lawrance, RPF
Timber Supply Forester

Dear Sirs,

Reference: TFL 49 MP No. 3 Timber Supply Analysis

Please accept the enclosed Timber Supply Analysis Report for TFL 49. We appreciate the time and effort that you and other Ministry staff have invested in producing this report.

Sincerely,

Hans Svendsen, RPF
Corporate Planning Forester

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Appendix I Timber Supply Analysis Information Package

**KEY MAP**

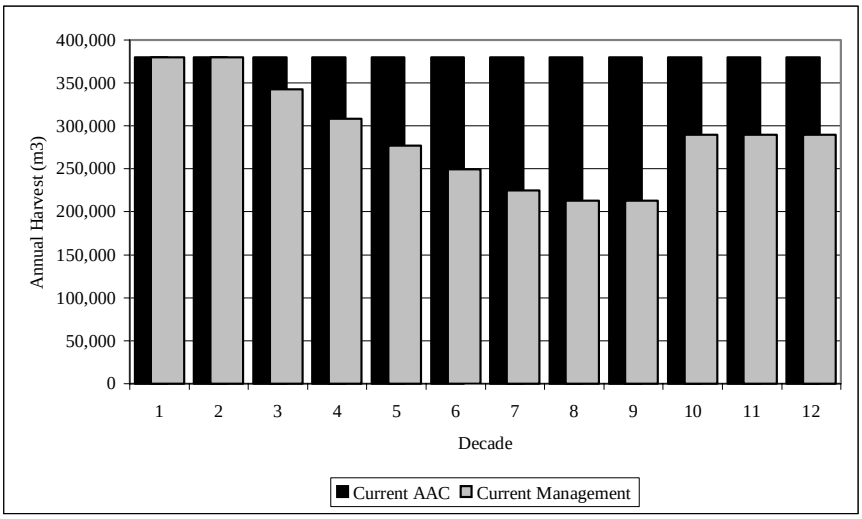
## EXECUTIVE SUMMARY

The availability of timber on TFL 49 has been examined as part of Management Plan No. 3. The analysis evaluates how current management, including allowance for management of non-timber resources, affects the supply of harvestable timber over a 250-year period. It also quantifies the sensitivity of the results to uncertainty associated with modeling inputs. The timber supply analysis provides the technical basis for the Chief Forester of British Columbia to determine an allowable annual cut (AAC) for TFL 49 for the next five years.

The proprietary simulation model Continuous Area Simulation of Harvesting and Forest Management (CASH_FM) was used to determine harvest schedules that incorporate all integrated resource management considerations. CASH_FM uses a pseudo-geographic approach to inventory in order to adhere as closely as possible to the intended effect of forest cover constraints on harvesting. Maximum disturbance and minimum retention constraints on forest cover are explicitly implemented.

Many options and sensitivities have been identified and analysed for this Timber Supply Analysis Report. These can be found in Sections 5 through 8 of this report.

The Current Management Option is one representation of timber supply on TFL 49. It represents current management as required and defined by Ministry of Forests Timber Supply Branch policy. A harvest schedule possible with this Option is presented (in comparison to the current AAC) in the figure below. The current harvest level (380,000 $m^3$) may be maintained for 20 years. The harvest level steps down until decade eight and returns to a long-term level of 290,000 $m^3$ in decade 10.

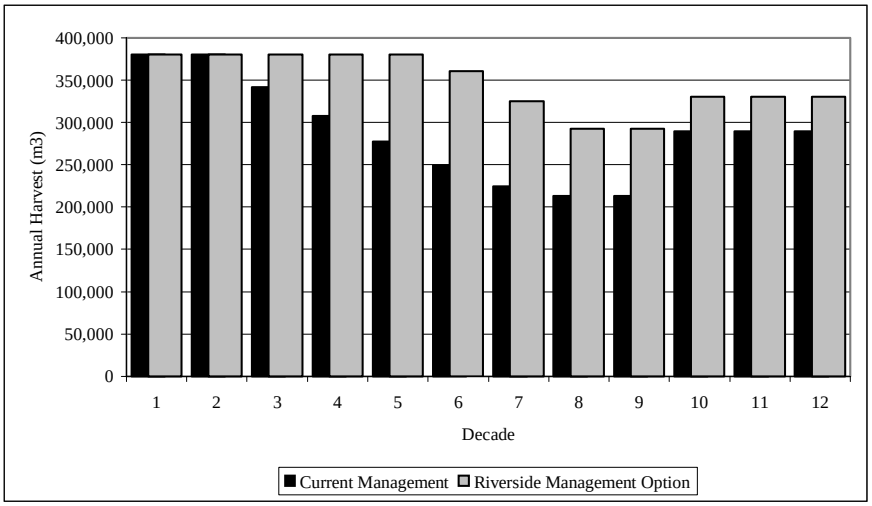



**Current Management Option harvest schedule**

An alternate scenario, the Riverside Management Option, incorporates alternative assumptions which Riverside feels are appropriate:

- Old growth site index adjustments for negative bias for the entire TFL;
- A 15% positive adjustment of current volumes based on cruise volume comparison;
- Implementation of average high/moderate/low landscape biodiversity emphasis; and
- Adjustment for boundary corrections in the GIS data set.

The harvest schedule possible under this scenario is presented in the figure below. The current harvest level can be maintained for five decades and the long-term level is 330,000 $m^3$.




**Harvest schedule Riverside Management Option**

Riverside Forest Products Limited (Riverside) recommends the AAC for TFL 49 be set at 380,000 $m^3$ for the term of Management Plan No. 3. Based on the analyses, there exists substantial evidence that this harvest level can be maintained for five decades, without compromising future harvest levels.

# 1. INTRODUCTION

Timber supply is the quantity of timber available for harvest over time. It is dynamic, not only because trees naturally grow and die, but also because conditions that affect tree growth, and the social and economic environment that effect the availability of timber for harvest, change with time.

Timber supply analysis is the process of assessing and predicting the current and future supply from a management unit. This information is used by the Chief Forester of British Columbia in determining a permissible harvest level for a management unit. Timber supply projections made in support of Tree Farm Licence (TFL) management plans look 250 years into the future. However, due to uncertainty surrounding both the information used in analysis, and future forest management objectives, these projections are not viewed as static or prescriptive. They remain relevant only as long as the supporting information is relevant. In recognition of this, TFL licencees are required to re-evaluate timber supply for each successive management plan.

Three options have been identified and analysed for this Timber Supply Analysis Report in support of Management Plan No. 3:

- Current Management Option;
- Okanagan TSA Integrated Resource Management (IRM) Timber Harvesting Guidelines Option; and
- Riverside Management Option.

In the case of the Current Management Option, various sensitivity runs are presented which can be used to isolate the effects of changes to inputs.

The following objectives were used in developing harvest schedules:

- Achieve the maximum flow of timber while addressing the requirements of other resources and resource users;
- Manage the land base in a manner consistent with the principles of integrated resource use; and
- Identify a reasonable balance between present and future absorption of any required harvest fall down.

The amended Information Package (Appendix I) describes the inputs and assumptions for this analysis. Changes introduced as a result of further research or analysis after that document was finalized are identified in this report.

Timber supply analysis involves three main steps:

1. Collection and preparation of information and data. This information has been documented in the Information Package. Summary and additional data can be found in Sections 2 and 3 of this report.

2. Use of the data with a forest estate model to develop harvest forecasts. The sensitivity of timber supply to input values is also tested. Methods are described in Section 4.

3. Reporting and interpretation of results. Sections 5 through 7 present analysis results. Section 8 presents a Riverside Management Option. Section 9 is a discussion of results, which contains a recommended AAC.

Section 10 provides the important last step in discussing data needs that have been identified and which will be addressed within the next planning cycle.

# 2. DESCRIPTION OF THE LICENCE AREA

Tree Farm Licence number 49 (TFL 49) referred to as the "Okanagan Tree Farm Licence" and located west of Okanagan Lake, is held in the name of Riverside. The primary importance of TFL 49 is its capability to produce timber values within an IRM framework.

TFL 49 (approximately 144,000 ha) was designated as a result of an amalgamation in 1984 of Tree Farm Licences 9 (Block A), 16 (Block B), and 32 (Block C). Management on this area-based licence has been conducted for over 45 years.

For a more complete description of TFL 49 please refer to Management Plan No. 3.

# 3. INFORMATION PREPARATION

Many pieces of information are required to conduct a timber supply analysis. Each piece falls into one of three categories: land base and inventory; timber growth and yield; and management practices.

## 3.1 Land Base and Inventory

Data synthesis and aggregation is required to prepare the forest inventory for analysis.

Completed in 1996, the TFL 49 Vegetation Resources Inventory (VRI) includes forest cover attributes in a fully digital and spatial format compatible with the provincial inventory database. Colour photography flown in 1994 was used to delineate strata to VRI standards. Polygons were delineated to 0.5 of a hectare or less. The forest cover inventory is updated for disturbance and projected for growth to January 1, 1996.

Inventory and ancillary data has been prepared using a geographic information system (GIS) in order that modeling will be as "spatially aware" as possible. For example, existing roads are buffered to provide specific area reductions from the net harvesting land base.

Non-timber resource inventories and approximate dates of completion are presented in Table 3.1.

**Table 3.1 Non-timber resource inventory status**

| Inventory Category | Date of Completion |
|---|---|
| Environmentally Sensitive Areas | 1991 |
| Recreation | 1993 |
| Landscape | 1994 |
| Biogeoclimatic Classification | 1989 |
| Site Association Mapping - Block B | 1982 |
| Canada Land Inventory - Wildlife | 1991 |
| Roads Classification | 1997 |
| FPC Stream Classification | 1997 |

The digital database contains information for all land within the licence area, including areas on which harvesting operations are not expected to take place. The net operable forest (also referred to as the working forest or timber harvesting land base) consists of all the hectares expected to be available for harvest over the long term. This land base is determined by reclassifying the total land base according to specified management assumptions. The details of the reductions are available in Appendix I. Figure 3.1 provides a graphic representation of the land base reductions. Figure 3.2 provides the current leading species and age class distribution.

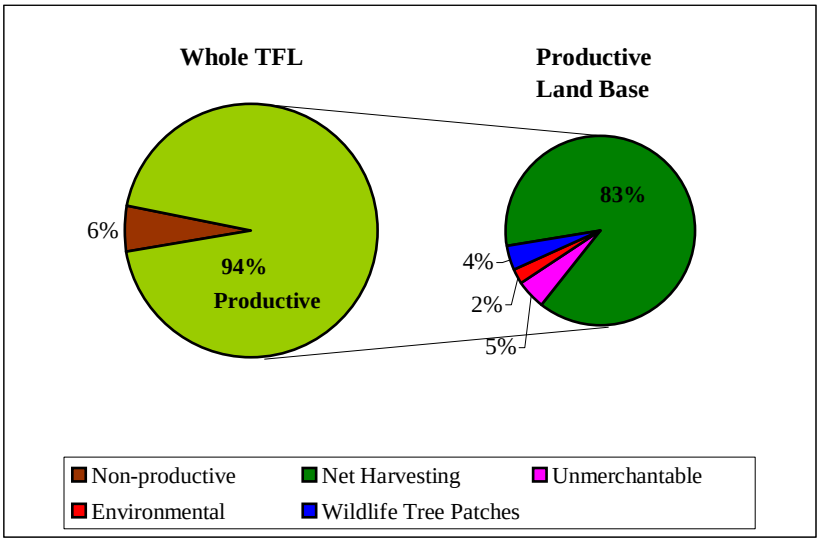



**Figure 3.1 Land base area summary**

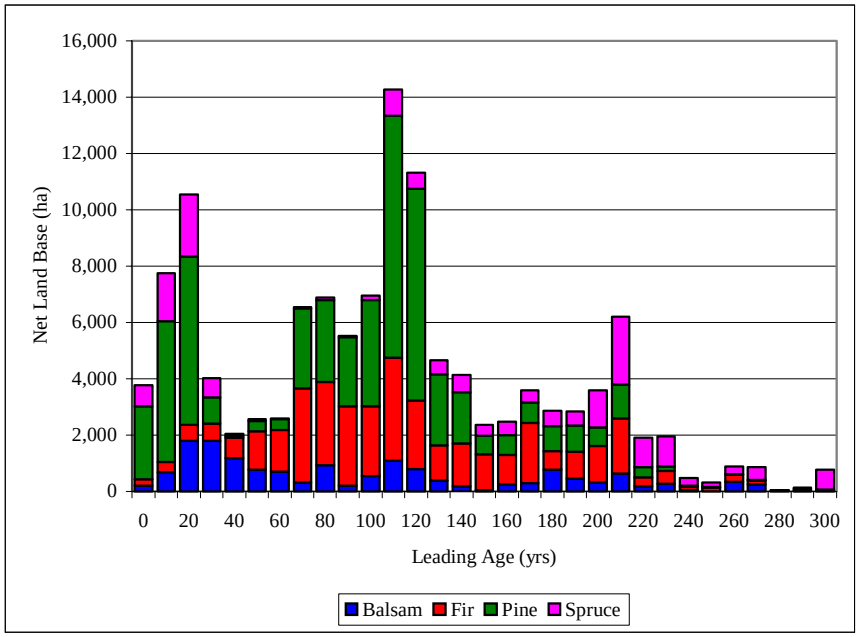



**Figure 3.2 Current leading species and age class distribution**

In Figure 3.2 leading age refers to the top of the age class. For example, leading age 40 includes stands 31 through 40 years of age.

## 3.2 Timber Growth and Yield

Timber growth and yield refers to the prediction of growth and development of individual forest stands over time. Growth and yield modeling is significantly improved over methods used in support of MP No. 2. Key changes are as follows:

- Actual stand site index information based on inventory age/height data;
- Use of current base age 50 years site index curves;
- Actual stand level crown closure data;
- Use of the best available site index information for regenerated stands to compensate for old growth site index bias;
- Use of WinTIPSY managed stand yield curves; and
- Yield prediction based on TFL specific pooled inventory attributes.

Yield curves for stands of natural origin have been prepared using the MoF program Variable Density Yield Prediction (VDYP) version 6.4. These are referred to as natural stand yield tables. Managed stand yields have been prepared for stands regenerated and conforming to minimum stocking standards. These managed stand yield tables were created using the Table Interpolation Program for Stand Yields (WinTIPSY).

Table 3.2 provides average productivity estimates for the Current Management Option based on both natural and managed stand yields.

**Table 3.2 Theoretical long-term productivity estimates**

| Yield Estimate | Average Culmination Mean Annual Increment ($m^3$/ha/yr) | Weighted Average Culmination Age (yrs) | Theoretical Long Run Harvest Level ($m^3$/yr) |
|---|---|---|---|
| Natural stands | 1.9 | 102 | 237,000 |
| Managed stands | 2.9 | 95 | 368,720 |

## 3.3 Management Practices

Timber supply is directly linked to forest management activities. Current practices are modeled by matching inputs to actual activity and using the functionality of CASH_FM.

The land base has been segregated into management zones for the purpose of modeling. These zones facilitate the application of management criteria. Specifically, these zones are defined on the basis of wildlife habitat, riparian management and the protection of visual quality. The number of zones and their definition gives considerable pseudo-spatial resolution to the problem modeled. Details of the zonation can be found in Section 7.1 of the Information Package (Appendix I).

Figure 3.3 provides a graphic representation of the management zones.

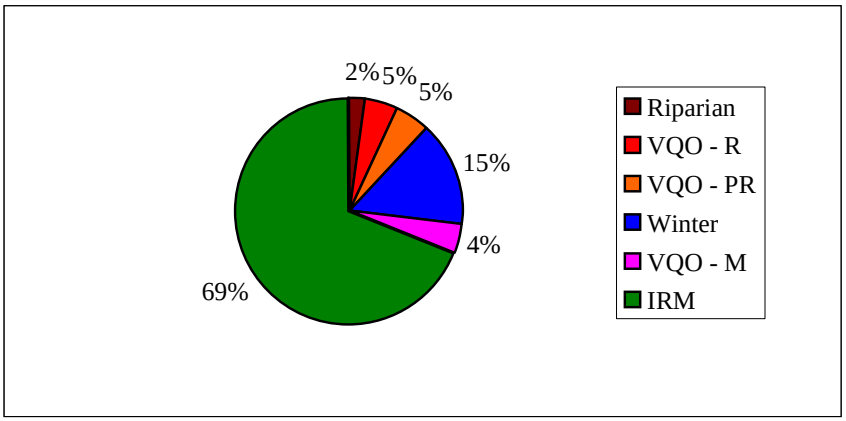



**Figure 3.3 Management zone summary**

Table 3.3 provides a key to the abbreviations used in Figure 3.3.

**Table 3.3 Management zones**

| **Management Zone** | |
|---|---|
| Riparian | Riparian management zone as required by the FPC |
| VQO - R | Retention visual quality objective |
| VQO - PR | Partial retention visual quality objective |
| Winter | Ungulate Winter Range |
| VQO - M | Modification visual quality objective |
| IRM | Integrated Resources Management |

Management on TFL 49 is best summarized by these commitments which appear in the Statement of Management Objectives, Options and Procedures document:

- Following the on-going strategies of the Okanagan Shuswap Land Resource Management Plan;
- Following the *Principles of Sustainable Forestry* as outlined by the Forest Alliance of B.C.;
- Minimizing losses and damage through the rapid detection and suppression of fires and through early detection of abnormal insect and disease activity;
- Following the Forest Practices Code and using its associated guidelines and *The Okanagan TSA Integrated Resource Management Timber Harvesting Guidelines* as appropriate in forest management activities and to consult with resource agencies in the application of these practices;
- Ensuring that all areas harvested are restocked to with commercial species to a "free growing" state;

- Maintaining a policy of open access to the TFL with a minimum of restrictions to the public;
- Harvesting steep slopes in proportion to their area in each Forest District;
- Maintaining Range opportunities at current levels;
- Completing detailed watershed analyses on identified watersheds;
- Using genetically improved planting stock as it comes available from ongoing tree improvement programs;

Riverside has achieved and will continue to achieve a high level of performance with respect to the above stated commitments.

# 4. ANALYSIS METHODS

CASH_FM uses a pseudo-geographic approach to inventory in order to adhere as closely as possible to the intent of forest cover constraints on harvesting. Maximum depletion and minimum disturbance constraints on forest cover are explicitly implemented. A variable degree of spatial resolution is available depending on the degree of inventory aggregation and on management zone definition. Non-productive forest stands are included to better model forest structure and disturbance levels.

CASH_FM was used to determine harvest schedules that incorporate all integrated resource management considerations.

Two forest cover constraint classes are used for modeling:

- Disturbance - the maximum area that can be younger than a specified age or shorter than a specified height. This is intended to model cutblock adjacency and green-up requirements.
- Retention - the minimum area that must be older than, or as old as, a specified age. This is intended to model both retention of cover and retention of old growth.

The use of forest cover constraints as described above improves forest management modeling by ensuring that non-timber resources are given appropriate consideration.

In addition to those described above, CASH_FM allows a second level of constraints to be applied. These are used to monitor seral stage distribution guidelines for the maintenance of landscape level biodiversity. Following direction in the MoF document *Higher Level Plans, Policy and Procedures, MoF, June 1996* and the *Forest Practices Code Timber Supply Analysis, MoF, February 1996*, it is assumed that the biodiversity emphasis is low, and that the required seral stage distributions are achieved within three rotations. Draft Landscape Unit boundaries overlapping the TFL have been supplied by the Penticton District.

Non-recoverable losses (assumed to be 15,600 $m^3$/year) are not included in harvest levels discussed in this report.

# 5. CURRENT MANAGEMENT ANALYSIS

This section presents the results of an analysis closely reflecting current management on the TFL. It would be considered base case in MoF terminology. Also presented are sensitivity runs that address any issues that have significant uncertainty associated with them. Table 5-1 lists sensitivity analyses presented.

**Table 5.1 Sensitivity analyses**

| Issue | Sensitivity Levels to be Tested |
|---|---|
| Negatively biased old growth site index | Provincial interim old growth site index equations:<br>1)TFL Blocks A, C<br>2)Whole TFL |
| Existing yields | Existing yields +/- 10%, +15%, + 20% |
| Landscape biodiversity | 1) 45/45/10 weighted biodiversity emphasis objectives<br>2) Applied at the subzone level |
| Aggressive basic silviculture | 1) All regeneration by planting<br>2) 2m green-up in IRM |
| Community watersheds | A disturbance constraint defined as a maximum 20% disturbed (below 6m tall) to reflect FPC hydrological green-up |
| Protected areas strategy | Goal One and Areas of Interest removed from land base |
| Land base sensitivity | 1) Boundary corrections<br>2) Succession of deciduous and overstocked pine<br>3) No wildlife tree patches |
| Harvest profile | Pine a harvest priority |
| Partial harvesting | Implement partial harvest modeling methodology |

Analysis results are dependent on harvest flow criteria. In all phases of the analysis, the harvest flow objectives will be to:

- Begin the analysis at as high a harvest level as possible;
- Sustain the initial harvest level for as long as possible;
- Achieve short and mid-term harvest levels which do not drop below a minimum long term sustainable harvest;
- Raise the long run sustainable harvest levels to reflect managed stand yields; and
- Keep shifts in harvest level to a maximum of 10% per decade.

## 5.1 Current Management Option

The Current Management Option includes the following assumptions or inputs as defined in the Timber Supply Analysis Information Package:

- Management activity as defined by operations over the last 5 years;
- Implementation of the Forest Practices Code (FPC) as it was interpreted August 1997, including riparian management, stand level biodiversity, and low emphasis landscape biodiversity guidelines;
- An up-to-date Vegetation Resources Inventory (VRI);
- Partial implementation of adjustments for negative site index bias in old growth stands;
- VDYP natural stand yields and WinTIPSY managed stand yields;
- Current utilization standards;
- Visual quality objectives;
- Wildlife management;
- Genetic gains from tree improvement;
- Basic silviculture; and
- Consideration of problem forest types and forest health consistent with current management.

Figure 5.1 presents the harvest forecast resulting from the current management assumptions and the harvest flow assumptions discussed above. The current AAC of 380,000 $m^3$ can be maintained for two decades after which harvests decline through six decades to a minimum level followed by an increase to a long-term sustainable level of 290,000 $m^3$. Figure 5.1 also displays the theoretical long run sustainable yield figure based on managed stand yields (see Section 3.2). IRM constraints, which retain timber past culmination age, are the main cause of the difference between the theoretical value and attainable levels. Table 5.2 provides the actual harvest values used in Figure 5.1.

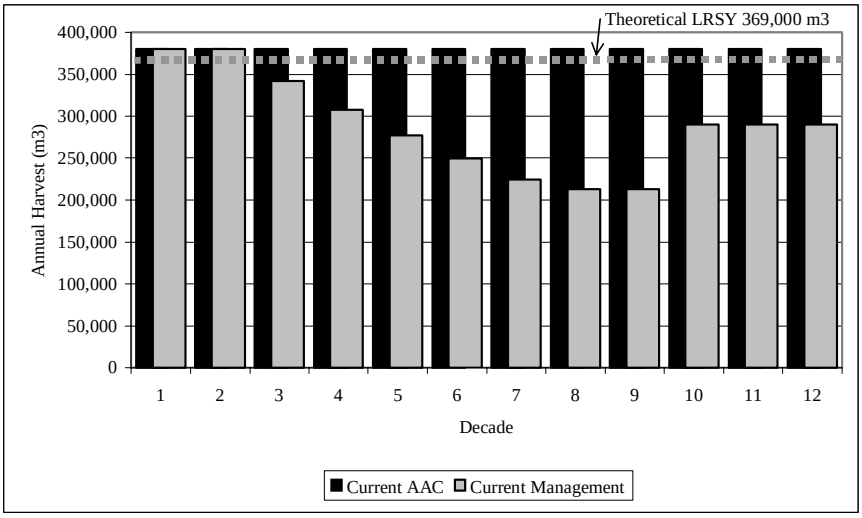



**Figure 5.1 Current Management harvest schedule**

**Table 5.2 Harvest schedule – Current Management Option**

| Decade | Current AAC | Current Management |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 380,000 | 342,000 |
| 4 | 380,000 | 307,800 |
| 5 | 380,000 | 277,020 |
| 6 | 380,000 | 249,318 |
| 7 | 380,000 | 224,386 |
| 8 | 380,000 | 213,167 |
| 9 | 380,000 | 213,167 |
| 10 | 380,000 | 290,000 |
| 11 | 380,000 | 290,000 |
| 12 | 380,000 | 290,000 |

Figure 5.2 presents the stock levels over time associated with the Current Management Option. Mature stock is volume in stands over the minimum harvest age; available stock is volume after the imposition of forest cover constraints. Mature and available stock both fall steadily but recover after decade eight. The factor of largest influence in timber supply on TFL 49 is the stock of existing timber available for harvest before managed stands become available about decade eight. The situation is exacerbated by the lack of stands in the range of 40 through 60 years of age as indicated in Figures 3.2 and 5.3. Table 5.3 provides the data represented in Figure 5.2.

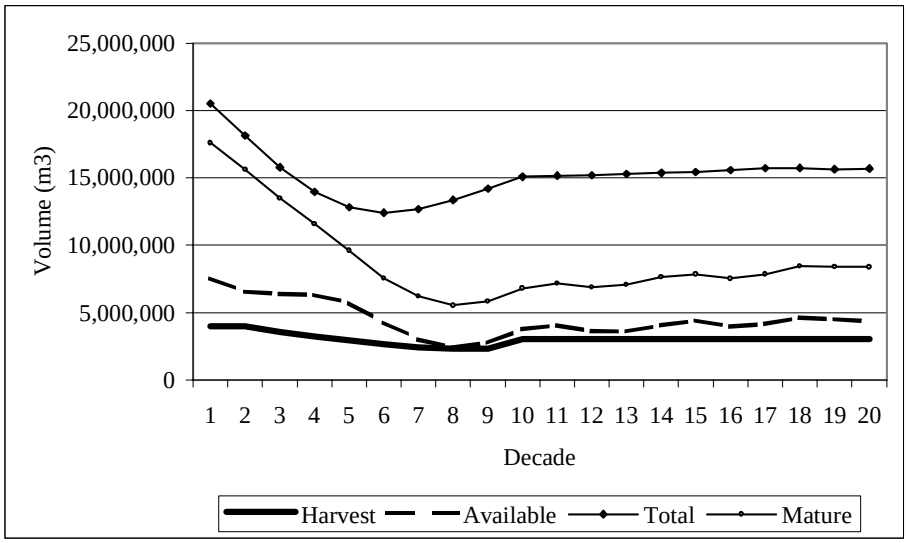



**Figure 5.2 Current Management harvest and stock values**

**Table 5.3 Decadal harvest and stock volumes**

| Decade | Decadal Harvest ($m^3$) | Available Volume ($m^3$) | Mature Volume ($m^3$) | Total Volume ($m^3$) |
|---|---|---|---|---|
| 1 | 3,956,000 | 7,548,744 | 17,618,147 | 20,524,616 |
| 2 | 3,956,000 | 6,552,525 | 15,639,113 | 18,169,437 |
| 3 | 3,576,000 | 6,389,477 | 13,494,518 | 15,794,547 |
| 4 | 3,234,000 | 6,303,847 | 11,591,342 | 13,965,197 |
| 5 | 2,926,200 | 5,734,905 | 9,617,965 | 12,826,514 |
| 6 | 2,649,180 | 4,269,155 | 7,558,033 | 12,421,229 |
| 7 | 2,399,860 | 3,007,534 | 6,216,256 | 12,678,026 |
| 8 | 2,287,660 | 2,403,207 | 5,544,472 | 13,366,109 |
| 9 | 2,287,660 | 2,742,637 | 5,822,718 | 14,208,933 |
| 10 | 3,056,000 | 3,771,439 | 6,800,988 | 15,087,743 |
| 11 | 3,056,000 | 4,055,548 | 7,159,615 | 15,161,493 |
| 12 | 3,056,000 | 3,635,291 | 6,873,447 | 15,210,040 |
| 13 | 3,056,000 | 3,595,316 | 7,062,349 | 15,306,525 |
| 14 | 3,056,000 | 4,045,323 | 7,629,155 | 15,385,280 |
| 15 | 3,056,000 | 4,410,053 | 7,848,875 | 15,447,832 |
| 16 | 3,056,000 | 3,956,235 | 7,528,078 | 15,576,035 |
| 17 | 3,056,000 | 4,130,059 | 7,846,265 | 15,740,420 |
| 18 | 3,056,000 | 4,628,404 | 8,440,744 | 15,760,174 |
| 19 | 3,056,000 | 4,500,983 | 8,403,621 | 15,662,677 |
| 20 | 3,056,000 | 4,359,811 | 8,385,584 | 15,689,756 |

In Table 5.3 decadal harvest refers to the volume harvested by the model in each decade. Available volume is volume not constrained by forest cover constraints or

maturity limits. Mature volume is volume above minimum harvest ages. Total volume is all net volume.

Figure 5.3 presents the age class structure over time associated with the Current Management Option. Each graph depicts age class distribution at the beginning of the indicated decade. Net land base refers to area contributing to harvest. Non-contributing is productive forest that does not contribute to harvest but contributes to other resource demands and used in calculation of forest cover constraints.

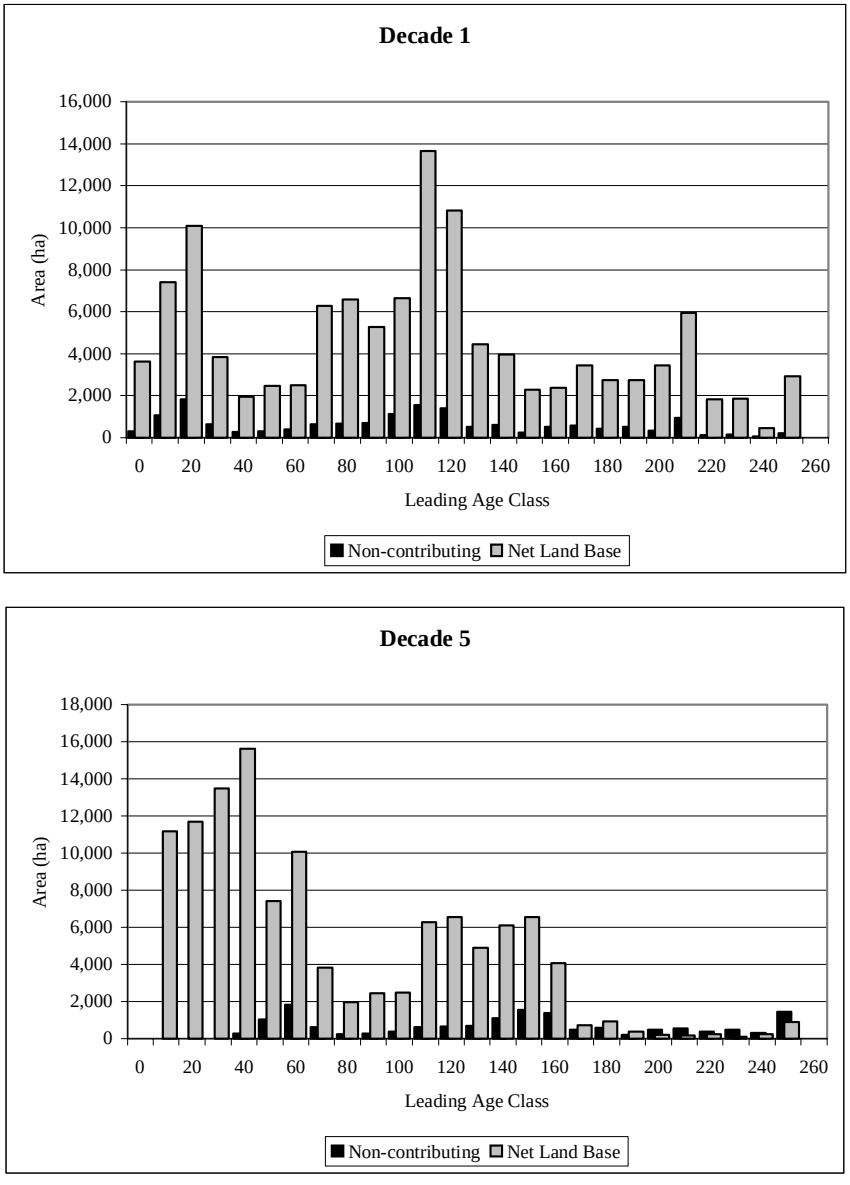



**Figure 5.3 Current Management Option age class distribution over time**

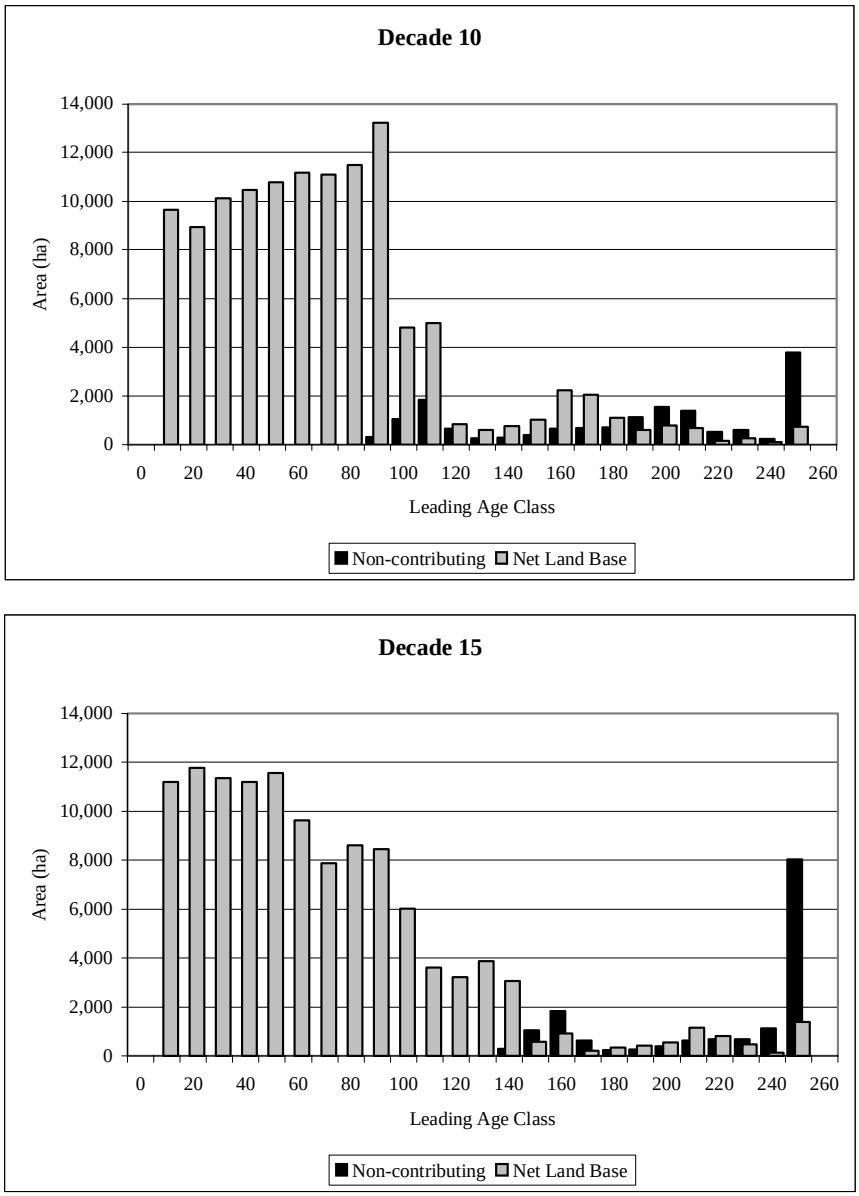



**Figure 5.3 Current Management Option age class distribution over time (continued)**

# 6. CURRENT MANAGEMENT SENSITIVITIES

This section presents analyses using alternative assumptions where uncertainty is associated with the Current Management Option.

## 6.1 Old Growth Site Index

The Current Management Option includes, for Block B of the TFL, the use of forest productivity estimates based on a biogeoclimatic ecosystem classification (BEC) and Provincial site index (SI) values correlated to the inventoried site series (SIBEC system). This addresses the widely accepted fact that for a large proportion of our forests age and height relationships perform poorly in the prediction of site productivity. For the remainder of the TFL, the Current Management Option underestimates the productivity of stands converted from old growth to managed stands.

This section deals with the adjustment of productivity estimates to account for old growth site index bias, beyond that undertaken for the Current Management Option.

Two sensitivity analyses were performed to evaluate the possible impact on harvest levels if old growth site index bias was addressed on the entire TFL.

The first, in addition to SIBEC on Block B, applies MoF interim old-growth site index (OGSI) adjustment equations on Blocks A and C. On A and C, where no site association inventory is available, site index of an analysis unit was adjusted based on interim results from the Ministry of Forests old growth project (*Interim Old Growth Site Index Adjustment Equations and Application Guidelines, MoF Research Branch, 1997*). Equations from that report were used to calculate alternate site index values which were used in an area-weighted calculation identical to that used for current management scenario site index values.

The second sensitivity replaces SIBEC on Block B by applying the MoF equations to all Blocks.

Figure 6.1 provides harvest schedules based on these two sensitivities. The figure presents incremental benefits as stacked columns to improve clarity. Table 6.1 presents the actual harvest values associated with Figure 6.1.

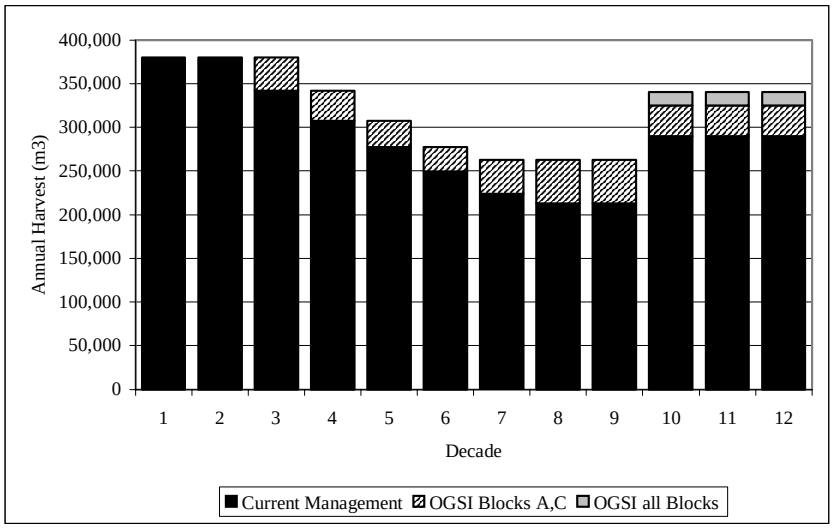



**Figure 6.1 Old growth site index sensitivities**

**Table 6.1 Harvest schedules OGSI sensitivities ($m^3$/yr)**

| Decade | Current Management | OGSI Blocks A,C | OGSI All Blocks |
|---|---|---|---|
| 1 | 380,000 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 | 380,000 |
| 3 | 342,000 | 380,000 | 380,000 |
| 4 | 307,800 | 342,000 | 342,000 |
| 5 | 277,020 | 307,800 | 307,800 |
| 6 | 249,318 | 277,020 | 277,020 |
| 7 | 224,386 | 263,169 | 263,169 |
| 8 | 213,167 | 263,169 | 263,169 |
| 9 | 213,167 | 263,169 | 263,169 |
| 10 | 290,000 | 325,000 | 340,000 |
| 11 | 290,000 | 325,000 | 340,000 |
| 12 | 290,000 | 325,000 | 340,000 |

Long-term harvest levels are improved through higher managed stand volumes based on the adjusted productivity figures. Short-term levels are improved based on accelerated availability for harvest due to the reduction of culmination age associated with the higher productivity estimates.

Evidence from other areas of the Province, and specifically from Block B of TFL 49, indicates that negative site index bias is adversely impacting estimates of future harvest levels. MoF Research Branch direction was to use adjustments in Block B only. Riverside believes that adjustments for the entire TFL should have been included in the Current Management Option. The ability of TFL 49 to support the current cut for an additional decade and the positive mid and long-term impacts as

demonstrated in Figure 6.1 is a strong indication of the productivity of the land base.

### 6.2 Existing yields

Riverside compared cruise volumes to volumes predicted by VDYP for use in the Current Management Option. Nine cutting permits, cruised but not yet harvested, were included in the comparison. Although the sampling methodology affords no ability to make inferences on as statistically reliable basis, the results indicated that VDYP was underestimating volumes by 24%.

**Table 6.2 Cruise volume comparison**

| Cutting Permit | Cruise (volume/ha) | VDYP (volume/ha) | Difference | Percent Difference (difference/cruise) |
|---|---|---|---|---|
| CP850 (Kelowna) | 313.53 | 324.51 | 10.98 | 3.5 |
| CP846 (Kelowna) | 304.74 | 225.58 | -79.16 | -26.0 |
| CP804 (Kelowna) | 274.06 | 194.11 | -79.95 | -29.2 |
| CP852 (Kelowna) | 316.02 | 247.35 | -68.67 | -21.7 |
| CP548 (Armstrong) | 369.82 | 273.84 | -95.98 | -26.0 |
| CP549 (Armstrong) | 264.76 | 205.13 | -59.63 | -22.5 |
| CP574 (Armstrong) | 384.40 | 199.86 | -184.54 | -48.0 |
| CP555 (Armstrong) | 242.59 | 269.22 | 26.63 | 11.0 |
| CP582 (Armstrong) | 339.16 | 199.86 | -139.3 | -41.1 |
| | **2809.08** | **2139.46** | **-669.62** | **-23.8** |

Phase II sampling of the TFL Vegetation Resources Inventory was undertaken in 1997 and results that will compare inventory and measured values of attributes used to calculate volumes will be available soon. These may remove the uncertainty associated with volume prediction in existing natural stands. It is hoped that they are available before determination of the AAC.

For this sensitivity, existing stand yield curves are increased and decreased by 10% and increased by 15% and 20%. Figures 6.2 and 6.3 present the harvest levels achieved by these analyses. Short-term harvest levels are very sensitive to changing estimates of natural stand yields. Table 6.3 provides the actual harvest values.

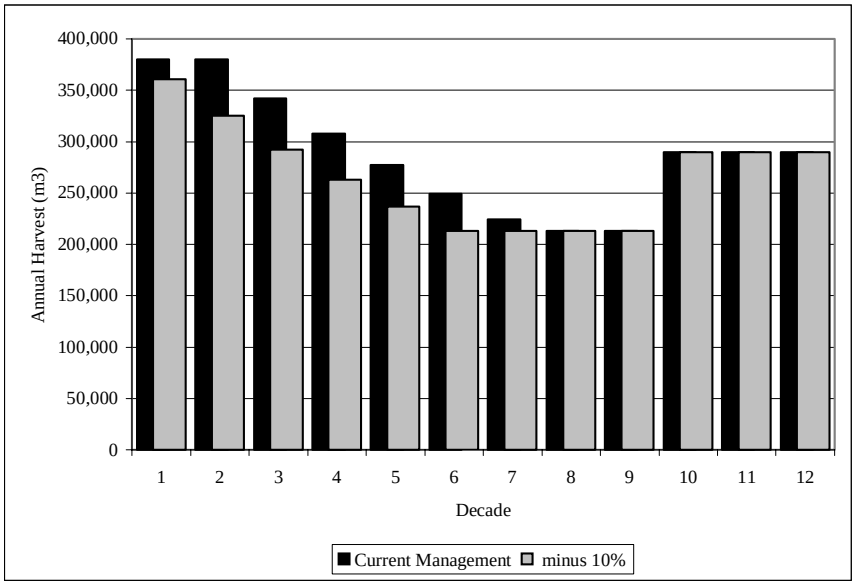



**Figure 6.2 Existing stand volumes reduced by 10%**

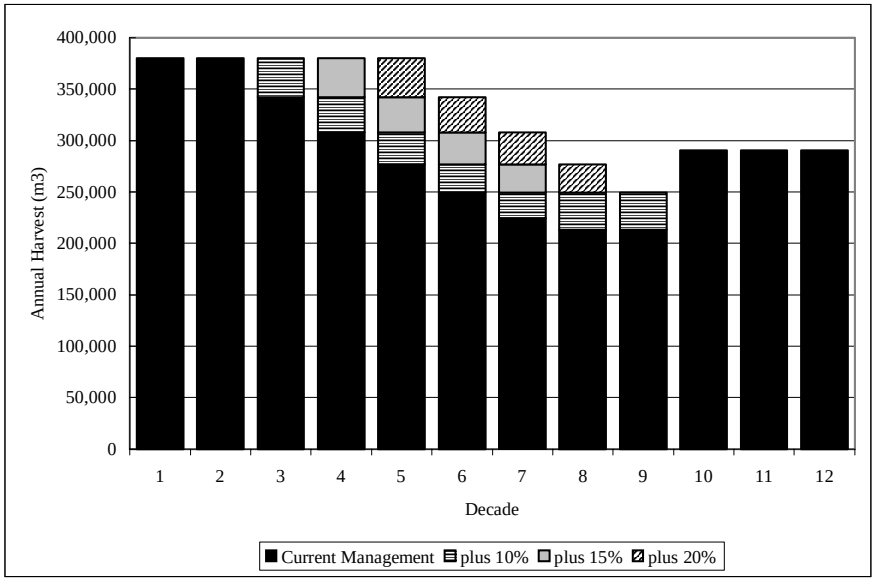



**Figure 6.3 Existing stand volumes increased by 10, 15, and 20%**

**Table 6.3 Harvest schedules - existing volume sensitivities ($m^3$/yr)**

| Decade | Current Management | -10% | +10% | +15% | + 20% |
|---|---|---|---|---|---|
| 1 | 380,000 | 361,000 | 380,000 | 380,000 | 380,000 |
| 2 | 380,000 | 324,900 | 380,000 | 380,000 | 380,000 |
| 3 | 342,000 | 292,410 | 380,000 | 380,000 | 380,000 |
| 4 | 307,800 | 263,169 | 342,000 | 380,000 | 380,000 |
| 5 | 277,020 | 236,852 | 307,800 | 342,000 | 380,000 |
| 6 | 249,318 | 213,167 | 277,020 | 307,800 | 342,000 |
| 7 | 224,386 | 213,167 | 249,318 | 277,020 | 307,800 |
| 8 | 213,167 | 213,167 | 249,318 | 249,318 | 277,020 |
| 9 | 213,167 | 213,167 | 249,318 | 249,318 | 249,318 |
| 10 | 290,000 | 290,000 | 290,000 | 290,000 | 290,000 |
| 11 | 290,000 | 290,000 | 290,000 | 290,000 | 290,000 |
| 12 | 290,000 | 290,000 | 290,000 | 290,000 | 290,000 |

## 6.3 Landscape Biodiversity

### *6.3.1 Average Biodiversity Emphasis*

The control areas for landscape biodiversity constraints are defined by interim landscape units provided by the Ministry of Forests. No biodiversity emphasis levels have been determined for the draft landscape units. The Current Management Option addresses this by assigning low emphasis to all landscape units as described in Section 10.2 of the Information Package. Constraint values are drawn from the Biodiversity Guidebook. Taking direction from the MoF memorandum "Achieving Acceptable Biodiversity Timber Impacts", the following is built into the analysis:

- Full use of non-contributing land base to fill requirements of landscape (and stand level) biodiversity requirements;
- In low biodiversity emphasis old growth reserves are drawn down by 2/3; and
- Apply mature plus old requirements only if non-constraining.

The MoF has directed that an average of low, intermediate and high emphasis levels be applied based on the 45/45/10 breakdown anticipated by the FPC. Such an average clearly does not represent current management on TFL 49 and for that reason has not been used in the Current Management Option. The expected balance of emphasis levels is more appropriately applied to full landscape units. The landscape units of TFL 49 encompass significant areas outside the TFL. The primary goal of Riverside is to maintain a long term, economically viable forest products operation while practicing sound integrated resource management. Within the spectrum of management intensity the TFL is expected to be primarily a low emphasis area.

To address the 45/45/10 average three sensitivities were undertaken. The 45/45/10 average will be applied for the old constraint fully implemented (see Table 6.4), for the old constraint at a 1/3 value (Table 6.5), and for all constraints fully implemented (Table 6.7).

**Table 6.4 Biodiversity emphasis - 45/45/10 average old constraint only**

| Group | Early | | Mature+Old | | Old | |
|---|---|---|---|---|---|---|
| | % of Landscape | Age (yr.) | % of Landscape | Age (yr.) | % of Landscape | Age (yr.) |
| **NDT3** | | | | | | |
| MS | n/a | <40 | n/a | >100 | >14.7 | >140 |
| ESSF | n/a | <40 | n/a | >120 | >14.7 | >140 |
| ICH | n/a | <40 | n/a | >100 | >14.7 | >140 |
| **NDT4** | | | | | | |
| IDF | n/a | <40 | n/a | >100 | >13.6 | >250 |
| PP | n/a | <40 | n/a | >100 | >13.6 | >250 |

**Table 6.5 Biodiversity - 45/45/10 average old constraint at 1/3 value**

| Group | Early | | Mature+Old | | Old | |
|---|---|---|---|---|---|---|
| | % of Landscape | Age (yr.) | % of Landscape | Age (yr.) | % of Landscape | Age (yr.) |
| **NDT3** | | | | | | |
| MS | n/a | <40 | n/a | >100 | >4.9 | >140 |
| ESSF | n/a | <40 | n/a | >120 | >4.9 | >140 |
| ICH | n/a | <40 | n/a | >100 | >4.9 | >140 |
| **NDT4** | | | | | | |
| IDF | n/a | <40 | n/a | >100 | >4.5 | >250 |
| PP | n/a | <40 | n/a | >100 | >4.5 | >250 |

Figure 6.4 provides analysis results associated with the application of biodiversity emphasis using an average of high, moderate, and low weighted by 45, 45, 10% respectively.

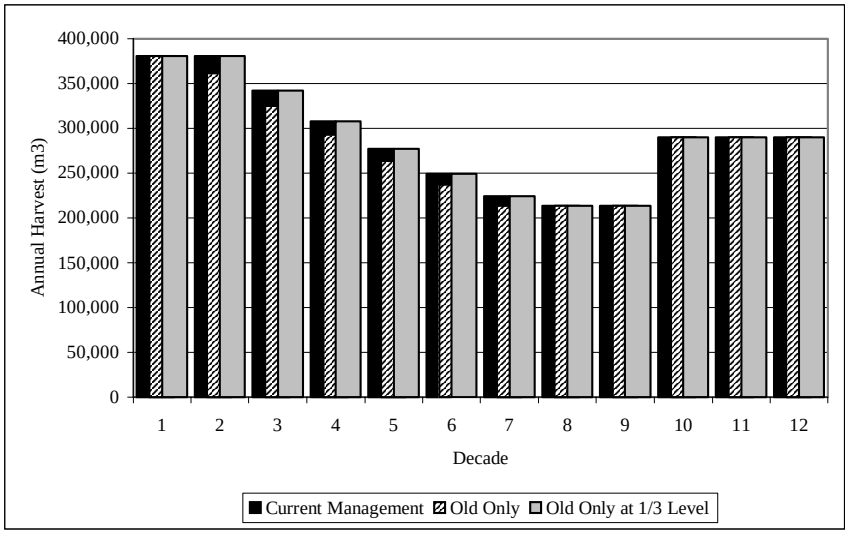



**Figure 6.4 Biodiversity emphasis average of high, moderate, low**

**Table 6.6 Harvest schedules biodiversity sensitivities ($m^3$/yr)**

| Decade | Current Management | Old Constraint Only Applied | Old only and at 1/3 Value |
|---|---|---|---|
| 1 | 380,000 | 380,000 | 380,000 |
| 2 | 380,000 | 361,000 | 380,000 |
| 3 | 342,000 | 324,900 | 342,000 |
| 4 | 307,800 | 292,410 | 307,800 |
| 5 | 277,020 | 263,169 | 277,020 |
| 6 | 249,318 | 236,852 | 249,318 |
| 7 | 224,386 | 213,167 | 224,386 |
| 8 | 213,167 | 213,167 | 213,167 |
| 9 | 213,167 | 213,167 | 213,167 |
| 10 | 290,000 | 290,000 | 290,000 |
| 11 | 290,000 | 290,000 | 290,000 |
| 12 | 290,000 | 290,000 | 290,000 |

When applied within MoF protocol of old only, harvest levels are affected negatively in the short and mid-term. When applied at the one-third level no impact is noted.

Table 6.7 provides the full FPC biodiversity emphasis requirements using figures based on an average of high, moderate and low emphasis weighted in the proportions 45/45/10 respectively. Implied rotations are provided to facilitate comparison, and include regeneration delay. MoF policy requests for information purposes that an analysis run based on these constraints be provided, with harvest levels unmanipulated. The resulting harvest schedule is displayed in Figure 6.5.

**Table 6.7 Full landscape biodiversity constraints average emphasis**

| Group | Early | | | Mature+Old | | | Old | | |
|---|---|---|---|---|---|---|---|---|---|
| | % of Landscape | Age (yr.) | Implied Rotation | % of Landscape | Age (yr.) | Implied Rotation | % of Landscape | Age (yr.) | Implied Rotation |
| **NDT3** | | | | | | | | | |
| MS | <24.2 | <40 | 182 | >21.9 | >100 | 133 | >14.7 | >140 | 169 |
| ESSF | <24.2 | <40 | 182 | >20.1 | >120 | 155 | >14.7 | >140 | 169 |
| ICH | <24.2 | <40 | 182 | >20.1 | >100 | 130 | >14.7 | >140 | 169 |
| **NDT4** | | | | | | | | | |
| IDF | <15.8 | <40 | 278 | >28.1 | >100 | 145 | >13.6 | >250 | 294 |
| PP | <15.8 | <40 | 278 | >28.1 | >100 | 145 | >13.6 | >250 | 294 |

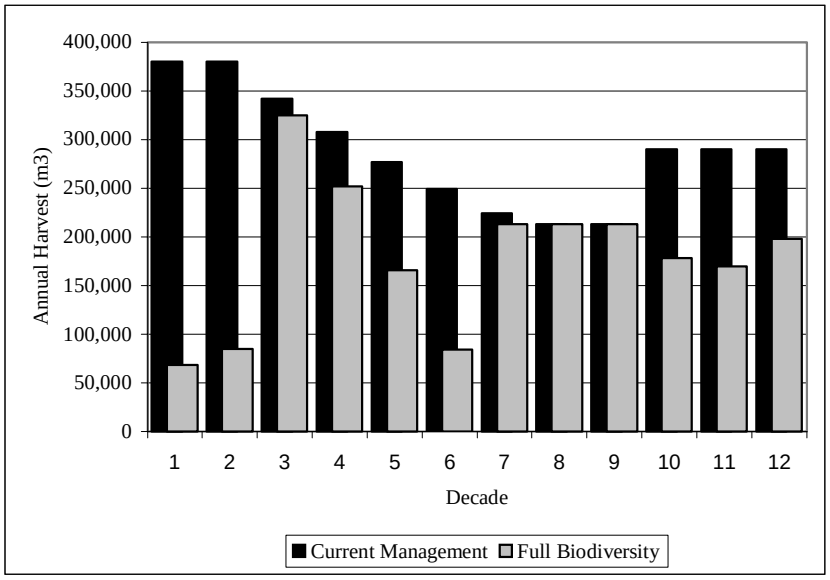



**Figure 6.5 Full biodiversity constraints using a 45/45/10 average emphasis**

### *6.3.2 Subzone Biodiversity Implementation*

Unique combinations of landscape unit and natural disturbance type (NDT) are used as control units to address landscape biodiversity (a Forest Practices Code requirement). Although the Current Management Option groups biogeoclimatic zone/subzone/variant into NDTs, constraints are applied at the zone level. This sensitivity tests constraints applied at the subzone level. As indicated in Figure 6.6 the only divergence from the Current Management harvest schedule is a small long-term impact. The long-term harvest level is 300,000 $m^3$.

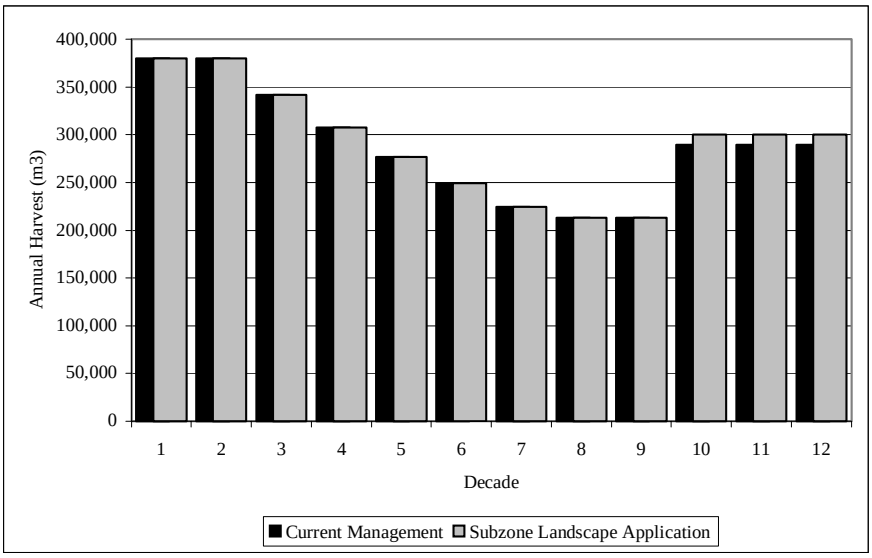



**Figure 6.6 Landscape biodiversity modeled to the subzone**

## 6.4 Aggressive basic silviculture

### *6.4.1 All Regeneration by Planting*

The Current Management Option assumes that 48 percent of pine stands are regenerated naturally. This sensitivity tests the impact of all regeneration by planting. Impacts are limited to the mid and long-term (Figure 6.7).

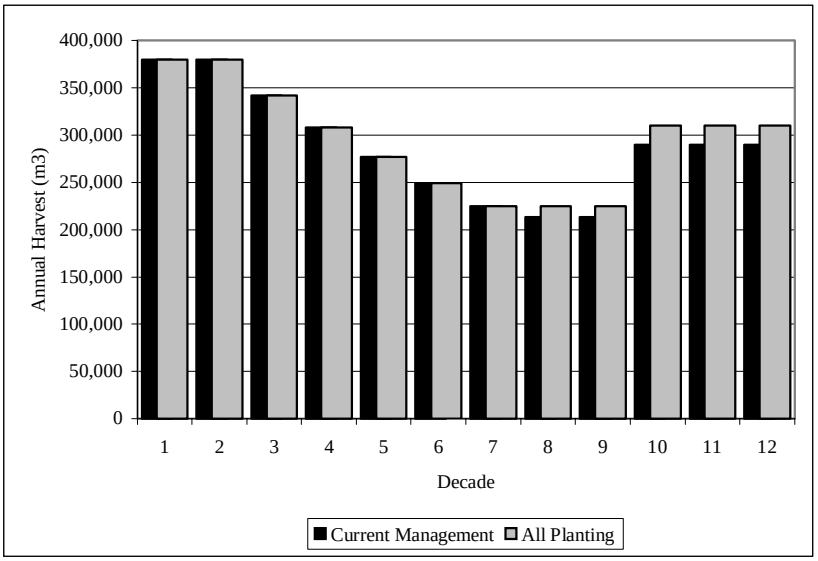



**Figure 6.7 All regeneration by planting**

**Table 6.8 Harvest schedule – all regeneration by planting ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 342,000 | 342,000 |
| 4 | 307,800 | 307,800 |
| 5 | 277,020 | 277,020 |
| 6 | 249,318 | 249,318 |
| 7 | 224,386 | 224,386 |
| 8 | 213,167 | 224,386 |
| 9 | 213,167 | 224,386 |
| 10 | 290,000 | 310,000 |
| 11 | 290,000 | 310,000 |
| 12 | 290,000 | 310,000 |

### *6.4.2 2m Green-up*

Two metre green-up has been suggested as appropriate for modeling adjacency. This analysis tests the use of two metre green-up in the integrated resource management zone only.

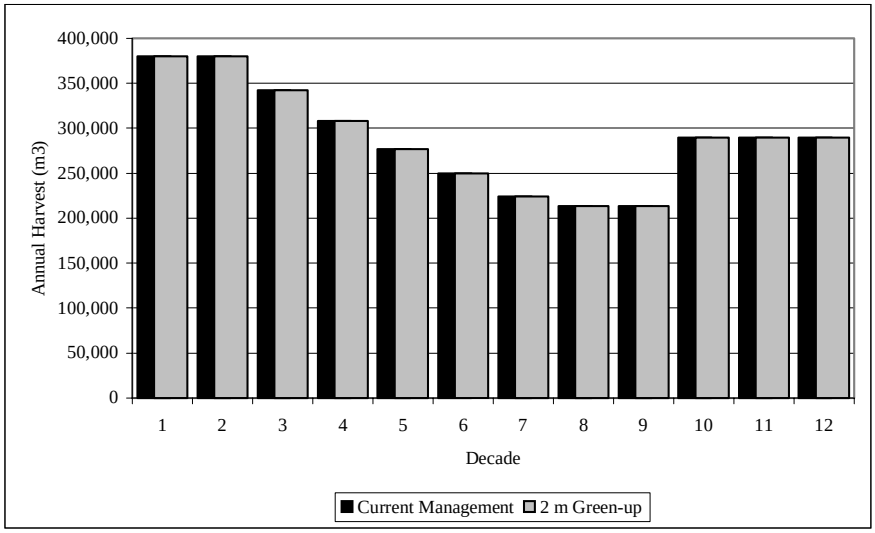



**Figure 6.8 Two metre green-up in IRM zone**

Despite a clearly relaxed constraint regime in the short-term, no impact on timber supply was noted. This is due to the fact that mature timber availability is the most limiting factor in the short-term.

## 6.5 Community watersheds

The Lambly, Powers, Norris and Silver Creek watersheds represent just under 15% of the TFL. Although they are designated community watersheds, they do not represent the typical watershed for which the Community Watershed Guidelines were designed. The Lambly and Powers (the vast majority of the area falls in these two) are controlled using surface storage. Current practice in these watersheds does not differ from the rest of the TFL. For these reasons, Current Management Option constraints in the watersheds are based on the IRM zone constraints.

For this sensitivity, green-up will be implemented using a maximum disturbance of 20% defined as six metre green-up as per the Forest Practices Code.

Figure 6.9 and Table 6.9 provide details of the harvest schedule possible with this scenario.

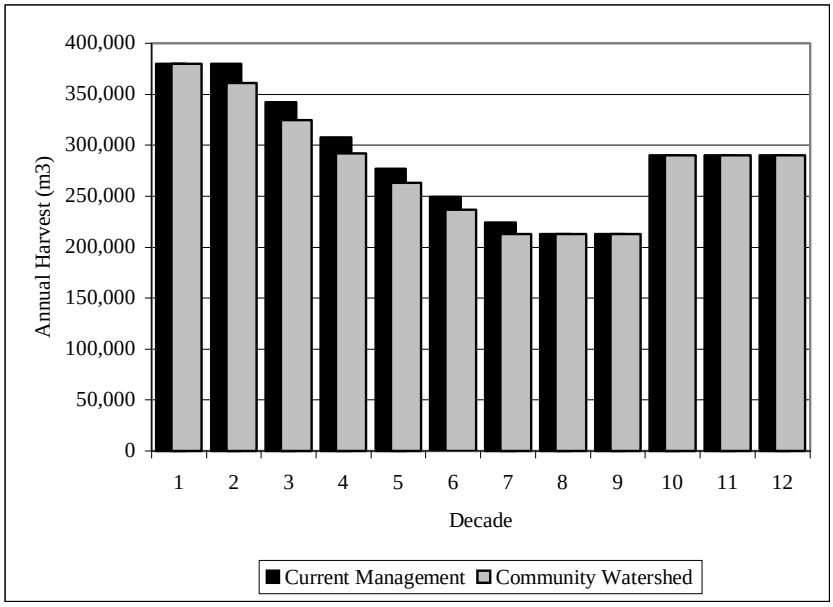



**Figure 6.9 Community watershed sensitivity**

**Table 6.9 Harvest schedule community watershed sensitivity ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 361,000 |
| 3 | 342,000 | 324,900 |
| 4 | 307,800 | 292,410 |
| 5 | 277,020 | 263,169 |
| 6 | 249,318 | 236,852 |
| 7 | 224,386 | 213,167 |
| 8 | 213,167 | 213,167 |
| 9 | 213,167 | 213,167 |
| 10 | 290,000 | 290,000 |
| 11 | 290,000 | 290,000 |
| 12 | 290,000 | 290,000 |

Short and mid-term impacts are less than one might anticipate due to the limiting impact of the finite pool of mature timber in the short-term.

## 6.6 Protected Areas Strategy Sensitivity

Goal One Areas and Areas of Interest as supplied by the Ministry of Forests in June of 1997 are overlaid in the GIS system and removed from the land base. This reduces the net harvesting land base by 10,860 (9%) to 109,136 ha. Analysis results are presented in Figure 6.10 and Table 6.10.

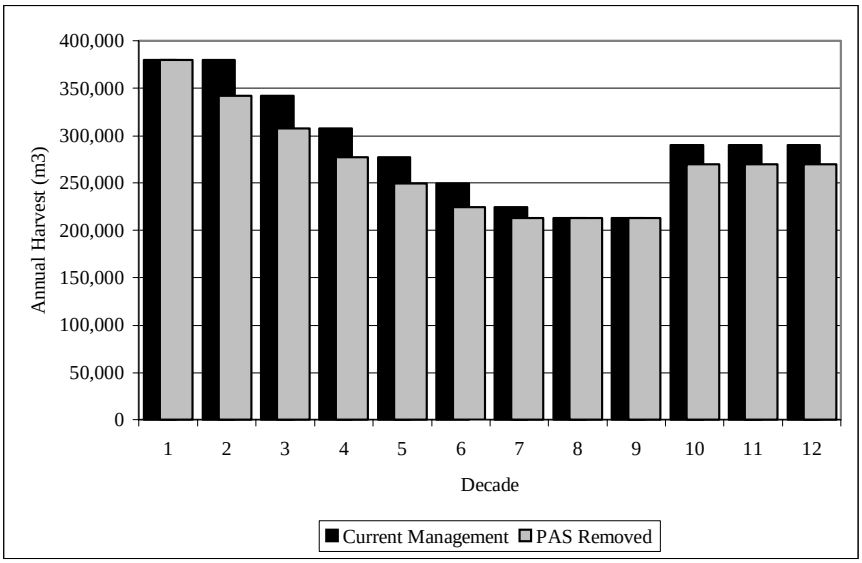



**Figure 6.10 Protected Areas Strategy areas removed**

**Table 6.10 Harvest schedule – PAS areas removed ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 342,000 |
| 3 | 342,000 | 307,800 |
| 4 | 307,800 | 277,020 |
| 5 | 277,020 | 249,318 |
| 6 | 249,318 | 224,386 |
| 7 | 224,386 | 213,167 |
| 8 | 213,167 | 213,167 |
| 9 | 213,167 | 213,167 |
| 10 | 290,000 | 270,000 |
| 11 | 290,000 | 270,000 |
| 12 | 290,000 | 270,000 |

Significant short and long-term harvest reductions result.

## 6.7 Land Base Sensitivity

### *6.7.1 TFL Boundary Correction*

Various versions of the TFL boundary have been represented in government and Riverside mapping in recent years. Work currently underway in redefining the TFL boundary indicates that approximately 1,000 ha of productive forest will be returned to the land base. This sensitivity adds this area in the form of a proration across analysis units and management zones. It was implemented using an adjustment factor to area. Small mid and long-term impacts are demonstrated in Figure 6.11.

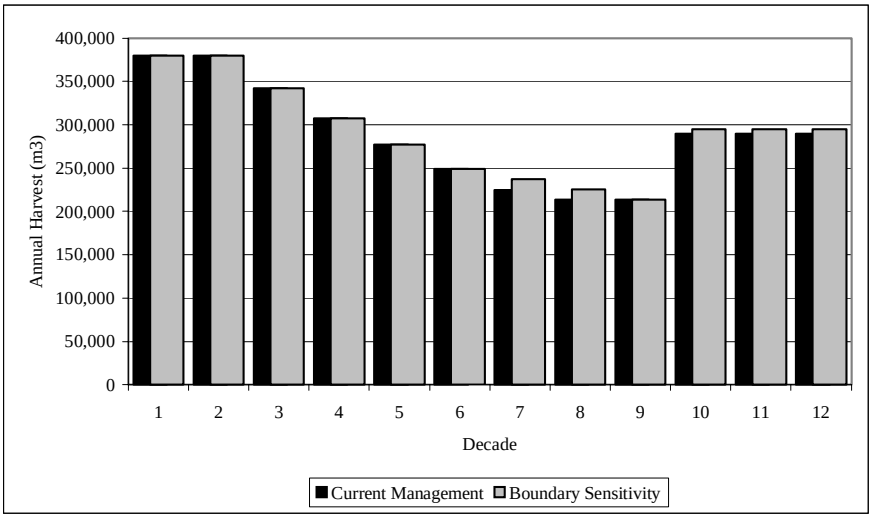



**Figure 6.11 Land base addition for boundary update**

**Table 6.11 Harvest schedule – boundary sensitivity ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 342,000 | 342,000 |
| 4 | 307,800 | 307,800 |
| 5 | 277,020 | 277,020 |
| 6 | 249,318 | 249,318 |
| 7 | 224,386 | 236,852 |
| 8 | 213,167 | 225,009 |
| 9 | 213,167 | 213,759 |
| 10 | 290,000 | 295,000 |
| 11 | 290,000 | 295,000 |
| 12 | 290,000 | 295,000 |

### *6.7.2 Natural Succession*

A second sensitivity with regard to land base acknowledges natural succession in deciduous and overstocked pine stands. Deciduous stands switch to a young spruce stand at 150 years of age and pine stands are harvested in 50 years and regenerated to pine by planting.

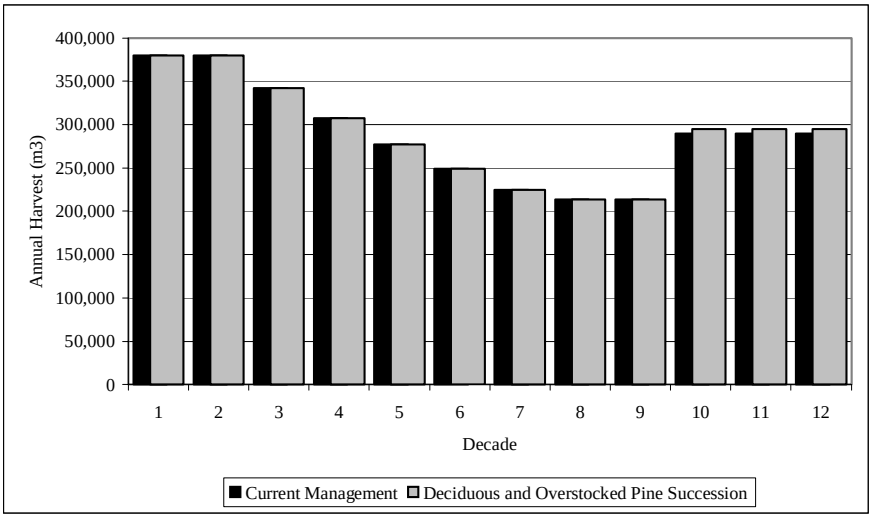



**Figure 6.12 Net land base expansion through succession**

Impacts are limited to the long term as would be expected. The long-term harvest level under this scenario is 295,000 $m^3$/yr.

### *6.7.3 Wildlife Tree Patch Sensitivity*

In preparation of the Current Management Option, a mapping exercise was undertaken to identify the extent to which existing reserve structures (ESAs, riparian reserves, non-merchantable stands, *etc.*) function as wildlife tree patches. That analysis was conservative for the following reasons:

- It did not include areas reserved from harvesting to accommodate forest cover constraints (which are valid contributions since wildlife tree patches are not static structures); and
- While a 500-metre buffer overestimates in some instances, the 250-metre buffer underestimates in other instances.

The Current Management Option used a land base reduction to account for the additionally required wildlife tree patches. Somewhere between that value and zero as applied in this sensitivity is the correct value.

Impacts are significant throughout the analysis period.

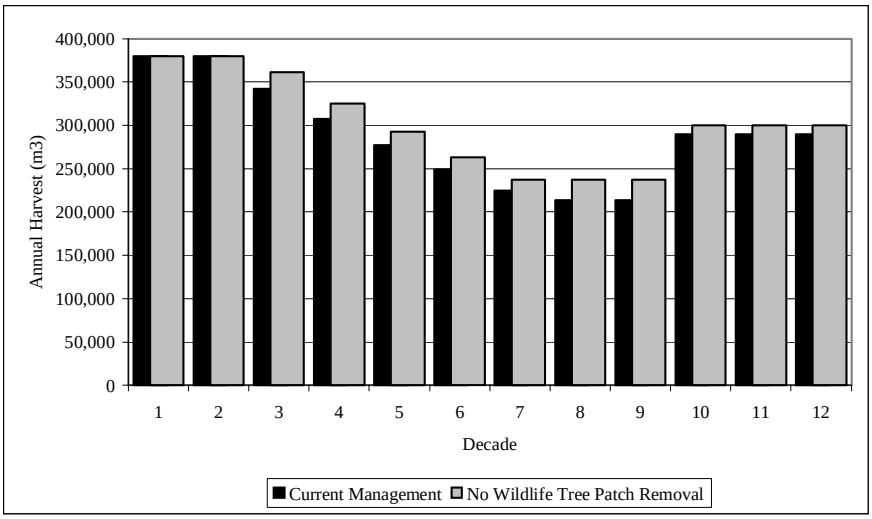



**Figure 6.13 No wildlife tree patch reduction to land base**

**Table 6.12 Harvest schedule – No WTP reductions ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 342,000 | 361,000 |
| 4 | 307,800 | 324,900 |
| 5 | 277,020 | 292,410 |
| 6 | 249,318 | 263,169 |
| 7 | 224,386 | 236,852 |
| 8 | 213,167 | 236,852 |
| 9 | 213,167 | 236,852 |
| 10 | 290,000 | 300,000 |
| 11 | 290,000 | 300,000 |
| 12 | 290,000 | 300,000 |

### 6.8 Harvest Profile Sensitivity

Recognizing the danger of mountain pine beetle, for this sensitivity lodgepole pine stands will be given the highest priority for harvesting. Figure 6.14 indicates that some timber supply benefit over and above risk management for epidemic losses is possible in the mid-term.

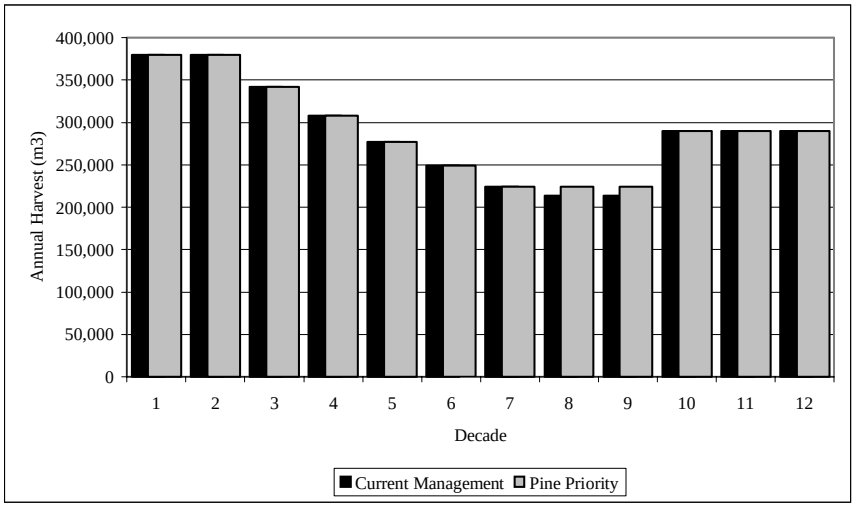



**Figure 6.14 Pine stands a priority for harvest**

### 6.9 Selective Harvest Sensitivity Analysis

Partial cuts of some kind currently contribute about 5% of the volume harvested on TFL 49. The majority of this takes place on the very driest sites where post harvest regeneration is problematic due to extreme conditions. Although in the past partial cuts have taken the form of various selective silvicultural systems, the predominant system is now small patch cuts.

In an attempt to model this management regime, the shelterwood functionality of CASH_FM has been used for a selective harvest sensitivity analysis.

All stands in the dry BEC variants are identified as candidates for a shelterwood intermediate cut. Intermediate cuts may take place on a maximum of 200 ha per year, in line with actual practice. The harvested stand moves to a yield curve which is 50% of the stand's originating yield curve, thus 50% of the volume is captured for harvest. The stand continues to grow on the proportional yield curve until a final cut at least 30 years after the intermediate cut. The regenerating stand is initiated at 30 years of age to acknowledge advanced growth under the shelterwood overstory. This methodology simulates selective harvesting in that forest cover is maintained at all times. No shelterwood zone was established and all zones are subject to the same forest cover constraints as the Current Management Option.

Figure 6.15 presents the harvest schedule possible when modeling selective harvesting with the shelterwood capabilities of the model as described above. No difference is found compared to the Current Management Option. This analysis may be conservative given that the methodology does not capture any boost in stand volume production after the initial shelterwood harvest cut. No short-term impact is indicated. Long-term harvests fall to 275,000 $m^3$ due to the lower productivity estimates associated with the natural yield curves used for regeneration resulting from selective harvests.

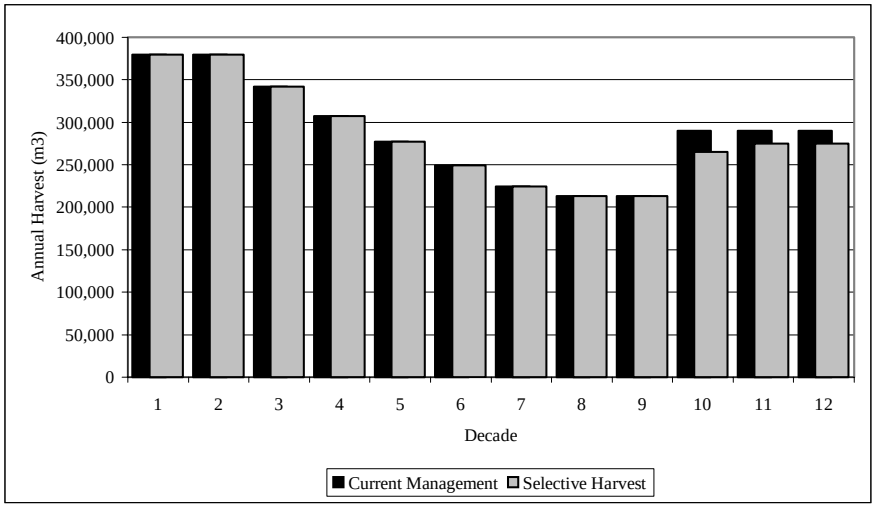



**Figure 6.15 Selective harvest sensitivity**

# 7. OKANAGAN TSA IRM TIMBER HARVESTING GUIDELINES OPTION

This Option is based on the Okanagan TSA Integrated Resource Management Timber Harvesting Guidelines and differs from the Current Management Option in that guidelines developed specifically as part of the Forest Practices Code (FPC) are not addressed. This Option will be most closely comparable to the previous timber supply analysis. It is intended to illustrate any "timber supply cost" associated with the FPC.

We have modeled IRM using methodology similar to the Okanagan TSR methodology. This analysis does not address FPC riparian reserves or management zones, and no landscape or stand level biodiversity measures are takne. In replacement of the landscape biodiversity constraints an old growth constraint of 5% over 140 years was implemented in line with the last Okanagan TSA Timber Supply Analysis.

Results are presented in Figure 7.1 and Table 7.1.

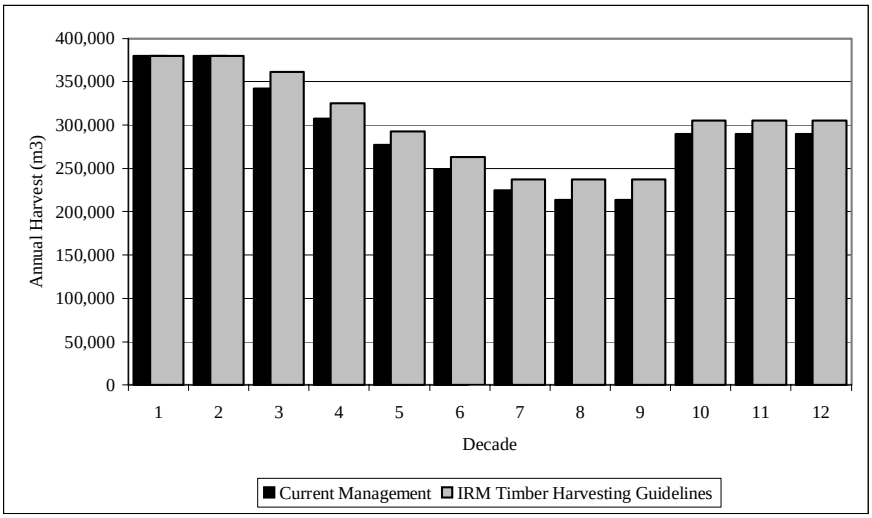



**Figure 7.1 IRM Timber Harvesting Guidelines implemented**

**Table 7.1 Harvest schedule – Okanagan Harvesting Guidelines ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 342,000 | 361,000 |
| 4 | 307,800 | 324,900 |
| 5 | 277,020 | 292,410 |
| 6 | 249,318 | 263,169 |
| 7 | 224,386 | 236,852 |
| 8 | 213,167 | 236,852 |
| 9 | 213,167 | 236,852 |
| 10 | 290,000 | 305,000 |
| 11 | 290,000 | 305,000 |
| 12 | 290,000 | 305,000 |

As with other analyses reported above, results are not very sensitive to changes in constraints but do respond to increases in land base. The net result is a significant positive impact throughout the analysis period.

# 8. RIVERSIDE MANAGEMENT OPTION

Aspects of the Current Management Option and the associated sensitivities have been aggregated into the Riverside Management Option. This option reflects Riverside's commitments and intentions for management on TFL 49. It forms the basis for a proposed AAC.

Productivity estimates and yield curves adjusted for negative old growth site index bias are used for the total TFL land base. Specifically, SIBEC values are used on Block B and MoF interim equations are used on regenerated old growth on Blocks A and C. All evidence suggests that such an adjustment is appropriate across the TSA and we would be remiss to exclude it from this analysis.

Riverside operational staff expressed the opinion that VDYP estimates of volume are consistently lower than cruise values. A study of available cruise data supported those opinions and indicates a 24% underestimate. If this study were used directly the yield curve adjustment factor would be 1.31. We anticipate VRI Phase II results to provide guidance on this issue. Sensitivity runs presented above provide results from a range of volume adjustment values. For this option, a moderate volume adjustment factor of 15% was applied to natural stand volumes.

This Option implements a 45/45/10 average of high, moderate and low biodiversity emphasis. Only the old constraint is applied, and at a one-third level.

Although the final data is not available, a review of the TFL boundary including exacting field layout work indicates that approximately 1,000 ha will return to the TFL database. A land base adjustment figure to make this correction is included in this Option.

Figure 8.1 and Table 8.1 provide the timber harvest schedule possible based on these inputs. A theoretical long run sustainable yield value (LRSY) based on the productivity of the forest using the current management managed yields is included in Figure 8.1. The difference between the theoretical value and the demonstrated long term harvest levels is the cost in terms of timber supply associated with the various management assumptions included in this analysis.

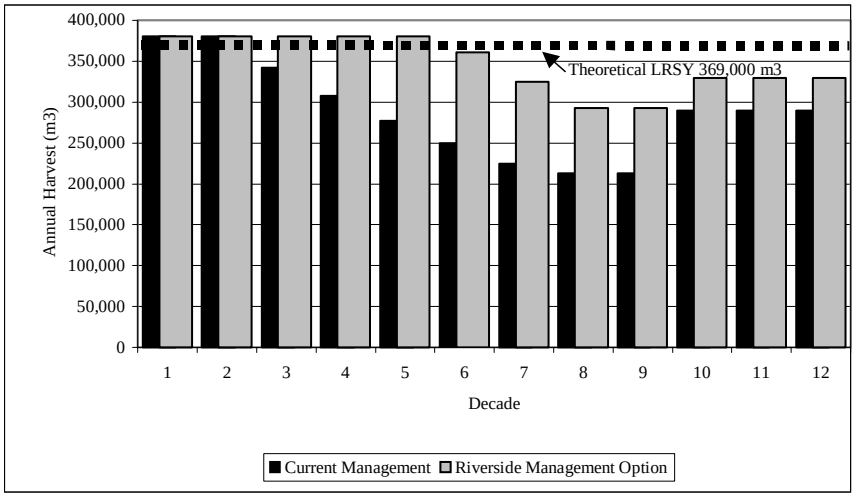



**Figure 8.1 Harvest schedule - Riverside Management Option**

**Table 8.1 Harvest schedule – Riverside management Option ($m^3$/yr)**

| Decade | Current Management | Harvest Schedule |
|---|---|---|
| 1 | 380,000 | 380,000 |
| 2 | 380,000 | 380,000 |
| 3 | 342,000 | 380,000 |
| 4 | 307,800 | 380,000 |
| 5 | 277,020 | 380,000 |
| 6 | 249,318 | 361,000 |
| 7 | 224,386 | 324,900 |
| 8 | 213,167 | 292,410 |
| 9 | 213,167 | 292,410 |
| 10 | 290,000 | 330,000 |
| 11 | 290,000 | 330,000 |
| 12 | 290,000 | 330,000 |

The current harvest level of 380,000 $m^3$/yr can be maintained for five decades before step-downs of 10% are required for three decades. A long-term harvest level of 330,000 is achieved in decade ten.

# 9. DISCUSSION AND CONCLUSIONS

The Current Management Option as defined in the Information Package (Appendix I), and reported in Section 5.1, is the starting point for analysis of the timber supply capability of TFL 49. Moving from this, various options and sensitivities were investigated. These were to identify the most realistic scenario, and to explore the impacts of assumptions given that uncertainty exists.

Riverside is very confident in the results presented in this Analysis Report for the following reasons:

- The high resolution of the new Vegetation Resources Inventory;
- The improvement in growth and yield methods since the last analysis; and
- The integration of various resource inventories in a spatial manner.

TFL 49 is situated on largely gentle rolling terrain, 94% of which is productive forest. As such, it represents a highly productive and flexible timber supply asset, the focus of which is timber production.

As one might expect of a forest with such a high proportion of lodgepole pine, TFL 49 does not have preponderance of old growth stands. Although there is a significant population of fir and spruce over 140 years, the bulk of the mature stands are between 60 and 120 years of age. This is the pool of mature volume for harvest over the first few decades. This volume becomes the limiting timber supply factor on TFL 49 due to the shortage of stands in the range of 30 through 60 years of age.

This analysis is a strategic one and should be considered in concert with the 20-Year Plan, submitted concurrently under separate cover. However, a high degree of spatial resolution is achieved in the analysis, based on the level of inventory aggregation used and the design of the management zones and landscape units. The full forest inventory is passed to the model with each hectare classified as to contribution. Contribution may be to cover constraints and harvest, or to cover constraints alone. Two levels of forest cover constraints are applied to ensure that the analysis adheres to the intent of the constraints. Management zone constraints address adjacency and disturbance requirements for the management of non-timber resources. Landscape level constraints ensure the maintenance of biodiversity requirements.

The Current Management Option presented in Section 5.1 is one representation of the possibilities for harvest on TFL 49 for the short and long-term. There is a need to step down toward a mid-term sustainable level that is roughly based on the productive capacity of the land in a natural state. In the short-term the current

harvest level of 380,000 $m^3$/yr can be maintained for 20 years. In the long-term, when managed stands become mature, the sustainable harvest level rises again.

### 9.1 Riverside Management Option

In an effort to explore uncertainty, or improve assumptions used in the Current Management Option, various sensitivity analyses were undertaken. The two most important issues are negative old growth site index bias and estimates of natural stand volume.

It is clear that some accounting of site index bias in old growth should be included for the entire TFL. The most reasonable approach includes the use of ecosystem correlation on Block B for which a site association inventory exists. For the remainder of the TFL the best available information is the MoF interim equations. These are discussed in Section 5.2 which also presents the harvest level benefits to this change in assumptions (Figure 5.4). Under this scenario the current harvest level can be maintained for three decades.

Riverside has compared cruise volumes with inventory volumes and consistently found that VDYP underestimates existing volume. Sensitivities around existing yields (-10%, +10%, +15%, and +20%) have been presented. Incrementing existing volumes by 15% was deemed to be reasonable (see Section 6.2) and based on that modified input alone, the current harvest level can be maintained for 40 years.

The definition of TFL boundaries has been contentious and Riverside is completing a detailed re-establishment of the boundary line. Final data is not available but indications are that 1,000 ha of productive forest will return to the TFL database. The recent forest inventory does not include these areas and therefore specific area additions were not possible for a sensitivity run on this issue. Instead a land base adjustment factor was applied to all stands. The result was a small mid and long-term harvest level improvement.

The MoF has indicated a preference for an average value for biodiversity emphasis in the absence of values determined through the Land and Resource Management Planning process.

The alternate assumptions discussed above were used in aggregate with other assumptions from the Current Management Option to produce the Riverside Management Option. In the role of primary managers of the TFL, Riverside has confidence in these assumptions. The results reflect Riverside's commitments and intentions for TFL 49. Figure 8.1 presents the harvest forecast for the Riverside Management Option. The current harvest level is maintained for 50 years.

Riverside recommends that the AAC for TFL 49 be set at 380,000 $m^3$ for the term of Management Plan No. 3. Based on the analyses, there exists substantial evidence that this harvest level can be maintained for decades to come without compromising future harvest levels.

## 9.2 Pressures on Timber Supply

Sensitivities involving aggressive basic silviculture indicated no short-term effect. Switching to all regeneration by planting yields long-term benefits due to the increased productivity of the stands and pushes mid-term levels up slightly due to lower average culmination values. Two metre green-up significantly increases short-term harvest flexibility due to earlier availability of stands but can not overcome the problem of limited mature harvestable timber in the short-term. No harvest level benefits are realized. More stringent constraint regimes could change the balance and make aggressive basic silviculture a positive pressure.

Using 'current management' as the criteria, community watershed management was addressed in a sensitivity run. Application of a 20% maximum disturbance constraint, using a six-metre definition of green-up, in community watersheds has a relatively small negative short-term effect in the context of other current management assumptions.

The Land and Resource Management Plan process will deal with both biodiversity emphasis and the designation of protected areas. Until direction is provided it is speculative to consider the impacts. However several sensitivity analyses were prepared to investigate the possible effects on timber supply. The removal from the timber harvesting land base of Goal One Areas and Areas of Interest as defined for the Protected Areas Strategy (a 9% reduction to the net harvesting land base) has significant impacts throughout the analysis period. The way in which biodiversity constraints are being applied masks the impact of switching emphasis levels, and the sensitivities on this show little effect. If full implementation of the Biodiversity Guidebook were implemented the impact is severe and immediate (Figure 6.5).

Landscape biodiversity constraints applied at the subzone level, rather than the biogeoclimatic zone level, had little impact on the analysis. These are the only levels to which the biodiversity constraints could practically be applied on the TFL.

Wildlife tree patches, by virtue of their operational nature, are difficult to deal with in a strategic analysis. The full spectrum of structures able to contribute to stand level biodiversity can not be identified. By following the recognized methodology for determining a land base reduction for tree patches the need has likely been overestimated.

A sensitivity analysis setting a harvest priority for pine (98% of the harvest from pine stands in the first 50 years) indicated only a small mid-term positive impact. From an operational point of view, such a restriction is unrealistic.

The effect of partial harvesting on cover constraints in a forest level analysis is difficult to assess with certainty. Similarly, the productivity characteristics and future yields from partially harvested stands are very uncertain. One would expect the timber supply impacts from partial harvests to be a trade-off between long-term productivity losses and short term increases in operational flexibility. The balance will depend on the characteristics of the forest estate in question. The selective harvest sensitivity (Section 6.9) indicates no effect in the short-term, but does have a long-term impact.

From the Riverside Management Option as a base, positive pressures on short-term harvest levels include:

- Aggressive silviculture; and
- Wildlife tree patches.

Negative pressures on short-term harvests include:

- Community watersheds;
- Protected areas strategy; and
- Landscape biodiversity guidelines.

# 10. DATA REQUIREMENTS

In the process of completing this timber supply analysis for TFL 49, information gaps that contribute to uncertainty in the planning and management process have been identified as follows:

- A rigorous inventory of streams, wetlands and lakes to FPC standards;
- Data to support the full implementation of adjustments for negative old growth site index bias. This may include a complete site series level biogeoclimatic classification of the TFL that would improve the confidence in productivity estimates used, as well as be useful in the management of non-timber resources;
- Silviculture records including growth intercept data that will improve productivity estimates of plantations;
- Information on the impact on managed stand yields with respect to strict stocking control;
- Documentation of gains from successive generations of genetically improved seed;
- A rigorous methodology to confirm natural stand yields;
- Forest cover constraints for IRM based on the specific requirements and characteristics of TFL 49;
- Data to support revised estimates of unsalvaged losses; and
- Localized operational adjustment factors (OAFs) for managed stand yields.

Riverside will investigate the opportunities to acquire this data before preparation of MP No. 4. Riverside anticipates that the results of a TFL boundary confirmation project and preliminary results of the Vegetation Resources Inventory Phase II sampling will be available before determination of AAC for MP No. 3.

Increased pressure to provide a wider range of benefits from limited resources, and increasingly complicated planning requirements and procedures, are advancing the need for improved modeling techniques. For the next round of timber supply Riverside will investigate:

- Full spatial modeling at the forest level which integrates total chance planning including specific reserve structures such as reserves for environmental sensitivity and wildlife tree patches;
- Better integration of selective harvesting into forest level analysis , especially in terms of forest cover constraint compliance; and
- Improved volume estimation tools in selection or other partially harvested or complex stands.

Riverside expects that uncertainty with regard to impacts of the Land and Resource Management Planning process will be clarified before the next analysis.

# APPENDIX I

# TIMBER SUPPLY ANALYSIS INFORMATION PACKAGE (Amended Version)